ExxonMobil Pipeline Company

Emergency Response Plan

Core Manual

PHMSA Sequence Number 848

Volume 1

Section 1. Introduction

In This Section

FOREWORD

The purpose of this section is to provide information that is not directly related to other sections of the plan. Information contained in this section consists of several regulatory cross-references and the initial plan certification and approval letters. Subsequent approval letters, re-certification letters, and other regulatory agency correspondences relative to this plan are maintained at company headquarters by the Safety, Health and Environment Department. The cross-references are included to identify the various regulatory planning requirements that apply to this plan and the sections of the plan where these requirements are addressed. The certification and approval letters have been included to demonstrate that ExxonMobil Pipeline Company has certified that resources are available to adequately respond to a worst case spill or emergency and that this plan has been approved by the Department of Transportation, Research and Special Program Administration.

Specifically, this section contains:

<u>Regulatory Cross-References</u>

- 49 CFR 194
- 49 CFR 195.402 & .403
- 49 CFR 192.615
- 29 CFR 1910.120(I)
- 40 CFR 262.34(a)(4) and 265 Subpart D

Initial Certification and Approval Letters

- EPC Certification of Consistency with ACPs and NCP (December 22, 1994)
- EPC Certification of Resources for Worst Case Discharge (July 15, 1993)
- DOT Interim Approval of Response Plans (July 22, 1993)

PHMSA Sequence Number 848

Department of Transportation
Final Rule
49 CFR 194
Cross-Reference Index

DOT 49 CFR 194 Sections	Location in This Plan
(1) Information Summary	
(a) Core Plan:	
a. Operator Name and address	Core Plan, Section 1, page 3, Zone Plan Section 11, page 1
b. Description of response zones	Core Plan, Section 2, pages 2 to 4 and Section 1, pages 13 to 16, Table 1-1.
(b) Each Zone Plan:	
a. Information summary for Core Plan	Core Plan, Section 1, page 3
b. 24-hour phone number for qualified individual	Core Plan, Section 1, pages 29 to 31, Table 1-3. and Zone Plan, Section 11, page 1.
c. Description of response zone	Zone Plan, Section 11 pages 2,3,4,5
d. List of line sections	Zone Plan, Section 11 page 5
e. Basis for determination of significant and substantial harm	Forward of Core Plan, Page ii, and Core Plan, Section 1, Page 17 to 22 Table 1-2, right hand column.
f. Type of oil and volume of worst case discharge	Zone Plan, Section 11, page 5 and Section 14, page 1
(c) Certification of necessary equipment for response to a worst case discharge	Core plan, Section 1, pages 12
(2) Notification Procedures - Volume 1 - Core Manual	
(a) Area notification requirements	Core Plan Section 5, and Zone Plan, Section 12
(b) Checklist of required notifications in order of priority	Core Plan Section 5, and Zone Plan, Section 12
(c) Names of persons to notify	Core Plan Section 5, and Zone Plan, Section 12
(d) Procedures for notifying qualified individuals	Core Plan Section 5, and Zone Plan, Section 12
(e) Primary and secondary communications methods for making notifications	Core Plan Section 5, and Zone Plan, Section 12
(f) Information to be provided in each notification	Core Plan Section 5, and Zone Plan, Section 12
(3) Spill Detection and On-Scene Spill Mitigation Procedures	Volume 1 - Core Manual
(a) Methods of initial discharge detection	Core Plan Section 4,
(b) Release mitigation/prevention procedures	Core Plan Section 4, Section 4 and Appendix A
(c) List of equipment needed for response activities	Core Plan Section 5, Appendix A and B, Zone Plan, Section 13
(d) 24-hour equipment contact information	Zone Plan, Section 13
(e) 24-hour personnel contact information	Zone Plan, Section 12 and 13

Department of Transportation
Final Rule
49 CFR 194
Cross-Reference Index (Continued)

DOT 49 CFR 194 Sections	Location in This Plan
(4) Response Activities - Volume 1, Core Manual	
(a) Personnel responsibilities	Core Plan, Section 3, Zone Plan Section 11 and 12
(b) Qualified individuals listing	Core Plan, Section 3, Zone Plan Section 11 and 12
(c) Procedures for coordinating with IC	Volume 1, Section 3.1.4
(d) Available oil spill response organizations (OSRO)	Zone Plan Section 13
(e) OSRO equipment lists	N/A All OSRO are USCG Classified
(5) List of Contacts	Volume 1, Table 5.1-1/Volume 2, Table 3-1, and Figure 3-3
(6) Training Procedures	Volume 1, Section 9.0
(7) Drill Procedures	Volume 1, Section 9.5.2
(8) Response Plan Review and Update Procedures	Volume 1, Section 1.8
(9) Response Zone Appendices - Volume 2	
(a) Qualified individual	Zone Plan Section 12
(b) Notification procedures	Zone Plan Section 11 and 12
(c) Spill detection and mitigation procedures	Core Plan Section 4, Section 4 and Appendix A
(d) Name, address, phone number of spill response organization	Zone Plan Section 13
(e) Response activities and resources	Core Plan, Sections 3, 4, and 5
(f) Federal, state and local agency contacts	Zone Plan, Section 12
(g) Discharge volume calculations	Zone Plan, Section 14
(h) Method of worst case discharge calculations	Zone Plan, Section 14
(i) Affected water ways/intakes	Zone Plan, Section 15
(j) Line piping diagram	Zone Plan, Drawings and Maps
(k) Emergency response data for each transported product	Core Plan Section 2, Table 2-2
Certification of Compliance with NCP and ACP	Volume 1, Section 1.4

Department of Transportation
49 CFR 195.402 & 403
Cross-Reference Index

Regulation Section	Section Description	Location in This Plan
195.402 (c) (12)	Establish and Maintain Liaison with Public Officials	Core Plan, Section 5
195.402 (e)	Emergencies	Core Plan, Section 5
195.402 (e) (1)	Receive, Identify, and Classify Notices of Event	Core Plan, Section 5
195.402 (e) (2)	Procedures for Prompt and Effective Responses	Core Plan, Section 5
195.402 (e) (3)	Availability of Response Personnel and Resources	Core Plan, Section 3 and 6; Zone Plan Section 12 and 13
195.402 (e) (4)	Emergency Shutdown and Pressure Reduction Procedures	Core Plan, Section 5
195.402 (e) (5)	Control and Minimization of Released Hazardous Liquid	Core Plan, Section 5
195.402 (e) (6)	Evacuation, Traffic, and Security Control	Core Plan, Section 5
195.402 (e) (7)	Notification of Emergency Officials	Core Plan, Section 5, Zone Plan, Section 12
195.402 (e) (8)	Assessment of HVL Clouds	Core Plan, Section 5
195.402 (e) (9)	Post Incident Critique	Core Plan, Section 5
195.403 (a)	Operator Personnel Training	Core Plan, Section 9
195.403 (a) (1)	Carry Out 195.402 Emergency Procedures	Core Plan, Section 5
195.403 (a) (2)	Characteristics and Hazards of Liquids and HVLs	Core Plan, Section 2
195.403 (a) (3)	Recognition of Emergency Causes and Preventative Actions	Core Plan, Section 4
195.403 (a) (4)	Steps to Control and Minimize Effects of Accidental Release	Core Plan, Section 5
195.403 (a) (5)	Firefighting Procedures and Equipment	Core Plan, Section 5
195.403 (b)	Operator's Training Program	Core Plan, Section 9
195.403 (b) (1)	Review and Evaluate Response Personnel Performance	Core Plan, Section 5 and Section 9
195.403 (b) (2)	Implement Training Program Changes Where Appropriate	Core Plan, Section 9
195.403 (c)	Supervise Knowledge of Applicable Response Procedures	Core Plan, Section 3 and Section 5

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Department of Transportation
49 CFR 192.615
Cross-Reference Index

Regulation Section	Section Description	Location in This Plan
192.615 (a)	Written Procedures to Minimize Hazards	Core Plan, Section 5
192.615 (a) (1)	Receive, Identify, and Classify Notices of Event	Core Plan, Section 5
192.615 (a) (2)	Establishment of Communication With Emergency Officials	Core Plan, Section 5
192.615 (a) (3)	Procedures for Prompt and Effective Response	Core Plan, Section 5
192.615 (a) (4)	Availability of Response Personnel and Resources	Core Plan Section 3 and 6; Zone Plan, Section 12 and 13
192.615 (a) (5)	Action Plan For Protecting People and Property	Core Plan, Section 5
192.615 (a) (6)	Emergency Shutdown and Pressure Reduction Procedures	Core Plan, Section 5
192.615 (a) (7)	Protection From Hazards to Life and Property	Core Plan, Section 5
192.615 (a) (8)	Notification of Local Emergency Officials	Core Plan, Section 5 and Zone Plan Section 12
192.615 (a) (9)	Restoring Service Outages	Core Plan, Section 5
192.615 (a) (10)	Post Incident Critique	Core Plan, Section 5
192.615 (b)	Training	Section 9
192.615 (b) (1)	Furnish Supervisors with Emergency Action Procedures	Core Plan, Sections 3 and 5
192.615 (b) (2)	Train Appropriate Operating Personnel	Section 9
192.615 (b) (3)	Review and Evaluate Response Personnel After Incident	Core Plan, Section 5
192.615 (c)	Establish Liaison With Local Emergency Officials	Core Plan, Section 5
192.615 (c) (1)	Learn Officials Responsibilities and Resources	Core Plan, Section 5
192.615 (c) (2)	Acquaint Officials With Emergency Response Procedures	Core Plan, Section 5
192.615 (c) (3)	Identify Types of Emergencies Where Officials are Notified	Core Plan, Section 5; Vol. 2, Section 3.5
192.615 (c) (4)	Plan for Mutual Assistance	Core Plan, Section 5
192.615 (d)	Continuing Public Education Program	Core Plan, Section 4

Occupational Safety and Health Administration
Hazardous Waste Operations and Emergency Response
29 CFR 1910.120(l)
Cross-Reference Index

29 CFR 1910.120(l) Required Sections		Location Within ERP
(2) Elements of an Emergency Response Plan		
(i)	Pre-emergency planning	Core Plan, Section 4
(ii)	Personnel roles, lines of authority, and communication	Core Plan, Section 3
(iii)	Emergency recognition and prevention	Core Plan, Section 4
(iv)	Safe distances and places of refuge	Core Plan, Section 5
(v)	Site security and control	Core Plan, Section 5
(vi)	Evacuation routes and procedures	Core Plan, Section 5
(vii)	Decontamination procedures which are not covered by the Site Safety and Health Plan	Core Plan, Section 5
(viii)	Emergency medical treatment and first aid	Core Plan, Appendix D
(ix)	Emergency alerting and response procedures	Core Plan, Section 5
(x)	Critique of response and followup	Core Plan, Section 5
(xi)	PPE and emergency equipment	Core Plan, Section 5 and 6
(3) Procedures for Handling Emergency Incidents		
(i)(A)	Site topography, layout, and prevailing weather conditions	Core Plan, Section 5
(i)(B)	Procedures for reporting incidents to local, state and federal government agencies	Core Plan, Section 5 and Zone Plan Section 12
(ii)	Site Safety and Health Plan	Core Plan, Appendix D
(iii)	Compatible with local, state, and federal agency response plans	Core Plan, Section 1
(iv)	Training and drills	Core Plan, Section 9
(v)	Periodic reviewing and updating	Core Plan, Section 1
(vi)	Employee alarm system in accordance with 29 CFR 1910.165	Core Plan, Appendix D
(vii)	Incident assessment and plan implementation	Core Plan, Section 5

Environmental Protection Agency
40 CFR 262 and 265 Subpart D
Contingency Plan and Emergency Procedures
Cross Reference Index

USEPA 40 CFR 262 and 265 Subpart D Sections	Location Within ERP
262.34 (a) (4) and 265.50 - Applicability	Core Plan, Section 1, page 7 and 8
265.51 - Purpose and implementation of contingency plan	Core Plan, Section 1, page 1 and 2
265.52 - Content of contingency plan	
(a) Actions taken in response to fires, explosions, or hazardous waste releases	Core Plan, Section 5, pages 23-25
(b) Amendments to the plan which incorporate hazardous waste management provisions.	Not Applicable
(c) Arrangements with state and local emergency response officials.	Core Plan, Section 5, Pages 38 and 39
(d) Names, addresses, and phone numbers of qualified individuals (emergency coordinators).	Core Plan, Section 1, Table 1-3 and Zone Plan, Section 11, page 1
(e) List and capabilities of all emergency equipment at facility.	Zone Plan, Section 13
(f) Evacuation plans.	Core Plan, Section 5, pages 33 and 34

INTRODUCTION

Scope and Purpose

This Emergency Response Plan (ERP) provides guidance on the immediate procedures and notifications which should be followed in an emergency situation, such as a fire, explosion, injury, or release of chemicals, hazardous substances, hazardous wastes, liquefied petroleum gases (LPG), crude oil, refined petroleum products, or gases. This plan also covers other emergencies such as terrorism, abductions, severe weather, tropical storms, tornadoes, hurricanes, dust storms, floods and earthquakes. This plan has been prepared for ExxonMobil Pipeline Company (EMPCo) in response to requirements of the Oil Pollution Act of 1990 (OPA 90) and other emergency planning requirements that are applicable to EMPCo's operations. The specific regulations under which this plan has been prepared are discussed in a subsequent section.

The focus of this plan is on EMPCo's operations, consisting of pipeline transportation and breakout storage of petroleum and petroleum products. This plan provides guidance for responding to various emergencies and releases or spills of all sizes, including small operational, moderate, and worst case discharges. Special attention has been given to significant waterways and environmental and human use sensitivities which are crossed by, or in close proximity to, the pipeline facilities and which may be affected by petroleum or chemical releases.

The ERP has three major objectives:

1. To establish safe and consistent methods for responding to, and mitigating impacts of, unplanned releases of hazardous substances, hazardous wastes, crude oil, refined petroleum products, LPG’s and chemicals from pipeline operations,

2. To comply with applicable U.S. Department of Transportation (DOT), Resource Conservation and Recovery Act (RCRA), Occupational Safety and Health Administration (OSHA), and comparable state rules and regulations governing releases of oil and hazardous materials, and

3. To comply with U.S. DOT, OSHA, RCRA, and comparable state regulations requiring written procedures for emergency operations. Rapid activation of the ERP and comprehensive knowledge of its contents are important to the success of response operations. All key personnel involved in emergency planning operations should become familiar with this plan. Copies of the ERP will be distributed to key management and response team individuals and will be maintained at selected facilities per DOT regulations (49 CFR 194).

The basic concept of the ERP is to minimize the spread of a release or the consequences of an emergency and mitigate its effects. This is best accomplished by securing the source of the release or emergency, containing a spill as close to the source as possible, protecting threatened environmentally sensitive and economically important areas, and removing the spilled material as quickly as possible.

Plan Format

The ERP is formatted to contain the majority of the background and response related information common to all response zones in this Volume 1 - Core Manual, and the more site specific information contained in each Volume 2 - Response Zone Appendix Manual. It is important to note that all Response Zone Appendix Manuals are numbered as Volume 2.

The Core Manual includes information on the following:

- Information Summary
- Qualified Individual Information
- Updating and Revision Procedures
- Certifications and Cross References
- Operations Covered by the Plan
- Emergency Response Organization
- Emergency Response Actions
- EMPCo and ExxonMobil Response Resources
- Communications System
- Public Affairs
- Training and Drills

Each Response Zone Appendix Manual contains the following information:

- Information Summary
- Commodity Characteristics
- Discharge Scenarios
- EMPRT initial response team - local organization
- EMPCo, Federal, State, and Local Notifications
- Sensitive Area Locations and Protection Measures
- Local EMPCo and Response Contractor/Cooperative Resources
- Piping Diagrams (source reference statement)

Information Summary

ExxonMobil Pipeline Company is the owner/operator of the systems described in the plan include: Bayport/Mid-Tex (PHMSA 606), Corpus Christi (PHMSA 1458), Montana (PHMSA 847), Raceland (PHMSA 843) and Sunset/Longview (PHMSA 839), and, and Mobil Pipe Line Company is the owner/operator of New England (PHMSA 98), Midwest (PHMSA 100, except for the Patoka to Joliet 18"), Corsicana (103) and Beaumont (105) and Mustang Pipeline is the owner/operator of the Patoka to Joliet 18" in the Midwest Plan (PHMSA 100) with headquarters mailing address and physical address at:

800 Bell Street, PL-EMB-603G
Houston, Texas 77002

Emergency Hotline (24 hours): 800-537-5200

Plan	Owner/Operator
Bayport/Mid-Tex (PHMSA 606)	ExxonMobil Pipeline Company
Corpus Christi (PHMSA 1458)	ExxonMobil Pipeline Company
Montana (PHMSA 847)	ExxonMobil Pipeline Company
Raceland (PHMSA 843)	ExxonMobil Pipeline Company
Sunset/Longview (PHMSA 839)	ExxonMobil Pipeline Company
New England (PHMSA 98)	Mobil Pipe Line Company
Midwest (PHMSA 100	Mobil Pipe Line Company
Corsicana (103)	Mobil Pipe Line Company
Beaumont (105)	Mobil Pipe Line Company
Patoka to Joliet 20" in the Midwest Plan (PHMSA 100)	Mustang Pipeline (Services agreement with Mobil Pipe Line Company)

EMPCo has operations in 11 geographic areas referred to as response zones. Nine of these zones contain oil and product operations which meet the criteria of 49 CFR 194 for “significant and substantial harm.” The other two zones contain systems that transport commodities that are not considered “oil” under 49 CFR 194.5. Table 1-1 provides a list of the states and parishes/counties in which each response zone is located. Table 1-2 contains a list of the pipeline sections within each response zone that have the potential to cause “significant and substantial harm” under 49 CFR 194.103 and the basis for that determination. Table 1-2A and 1-2B contain a list of systems in LPG/Chemical service in the TX Chem LPG/NGL and LA Chem/LPG Response Zones. Figure 1-1 provides a map of the entire EMPCo and Mobil Pipe Line systems and Figures 1-2 thru 1-17 provide maps of the individual response zones.

Consistency With NCP and ACPs

This ERP has been prepared and is maintained in accordance with the policies and information contained in the current NCP. The ACPs and relevant GRPs are reviewed to ensure consistency with the oil spill response sections of this ERP regarding:

- Identification of environmentally and economically sensitive areas potentially impacted by a spill,
- Descriptions of EMPCo response strategies and responsibilities, and
- Integration of EMPCo response efforts with those of the Federal, state, and local agencies.

Sections of this ERP and associated response zones pertaining to responses to hazardous chemical releases are presently not required to be consistent with the ACPs since current ACPs do not yet fully address hazardous substance releases.

The ACPs that are reviewed for this ERP include:

- EPA Region I Inland ACP PHMSA 98
- Maine and New Hampshire ACP PHMSA 98
- Rhode Island & Southeastern Massachusetts ACP PHMSA 98
- Plymouth to Salisbury MA ACP PHMSA 98
- Region V Region 5 Oil & Hazardous Substances ICP PHMSA 100
- MSO Chicago Area ACP PHMSA 100
- Region VII Integrated Contingency Plan PHMSA 100
- Region VI Regional Integrated Contingency Plan PHMSA 103, 105, 606, 839, 843, 1458
- One Gulf Plan (Including All Applicable GRP)
    - MSO New Orleans/MSD Baton Rouge, LA GRP PHMSA 839, 843
    - MSO Morgan City, LA GRP PHMSA 839, 843
    - MSO Port Arthur, TX GRP PHMSA 105, 606
    - MSO Houston/Galveston, TX GRP PHMSA 105, 606
    - MSO Corpus Christi, TX GRP PHMSA 1458
- EPA Region VIII Regional Contingency Plan PHMSA 847

Legal Requirements

This ERP has been prepared, to the extent practical, in accordance with the DOT emergency planning requirements in 49 CFR 194 (Interim Final Rule); 49 CFR 192 and 195; EPA requirements in 40 CFR 265 Subpart D; and applicable OSHA planning requirements in 29 CFR 1910.129(1). A summary of the pertinent portions of each of these regulations is provided below.

49 CFR 194 - Response Plans for Onshore Oil Pipelines

The U.S. Department of Transportation regulation was written to meet the federally mandated requirements of the Oil Pollution Act of 1990 (OPA 90) which were to improve response capabilities and minimize the environmental impact of oil discharges from pipelines. To meet those standards, the major objective of OPA 90 is to utilize effective response planning to reduce the likelihood that an accidental oil discharge will reach navigable waters. The now the Pipeline and Hazardous Materials Safety Administration (PHMSA) of the DOT is requiring operators of onshore pipelines that handle, store, or transport oil to prepare and submit response plans if they could reasonably be expected to cause either significant or substantial harm to the environment.

The required key elements of the plan include:

- Facility information summary including a list and description of response zones
- Internal and external notification procedures, and a list of contacts indicating qualified response personnel
- Spill detection and on-shore mitigation procedures
- Response activities detailing responsibilities, authority, and actions
- Training and drill procedures
- Response plan review and update procedures
- Response zone appendices outlining the information listed above

49 CFR 195.402 - *DOT Liquids Procedural Manual*

Under this DOT regulation, each pipeline operator is required to prepare and follow a manual of written procedures for conducting normal operations, maintenance activities, abnormal operations, and emergencies. This ERP and the EMPCo *DOT Liquids Procedural Manual* both address the requirements for responding to emergencies. EMPCo's *DOT Liquids Procedural Manual* should be consulted for procedures covering normal operations, maintenance activities, and abnormal operations. The Procedural Manual provides procedures for responding to specific abnormal operations which can pose a substantial threat of a Worst Case Discharge.

To ensure an adequate response to emergencies, the Procedural Manual must include the following main items:

- Data needed to analyze and report pipeline accidents in a timely manner
- Locations of pipeline facilities which present hazards to the public and a plan to minimize those hazards
- Procedures for establishing a relationship with emergency and public officials to identify responsibilities and resources in response to emergencies

49 CFR 192.615 - Emergency Plans for Gas Pipelines

Similar to the DOT requirements under 49 CFR 194 for oil pipelines and 49 CFR 195 for all liquid pipelines, 49 CFR 192.615 requires that gas pipeline operators develop written emergency procedures for incidents involving gas releases. These procedures include:

- Identification and classification of emergency incidents
- Notification and communication with local emergency officials
- Responses to specific types of emergencies
- Protection of people and property
- Restoration of pipeline operations
- Analysis of accidents and failures
- Availability of response personnel and resources

In addition to the above procedures, the pipeline operator must:

- Train appropriate operations personnel in the above procedures
- Establish liaison with local emergency officials
- Establish a public education program

29 CFR 1910.120(l) - Emergency Response Plan

This Occupational Safety and Health Administration (OSHA) regulation requires that an emergency response plan be developed and implemented to handle anticipated emergencies for all facilities and operations that involve hazardous substances. The emergency plan shall be reviewed periodically to keep all information current. The written plan must address, as a minimum, the following:

- Pre-emergency planning including emergency recognition and prevention
- Personnel roles, lines of authority, communications, and site security and control
- Emergency alerting and response procedures
- Evacuation routes, distances, procedures, and place of refuge

- Decontamination procedures not covered by the site health and safety plan
- Personal protective equipment (PPE), emergency equipment, and emergency medical treatment
- Critique of response and follow-up

In addition to the emergency elements of the plan, other items such as site conditions, reporting procedures and response rehearsals must be included in the plan. The operator shall confirm that the site emergency response plan is compatible and integrated with response plans of local, state, and federal agencies.

40 CFR 262 and 265 Subpart D - Contingency Plan and Emergency Procedures

Under U.S. Environmental Protection Agency and comparable state regulations, sites which generate greater than 220 lbs. of hazardous waste in a calendar month (any amount in Louisiana) are generally required to have a contingency plan or other written procedures which are designed to minimize hazards to human health and the environment from a release of hazardous waste. The plan must be carried out immediately whenever there is a fire, explosion, or release of hazardous waste which could threaten human health or the environment.

The required key elements of the plan include:

- Description of the actions taken by facility personnel to comply with 40 CFR 265.51 (plan implementation) and 40 CFR 265.56 (emergency response) in response to a release of hazardous waste
- Amendments to the plan to incorporate hazardous waste management provisions
- Coordination with local and state emergency response agencies
- Names, addresses, and phone numbers of qualified individuals who will act as site emergency coordinators
- List and capabilities of all emergency equipment at the facility (fire, spill control, communications, alarm, and decontamination)
- Evacuation plans

Company Policy Statements

ExxonMobil Pipeline Company responds to every emergency immediately, in order to protect people, the environment, property, and the Company. It is EMPCo's policy to conduct its business in a manner that is compatible with the balanced environmental and economic needs of the communities in which it operates. Further, it is EMPCo's policy to comply with all applicable environmental laws and regulations and apply responsible standards where laws or regulations do not exist. EMPCo is committed to continuous efforts to improve environmental performance throughout its activities. It will encourage concern and respect for the environment, emphasize every employee's responsibility in environmental performance, and ensure appropriate operating practices and training. EMPCo will communicate with the public on environmental matters and share its experience with others to facilitate improvements in industry performance

In furtherance of this policy EMPCo will:

- Work with government and industry groups to foster timely development of appropriate environmental laws and regulations, providing advice on the impact of such laws and regulations on the environment, costs, and supply.
- Manage its business with the goal of preventing incidents, and design, operate and maintain facilities to this end.
- Respond quickly and effectively to incidents resulting from its operations, cooperating with industry organizations and authorized government agencies.
- Conduct and support research to improve understanding of the impact of its business on the environment, to improve methods of environmental protection, and to enhance its capability to make operations and products compatible with the environment.
- Undertake appropriate reviews and evaluations of its operations to measure progress and to ensure compliance with this environmental policy.

Qualified Individuals

EMPCo is committed to the safety and health of its employees and the general public, to minimizing environmental damage, and to quickly responding to any emergency. Therefore, all employees have the authority to initiate an emergency response, regardless of the magnitude of the emergency or release. However, for the purpose of satisfying DOT/PHMSA and other regulatory requirements, selected EMPCo personnel have been designated as the primary and alternate qualified individuals or emergency coordinators (see Table 1-3) for each response zone. In general, the cognizant Area Supervisor will be the primary qualified individual for each response zone and the alternate will be the Field Supervisor or another person within the response zone. In addition, the designated qualified individual may be displaced by a higher management position in the event of a major incident. See Section 3.0 for more information about Qualified Individual.

Plan Updating and Revisions

Updating

The ERP is to be reviewed and updated, as needed, at least annually and/or whenever “significant or material changes” (defined by DOT-PSHMA/EPA/USCG/MMS and State jurisdictional agencies) occur to the operations that may affect EMPCo's emergency response capabilities. Significant changes shall be addressed in the ERP immediately and submitted to DOT-PSHMA/EPA and State jurisdictional agencies are required respectively.

Examples of regulatory significant/material changes to the plan include:

- Change in ownership or general response strategies.
- New facilities or extension or significant modification of a pipeline or tank into an area not previously covered by a response zone plan.
- Significant changes to worst case discharge from pipeline or tank relocation, modification or replacement, including significant changes in pump rates.
- Change in type of oil transported (if it affects response capabilities).
- Addition or deletion of response contractors (primary OSROs only).
- Emergency response procedures (if it affects response capabilities).
- Qualified individuals changes
- National Contingency Plan or Area Contingency Plan changes that significantly impact appropriate response equipment
- Response equipment (changes which materially affect response capabilities).
- Other information that may affect full implementation of the plan

The EMPCo Field Operations organization has primary responsibility for conducting a review of the plan, which includes soliciting suggestions from employees, conducting a review of past incidents and drills, and adding new requirements based on changes in legislation or government regulations. EMPCo's Safety, Health and Environment (SHE) Department will assist Field Operations with changes resulting from revised laws or regulations.

The Area Supervisors are responsible for notifying the Field Operations Emergency Preparedness and Response (EPR) staff of changes, additions, and deletions to the plan relative to their respective operational areas of responsibility. The ERP is considered a “Controlled Document” by EMPCo’s Operations Integrity Management System (OIMS) element entitled “Management of Change” (MOC). The MOC process (OIMS Element 7.A) is utilized to implement any significant changes to the ERP.

Key items of the plan that influence response capability and that should be reviewed and updated as necessary include:

- Inventories of response equipment for EMPCo and key response contractors (Zone Plan)
- Names and/or phone numbers of the key response contractors (Zone Plan)

- Names and/or phone numbers of the Response Team key personnel and cognizant regulatory agencies (Zone Plan)
- Necessary changes to response procedures identified during response training drills or exercises (Section 9)
- Revised spill/release response procedures as determined through learnings from outside research or actual spill responses (Sections 5)
- Pertinent legislative rules and regulations (Section 1)

Possible sources of input data on the above key items are:

- Training sessions or drills that generate ideas on how to improve communications, personnel notification, equipment dispatch and deployment, and the efficiency and effectiveness of the ERP
- Periodic inspections of the on-site response equipment and supplies
- Information supplied by key response contractors regarding name, phone number, equipment, or service changes
- Information supplied by regulatory agencies on changes in legislation or regulations
- Information supplied by environmental consultants or industry organizations (API, spill associations and co-ops, etc.) on release response technique developments

Re-submittal

The applicable plan must be re-submitted for approval to TRRC, PHMSA, TGLO, and EPA every five years (re-certification) or following the incorporation of significant changes into the plan. Significant changes, as defined in 49 CFR 194, are listed above.

Revision Procedures

All pages in the plan have the preparation date shown in the footer to identify when the information was last revised. Any changes to the text or figures must also include revising the date in the footer. Copies of all revised pages must be distributed to each person on the plan distribution list to ensure all copies of the ERP are current. Pen and ink changes may be made to the plan immediately for minor revisions only, such as phone numbers or minor increases or decreases in response equipment quantities. In this case, a transmittal letter is all that is required explaining the change and instructing the plan holders to enter the updated information into their copies.

Record of Plan Revisions (Revision Log)

Plan revisions or amendments will be numbered sequentially with the year and month of the revision indicated and entered on the Record of Plan Revisions page(s) behind the title page. The revised section, page number, and purpose of the revision will also be entered on the log sheet along with the initials of the individual making the revision entries. The plan and the revision process are regulatory requirements which are subject to audit. Therefore, it is essential that revisions are expeditiously and accurately inserted in the plans/manuals.

Plan Distribution

A copy of this ERP has been assigned to key EMPCo personnel and regulatory agencies. Copies of all revised or updated pages must be distributed to these parties.

Certifications

Estimates of the key response resources required to implement spill response activities for each response zone have been identified in the Vol. 2, Zone Plan. Based on these estimates, EMPCo has ensured by contract or other means the availability of resources to respond, to the maximum extent practical, to a Worst Case Discharge (WCD) or the threat of a WCD within each response zone. Initial certification/approval letters to this effect are provided in the Introduction section of this plan. Subsequent re-certification and re-submittal letters are maintained at company headquarters by the Safety, Health and Environment Department.

List of Tables

TABLE 1-1

Pipeline Response Zones

Response Zone	Counties and States Covered (crude Lines only)	
Corpus Christi - PHMSA 1458 (ExxonMobil Pipeline Co.)	Kenedy County, TX	Kleberg County, TX
	Nueces County, TX	San Patricio County, TX

Response Zone	Counties and States Covered	
Bayport / Mid-Tex - PHMSA 606 (ExxonMobil Pipeline Co.)	Austin County, TX	Bexar County, TX
	Bastrop County, TX	Brazoria County, TX
	Blanco County, TX	Caldwell County, TX
	Brazos County, TX	Fayette County, TX
	Colorado County, TX	Galveston County, TX
	Fort Bend County, TX	Grimes County, TX
	Gonzales County, TX	Hardin County, TX
	Guadalupe County, TX	Montgomery County, TX
	Harris County, TX	Travis County, TX
	Robertson County, TX	Wharton County, TX
	Waller County, TX	

Response Zone	Counties and States Covered	
Montana - PHMSA 847 (ExxonMobil Pipeline Co.)	Yellowstone County, MT	Carbon County, MT

Response Zone	Parishes and States Covered	
Raceland - PHMSA 843 (ExxonMobil Pipeline Co.)	Assumption Parish, LA	St. James Parish, LA
	Lafourche Parish, LA	Plaquemines Parish, LA
	Jefferson Parish, LA	

Response Zone	Parishes/Counties and States Covered	
SW LA - PHMSA 839 (ExxonMobil Pipeline Co.)	Asension Parish, LA	Assumption Parish, LA
	Avoyelles Parish, LA	East Baton Rouge Parish, LA
	East Feliciana Parish, LA	Iberia Parish, LA
	Iberville Parish, LA	Lafayette Parish, LA
	Point Coupee Parish, LA	Rapides Parish, LA
	St. Landry Parish, LA	St. Martin Parish, LA
	St. Mary Parish, LA	West Baton Rouge Parish, LA

Pipeline Response Zones

Response Zone	Counties and States Covered	
Beaumont - PHMSA 105 (Mobil Pipe Line Co.)	Brazos County, TX	Grimes County, TX
	Hardin County, TX	Harris County, TX
	Jasper County, TX	Jefferson County, TX
	Liberty County, TX	Montgomery County, TX
	Polk County, TX	Robertson County, TX
	Trinity County, TX	Waller County, TX

Response Zone	Counties and States Covered	
Corsicana - PHMSA 103 (Mobil Pipe Line Co.)	Bowie County, TX	Dallas County, TX
	Ellis County, TX	Falls County, TX
	Franklin County, TX	Freestone County, TX
	Gregg County, TX	Henderson County, TX
	Hill County, TX	Harrison County, TX
	Hopkins County, TX	Houston County, TX
	Kaufman County, TX	Leon County, TX
	McLennan County, TX	Navarro County, TX
	Panola County TX	Rains County, TX
	Red River County, TX	Robertson County, TX
	Sabine County TX	San Augustine
	Shelby County TX	Tarrant County, TX
	Titus County, TX	Trinity County, TX
	Van Zandt County, TX	Upshur County, TX
	Wood County, TX	
	Faulkner County, AR	Garland County, AR
	Howard County, AR	Independence County, AR
	Lawrence County, AR	Little River County, AR
	Montgomery County, AR	Pike County, AR
	Pulaski County, AR	Randolph County, AR
	Saline County, AR	Sevier County, AR
	White County, AR	
	Caddo Parish, LA	Natchitoches Parish, LA
	Red River Parish, LA	

TABLE 1-1 (Continued)

Pipeline Response Zones

Response Zone	Counties and States Covered	
New England - PHMSA 98 (Mobil Pipe Line Co.)	Cumberland County, ME	Androscroggin County, ME
	Kennebec County, ME	Waldo County, ME
	Penobscot County, ME	Bristol County, MA
	Hamden County, MA	Worcester County, MA
	Hartford County, CT	Providence County, RI

Response Zone	Counties and States Covered	
Midwest - PHMSA 100 (Mobil Pipe Line Co.)	Randolph County, IL	Perry County, IL
	Washington County, IL	Clinton County, IL
	Marion County, IL	Will County, IL
	Ripley County, MO	Carter County, MO
	Wayne County, MO	Madison County,
	Bollinger County, MO	MO Perry County, MO

Mustang Pipe Line (Joint Venture)

Response Zone	Counties and States Covered	
Midwest - PHMSA 100 (Mustang Pipe Line Co.)	Marion County, IL	Fayette County, IL
	Shelby County, IL	Moultrie County, IL
	Pratt County, IL	Champaign County, IL
	Ford County, IL	Livingston County, IL
	Kankakee County, IL	Will County, IL

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Non-OPA LPG/Chemical Zones

Response Zone	Parishes/Counties and States Covered	
Texas LPG/Chem PHMSA (N/A) (ExxonMobil Pipeline Co. & Mobil Pipe Line Co.)	Brazoria County, TX	Calhoun County, TX
	Fort Bend County, TX	Galveston County, TX
	Gregg County, TX	Harris County, TX
	Jackson County, TX	Jefferson County, TX
	Jim Wells County, TX	Kleberg County, TX
	Nueces County, TX	Orange County, TX
	Refugio County, TX	San Patricio County, TX
	Victoria County, TX	Waller County, TX
	Wood County, TX	Chambers County, TX
	Liberty County, TX	Calcasieu Parish, LA
	Cameron Parish, LA	Jefferson Davis Parish, LA

Response Zone	Parishes and States Covered	
LA LPG/Chem PHMSA (N/A) (ExxonMobil Pipeline Co.)	Ascension Parish, LA	Assumption Parish, LA
	East Baton Rouge Parish, LA	Iberia Parish, LA
	Iberville Parish, LA	St. James Parish, LA
	St. Martin Parish, LA	St. Mary Parish, LA
	W. Baton Rouge Parish, LA	

TABLE 1-2

Line Sections Applicable to 49 CFR 194

ExxonMobil Pipeline Company

TLC No.[1]	Line	Miles Pipe	ROW[2] Miles	Largest[3] Segment	Compliance Reason
Beaumont Area Response Zone					
	Corsicana to Nederland -20"	210.7			Neches River, Creeks
	Sun-Nederland to Beaumont 16" Crude	5.93			Neches River, Port Arthur Fresh Water Canal
	West Texas Gulf Junction to Beaumont 16" No Longer In Service	3.65			Neches River, Port Arthur Fresh Water Canal
Collins Area Response Zone					
	Collins 16" and T&M Terminal	124.5		12.99	Lake Pontchartrain and Mississippi River
	Chalmette, LLC to Meraux 14"	1.89		1.89	
	MOEM (Empire), LLC 14"	54.8			Mississippi River
Corpus Christi Area Response Zone					
77	Rita-Borregas (Sarita Jct.) 6" and 8"	30.7	30.7	13.41 (6")	Creek

80	Sarita-Borregas 4" and 8"	31.6	31.6	15.06	Streams
32	Alazan - Jct. on Borregas/Viola 8" **Abandoned and displaced**	17.9	17.9	17.9	Streams
42	Borregas - Viola 8" and 10"	38.6	38.6	14.75 (10")	Nueces River

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TLC No.[1]	Line	Miles Pipe	ROW[2] Miles	Largest[3] Segment	Compliance Reason
Corsicana Area Response Zone					
	Patoka to Corsicana #1-20”	656.7		31.38	Arkansas & Mississippi Rvr.
	Corsicana to Nederland #2-20”	210.7		20.79	Trinity River, Creeks
111	Navasota-Hearne Refined Products 8” and 12”	48.0	48.0	10.49	Navasota River
112	Hearne - Waco Refined Products 8”	61.5	61.5	11.06	Techuacana Creek
113	Waco- Irving Refined Products 8” and 12”	87.5	87.5	10.47	Trinity River
160	Irving - DFW Airport Refined Products 8”	13.0	13.0	9.84	Several drainage ditches
59	Hawkins - Longview 16”	29.7	29.7	11.09	Vicinity Sabine River
66	Longview-Finney 18”	63.0	63.0	28.77	Creeks

[redacted] (b) (3), (b) (7)(F)

TLC No.[1]	Line	Miles Pipe	ROW[2] Miles	Largest[3] Segment	Compliance Reason
LA Chem/LPG Area Response Zone					
See Table 1-2B					

PHMSA Sequence Number 848

[1] TLC No. = Trunk Line Chart Number	[2] ROW = Right of Way
[3] Largest Segment = longest segment of this section (in miles) which contains the largest volume between adjacent block valves	
N/A = Not Applicable	NOTE: Blank mileage will be added at a later date.

Mid-Tex/Bayport Area Response Zone					
TLC No.[1]	**Line**	**Miles Pipe**	**ROW**[2] **Miles**	**Largest**[3] **Segment**	**Compliance Reason**
63A	Webster-Baytown 16”	20.6	20.6	16.43	Armand Bayou, Houston Ship Channel
25	Moore Rd. - Baytown 20”	10.9	10.9	7.12	San Jacinto River
33, 33A	Sour Lake - (Hathaway Junction) - Hull 8” (Idle)	14.0	14.0	8.40	Streams
61	Hull - Baytown 4” and 8” (Idle)	40.1	40.1	11.43	Trinity River
34	Anahuac - Turtle Bay - Baytown 6” and 10” (Idle)	29.6	29.6	3.11	Trinity River
40, 40A	South Boiling (Danbury) Webster 4”, 6” and 8” (Sold to Salter Creek)	66.4	61.5	15.92 (8”)	San Bernard, Brazos Rivers, 1500 bbl leak in ‘88
67	Magnet - South Boiling 4” (Idle)	11.4	11.4	11.37	Canal
85	Sugarland- Pierce Jct. 4”, 8” & 10”	22.7	14.1	4.71 (10”)	Streams
87	Thompsons-Sugarland 6” and 8”	7.2	7.2	3.06 (8”)	Brazos River
93	Webster-Baytown 8”, 10”, 12”, & 16”	61.5	18.6	6.77 (10”)	Houston Ship Channel

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200	Webster Station - ARCO Receipt	0.8	0.8	0.75	Clear Creek
217	Genoa Jct. to Webster 24"	10.7 4	10.7 4	5.71	
117	Luling - San Antonio RP 6"	51.7	51.7	23.64	Guadalupe/ San Marcos Rvr
118	Luling - Austin RP 6" (Idle)	39.5	39.5	20.03	Colorado River
138	Aldine - Intercontinental Jet Fuel 6"	7.7	7.7	7.7	Drainage ditches
109	Hwy 59 - Satsuma 8", 10" Refined Products (Baytown - Satsuma R. P.)	18.1	18.1	13.35	White Oak Bayou
110	Satsuma - Navasota Refined Products 8"	40.4	40.4	10/08	Spring Creek
1A	Pierce Jct. (Friendswood) - Webster 8"	66.0	20.6	10.52	Several ditches
109	Baytown-Hwy 59 Refined Products 8"and 10" (Btn-Satsuma)	43.1	21.6	12.8 (10")	San Jacinto River

[1] TLC No. = Trunk Line Chart Number

[2] ROW = Right of Way

[3] Largest Segment = longest segment of this section (in miles) which contains the largest volume between adjacent block valves

N/A = Not Applicable NOTE: Blank mileage will be added at a later date

TABLE 1-2 (Continued)

Line Sections Applicable to 49 CFR 194

ExxonMobil Pipeline Company

TLC No.[1]	Line	Miles Pipe	ROW[2] Miles	Largest[3] Segment	Compliance Reason
Mid-Tex/Bayport Area Response Zone *(continued)*					
115	Baytown #3 - Pasadena16" Refined Products	30.4	30.4	7.01 (8")	Houston Ship Channel
116	Pierce Jct. - Colorado River 8" Refined Products (P.J. - Luling)	67.2	67.2	26.7	Brazos, Colorado Rivers
169	Baytown #3 - Pasadena 16" Refined Products (Gaso)	10.2	10.2	8.17	Houston Ship Channel & Harris County. F/C Ditch
169A	Baytown #3 - Pasadena 12" Refined Products (Dist)	10.2	10.2	4.27	Houston Ship Channel & Harris County. F/C Ditch
171	Pasadena - Colonial/Explorer 16"/36Refined Products	4.4	1.5	1.325 (36")	Could migrate to drainage ditch
Midwest Area Response Zone					
	Patoka to Corsicana #1-20"	656.7			
	N. Patoka to Mobil Junction 18"	198.8			
	Mokena to Joliet 30"	21.1			

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TLC No.[1]	Line	Miles Pipe	ROW[2] Miles	Largest[3] Segment	Compliance Reason
	Wolverine to Lockport 16"	2.96			
	Woodhaven to Dearborn 8"	15.59			
	Pine Bend to St. Paul 6" **IDLE**	12.95			
Montana Response Zone					
14	Silver Tip - Clarks Fork 12"	14.28	14.28	10.88	Clarks Fork
14	Clarks Fork - Rock Creek 12"	22.84	22.84	6.84	Rock Creek
14	Rock Creek - Laurel Terminal 12"	11.97	11.97	4.64	Yellowstone River
13	Laurel Terminal 12'-Billings Refinery	20.03	20.03	5.48	Yellowstone River

[1] TLC No. = Trunk Line Chart Number

[2] ROW = Right of Way

[3] Largest Segment = longest segment of this section (in miles) which contains the largest volume between adjacent block valves

N/A = Not Applicable NOTE: Blank mileage will be added at a later date

TABLE 1-2 (Continued)

Line Sections Applicable to 49 CFR 194

ExxonMobil Pipeline Company

TLC No.	Line	Miles Pipe	ROW[2] Miles	Largest[3] Segment	Compliance Reason
New England Area Response Zone					
	Portland to Bangor 6"	124.8		17.4	
	East Providence to Springfield 6"	84.4		11.4	
Raceland Zone					
19 & 30	GI - Little Lake - Clovelly Jct. - Larose 8" 12" & 16" (Domestic)	38.7	38.7	14.5 - 12" + 7.1 - 16"	Bayou Rigaud, Bays Lakes, & Canals
19 & 30	GI - Little Lake - Clovelly Jct. - Larose 12" & 16"	38.7	38.7	21.6 - 16"	Bayou Rigaud, Bays Lakes, & Canals
26	La Rose - Raceland 12" (Domestic)	16.8	16.8	16.7	Intracoastal Canal Bayou Lafourche
26	La Rose - Raceland 16" (Import)	16.8	16.8	16.7	Intracoastal Canal Bayou Lafourche
39	Raceland - Belle Rose 16" (Domestic)	36.1	36.1	34.9	Bayou Lafourche
39	Raceland - St. James Station - Belle Rose 16 & 20" (Import)	41.4	41.4	12.8 - 20"	Bayou Lafourche St. James Canal

30A	Clovelly - Junction on Little Lake/La Rose 16" (Import, 20") (Clovelly - Raceland)	6.7	6.7	6.7	Scully Canal
84A	Empire Terminal - Empire Station 12"	2.1	2.1	2.1 - 12"	Mississippi River
84	Empire Sta. - Jct. on Location 350 12"	4.8	4.8	4.8	Canal, Bayous
35	Ferrand Bay Platform - Lake Washington 12" (Pelican Island - Lake Washington)	11.4	11.4	11.4	Ferrand Bay
25	Lake Washington - Manila Jct. 12"	11.6	11.6	11.6	Barataria Bay
10	St. James Junction - Belle Rose 16"	10.7	10.7	10.1	Bayou Lafourche
98	LOCAP to Anchorage 24"	4.7	4.7	4.0	Mississippi River
Off 1	(b) (3), (b) (7)(F) [redacted]	≈ .5	≈ .5	---	Gulf of Mexico
Off 4	(b) (3), (b) (7)(F) [redacted])	≈ .5	≈ .5	---	Gulf of Mexico

[1] TLC No. = Trunk Line Chart Number

[2] ROW = Right of Way

[3] Largest Segment = longest segment of this section (in miles) which contains the largest volume between adjacent block valves

N/A = Not Applicable NOTE: Blank mileage will be added at a later date

TABLE 1-2 (Continued)

Line Sections Applicable to 49 CFR 194

ExxonMobil Pipeline Company

TLC No.[1]	Line	Miles Pipe	ROW[2] Miles	Largest[3] Segment	Compliance Reason
SW LA Area Response Zone					
16A	(b) (3), (b) (7)(F) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]
16B	Bunkie - Anchorage 12", 20", & 22"	66.8	66.8	31.8 -20"	Atchafalaya River
8	Cecelia - Jct. N.I./Sunset 4" (Idle)	5.7	5.7	4.9	Bayou Teche
34	Parks - Jct. New Iberia Line 4" (Idle)	2.5	2.4	1.5	Bayou Teche
1	(b) (3), (b) (7)(F) [redacted]	9.0	9.0	8.3	Bayou Tetite Anse
52	Weeks Island Station - Jct. on New Iberia Line 6" and 8"	12.7	12.7	12.7	Bayou Warehouse
53	Weeks Island Station - Jct. on New Iberia Line 4"	.9	.9	.9	Bayou Warehouse
14	Patterson Station - Jct. on New Iberia Line 8" (Idle)	3.5	3.5	3.5	Bayou Teche
4	South Bend - New Iberia 12"	36.3	36.3	15.6	Intracoastal Waterway

32	New Iberia - Sunset 12"	46.6	34.5	34.5	Bayou Teche
49	Sunset - Anchorage 16"	52.7	52.7	32.2	Atchafalaya River
	SMI 6A - South Bend (inland segment) 12"	≈10.0	≈10.0	≈10.0	Cote Blanche Bay and Gulf of Mexico
90	Baton Rouge Refinery to Texaco 16"	19.6	19.6	8.8	Miss River & Bayous
98	(b) (3), (b) (7)(F) [redacted]	(b) (3), (b) (7)(F) [redacted]	[redacted]	[redacted]	[redacted]
39A	Belle Rose-Anchorage 16-in. (Domestic and Import)	71.2	35.6	22.8	Intracoastal Waterway
	Maryland Tank Farm to BRRF 16 & 20"	5.2	5.2		Monte Sano bayou
N/A	Avery Island	N/A	N/A	N/A	Bayous
N/A	Weeks Island	N/A	N/A	N/A	Intracoastal Waterway

[1] TLC No. = Trunk Line Chart Number

[2] ROW = Right of Way

[3] Largest Segment = longest segment of this section (in miles) which contains the largest volume between adjacent block valves

N/A = Not Applicable NOTE: Blank mileage will be added at a later date

TX Chem LPG/NGL Area Response Zone
See Table 1-2A

PHMSA Sequence Number 848

TABLE 1-2A

ExxonMobil Pipeline Company

Line Segments within the Texas LPG/Chem Zone

TLC #	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF R.O.W.
199	42-562	BPU - Texas Olefins Acetone	0.73	Industrial Area
193	42-559	ECA Butene System	12.39	Interstate Highway 10, Cedar Bayou
159	42-529	Corpus Christi- Mt. Belv Dilute Propylene	30.96	City of Friendswood, Houston Ship Channel
159A	42-529	C. C. - Mt. Belv. Dil Propylene	57.46	Oyster Creek, Brazos River
187A	42-549	M.B. - BOP NGL “B” Feedline	11.05	Interstate Highway 10, Industrial Area
144	42-434	Shell Mt. Belv Propylene	18.39	(Leased to Shell)
145	42-433	Shell Mt. Belv Ethylene	18.39	(Leased to Shell)
139	42-468	Clear Lake - Bay. Crude LPG	14.17	City of Clear Lake, Houston Ship Channel

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TLC #	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF R.O.W.
195	42-571	BOP - Tex. Olefins PIP/RAF System	0.90	Industrial Area
120D	42-594	Cor. Jct. (Big 3) - Bay. Oxygen	2.76	Houston Ship Channel
206	42-487	Pasadena - Baytown Dil Propylene	9.71	Industrial and Residential Areas
198	42-462	KRGP - Oxy Chem Ethane	10.25	Line filled with Nitrogen and out of service
156	42-444	ARCO - Bay NJ TB Alcohol	11.48	Town of Lomax, Houston Ship Channel
135A	42-529	M.B. - BOP NGL “C” Feedline	24.55	Houston Ship Channel
173	42-545	PCU Poly Gr Propylene	3.36	Industrial Area
173A	42-545	PCU Poly Gr Propylene	23.49	Industrial Area, Clear Creek
173B	42-545	PCU Poly Gr Propylene	3.10	Houston Ship Channel, Industrial Area
173C	42-446	PCU Poly Gr Propylene	13.20	Cedar Bayou, Industrial Area
173E	42-545	PCU Poly Gr Propylene	0.35	Industrial Area

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TLC #	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF R.O.W.
173F	42-563	PCU Poly Gr Propylene	1.20	Industrial Area
181	42-544	PCU Chem Gr Propylene	3.20	Houston Ship Channel, Industrial Area
182	42-544	PCU Chem Gr Propylene	7.62	Town of Lomax, Clear Creek
182A	42-546	PCU Chem Gr Propylene	18.90	Texas City, Clear Creek
182C	42-546	PCU Chem Gr Propylene	0.07	Industrial Area
182D	42-582	Clear Lake G.P to Celanese Dil. P	1.56	Industrial and Residential Areas
183	42-544	PCU Chem Gr Propylene	5.63	Industrial Area
202	42-544	PCU Chem Gr Propylene	4.13	Oyster Creek, Chocolate Bayou
202A	42-544	PCU Chem Gr Propylene	38.19	City of Clute, Chocolate Bayou
210	42-544	PCU Chem Gr Propylene	18.99	Chocolate Bayou, City of Clute
212	42-544	PCU Chem Gr Propylene	9.48	City of Clear Lake, Armand Bayou
212A	42-544	PCU Chem Gr Propylene	26.40	City of Friendswood, Elementary School

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TLC #	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF R.O.W.
209	42-538	BPU Butylene System	9.71	Houston Ship Channel, Industrial Area
211	42-539	BPU Butylene System	2.98	Residential and Industrial Areas
211A	42-538	BPU Butylene System	19.07	City of Clear Lake
211B	42-539	BPU Butylene System	26.46	Clear Creek
211C	42-539	BPU Butylene System	1.51	Clear Creek
148	42-458	Clear Lake - Seadrift 8" Ethane	5.60	City of Clear Lake
146	42-596	Clear Lake - TET Propane	14.44	Houston Ship Channel, City of Clear Lake
189	42-476	Bay - Mt Belv Isobutane	10.25	Clear Creek, Industrial Area
173C	42-446	Bay - Dia Shmrk Poly Gr Propylene	13.20	Cedar Bayou, Residential and Industrial Areas
197	N/A	BOP - TET Propane System	0.20	Industrial Area
135A	42-453	King Ranch Ethane "A" Line	24.55	Houston Ship Channel, City of Clear Lake

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TLC #	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF R.O.W.
135B	42-453	King Ranch Ethane "A" Line	1.67	(Displaced with Nitrogen - Inactive)
187	42-557	King Ranch Ethane "A" Line	12.13	Goose Creek, Residential and Industrial Areas
208	42-539	ITC - BOP Cr Butadiene	6.99	Houston Ship Channel, Industrial Area
174	42-489	BOP Off Spec Ethylene	10.00	Residential and Industrial Areas
178	42-541	BOP Ethylene	4.94	Houston Ship Channel, Residential and Industrial Areas
178A	42-541	BOP Ethylene	0.22	Industrial Area
180	42-541	BOP Ethylene	6.91	Residential and Industrial Areas
179	42-541	BOP Ethylene	10.20	Town of Lomax
191	42-543	BOP Ethylene	0.89	Industrial Area
202	42-544	PCU Chem Gr Propylene	4.13	Oyster Creek, Chocolate Bayou
202A	42-544	PCU Chem Gr Propylene	38.19	City of Clute, Chocolate Bayou
191A	42-543	BOP Ethylene	1.69	Industrial Area

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TLC #	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF R.O.W.
213	42-490	BOP Ethylene	10.04	Industrial Area
170	42-531	BOP - Goodyear Butadiene	12.31	Residential and Industrial Areas
204	42-547	BOP - Goodyear Butadiene	56.01	Trinity River, Interstate Highway 10, and Industrial Area
204A	42-547	BOP - Goodyear Butadiene	20.10	Industrial Area
204B	42-547	BOP - Goodyear Butadiene	12.94	Neches River, Industrial Area
204C	42-547	BOP - Goodyear Butadiene	1.78	Industrial Area
207	42-531	BOP - ITC Butadiene	6.86	Houston Ship Channel
204D	42-547	BOP - Goodyear Butadiene	1.62	Industrial Area
190	42-556	Baytown - D. S. Chem Gr Propylene	0.99	Industrial Area
107	42-382	King Ranch to Viola LPG Line	41.88	Residential, Ranching and Industrial Areas
91	42-569	Viola to Corpus Christi LPG Line	6.47	Residential and Industrial Areas

PHMSA Sequence Number 848

TLC #	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF R.O.W.
120	42-597	Corr. Jct. to Praxair Nitrogen	3.26	None, Nitrogen is not regulated
120A	42-597	Baytown to Pasa. Nitrogen	11.37	None, Nitrogen is not regulated
120B	42-597	Baytown - DuPont Nitrogen	2.36	None, Nitrogen is not regulated
120C	42-597	Extension to Armco Nitrogen	1.00	None, Nitrogen is not regulated
120F	42-597	Praxair to Phibro Nitrogen	0.71	None, Nitrogen is not regulated
120G	42-597	Lateral to Geon, Fina, Oxy Nitrogen	0.50	None, Nitrogen is not regulated
98A	42-460	Hawkins to London 3" LPG	28.51	Sabine River, Residential and Industrial
98A	42-461	Hawkins to London E/P Mix	28.51	Sabine River, Residential and Industrial Areas
42A	42-570	King Ranch to Coastal States	46.00	Residential and Industrial Areas
203	42-485	Katy to Baytown LPG (Inactive)	32.06	IH 45, Residential and Industrial Areas
174A	42-548	N. Main to Groves 8" Ethylene	66.01	Industrial Area, Cedar Bayou, Trinity River, Interstate Highway 10

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TLC #	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF R.O.W.
205	42-486	Dia. Shamrock to Mt. Belv. P/P Mix	1.18	Industrial Area
214	42-581	Enterprise to ECA MBPP	1.11	Industrial Area
215	42-588	South Texas Ethane System	128.57	Nueces River, Aransas River, San Antonio River, Guadalupe River, Garcitas Creek
215A	42-575	South Texas Ethane System	106.95	Lavaca River, Colorado River, San Bernard River, Brazos River, Clear Creek
215B	42-575	South Texas Ethane System	10.83	Armand Bayou
215C	42-575	South Texas Ethane System	9.86	Residential Areas
216	42-574	8” Ethane System	46.59	Brazos River
218	42-579	10” Ethylene	0.76	Industrial Area
219	42-589	Dilute Propylene System	5.68	Industrial Area
219A	42-589	Dilute Propylene System	19.76	Nueces River, Nueces Bay, Industrial and Residential Areas

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TLC #	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF R.O.W.
219B	42-589	Dilute Propylene System	79.16	Aransas River, Guadalupe River, Garcitas Creek, Industrial and Residential Areas
219C	42-453	8" Ethane System	109.59	Lavaca River, Blue Creek, Colorado River, San Bernard River, Brazos River, Oyster Creek, Clear Creek, Industrial and Residential Areas
220	42-590	South Texas Ethane System	10.31	Cedar Bayou, Industrial and Residential Areas
222	42-572	Dia. Shamrock - Trident Ethane	0.59	Industrial Area
223	42-584	Dia Shrk East - Dia Shrk West NGL System	1.54	Industrial Area
224	42-549	6" NGL "B" Feed Line	1.30	Industrial Area
92A		Viola-Ingleside 16" Dilute Propylene)	19.76	Nueces River
63		Ingleside to Vanderbilt 16" Dilute Propylene	79.16	Aransas, Mission, & Guadalupe Rivers
63A		Vanderbilt to Webster 16"	107	Lavaca, Colorado, San Bernard, & Brazos Rivers

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TLC #	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF R.O.W.
		Dilute Propylene)		
		MR-7 Hull to Daisetta Butane 8"	1.6	Schools, roads and highways
		MR-8 Hull to Daisetta Butane 8"	1.6	Schools, roads and highways
		MR-9 Hull to Daisetta Propane 8"	1.6	Schools, roads and highways
		MR-10 Hull to Daisetta Propane 8"	1.6	Schools, roads and highways
		MR-11 Hull to Daisetta Propane 8"	1.6	Schools, roads and highways
		MR-12 Hull to Daisetta Butane 12"	1.6	Schools, roads and highways
		MR-13 Hull to LPG 12"	1.6	Schools, roads and highways

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TABLE 1-2 B
ExxonMobil Pipeline Company
LINE SEGMENTS WITHIN LOUISIANA LPG/CHEM ZONE

TLC #[1]	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF ROW
La. 57	17-547	Blue Water Ethane - Exxon Chemical (Ethane) 8”	6.81	Miss. River/Intracoastal Waterway/Hwy.I-10
La. 57A	17-537	Baton Rouge - Choctaw Dome (LPG) 6”	14.98	Miss. River/Intracoastal Waterway/ Hwy.I-10
La. 57B	17-535	Jct. On 537 - Dow Plant Terminal (E/P Mix) 6”	2.95	Miss. River/State Highway 1
La. 58	17-534	Baton Rouge Ref. - Sorrento (Propane) 8”	42.92	Miss. River/Intracoastal Waterway
(b) (3), (b) (7)(F) [redacted]				
La. 61	17-594	Baton Rouge Ref. - Dixie 6” LPG	8.12	Monte Sano Bayou/City of Scotlandville
La. 62	17-538	Garden City - Baton Rouge (LPG) 4”,6”, & 8”	47.52	Miss. River/Highway 1
La. 62	17-543	Garden City - Baton Rouge (LPG) 8” **(Sunset end)**	9.23	Atchafalaya River
(b) (3), (b) (7)(F) [redacted]				
La. 66	17-540	Jct. on B. R. Exxon Chem - Allied (Ethylene) 2,3,&4”	1.46	State Highway 61

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TLC # [1]	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF ROW
La. 70	17-532	Baton Rouge Ref. - Sorrento (Butane) 12”	43.22	Miss. River/ICWaterway/Hunt Prison
La. 71	17-530	Baton Rouge Ref. - Choctaw (Dilute Propylene) 8”	15.78	Miss. River/Intracoastal Waterway/ Hwy.I-10
La. 72	17-529	Baton Rouge Ref. - Choctaw (Ethylene) 8”	0.97	Miss. River
La. 74	17-526	Jct. On 530 to Dow Choctaw Plant (Ethylene) 6”	3.44	Subdivision on Hwy 1148
La. 75	17-390	Multiple line Miss. Crossing at BRRF	4.91	Miss. River
La. 76	17-579	Jct. On 530 to Copolymer Meter Station (Ethylene) 4”	5.20	State Highway 1
La. 77	17-544	Allied - Vulcan - Goodrich (Ethylene) 6”	5.85	Industrial Plants in Geismar
La. 77	17-545	Allied - Vulcan Jct. on 544 (Ethylene) 4”	.36	Industrial Plants in Geismar
La. 77A	17-549	Vulcan - Occidental (Ethylene) 6”	15.79	St. James Canal
(b) (3), (b) (7)(F) [redacted]				
La. 79	17-551	Napoleonville - Jct. On 548 (Ethylene) 8”	19.04	Bayou Crouix
La. 80	17-550	DOW - Westbank Chemical Butadiene	14.83	Miss. River/Intracoastal Waterway/ Hwy.I-10
La. 85	17-394	Baton Rouge Ref. - Cryo GP - B.R. Ref'y	2.86	Miss. River
La. 87	17-528	Baton Rouge Ref. - Choctaw (Ethylene) 12”	15.57	Miss. River/Intracoastal Waterway/ Hwy.I-10

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TLC # [1]	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF ROW
La. 88	17-542	Baton Rouge Chem Plant - Sorrento 6" (4" lateral)	0.95	
[redacted] (b) (3), (b) (7)(F)				
La. 92	17-534	Baton Rouge Ref. - Sorrento (Propane) 4"	42.92	Miss. River/Intracoastal Waterway
La. 93	17-534	Baton Rouge Ref. - Sorrento (Butane) 4"	42.92	Miss. River/Intracoastal Waterway
La. 94	17-542	Baton Rouge Ref. - Sorrento (Propylene) 6"	42.92	Miss. River/Intracoastal Waterway
[redacted] (b) (3), (b) (7)(F)				
La. 75	17-553	Baton Rouge Refined Butadiene System		Miss. River
La. 75	17-390	Baton Rouge Ref. - Big Three (Nitrogen) 10"	.70	Miss. River
La. 75	17-390	Baton Rouge Ref. - Big Three (Oxygen) 6"	.70	Miss. River
[redacted] (b) (3), (b) (7)(F)				
	17-557	Sorrento Dome to PCU (Dilute Propylene) 12"	≈11	Miss. River
	17-558	Sorrento Dome to ECA Fractionator (Raw make) 12"	≈30	Miss. River/Intracoastal Waterway

[redacted] (b) (3), (b) (7)(F)

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TLC #[1]	LOC.CODE	SYSTEM NAME	PIPE MILES	SENSITIVITY IN VICINITY OF ROW
[redacted]				
Al/FL 2	01-526	Jay - L & N R.R. Loading Rack (LPG) 2-6"	8.50	Escambia River/AL&FL State Line

[1] **TLC # means EMPCo's "Trunk Line Chart Number" which is used to reference piping diagrams or schematic sketches of specific pipeline section or segments which are also indexed and cross referenced by EMPCo Location (Loc) Code numbers.**

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TABLE 1-3

QUALIFIED INDIVIDUALS

See Zone Plans

Section 2. Operations Covered By Plan

In This Section

OPERATIONS COVERED BY PLAN

ExxonMobil Pipeline System

EMPCo's operations cover eleven states (Arkansas, Connecticut, Illinois, Louisiana, Maine, Massachusetts, Michigan, Missouri, Montana, Rhode Island, and Texas). These operations are divided into eleven response zones (including LPG and Chemical Operations). EMPCo Field Operations Management, Engineering, and Safety, Health and Environment (SHE) Departments are located in Houston, Texas, while Field Operations and maintenance personnel are located in field offices within the response zones. Figure 1-1, which is located in Section 1.0, shows the locations of EMPCo facilities and response zones. Addresses of field offices for response zones are provided in Table 2-1.

The stations operated by EMPCo consist primarily of breakout tankage and manifolding, sampling, and pumping facilities. EMPCo Distribution Terminals operate barge, truck and rail operations which are covered by USCG and EPA Jurisdictional Facility Response Plans (FRP) and in some case also address DOT regulations when applicable.

EMPCo may also be an "episodic" generator of hazardous waste, in most cases a "small quantity generator" or "conditionally exempt small quantity generator".

The EMPCo system transports crude oil, refined products, highly volatile liquids, liquefied petroleum gases, and chemicals. The principle commodities transported by EMPCo pipeline systems are:

Acetone	Gasoline
Benzene	Heating oil
Butadiene (crude and product)	Natural gas liquids (NGL)
Butane (normal and Iso)	Nitrogen
Butylene (Including Mixed)	Oxygen
Condensate (sweet and sour)	Pentane
Crude oil (sweet, intermediate and sour)	Propane
Diesel fuel	Propylene (Dilute, Chem., Poly)
Distillate - heavy plant (HPD)	Raffinate
Distillate - light plant (LPD)	Resins

Ethane	T-Butyl alcohol (TBA)
Ethane/Propane Mix	Turbo fuel (TFA-1)
Ethylene	Varsol
Fuel oil	

A summary of the characteristics and potential hazards of each of these commodities is provided in Table 2-2.

Response Zones

General descriptions of EMPCo's eleven response zones are provided below. LPG/Chemical pipeline sections are also listed in Tables 1-2A and 1-2B. Additional information on the individual response zone operations is provided in the respective Response Zone Appendices (Volume 2).

Beaumont Zone

The Beaumont Zone includes 2 pipeline sections within the primary geographic response area. All of the pipelines are dedicated to transporting crude oil. There are approximately 103 miles of pipelines ranging from 20 inches to 16 inches in diameter. The worst case discharge has been calculated at [redacted] resulting in a break in the [redacted]. There are no tanks in the response zone.

Corpus Christi Zone

The Corpus Christi Zone includes 3 pipeline sections with the potential to cause "significant and substantial environmental harm". The pipeline sections are dedicated to the transportation of crude oil. There are approximately 125 miles of pipelines ranging from 4 to 10 inches in diameter. [redacted]rude oil resulting from a break in the [redacted]

Corsicana Zone

The Corsicana Zone includes 10 pipeline sections within the primary geographic response area. The pipelines are dedicated to transporting crude oil and refined products. There are over 1043 miles of pipelines ranging from 8 to 22 inches in diameter. The worst case discharge has been calculated at (b) (3), (b) (7)(F) [redacted].

Bayport/Mid-Tex Zone

The Mid-Tex Zone includes 23 pipeline sections with the potential to cause "significant and substantial environmental harm". The pipeline sections are dedicated to the transportation of crude oil and refined products. The pipelines in this section range from 4 to 26 inches in diameter. The worst case discharge has been calculated at (b) (3), (b) (7)(F) [redacted] (b) (3), (b) (7)(F)

Mid West Zone

The Mid West Zone includes 6 pipeline sections within the primary geographic response area. All of the pipelines are dedicated to transporting crude oil and refined products. There are approximately 1350 miles of pipelines ranging from 6 to 30 inches in diameter. The worst case discharge has been calculated at (b) (3), (b) (7)(F) [redacted]

Montana Zone

The Montana Zone includes 4 pipeline sections with the potential to cause "significant and substantial environmental harm". These sections are approximately 70 miles in length and all are 12 inches in diameter. (b) (3), (b) (7)(F) [redacted] ion.

New England Zone

The New England Zone includes 2 pipeline sections within the primary geographic response area. All of the pipelines are dedicated to transporting refined products (gasoline and fuel oil) There are approximately 210 miles of 6-inch diameter pipelines. The worst case discharge has been calculated at (b) (3), (b) (7)(F) [redacted]

Raceland Zone

The Raceland Zone includes 15 pipeline sections with the potential to cause "significant and substantial environmental harm". These approximately 231 miles of pipeline range from 8 to 24 inches in diameter. The worst case discharge has been calculated to (b) (3), (b) (7)(F) [redacted]

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(b) (3), (b) (7)(F) [redacted]

SW Louisiana Zone

The SW Louisiana Zone consists of 16 pipeline sections or gathering systems with the potential to cause "significant and substantial environmental harm". These approximately 896 miles of pipeline transport crude oil and distillates that range from 4 to 24 inches in diameter. The Worst Case Discharge has been calculated at (b) (3), (b) (7)(F) [redacted].

Louisiana LPG/Chemical Zone (non-OPA 90)

The Louisiana LPG/Chemical Zone includes 43 pipeline segments in the primary geographic response area. This response zone plan also addresses part of a pipeline sections which extends into another geographic area known as the Sunset operating area. These pipelines are dedicated to transporting LPG's, HVL's, and chemicals. There are approximately 518 miles of pipelines ranging from 4 to 12 inches in diameter.

Texas LPG/Chemical Zone (non-OPA 90)

The Texas LPG/Chemical Zone includes 95 pipeline segments in the primary geographic response area. This response zone plan also addresses 1 pipeline section which is located in another geographic area known as the Corsicana operating area, and 3 pipeline sections located in the geographic area known as the Corpus Christi operating area. These pipelines are dedicated to transporting LPG's, HVL's, and chemicals. There are approximately 1,102 miles of pipelines ranging from 3 to 16 inches in diameter.

TABLE 2-1

Pipeline Response Zone Information

Response Zone	Area Operator Address
Beaumont	15651 West Port Arthur Road Beaumont, Texas 77705 Phone No: 409-719-4392 Fax No: 409-722-7783
Corpus Christi	1638 N. Lexington Corpus Christi, TX 78409 Phone No: 361-289-7028 Fax No: 361-289-7026
Corsicana	P.O. Box 618 1604 South 15th St. Corsicana, TX 75110 Phone No: 903-654-5331 Fax No: 903-654-5302 Longview Area Office 1202 Morgan Street Longview, Texas 75602-2148 Phone No: 903-236-8127 Fax No: 903-236-8112
Mid-Tex / Bayport	Friendswood Office (Main Office) 301-A Old Choate Road Houston, Texas 77034 Phone No: 281-925-3870 Fax No: 281-925-3786
Mid West	8328 U. S. Hwy 51 Patoka, IL 62881 Phone No: 618-432-5953 Fax No: 618-432-7799
Montana	607 ExxonMobil Refinery Road Billings, Montana 59101 Phone No: 406-657-5400 Fax No: 406-657-5403
New England	170 Lincoln Street South Portland, ME 04106 Phone: 207-741-2403 Fax No: 207-767-3253 104 Main St. East Douglas, MA 01516 Phone No: 508-476-3054 Fax No: 508-476-2230

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Pipeline Response Zone Information

Response Zone	Area Operator Address
Raceland	4037 Highway 308 Raceland, Louisiana 70394 Phone No: 504-537-4800 Fax No: 504-537-4825
SW Louisiana	Sunset Area Office 1676 Napoleon Ave., Highway 182 South Sunset, LA 70584 –0908 Phone No: 337-269-5362 Fax No: 337-662-5950
Louisiana LPG/Chem. (Baton Rouge Office)	18440 Highland Road Baton Rouge, Louisiana 70809-6105 Phone No: 225-977-4660 Fax No: 225-755-2422
Texas LPG/Chem. (Baytown Office)	Friendswood Office (Main Office) 301-A Old Choate Road Houston, Texas 77034 Phone No: 281-925-3870 Fax No: 281-925-3786

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TABLE 2-2
Summary of Commodity Characteristics

Common Name	MSDS Name	Health Hazard	Flash Point	Special Hazard	Reactivity	Health Hazard Warning Statement
Acetone	Acetone	1	3	----	0	17 Causes eye, skin, and respiratory irritation.
Benzene	Benzene	2	3	C	0	4 Contains benzene, may cause cancer; blood system damage.
Butadiene	Butadiene (Crude & Refined)	2	4	C	2	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite. 21 Liquid causes severe frost bite or burn.
Butane	Butane (Normal & Iso)	1	4	A,P	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Butylene	Butylene Butene	1	4	----	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Condensate (Sweet)	Condensate (Sweet)	1	3	C	0	2 Long term, repeated exposure may cause cancer and blood and nervous system damage.
Condensate (Sour)	Condensate (Sour)	1	3	C,H_2S	0	5 Contains hydrogen sulfide (H_2S), inhalation of H_2S is fatal. 2 Long term, repeated exposure may cause cancer and blood and nervous system damage. 4 Contains benzene, cancer hazard.
Crude Oil (Flash Point 100F)	Crude Oil (Sweet)	1	3	C	0	3 Long term, repeated exposure may cause skin cancer. 4 Contains benzene, cancer hazard
Crude Oil (Flash Point 100-200F)	Crude Oil (Intermediate)	1	2	C	0	3 Long term, repeated exposure may cause skin cancer. 4 Contains benzene, may cause cancer, blood system damage.

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TABLE 2-2
Summary of Commodity Characteristics

Common Name	MSDS Name	Health Hazard	Flash Point	Special Hazard	Reactivity	Health Hazard Warning Statement
Crude Oil Sour (Flash Point 100-200F)	Crude Oil (Sour)	1	2	C,H_2S	0	5 Contains hydrogen sulfide (H_2S), inhalation of H_2S is fatal. 3 Long term, repeated exposure may cause skin cancer. 4 Contains benzene, cancer hazard
Diesel Fuel	Diesel Fuel	0	2	C	0	3 Long term, repeated exposure may cause skin cancer.
Distillate - Heavy Plant	Distillate	0	2	C	0	3 Long term, repeated exposure may cause skin cancer.
Distillate - Light Plant	Distillate	0	2	C	0	3 Long term, repeated exposure may cause skin cancer.
Ethane	Ethane	1	4	A	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Ethane - Propane Mix	EP Mix	1	4	A, P	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Ethylene	Ethylene	1	4	A	2	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Fuel Oil	Fuel Oil	1	2	C, T	0	16 May form hydrogen sulfide (H2S) when heated, inhalation of H2S may be fatal.
Gasoline	Appropriate Product Name	1	3	C	0	18 Long term, repeated exposure may cause cancer, blood, kidney and nervous system damage, contains benzene.
Heating Oil	Appropriate Product Name	0	2	C	0	3 Long term, repeated exposure may cause skin cancer.

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TABLE 2-2
Summary of Commodity Characteristics

Common Name	MSDS Name	Health Hazard	Flash Point	Special Hazard	Reactivity	Health Hazard Warning Statement
Hydrogen	Hydrogen	0	4	A	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite. Invisable flame
Natuarl Gas	Methane	1	4	A	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite. Invisable flame
Natural Gas Liquids (NGL)	Natural Gas Liquids	1	3	C	0	2 Long term, repeated exposure may cause cancer and blood and nervous system damage. 4 Contains benzene, may cause cancer, blood system damage.
Nitrogen	Nitrogen	1	0	A, P	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Oxygen	Oxygen	1	0	OX, P	0	21 Liquid causes severe frost bite or burn.
Pentane	Normal Pentane	1	4	----	0	--------
Propane	Propane	1	4	A, P	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Propylene (Poly, Dilute, and Chemical Grade	Propylene	1	4	A, P	1	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Raffinate	Raffinate	1	4	----	0	17 Causes eye, skin, and respiratory irritation.

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TABLE 2-2
Summary of Commodity Characteristics

Common Name	MSDS Name	Health Hazard	Flash Point	Special Hazard	Reactivity	Health Hazard Warning Statement
Petroleum Resins Concentrate	Resins	4	4	A, C	4	17 Causes eye, skin, and respiratory irritation.
Tertiary Butyl Alcohol (TBA)	Tertiary Butyl Alcohol	1	3	----	0	--------
Turbo Fuel A (TFA-1)	Turbo Fuel	0	2	C	0	3 Long term, repeated exposure may cause skin cancer.
Varsol	Varsol					

Health Hazard	4 = Extremely Hazardous 3 = Hazardous 2 = Warning 1 = Slightly Hazardous 0 = No Unusual Hazard	**Fire Hazard (Flash Point)**	4 = Below 73°F, 22°C 3 = Below 100°F, 37°C 2 = Below 200°F, 93°C 1 = Above 200°F, 93°C 0 = Will Not Burn
Special Hazard	A = Asphyxiant C = Contains Carcinogen W = Reacts with Water Y = Radiation Hazard COR = Corrosive OX = Oxidizer H_2S = Hydrogen Sulfide P = Contents under Pressure T = Hot Material	**Reactivity Hazard**	4 = May Detonate at Room Temperature 3 = May Detonate with Heat or Shock 2 = Violent Chemical Change with High Temperature & Pressure 1 = Not Stable if heated 0 = Stable

Note: For more detailed hazard information about these commodities, refer to "EMPCo's Hazard Communication Manual", OSHA Regulation 29 CFR 1910.1200 and/or the latest MSDS sheets.

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Section 3. Spill Response Organization

In This Section

PHMSA Sequence Number 848

SPILL RESPONSE ORGANIZATION

SPILL RESPONSE ORGANIZATION

General

The purpose of this section is to describe the organizational structure used by ExxonMobil Pipeline Company (EMPCo) to manage emergency incidents. This section also describes the pre-designated relationships between the response organizations of EMPCo and ExxonMobil Company, (ExxonMobil). EMPCo is a member of the ExxonMobil tiered response system, whereby EMPCo can activate through ExxonMobil additional resources to assist with the effective management of major spills/releases or other emergency incidents.

EMPCo's Incident Command System

Although many similarities exist between normal business management and emergency management, several factors make emergency management more difficult. Critical factors common to most emergency management situations are urgency and danger. Without an effective incident management system to organize and coordinate all of the necessary activities and resources of an incident, chaos would result. Therefore, a systematic management approach must be utilized to safely and efficiently control the emergency activities of all personnel and resources responding to an incident.

Regulations and standards such as the National Contingency Plan (NCP), the Superfund Amendments and Reauthorization Act of 1986 (SARA), the Occupational Safety & Health Administration (OSHA), and the National Fire Protection Association (NFPA), require organizations handling hazardous materials incidents and fire emergencies to operate within an Incident Command System (ICS) management system.

EMPCo has adopted an Incident Command System compliant with applicable regulations for managing emergency incidents. EMPCo utilizes a site-specific ICS which is compatible with the National Incident Management System (NIMS) standardized version of ICS. NIMS based ICS is preferred and practiced by most federal and state agencies and many other organizations involved in emergency management.

The ICS is recognized as a documented system that has been successfully used in managing available and necessary resources at emergency incidents throughout the USA. The system consists of commonly acceptable procedures for controlling personnel, equipment, and communications during emergency situations. The ICS is designated to effectively command and control an emergency situation, regardless of the nature or the size of the incident.

ICS encompasses such activities as:

- Assessing the emergency situation
- Determining an appropriate incident action plan
- Organizational structure to implement the incident action plan
- Assessing available/necessary resources and deploying them effectively
- Monitoring the plan's effectiveness and continually modifying the plan to meet changing needs
- Internal/external communications

Some of the basic components of the ICS concept are:

- Common terminology
- Modular organization depicted by a standardized organization chart
- Integrated communications
- Consolidated action plans
- Manageable spans of control (chain of command whereby small work groups report to one leader who reports upward).
- Comprehensive resource management
- Unified command structure (when applicable)

The Unified Command Structure (UCS) is a mode or method of ICS generally required when an incident involves an emergency where local, state, and federal agencies have multi-jurisdictional responsibility. EMPCo subscribes to the UCS, which promotes collaboration between EMPCo, regulatory agencies, and other public organizations impacted by the incident. It brings appropriate incident decision makers together on a regular basis to make command-level decisions. In a UCS, representatives from the lead federal (Federal On-Scene Coordinator) and the lead state (State On-Scene Coordinator) agencies, and possibly other local agencies will work with EMPCo's Incident Commander to make decisions regarding incident response and emergency management issues including:

- Determining overall incident objectives

- Selection of strategies and priorities
- Ensuring that joint planning for tactical activities will be accomplished
- Making maximum use of all available resources

The UCS concept promotes uniform procedures that enable all applicable emergency response agencies and EMPCo to reach a "common ground" from which to jointly coordinate the command of an incident response. The involvement of senior representatives from each entity can facilitate quick high-level emergency actions being executed without delays.

The ICS also facilitates the compiling and management of pertinent incident information by promoting standardized forms to document and disseminate incident data. EMPCo uses ICS forms which are consistent with Strike Team-ICS forms and NIMS-ICS based doctrines. EMPCo's ICS forms are electronically retrievable on EMPCo's Local Area Network (LAN) computer system. The "ICS Forms" computer files are located on LAN in EMPCo Headquarters' Group Directory titled "Emergency Response Plan".

ExxonMobil Response Organization and Interactions

The ExxonMobil Pipeline Response Team (EMPRT) consists of trained personnel that will respond to all EMPCo emergency incidents. The EMPRT will be supplemented, as required, by ExxonMobil Company's tiered response system consisting of regional ExxonMobil Strike Teams and the national ExxonMobil North America Regional Response Team (NARRT); descriptions of both teams are included in this section.

The various response teams are activated progressively depending on the size, severity, and circumstances of the spill/release. The EMPRT will generally conduct all response activities for small to medium releases and the initial response for larger releases. Technical and operational assistance from the nearest Strike Team will generally be required for many medium to large spills and support from the NARRT for the largest spills. Each response team's general role and responsibility is as follows:

- **ExxonMobil Pipeline Response Team (EMPRT) -** Composed of employees trained to implement the initial response to all spills/releases. For small incidents, local personnel will generally execute all containment, recovery, and cleanup activities. For larger incidents, the EMPRT may include EMPCo employees from beyond the local geographic area. (Category I spills as defined in Table 3-1).
- **ExxonMobil's Strike Teams -** For spills that exceed the response capability of the EMPRT (Categories II and III releases as defined in Table 3-1), the appropriate regional Strike Team will be activated and provide

additional response capabilities (equipment and personnel support) as necessary. The Strike Team consists of trained personnel from various ExxonMobil functions within the particular geographic region.

- **ExxonMobil North America Regional Response Team (NARRT)** - For high profile and/or significant releases exceeding the capabilities of the combined EMPRT and Strike Team organizations (Category III releases as defined in Table 3-1), the NARRT can be activated to provide supplemental response and technical support capabilities. The NARRT may be mobilized in its entirety or in "as-needed" components depending on the situation. The NARRT consists of managers and other specialists from ExxonMobil and affiliates nationwide. It is not expected that any spill from EMPCo's operations will require a response by the NARRT.

The EMPRT-ICS organizational chart is provided in Figure 3-1 and the general relationship between the various EMPCo and ExxonMobil response teams is illustrated in Figure 3-2.

Response Levels and Team Structure

The extent to which the EMPCo and ExxonMobil response teams may be activated for an emergency incident will depend primarily on the severity and circumstances of the incident. As a general guideline, oil spill and HVL/chemical release incidents have been divided into three categories, each with different levels of severity and response resource requirements. These categories are summarized in Table 3-1. It is important to note that these response teams do not operate independently but will successively supplement the capabilities of the previous team with personnel of higher authority and expanded expertise. All teams have similar organizational structures to facilitate transfers of command and to ensure a "seamless interface". For example, during transition from an EMPRT managed response to a Strike Team response, personnel from both teams will work together until the Strike Team personnel are "up to speed" on the current status of the response. Response momentum will be maintained during the transition and then accelerated soon after the transition into the larger team with greater capabilities.

In some cases, EMPRT personnel will be used to staff selected Strike Team positions and, similarly, Strike Team personnel may be used to staff NARRT positions. A catastrophic release could require the simultaneous involvement of all three teams, which will function as a single organization to maximize response effectiveness.

For most emergencies, the "Qualified Individual" (QI) of the affected Response Zone Plan will be the Implementer of the Emergency Response Plan. If the incident's consequences escalate, the QI will usually be relieved by EMPCo personnel with successively greater management and financial authority to ensure an effective and efficient response. Ultimately if required, EMPCo's highest level of management qualified will assume the responsibilities of the Incident Commander. For larger incidents involving Strike Team or NARRT activation (Category II or III), the EMPRT Incident Commander may continue to function as the Incident Commander for the Strike Team and NARRT organizations.

The EMPRT response capability is described in considerable detail in this section. However, only limited information is provided for the Strike Team and NARRT response capabilities as they are external organizations and will supplement EMPCo operations where needed.

Qualified Individual

The term "Qualified Individual" (QI) has a specific meaning in the context of this plan as required by the Oil Pollution Act of 1990 (OPA-90). The OPA-90 regulations mandate that each operator required to maintain a response plan designate a Qualified Individual who is the operator's representative with full authority to implement response actions within the geographic zone of the plan. The Qualified Individual is also the Emergency Coordinator for purposes of hazardous waste related emergency response.

EMPCo has identified in each response zone of the Emergency Response Plan a QI who is available on a 24-hour basis, and is familiar with facilities and operations in their perspective Areas and with the Emergency Response Plan, and has been trained in the responsibilities of a QI/Incident Commander. In addition, the QI has full authority to implement this response plan, including:

- Activating company maintained personnel and equipment
- Activating and engaging in contracting with identified oil spill removal organization(s)
- Acting as the company representative with the pre-designated Federal On-Scene Coordinator (FOSC), and the State On-Scene Coordinator (SOSC)
- Obligating, either directly or through prearranged means, funds required to carry out all required or directed response activities

The respective Area Supervisor (except in the Montana Response Zone Plan) is designated as the primary Qualified Individual (QI) for each of EMPCo's geographic Response Zone Plans. Generally, the local individual prescribed as the relief person for the Area Supervisor is designated as the alternate Qualified Individual. A list of names and contact numbers for the primary and alternate Qualified Individuals for each response zone is included in Table 1-3, located in Section 1.0.

All Qualified Individuals may be superseded by higher management personnel based on the nature of the incident so that the QI remains authorized to obligate sufficient funds required by the incident response. However, all EMPCo employees have the authority to initiate an emergency response regardless of the magnitude of the emergency.

In Incident Command System terminology, Incident Commander has a generally similar meaning and role as the regulatory term of Qualified Individual.

EMPRT's ICS Organization and Function

This section outlines the main features of EMPCo's Incident Command System. The ICS categorizes emergency management into five (5) standardized major activities. These activities or groups working together compose a modular organization and are known as:

- COMMAND
- OPERATIONS
- PLANNING/TECHNICAL
- LOGISTICS
- FINANCE/ADMINISTRATION

The ICS standard functional designations of the ExxonMobil Pipeline Response Team (EMPRT) organization are described below. The functional levels of response (modules of people and resources) utilized to respond to an incident will greatly depend on the size and complexity of the incident.

The function of **COMMAND** is the overall management of the incident. The Incident Commander (IC) is the primary EMPCo management representative for the incident. Command will determine the incident's response objectives, strategies, and priorities. Command may manage the overall incident response utilizing an infrastructure of a "Command Staff" and four subdivisions of responsibility known as "General Staff". The IC will assume all activities and positions not delegated to other individuals. Delegation of authority, however, does not relieve command from overall responsibility.

Command Staff are individuals delegated to assist Command in providing important functions and services. The Command Staff is composed of delegates known as "Officers". The primary prescribed responsibilities of the Command Staff are; Safety, Information, and Liaison. The IC may also utilize special management advisors as part of the IC's personal staff.

The four ***General Staff*** groups are known as "Sections" and are managed by individuals known as "Chiefs".

The function of the **OPERATIONS Section** is to execute tactical actions to achieve response objectives. With technical and logistical support from the other sections, the operations section implements and supervises all response tactical operations.

The function of the **PLANNING/TECHNICAL Section** is to develop response strategy and action plans to accomplish incident objectives. The planning section provides technical support for operations and manages incident resource information and documentation.

The function of the **LOGISTICS Section** is to provide services and support all incident needs. The logistics section will procure the equipment, materials, supplies, and services necessary to support emergency response operations.

The function of the **FINANCE/ADMINISTRATION Section** is to track all incident-related costs including personnel and resource accounting and contracting associated with the incident.

The ICS organization structure develops in a modular fashion. Staffing of the organization, as illustrated by the organization chart diagram at the end of this section, builds from the top down. As the need exists, more sections, divisions, branches, and units are developed. The size of the response organization depends on the scope of the incident. EMPCo's ICS organizational assignments will be filled on an "as needed" basis, depending on the circumstances of the incident.

The ICS can be applied to manage all emergency incidents. The ICS organization has considerable internal flexibility which is designed to maintain response efficiency. The specific organizational structure established for any given incident will be based upon the management needs of the incident. If one individual can simultaneously manage more than one functional responsibility, then no further organizational development in that area is required. The organization can grow or shrink at any time to accommodate the incident's changing needs. Some small incidents may not require all ICS positions to be filled. The responsibilities of an ICS position not filled by an individual are assumed by the next management level up in the modular hierarchy.

The ICS organizational structure that may be implemented to respond to a significant EMPCo incident is described in the following pages and a model of the associated organization chart is illustrated in Figure 3-1.

Incident Commander (IC)

Typical EMPCo Job Title: Highest management level appropriate for incident circumstances. May be the Qualified Individual of the applicable Zone Plan or other EMPCo representative with proper authority.

ICS Function: Command

Duties and Responsibilities:

- Implements EMPCo emergency response plan and establishes Incident Command System.
- Assesses incident situation and establishes appropriate level of response.
- Determines incident objectives, strategies, and establishes priorities.
- Approves and authorizes the implementation of an Incident Action Plan.
- Manages overall incident response, ensures safety of all personnel, and authorizes release information to the media, government, and local community.
- Determines the Incident Command Post location.
- Coordinates a Unified Command Structure when appropriate.
- Serves as the primary contact with EMPCo senior management and keeps them apprised of incident developments.

Deputy Incident Commander

Typical EMPCo Job Title: The Deputy IC position may be activated to assist with carrying out the Incident Command responsibilities. The Deputy should be fully qualified to assume the position of IC in the absence of the IC.

ICS Function: Command

Duties and Responsibilities:

- Assist Command with the management of the on-site incident response activities of all the General Staff Sections.
- Stewards the development and implementation of the Incident Action Plan.
- Coordinates casualty/damage control activities including returning pipeline operations back to normal.
- Monitors response activities and consults with incident advisors to assist IC with information flow and command decisions.

Safety Officer

Typical EMPCo Job Title: Operations Integrity Department Safety Specialist,

	Field Regulatory Specialist, Field ERST Technician, or Lead Hazardous Materials Technician
ICS Function:	Command Staff

Duties and Responsibilities:

- Develops the incident's Site Safety and Health Plan (SSHP) and obtains authorization from IC to implement SSHP. Also advises IC on all incident safety implications.
- Monitors and assesses hazardous situations and develops measures for assuring the safety of all incident personnel.
- Advises on-site response team on policies, practices, and procedures relating to safety during emergency response operations. Has direct authority to stop hazardous activities and correct any unsafe acts.
- Coordinates the activities of the incident's safety organization, i.e., Lead Hazardous Materials Technicians and others performing safety oriented tasks.
- Investigates and documents all accidents and injuries related to the incident.

Information Officer

Typical EMPCo Job Title:	EMPCo Public Affairs Coordinator or person approved by EMPCo management
ICS Function:	Command Staff

Duties and Responsibilities:

- Obtains accurate incident information and develops materials for use in media briefings.
- Establishes a "Joint Information Center" to manage the release and of incident information.
- Obtains Incident Command approval of media releases and conducts media briefings.
- Is the central contact point for dissemination of information to the news media, agencies, and organizations.

Liaison Officer

Typical EMPCo Job Title:	Designee by IC, e.g., Emergency Preparedness & Response Regulatory Analyst or Public Official
ICS Function:	Command Staff

Duties and Responsibilities:

- Primary point of contact for assisting or cooperating agencies which do not have direct incident jurisdictional responsibilities.
- Facilitates communications between Incident Command and any outside stakeholders affected by the incident, including inter-organizational issues.
- Coordinates arrangements for Public Officials to visit the incident site.
- Advises IC on capabilities and limitations of assisting and cooperating agency resources. May coordinate interactions between external stakeholders and appropriate incident personnel.

Legal Advisor

Typical EMPCo Job Title:	EMPCo Law Department Counsel
ICS Function:	IC Advisor

Duties and Responsibilities:

- Advises Incident Commander on all legal matters related to emergency response operations.
- Provides issue specific legal guidance to Command Staff and General Staff.
- Maintains familiarity with all aspects of incident response operations in order to identify and appropriately address any legal issues.
- Coordinates with other legal counsel, as necessary.

Security Advisor

Typical EMPCo Job Title:	ExxonMobil Security Personnel
ICS Function:	IC Advisor

Duties and Responsibilities:

- Advises IC on providing incident security for all sites, including Incident Command Post, Joint Information Center, staging areas, wildlife rehabilitation centers, and other response activity areas.
- Coordinates security activities such as the protection of people and equipment with local law enforcement agencies.
- Arranges for and supervises contract security services, as necessary.
- Maintains incident records of security service activities, i.e., controlled access rosters, etc.

Right of Way/Claims Advisor

Typical EMPCo Job Title: ROW/Claims Coordinator, ROW Agent, or Contractor

ICS Function: IC Advisor

Duties and Responsibilities:

- Secures permission from private property owners, as necessary, for activities associated with incident operations.
- Maintains necessary incident documentation to coordinate settlement of damages and claims.
- Assists Incident Command with managing evacuations by coordinating temporary room and board for evacuees, as necessary.

Operations Section Chief (Ops Chief)

Typical EMPCo Job Title: Designee by IC (Appropriate management for incident circumstances, e.g., Area Supervisor, Field Supervisor, Tech Leader, or etc.).

ICS Function: General Staff - Operations

Duties and Responsibilities:

- Manages incident response tactical operations and reports to Incident Command.
- Develops and executes the operations portion of the Incident Action Plan.
- Supervises the activities delegated to: Assessment/Control Director,

Containment/Cleanup Director, Casualty/Repair Director, Staging Area Coordinator, and Lead Hazardous Materials Technician.

- Briefs and assigns operations personnel and resources in accordance with the Incident Action Plan.
- Ensures safe tactical operations and executes the Site Safety and Health Plan throughout the Operations Section.
- Determines resources needs and requests support from the Logistics Section Chief.
- Evaluates the Operations Section's effectiveness at achieving strategic objectives and reports results and changes to Command and the Planning/Technical Section Chief.
- Maintains complete operations records and periodically reports status to Command.

Planning/Technical Section Chief (P/T Chief)

Typical EMPCo Job Title:	Designee by IC, e.g., Technical Services Department, Engineering Technologist, or other knowledgeable personnel
ICS Function:	General Staff - Planning/Technical

Duties and Responsibilities:

- Manages strategic planning, information flow, the utilization of technical resources, and reports to Incident Command.
- Supervises the activities delegated to: Technical Specialists Coordinator, Situation/Documentation Unit Leader (including the role of incident Historian), and Resources/Demobilization Unit Leader.
- Manages all information relevant to the incident. Collects, evaluates, processes, and disseminates information through the use of ICS forms, meetings, maps, and status displays, etc. Establishes information flow requirements and process schedule.
- Provides technical specialists as needed, i.e., environmental impact, hazardous substance/IH, permitting, training, wildlife, meteorological, surveillance, waste management, air/water dispersion modeling, etc.
- Coordinates with other Section Chiefs, conducts planning meetings, and prepares the Incident Action Plan.
- Assigns available personnel where needed and maintains ICS organization chart. Assembles and coordinates specialized teams to address technical

response issues, i.e., NRDA, wildlife, etc.

- Determines resources needed to support Incident Action Plan and considers alternative response technologies such as in-situ burning and dispersants use.
- Maintains complete planning documents and periodically reports to Command and requesters.

Logistics Section Chief (Log Chief)

Typical EMPCo Job Title: Designee by IC, e.g., Projects Group or other knowledgeable personnel

ICS Function: General Staff - Logistics

Duties and Responsibilities:

- Manages support and services required to maintain the incident response and reports to Incident Command. Provides all services and support including personnel, transportation, maintenance, food, equipment, supplies, etc.
- Supervises the activities delegated to: Procurement/Supply Unit Leader, Communications Unit leader, and Transportation/Food Unit Leader.
- Must coordinate with the Operations Section Chief and the Planning/Technical Section Chief in order to provide support services and materials necessary to keep the response operations functioning at optimum performance.
- Processes incident requests for procuring necessary resources and coordinates delivering the resources to where they are needed.
- Establishes and Incident Communications Plan, determines and provides the required communication facilities, including integrated communications with responding agencies.
- Maintains complete logistics documents and periodically reports to Command and requesters.

Finance/Administration Section Chief (F/A Chief)

Typical EMPCo Job Title: Designee by IC, e.g., Controller, Clerk, or other knowledgeable personnel

ICS Function: General Staff - Finance/Administration

Duties and Responsibilities:

- Manages all financial accounting and administrative aspects associated with the incident and reports to Incident Command.
- Supervises the activities delegated to: Contracts Unit Leader, Time/Cost Unit Leader, and Administrative Support Unit Leader.
- Provides for contracts, leases, invoicing, and rental agreements for incident resources.
- Provides for cost management data, including incident cost reports and analysis.
- Provides administrative/clerical support to all functions of the incident.
- Maintains complete finance/administration documents and periodically reports to Command and Planning Section Chief.

Lead Hazardous Materials Technician

Typical EMPCo Job Title: Hazardous Materials Technician assigned by IC as lead for incident. When appropriate for some small incidents, the Safety Officer and the Lead Hazardous Materials Technician may be the same person.

ICS Function: Operations

Duties and Responsibilities:

- Serves as point of contact between the Safety Officer and the incident safety organization (other Hazardous Materials Technicians, etc.) to assist with the execution and maintenance of the Site Safety and Health Plan (SSHP).
- Works closely with other safety personnel initiating and maintaining hazard exposure monitoring to determine personal protective equipment (PPE) and SSHP requirements. Gas monitoring instruments will assist responders in determining the actual vapor plume size and trajectory.
- Reports exposure monitoring results to the Safety Officer and informs the Operations Section Chief of recommended safe practices for site operations.
- Coordinates with other Hazardous Materials Technicians and safety personnel assigned to the incident, particularly in activities requiring the "Buddy System".

Staging Area Coordinator

Typical EMPCo Job Title: Delegated by Operations Section Chief.

ICS Function: Operations

- Coordinates the staging of resources (disposition before deployment) at temporary locations near the scene of the incident.
- Reports resource staging status directly to the operations Section Chief and the Planning/Technical Chief.

Assessment/Control Director

Typical EMPCo Job Title: Delegated by Operations Section Chief.

ICS Function: Operations

Duties and Responsibilities:

- Reports to the Operations Section Chief.
- Verifies and assesses the impact of the incident and reports information necessary to determine required mitigation actions.
- Coordinates with Containment/Cleanup and Casualty/Repair Directors.
- Takes appropriate immediate actions to control or mitigate the incident, i.e., facilities or pipeline system shut down and interfaces with public/agencies, including isolations/evacuations.
- Directs the System Control Supervisor and the Air Operations Supervisor.
- Establishes ground and aerial surveillance of the release and reports findings to the Operations Section and the Planning/Technical Section Chiefs.

System Control Supervisor

Typical EMPCo Job Title: Delegated by Assessment/Control Director.

ICS Function: Operations

Duties and Responsibilities:

- Reports to the Assessment/Control Director.
- Assists with the incident assessments and coordinates the orderly control,

shut down, and restart of the affected systems.

Air Operations Supervisor

Typical EMPCo Job Title: Delegated by Assessment/Control Director

ICS Function: Operations

Duties and Responsibilities:

- Reports to the Assessment/Control Director.
- Coordinates aerial surveillance and air transportation for the incident.

Containment/Cleanup Director

Typical EMPCo Job Title: Delegated by Operations Section Chief

ICS Function: Operations

Duties and Responsibilities:

- Reports to the Operations Section Chief. Coordinates with Assessment/Control and Casualty/Repair Directors.
- Directs company and contract personnel in the operations of containing and recovering the spill/release. Also directs operations of protecting resources at risk.
- Evaluates performance of containment and recovery operations and makes changes as necessary.

Land Operations Supervisor

Typical EMPCo Job Title: Delegated by Containment/Cleanup Director

ICS Function: Operations

Duties and Responsibilities

- Reports to the Containment/Cleanup Director. Coordinates with Water Operations Supervisor.

- Supervises inland control, containment, recovery, and cleanup operations. Also supervises operations of protecting resources at risk.

Water Operations Supervisor

Typical EMPCo Job Title: Delegated by Containment/Cleanup Director

ICS Function: Operations

Duties and Responsibilities

- Reports to the Containment/Cleanup Director. Coordinates with Land Operations Supervisor.
- Supervises on-water control, containment, recovery, and cleanup operations. Also supervises operations of protecting resources at risk.

Casualty/Repair Director

Typical EMPCo Job Title: Delegated by Operations Section Chief

ICS Function: Operations

Duties and Responsibilities:

- Reports to Operations Section Chief. Coordinates with Assessment/Control and Containment/Cleanup Directors.
- Directs company and contract personnel modifying or repairing facilities affected by the incident. Also assists in protecting resources at risk and constructing any facilities necessary for response operations, i.e., access road/ramp, etc.

Repair Crew Supervisor

Typical EMPCo Job Title: Delegated by Casualty/Repair Director

ICS Function: Operations

Duties and Responsibilities:

- Reports to the Casualty/Repair Director.
- Supervises personnel in activities of modifying or repairing facilities affected by the incident.

Technical Specialists Coordinator

Typical EMPCo Job Title: Technical Specialist designated as group leader by the P/T Chief

ICS Function: Planning

Duties and Responsibilities:

- Certain incidents may require Technical Specialists who have specialized knowledge and expertise. The Technical Specialists Coordinator serves as a point of contact for the Technical Specialists Group and reports to the P/T Chief.
- Technical Specialists may function within the P/T Section, or be assigned to other parts of the organization wherever their services are required.
- Coordinates the technical support required from various Technical Specialists addressing issues such as: engineering, environmental impact, hazardous substances, training, wildlife, meteorology, waste management, air/water dispersion modeling, natural resource damages, GIS/GPS, etc.

Situation/Documentation Unit Leader

Typical EMPCo Job Title: Delegated by the Planning/Technical Section Chief

ICS Function: Planning

Duties and Responsibilities:

- Serves as the Historian for the incident. Documents all significant activities and occurrences.
- Collects and evaluates information necessary to compile incident status reports.
- Distributes Situation Update Reports on a scheduled basis.
- Displays incident situation/status information on a status board at the Incident Command Post.
- Maintains incident photo/video documentation and maps.

Resources/Demobilization Unit Leader

Typical EMPCo Job Title: Delegated by the Planning/Technical Section Chief

ICS Function: Planning

Duties and Responsibilities:

- Maintains a resource tracking system which identifies all primary incident resources and indicates pertinent data such as the current location and operational status of each unit.
- Establishes a master list of all resources which provides a check-in function for accountability and also facilitates the demobilization process.
- Develops an Incident Demobilization Plan to assist all section/units with a safe, orderly, and cost effective demobilization of personnel and equipment. The plan will include decontamination procedures where applicable.
- Coordinates with Finance/Administration Section to verify time and cost documentation.

Procurement/Supply Unit Leader

Typical EMPCo Job Title: Delegated by Logistics Section Chief

ICS Function: Logistics

Duties and Responsibilities:

- Locates, orders, receives, stores, and distributes necessary resources and supplies requested to support incident response activities.
- Sets up and maintains facilities necessary to support incident operations, i.e., Incident Command Post and other facilities used for feeding, sleeping, and sanitation services.
- Provides and services all resources required to maintain response productivity, i.e., lighting, maintenance, fueling, repair/replacement, etc..

Communications Unit Leader

Typical EMPCo Job Title: Delegated by Logistics Section Chief

ICS Function: Logistics

Duties and Responsibilities:

- Installs and maintains all incident communication resources including radios, telephones, copy and fax machines, computers, etc.

- Sets up communications equipment accountability system to manage distribution and maintenance of communication units.

Transportation/Food Unit Leader

Typical EMPCo Job Title: Delegated by Logistics Section Chief

ICS Function: Logistics

Duties and Responsibilities:

- Provides transportation for personnel, equipment, and supplies to and from field work sites.
- Assures that sufficient potable water is available to meet all incident needs.
- Provides for field and command personnel to have adequate food and drinks to sustain operations.
- Coordinates the securing of lodging for response personnel.

Contracts Unit Leader

Typical EMPCo Job Title: Delegated by the Finance/Administration Section Chief

ICS Function: Finance/Administration

Duties and Responsibilities:

- Processes all contracts and agreements required to support the incident.
- Assists Logistics Section with locating and contracting available resources required by the incident.

Time/Cost Unit Leader

Typical EMPCo Job Title: Delegated by the Finance/Administration Section Chief

ICS Function: Finance/Administration

Duties and Responsibilities:

- Manages cost tracking documentation and provides cost accounting records.

- Assists all sections/units in establishing a system for collecting, verifying, and processing all appropriate time tickets and invoices on a routine basis.

Administrative Support Unit Leader

Typical EMPCo Job Title:	Delegated by the Finance/Administration Section Chief
ICS Function:	Finance/Administration

Duties and Responsibilities:

- Provides the incident response organization with administrative support as requested.

Strike Team Response Team

The ExxonMobil Strike Teams that cover EMPCo's operations include the following:

- Lower Mississippi River - Baton Rouge area and the Mississippi River.
- Southeastern - Onshore operations in Louisiana, Mississippi, Alabama, and Florida and offshore Louisiana and Texas.
- Houston Ship Channel - Baytown, Houston Ship Channel, and Galveston Bay areas; Texas inland operations; and the Texas GOM shoreline.
- Yellowstone River - Billings Refinery and Montana pipeline operations

An example of an Strike Team structure is the Southeastern Strike Team organization chart shown in Figure 3-3.

The Strike Team can be mobilized in its entirety or in modular components as dictated by the situation. The Strike Team were formed to improve ExxonMobil's capability to respond to oil spills and eventually to other "incidents" with improved depth, speed, and preparedness. The team was also formed to respond to spills and/or other incidents from facilities or equipment owned and/or operated by the supporting ExxonMobil functions/affiliates. Response time to a spill or incident is critical. Notification of Strike Team is expected to result in the team being en route to the incident site within 2 hours from the time of notification.

When responding to a Category II incident (confirmed off-site impact), the EMPCo Incident Commander (Operations Manager), and Casualty/Damage Control Manager (Area Managers) will staff those spilling function positions as indicated on the

Strike Team organizational chart (Figure 3-3). In addition to overall response management, the Incident Commander is responsible for interactions with the public, government officials and agencies, and the news media.

Descriptions of each of the Strike Team positions, their primary responsibilities and duties, minimum training requirements, and other information are provided in the Strike Team Manuals.

ExxonMobil North America Regional Response Team (NARRT)

The ExxonMobil North America Regional Response Team (NARRT) is composed of the Incident Command management, technical, and support functions' staffs. The organizational structure of the NARRT is shown in Figure 3-4. The Emergency Support Group (ESG) (Crisis Management Team) is also shown in Figure 3-4. ESG has members from senior management both in Headquarters and at the incident site. In most incidents EMPCo's Operations Area Managers or Area Supervisors would likely respond to the scene, while ExxonMobil's President or Operations Vice President would lead the Headquarters component of the ESG. The roles for the Headquarters component include:

- Support for the on-scene team
- Long-range strategy and policy for the response, and
- Coordination of off-site external interactions.

The two support groups shown at the bottom left in Figure 3-4 would be expected to have representatives in, or be in communication with, the Crisis Management Center in Room 697-I of the ExxonMobil Headquarters Building in Houston, Texas.

Descriptions of the NARRT positions, their responsibilities and duties, planning functions, and training requirements are provided in the NARRT Manual, which is available in the Emergency Response Reference Library.

PHMSA Sequence Number 848

TABLE 3-1

Response Categories

INITIAL RESPONSE (On-Site) - A small spill confined to the Pipeline right-of-way, or near the source within an EMPCo facility. The responders will likely include:

- EMPRT (initial response mode - local operating organization only)
- EMPCo equipment and personnel
- Local contractors (as required)

Category 1 (Local) - A limited aquatic spill with the potential to impact others' property downstream, or a terrestrial spill that is impacting other people's property. These spills generally require no additional response beyond EMPCo's capabilities. The responders will typically include:

- EMPRT (initial response mode - local operating organization only)
- EMPRT (expanded response mode - regional and/or Headquarters support as needed
- EMPCo equipment and personnel (may include some Strike Team equipment)
- Local contractors and resources (as required)

Category 2 (Regional) - A large spill with impact to others' property and that requires response beyond the capability of EMPCo. The responders may include the following regional resources:

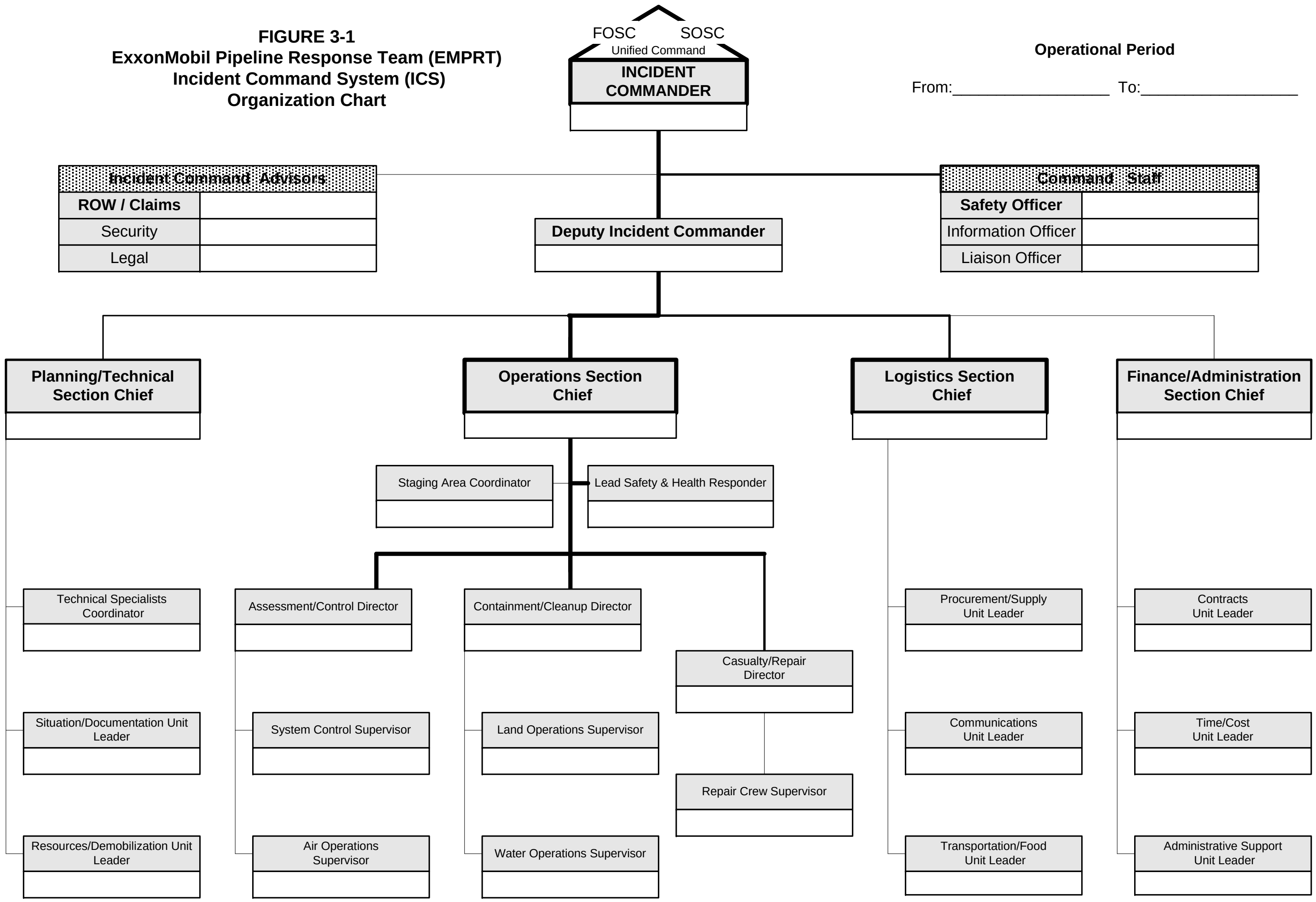
- Strike Team activation (including Strike Team equipment)
- EMPCo equipment and personnel
- Local and regional contractors and resources
- Regional equipment and selected major spill contractors

Category 3 (National) - A very large spill with significant impact to others' property and that requires a response which is beyond the capability of EMPCo's resources. The responders will likely include equipment and trained personnel from a specific geographic area or region and may require the combined resources from other regions including specialized or technical services, as follows:

- Strike Team /NARRT activation (including Strike Team equipment)
- EMPCo equipment and personnel
- Local and regional contractors and resources
- National equipment and selected spill contractors
- Cleanup Cooperatives - Marine Spill Response Corporation, as required.

Note: It is not expected that any EMPCo incident will require a Category 3 response.

PHMSA Sequence Number 848



ExxonMobil Pipeline

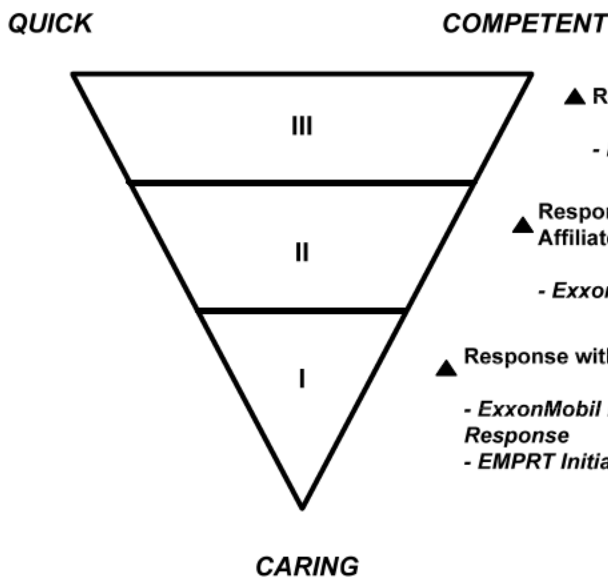
PHMSA Sequence Number 848

ExxonMobil Pipeline

Volume I, Section 3, Spill Response Organization

FIGURE 3-2

OVERVIEW OF TIERED RESPONSE SYSTEM



▲ **Response requires additional ExxonMobil involvement**

- North American Regional Response Team (NARRT)

▲ **Response by combined resources of several ExxonMobil Functions/ Affiliates**

- ExxonMobil Strike Teams

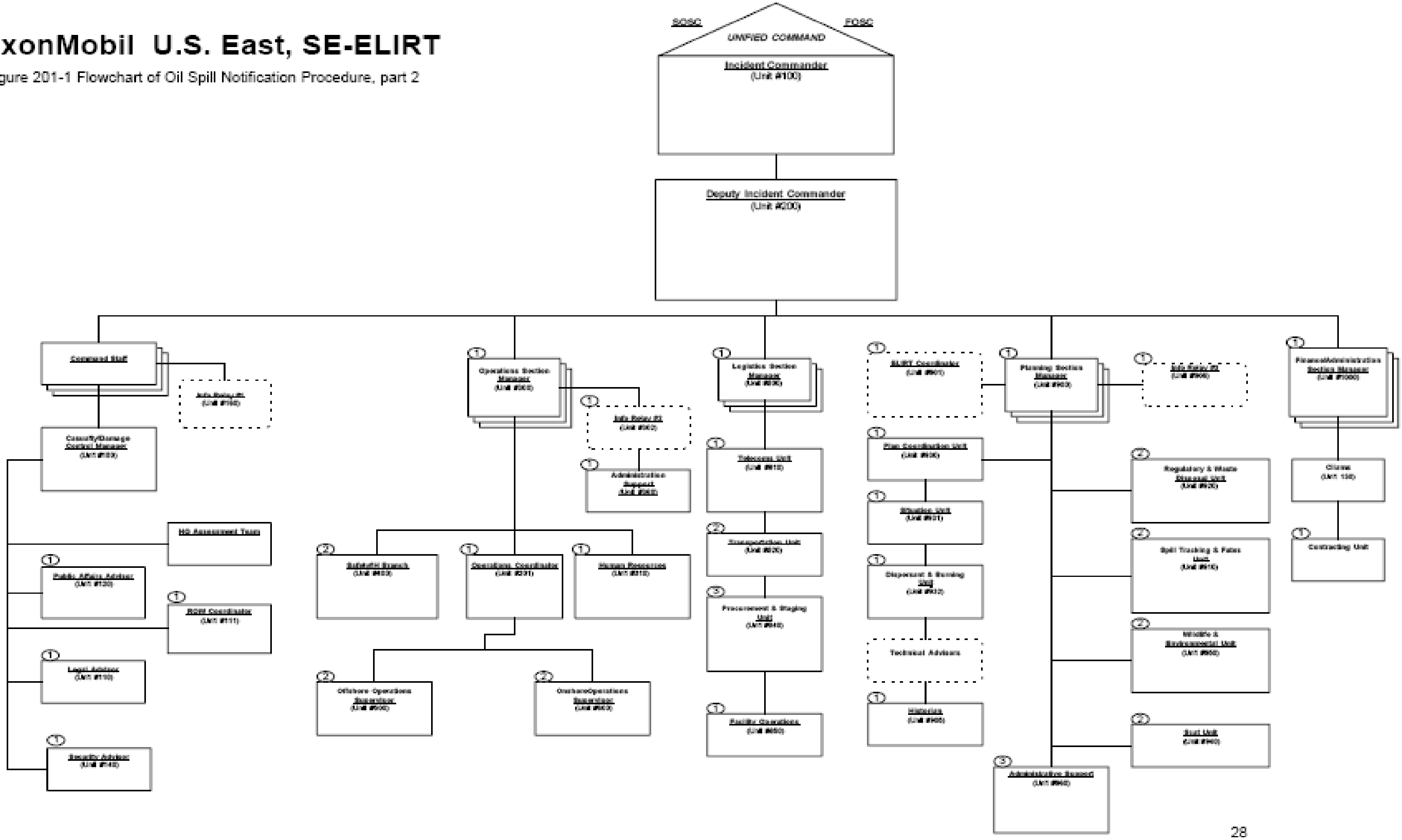
▲ **Response within ExxonMobil Functional/Affiliate capabilities**

- ExxonMobil Pipeline Response Team (EMPRT) - Expanded Response
- EMPRT Initial Responders

PHMSA Sequence Number 848

ExxonMobil U.S. East, SE-ELIRT

Figure 201-1 Flowchart of Oil Spill Notification Procedure, part 2



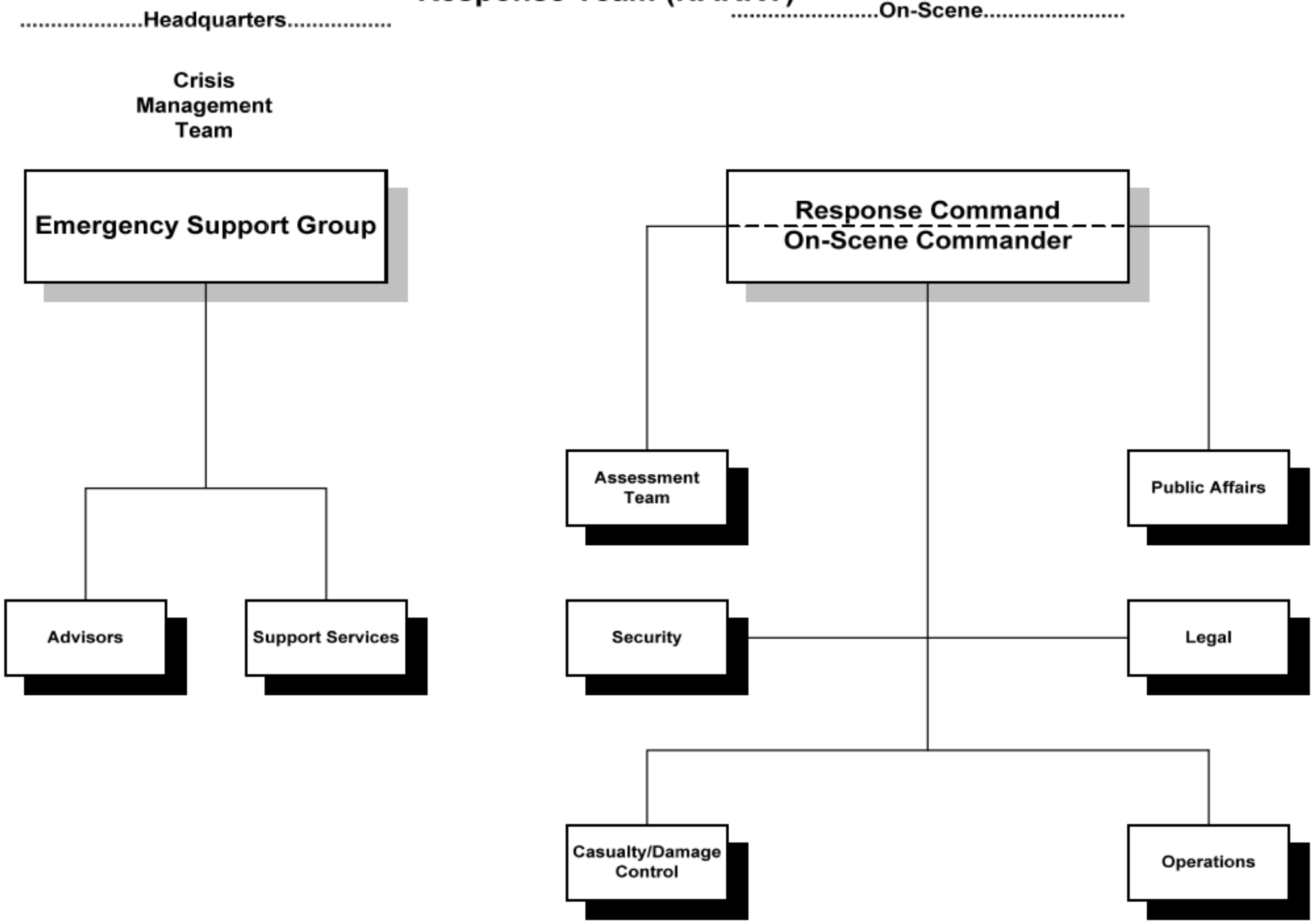
ExxonMobil Pipeline

Volume I, Section 3, Spill Response Organization

PHMSA Sequence Number 848

FIGURE 3-4

Emergency Support Group and North American Regional Response Team (NARRT)



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ExxonMobil Pipeline

Section 4 Pre-Emergency Planning

In This Section

PRE-EMERGENCY PLANNING AND MITIGATION SYSTEMS

Introduction

EMPCo has implemented a number of programs and procedures and installed several devices on their pipeline system to prevent spills from occurring and to rapidly detect and recognize spills in the event that they do occur. Included in these programs, procedures, and equipment are:

- Prevention procedures
- Pipeline and breakout tank inspection and testing procedures
- Discharge detection equipment and procedures
- Recognition of emergency conditions and prediction of the consequences
- Leak response actions
- Public education

Discharge Prevention

EMPCo's approach to preventing discharges is to assure that all facilities are properly designed, constructed, maintained, and operated.

EMPCo's facilities are designed, constructed, maintained, and operated in accordance with applicable codes (ASME B31.4, Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols, and those standards that it references), regulations (49 CFR Parts 192 or 195), and good engineering practices. Examples are as follows:

- Components in the pipeline system are designed and constructed in accordance with written specifications.
- Components are inspected to ensure that quality is maintained during material procurement and construction.
- Trained personnel are used during the construction of the facilities.
- Various testing methods are used during construction of the facilities.

- External and internal corrosion control methods are used to maintain the facilities in the best possible condition.
- A preventive maintenance program reduces the potential for component malfunction or failure.
- EMPCo personnel are properly trained to operate and maintain the pipeline system.
- EMPCo has an extensive safety and drug testing program for its employees and requires the same for its contractors.
- EMPCo's systems are designed and operated with safety factors in place. For example, the maximum operating pressure of a system is always less than the design pressure of the system and the test pressure of the system.
- Pressures are monitored and controlled so that the maximum operating pressures are not exceeded.
- When appropriate, internal inspection tools are used or lines are subjected to additional hydrostatic testing to determine and assure their integrity.
- All wastes are stored in accordance with applicable regulatory requirements (DOT containers that are non-leaking, closed, in good condition, properly marked/labeled, inspected to ensure integrity, etc.).

If the systems are properly designed, constructed, operated and maintained, then the most probable source of discharge is due to third-party damage. In order to minimize the chance of third-party damage a number of things are done:

- The facilities are designed to reduce the chance of third-party damage. For example, most of the facilities are buried or located within fenced and locked areas.
- Areas especially sensitive to third-party damage are road, railroad, and water crossings. Pipelines in these areas usually have additional wall thickness, or burial depth, or are cased to reduce the chance of damage.
- EMPCo's facilities are normally located on well-maintained and clearly marked rights-of-way.
- EMPCo's facilities are normally monitored by aerial or other patrol at least once per week to check for encroachment and construction activities.
- EMPCo participates in one-call pipeline locating and notification systems where available.
- EMPCo conducts education programs to reduce the possibility of third-party damage.

Integrity Testing and Maintenance

Pipelines

External Corrosion Mitigation

Coatings: EMPCo generally prevents corrosion of buried pipelines by using approved long-life pipeline coatings supplemented with cathodic protection (see below). EMPCo follows certain pipeline coating standards that are pertinent to its operations as spelled out in NACE Coatings and Linings Handbook (NACE RP-01-69 [latest revision]) the Steel Structures Painting Council's Steel Structures Painting Manual Volumes 1 & 2, and other industry-recommended practices. The external coating systems currently used in EMPCo's operations are:

- Fusion Bonded Epoxy - Electronically applied epoxy

Aboveground EMPCo facilities are typically inspected annually and provided protective coating systems to prevent corrosive deterioration. These primarily include buildings, aboveground piping, and tanks.

Cathodic Protection: Pipeline systems are protected with impressed current groundbeds and a number of magnesium and zinc galvanic anodes. Of the numerous impressed current groundbeds in service, conventional and deep groundbeds are approximately equal in number. For the cathodic protection of EMPCo's facilities, EMPCo follows NACE RP-01-69, NACE Publication 10A190, *Control of Pipeline Corrosion* by A.W. Peabody, DOT regulations, and other industry practices. EMPCo has a representative on the corrosion supervisory committee of the American Gas Association (AGA) who stays abreast of new corrosion mitigation techniques developed by AGA research.

Cathodic Protection Monitoring of Coated and Bare Trunklines: On trunklines, pipe-to-soil potential surveys are made annually. The criterion for cathodic protection used for coated systems is a minimum of 0.85 volt negative. For bare trunklines, the cathodic protection criterion is a minimum 100 mV polarization or a minimum of 0.85 volt negative.

Cathodic Protection Monitoring of Tank Bottoms and Stations: Structure-to-soil potential surveys are made annually at stations. Potential readings are taken at a minimum of four points around each tank and on station lines at key locations. The cathodic protection criterion used is either a minimum of 0.85 volt negative or a minimum 100-mV polarization.

Test Leads for Pipe-to-Soil Potentials: Test leads for pipe-to-soil potential readings are installed at road, railroad, and pipeline crossings. Other test leads are located at approximately 1- to 1.5-mile intervals.

Equipment Monitoring: The operation of cathodic protection rectifiers is inspected monthly. A number of rectifiers at critical locations allow 24-hour monitoring by satellite.

Each interference bond whose failure might jeopardize structure protection is electrically checked for proper performance six times each calendar year with intervals not to exceed 2 .5 months.

Reporting Requirements: Reporting is considered a very important requirement in maintaining proper protection of pipeline facilities. Records are maintained for the following:

- Rectifier and groundbed installations
- Galvanic anode installations
- Rectifier operation
- Annual pipe-to-soil potentials
- Locations of foreign pipelines
- Results of bonding tests made to other companies' pipelines
- Pipeline leaks and repairs
- Inspection of exterior and interior of pipe when excavated
- General condition of tanks
- Painting of tanks and other facilities

A corrosion report is prepared annually by EMPCo's Technical Services Department to give management a summary of the overall status of EMPCo's corrosion control program, to identify significant corrosion trends, and to provide general guidelines for corrective action when required. Engineering provides staff assistance to the areas as required to implement the yearly corrective action work plans.

Internal Corrosion Mitigation

Corrosion Mitigation Methods: EMPCo operates several thousand miles of trunklines transporting corrosive commodities, of which approximately 70 percent require the injection of chemicals for corrosion mitigation purposes. Pigging and the use of corrosion inhibitors have played the primary role in the mitigation of internal corrosion in EMPCo's pipeline systems. Chemicals that are used to mitigate internal corrosion include biocides and oxygen scavengers.

Internal Corrosion Monitoring: Although there are numerous internal corrosion monitoring tools that may be employed in liquid pipelines, EMPCo's trunklines use primarily weight loss coupons and electrical resistance probes. Where internal corrosion has been severe in the past, such as in EMPCo's offshore pipelines, a combination of ultrasonic inspection, radiography, and magnetic flux leakage in-line inspection pigs are used.

In-Line Inspection of Pipelines

EMPCo inspects pipelines located in high population density and environmentally sensitive areas with in-line inspection pigs, where appropriate.

Additional Pipeline Testing

A large number of pipelines are hydrostatically tested.

Breakout Tanks

The purpose of this section is to provide a brief description of EMPCo's policies and standard practices regarding the construction, operation, maintenance, and testing of aboveground breakout tanks.

During construction or testing of a tank, the requirements of the American Petroleum Institute (API) Standard 650, "Welded Steel Tanks for Oil Storage," are specified. The standard is one of many developed by API which cover a broad range of subjects and are generally accepted throughout the oil industry. API Standard 650 covers the design, material, fabrication, erection, and testing requirements for welded steel storage tanks. The testing requirements for new tanks under construction include radiographic inspection of shell welds and vacuum box testing of bottom welds. The completed tank is tested by either hydrostatic testing or a combination of vacuum box and liquid penetrant leak test.

Installation of a fiberglass-reinforced epoxy bottom coating is required in all new tanks and tanks that are cleaned and gas freed for other purposes. Cathodic protection is also provided for external protection of the tank bottom.

The requirements of API Standard 653, "Tank Inspection, Repair, Alteration, and Reconstruction," are followed for existing tanks. EMPCo's tanks are externally inspected annually for the condition of roof seals, paint, and all appurtenances. They are informally inspected at least weekly by local operating personnel and/or pipeline surveillance aircraft.

Tank roof drains and firewall drains are normally kept closed.

EMPCo's major tanks have tank gauges which transmit oil heights to the EMPCo Operations Control Center (OCC), where tank levels are monitored continuously. The tank gauges have alarms set for each tank for high tank level, low tank level, and emergency low tank level. Each tank also has an independent device which gives an alarm for emergency high tank level.

Discharge Detection

The detection of a discharge from the EMPCo pipeline system may occur in a number of ways including:

- Discharge detection by EMPCo personnel, pipeline patrols, or the general public
- (b) (3), (b) (7)(F) [redacted]
- Various other procedures and practices

These procedures and equipment are discussed in greater detail below.

Discharge Detection by Personnel

Periodic Inspection

Aerial patrols over each major pipeline are normally made a minimum of once each week. In addition, for offshore pipelines, the U.S. Coast Guard periodically flies over the entire Gulf of Mexico petroleum-producing area to check for offshore oil spills. Vessels operating in the Gulf of Mexico may also sight an oil slick.

Other Sightings of Spills/Releases

Other spills/releases on land can be detected during routine travel along the right-of-way by EMPCo personnel. In some instances they may be observed and reported by the general public or the employees of others in the industry.

Right-of-way marker signs are installed and maintained at road crossings and other noticeable points and provide an emergency 24-hour telephone number to be used by any person wishing to report a pipeline leak.

More details about sighting and reporting leaks are periodically carried in local newspaper notices and are described in the EMPCo bulletin, "Living Near Pipelines" and is part of the ExxonMobil Pipeline Company Public Education Program. This bulletin is available to the public and to civil authorities and shows the EMPCo emergency phone number 1-800-537-5200.

Automated Discharge Detection

(b) (3), (b) (7)(F)

[redacted]

Leak Detection Systems, Devices, Equipment, or Procedures

Operational Control and Surveillance Guidelines

EMPCo's operational control and surveillance guidelines cover all facilities, controls, and operations normally required to operate the pipeline system(s) in a safe, feasible, cost-effective manner in moving commodities from one point to another. Specific guidelines are:

1. Utilize a maximum of feasible, cost-justifiable local/automatic "fail safe" type controls and designs.

[redacted]

facilitate ease and reliability of operation and maintenance. Whenever possible, use tried and proven design techniques and equipment. This is not intended to preclude development and testing of new techniques or equipment, but to make certain that when new techniques and equipment are to be used or tested, that fact is conveyed ahead of time to all concerned and approval is obtained.

This guideline is not to be interpreted as promoting "cookbook" type designs. Each system should be evaluated individually without simply repeating design techniques used in the past for similar systems.

5. On new or revised facilities, consider cost vs. benefit, both through detailed study and by past experience. Check for compliance with code and regulatory requirements.

6. Utilize the "design criteria" as the vehicle to clearly define all facilities and the proposed operational modes. Include specific details of the "Operational Control and Surveillance," systems. Also include a section describing all major equipment, including electrical/electronic/computer packages, so that all concerned are aware and in agreement with the planned facilities. New, unfamiliar equipment can result in extra costs in training/debugging that may not justify the cost. The design criteria should be developed/reviewed/formally approved in the early stages of the project. If significant changes occur during the design of the project, the criteria should be updated and resubmitted for review and approval.

7. Each time a significant system is completed/revised and placed on line, debug and optimize it before releasing it for normal operation.

8. Periodically review the control and surveillance on each existing system including those remotely controlled and those locally controlled. A cursory review should be performed periodically to identify systems requiring in-depth study.

9. Reassess long-range, multiyear programs periodically to see that plans are still valid and to report progress and costs. If modifications are required, the plan should be revised.

Leak Detection and System Shutdown

EMPCo's leak detection and response guidelines cover those facilities, controls, and actions required to detect a leak or spillage from the pipeline and to minimize the extent of such leak or spillage and its effect on public safety, the environment, and property.

Levels of Leak Detection: EMPCo currently uses the following three types of leak detection systems:

- Level I - Volume Balance
- Level II - Flow Rate and Pressure Deviation
- Level III - Pressure and Equipment Status Change

In determining the proper level to assign to a given pipeline system, a system analysis is required. In making such an analysis, consideration should be given to:

- Material characteristics
- System physical condition
- System size, throughput, and operating conditions
- Existing controls
- Evaluation of leak/hazard/response scenarios (a computer program "Leakhaz" has been developed to assist in such evaluations)
- Public safety
- Environmental pollution exposure
- Potential property losses
- Cost/benefit

The primary consideration in selecting the leak detection system is public safety. Environmental pollution and property losses are important considerations, but since restoration and compensation means are available, these effects should be considered secondary to public safety.

Level I - Volume Balance:

(b) (3), (b) (7)(F)

[redacted]

(b) (3), (b) (7)(F)

[redacted]

(b) (3), (b) (7)(F)

[redacted]

General Pipeline Leak Response Actions

1. Travel to Suspected Site of Leak

   A means of locating the leak site is necessary for minimum travel time. The general location of the leak may be known from reports.

If precise directions are not available for finding the site, air surveillance and assistance from a helicopter or other aircraft may be necessary. Areas should maintain a list of companies with aircraft for charter.

2. Locate Underwater Pipeline

EMPCo operates pipelines in the Gulf of Mexico offshore from Texas and Louisiana. In this situation, locating the point of spill may be difficult. Once the general vicinity of the leak is established, pipeline location equipment will increase the chances of finding the pipeline in the least amount of time.

There are three basic systems for detecting underwater pipelines: ferrous metal detectors, magnetometers, and subsurface profiling systems. The ferrous metal detector is the most reliable method of detecting an underwater line. Other pipeline detectors, such as magnetometers and subsurface profiling systems are usually available from diving companies.

Locating leaks for pipeline crossings at rivers, intercoastal canals, or large water bodies will generally use the same procedures as described above, although some modifications will be required to the locating equipment depending on the situation.

3. Find Leak

If oil continues to escape from the line, the leak may be detected visually.

If underwater, the leak can be found by having a diver survey the line. The line may have to be pressured up to force gas or oil out of the leak to aid in locating the leak.

4. Determine Extent of Damage

In determining the extent of damage, three basic conditions of the line must be determined:

- Degree of damage to the line
- Length of damaged line
- Misalignment angle if an underwater pipeline

5. Report to Area Supervisor

Once the extent of damage has been determined, the following information should be reported:

- Location of leak
- Size of the line
- Type of coating
- Length of damaged section
- Misalignment angle
- Water depth (if appropriate)
- Local terrain conditions

6. Begin Repair Preliminaries

Perform whatever repair preliminaries are possible if it is safe to do so.

Recognizing an Emergency

A person evaluating a situation must assess the circumstances surrounding an event, determine if an emergency situation exists, and respond accordingly. EMPCo personnel are trained in hazards or emergency recognition procedures as described below.

An emergency in pipeline and facility operations often originates with the unexpected release or spill of commodities. Uncontained commodities and high vapor concentrations present substantial hazards for fires or explosions until they dissipate to safe levels. In these situations, sources of ignition must be controlled to eliminate fire and explosion hazards. EMPCo has strict rules for controlling sources of ignition within tank farm property to avoid such explosions or fires. Potential sources of ignition become more difficult to control on public property. Early detection and quick response are the best actions to reduce the hazards.

Visual Keys

There should never be petroleum or refined products exposed to the atmosphere during EMPCo's normal operations except during maintenance activities. Following an oil spill, dark stains, sheens, rainbows, or spilled material will accumulate near the source or at the lowest point along the surrounding terrain. That point may be in the diked area around a tank or, in the case of a pipeline, in a ditch, creek, pond, river, lake, or gutter. The oil products that EMPCo transports are lighter than water and therefore will remain on the surface of open water. If the surface of a waterway appears abnormal, further investigation is required.

Liquefied petroleum gas (LPG) or HVLs will freeze anything in the immediate area of a release. Signs of frost, white soil, or a vapor cloud may indicate an LPG release.

Vapor clouds may also accompany a release of petroleum or chemical product, not just LPG. Response personnel should be careful and assume that an apparent fog is an explosive vapor cloud capable of flashing. These clouds will eventually dissipate to the atmosphere. Wind can help the situation by accelerating vapor cloud dissipation. However, before the cloud dissipates it may move into populated areas with numerous ignition sources, thus creating a significant safety hazard.

Auditory Keys

Splashing, spraying, or hissing sounds near tankage or pump stations may indicate a breach of mechanical integrity resulting in a release.

Smell

Most of the products that EMPCo transports have a unique smell, identifiable to experienced personnel. If unusual odor concentrations are noticed or reported, they should be investigated.

Automation

[redacted] (b) (3), (b) (7)(F)

Additional information on the automated discharge detection systems is provided in the previous section entitled "Discharge Detection."

Public Education

EMPCo's Public Education Program:

- EMPCo is committed to public education and has been active in industry efforts since 1980, including periodic public education mailings, public service announcements, and other education programs through the API Public Education and Emergency Preparedness Committee.
- DOT 195 requires a public education program be in place to educate nearby residents about the dangers of underground pipelines. These requirements have also been adopted by reference by the Texas Railroad Commission (TRRC) and the Louisiana Department of Conservation. EMPCo satisfies these educational requirements primarily through a mass mailing of educational brochures every 2 years.
    - Past mailings have included over 300,000 residences. The Texas mailing is in both English and Spanish.
- TRRC requires a specific program for education of residents living within 1 mile of an underground salt dome storage facility. Industry has a coordinated program for the Mont Belvieu facility.
- Specific locations, e.g., Corpus Christi and Friendswood, may have additional requirements for public education. EMPCo complies with these standards imposed by the city or state by increasing the frequency of mailings or tailoring the delivery method, e.g., hand delivery, to nearby residents and businesses.
- EMPCo also sponsors programs which provide information to local emergency responders and the contractor/excavator communities. Community outreach sessions are also conducted to provide information on EMPCo operations to elected and administrative municipal officials.

Section 5. Emergency Response Actions and Strategies

In This Section

EMERGENCY RESPONSE ACTIONS AND STRATEGIES

This section serves as a guide for the notification and response actions that should be taken by EMPCo and contractor personnel following the discovery of a release or other emergency from the EMPCo system, including a release of hazardous waste. The response guidelines and actions are presented in the general order in which they are typically implemented and include:

- Notification and Initial Response (shutdown/mitigation)
- Safety and Health/Incident Assessment
- Isolation and Evacuation
- Site Security and Control
- Crude Oil/Refined Products Response Procedures
- HVL Response Procedures
- Waste Management and Emergency Response Guidelines
- Fire Response and Prevention
- Wildlife Protection
- Other Emergency Response Procedures
- Post Incident Critique

Certain response actions including assessment and waste management may be implemented at any time during the response but are shown in the sequence where they generally become most prevalent. Fire response actions may also be implemented at any point during a spill response, but because spills do not typically involve fires, the fire response actions and guidelines have been included near the end of this section.

While each response is incident specific, the strategy remains constant. The first priority is to protect human life and health including company personnel, responders, and the public. Also vitally important is the protection of the environment by minimizing ecological, economical, and public impacts.

General strategies for responses to spills/releases include the following:

- Determine objectives based on response priorities.
    - Protect human life and health
    - Minimize ecological impacts
    - Minimize economic and public impacts

- Implement source controls and appropriate countermeasures.
- Implement containment, clean-up, removal, and disposal operations.
- Implement sensitivities protection and mitigation tactics.

Notification and Initial Response (Shutdown/Mitigation)

Immediate actions are required at the onset of an emergency response to limit the extent of a release, minimize the potential hazard to human health and the environment, and implement an effective response. It is also important to act decisively to create a professional working atmosphere among EMPCo and regulatory authority personnel and public officials. This section is intended to provide guidance for determining the appropriate initial response and notification actions that should be carried out in the event of a release or other emergency incident.

The initial response and notification actions following detection of a release are depicted in Figure 5-1 and a list of the key internal EMPCo and federal agency notifications is provided in each Zone Plan Section 12. Spill Response Notification Forms (Vol.2) should be used to collect the necessary information for making regulatory agency notifications. Specific federal, state, and local notification requirements and phone numbers are provided in the individual response zone plans (Vol. 2). A checklist that should be used for ensuring that key response factors are considered and the appropriate actions taken is provided in Table 5-2.

Many of the recommended notification and response actions should and will occur simultaneously and do not have to follow precisely the order listed.

The initial response actions generally consist of the following components:

1. Initial notification and pipeline shutdown
2. Preliminary assessment
3. Source control/mitigation measures
4. Supplemental internal and external notifications
    - EMPCo personnel (see also Vol. 2)
    - Federal regulatory agencies

- State agencies and local authorities (Vol. 2)

These actions are further described below.

Initial Notification and Shutdown

The first employee detecting a release or receiving notification of a pipeline emergency shall obtain certain basic information and immediately (24 hours a day) relay that information to their supervisor. Spill Response Notification forms can be used to obtain the necessary information. If the incident involves an immediate threat to human health and safety, the first responder or his or her supervisor should contact the local authorities to assist in evacuations and/or site control as necessary.

The initial notifications and actions taken after discovery of a release, or actions taken if there is a substantial threat of a release, will vary somewhat depending on whether the incident has been confirmed or not. Unless the leak has been confirmed by the SCADA system at the OCC and/or visually by field personnel, the first response action generally involves confirmation of the release.

Following an unconfirmed report of a leak, or the substantial threat of a leak, to an EMPCo area office, the sequential response actions that should be implemented immediately are:

1a. Contact the OCC and request a line balance check and shut down line if a leak is confirmed, or

1b. Conduct aerial or ground reconnaissance of the area at the first possible opportunity (incident may occur at night or in inclement weather) and contact the OCC to shut down line if reconnaissance detects a potential leak.

2. Isolate line segment

3. Depressurize line.

4. Start internal and external notification procedures.

5. Mobilize response and repair personnel.

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Preliminary Assessment

It is the responsibility of the first EMPCo representative on-site to conduct a preliminary assessment of the release and the potential circumstances. Prior to conducting the assessment, the first responder(s) should ask themselves the following questions:

1. Can I respond safely?
2. Do I have the proper PPE to assess the situation?
3. Is anyone in immediate danger?
4. Is evacuation necessary?
5. Is there property damage?
6. Is there a potential for property damage?
7. What are the hazards on-site, i.e., physical, chemical, etc.?
8. Which way is the wind blowing?
9. What is the plume size and direction of vapor release?
10. Is there a fire or explosion possibility?
11. What is the source of the hazard?
12. Are EMPCo's facilities the source?
13. Is there a source of ignition?
14. Will release enter a waterway?
15. Is water downstream used for drinking?
16. What additional resources do I need in order to respond?

NOTE: Response to significant releases involving HVL's, gasoline or jet fuel should be approached with extreme caution due to the fire and/or explosion hazard. Responses to any large releases should involve the assistance of the local fire department.

Once these questions have been answered to the extent possible, the preliminary assessment should be conducted and involve the following items.

1. Safety and Health Hazards

- Assume that all releases possess potential fire, explosion, and toxic hazards, and evacuate personnel to upwind area if spill is large or strong odors are present. Refer to DOT's North American Emergency Response Guidebook for general safety considerations and guidelines.
- Monitor air for explosive levels, toxic vapors, and oxygen-deficiency atmospheres using a combustible gas indicator and calorimetric tube/organic vapor meter, respectively (performed by qualified personnel only). Consider isolations and/or evacuations if vapor readings are above 0 percent of LEL. Refer to DOT's North American Emergency Guidebook for general safety considerations.
- See section entitled Safety and Health/Incident Assessment for additional information on air monitoring, safety and health procedures, PPE, and a copy of the Site Safety and Health Plan template.
- Assist injured personnel, if applicable.
- Assess vapor migration hazards (direction and speed of travel).
- Establish plume size and direction of vapor release.
- Determine local population density and location relative to release area.
- Warn all on-site personnel and local residents of the incident and potential hazards by activating appropriate alarms, notifying the local authorities, or directly contacting the potentially affected parties.
- Determine appropriate PPE required to approach and re-assess the release.

2. Nature of Release

- Determine location and source of release.
- Identify the receiving environment (water, air, or land).
- Estimate size and direction of release and identify material type.
- Determine how to stop release if continuing.

3. Release/Spill Movements

- Assess direction and rate of movement of release.
- For aquatic spills, estimate the wind/current speeds and directions, also areas at risk.
- For land spills, estimate probable spill movements and potential for entering water.

- For airborne releases, estimate plume size, wind direction, and speed, also potential for impacting local communities. If a vapor cloud is visible, remember the actual vapor area is many times larger than the visible cloud.

4. Response Resources Required

- Determine what procedures are required to stop and contain or control the spill.
- Determine number of personnel and quantities of equipment necessary to implement the response techniques.

Mitigation Measures/Source Control

This section provides guidelines for controlling a release near the source and mitigating the associated consequences. Source control and mitigation involve anything from shutdown of operations to patching a leak, containing a spill, dispersing a vapor cloud, protecting a sensitive area, recovering the spilled material, or other such activities that are involved in an emergency response. Because of the infinite number of circumstances under which an incident could occur and the variety of equipment that could be involved, it is impractical to describe procedures that should be followed in all foreseeable emergency situations.

In the event of a spill involving a pipeline leak or rupture, the initial mitigation actions will likely consist of:

- Shutting down the pipeline
- Relieving the pressure on the affected line section
- Isolating the line section by closing the appropriate valves
- Evacuating the remaining contents of the affected line section
- Exposing the leak or rupture and installing a temporary patch

If the incident were to involve a breakout tank leak or overfill, the initial mitigation actions may include:

- Terminating transfer operations to the tank, if in progress
- Ensuring associated secondary containment system drain valves are closed
- Transferring the tank contents into available tankage or back into the pipeline
- Patching the leak if feasible and safe
- Water flooding the containment area, if applicable, to minimize soil penetration

Should the incident involve a pipeline release of HVLs or very toxic chemicals, the mitigation actions will likely involve those actions discussed above for pipeline leaks or ruptures as well as the following:

- Establish plume size/direction and eliminate ignition sources
- Contact local authorities to evacuate potentially affected areas
- Control access to affected area
- Use foam or water fog to blanket or disperse and knockdown vapors
- Displace, blow down, flare, purge, stopple, or use other methods to minimize the risk of a large release in a dangerous location.

Source control measures are implemented as close as possible to the source of a spill to minimize the extent of the affected area and generally involve:

- Construction of barriers, trenches, or earthen berms for containment
- Construction of berms or trenches for diverting spill to containment area
- Deployment of containment booms in waterways down current of the source
- Deployment of recovery equipment (pumps, vacuum trucks, skimmers)

Additional information on initial response and mitigation actions is provided in the individual response zone plans (Volume 2).

Emergency Notifications

General guidelines on the procedures and sequence for making the various internal (EMPCo) and external (regulatory agencies and local authorities) notifications following discovery of a pipeline release or other emergency incident follow. The information provided herein focuses primarily on internal notifications and reporting with some general information provided for external notifications. Due to the variability in state and local regulatory notification requirements, external notifications are addressed in greater detail in the EMPCo Spill/Release Notification Guide.

The internal notification procedures are essentially the same for all emergency incidents although the external notifications will vary depending on the type of incident, type and quantity of material released, and the consequences (injuries, deaths, and property damage). An overall incident notification chart is shown in Figure 5-3, which displays the common types of incidents that will require activation of the notification process.

Internal Notifications (EMPCo Personnel)

Whenever an emergency situation exists or is suspected, it is the responsibility of all EMPCo personnel to alert their immediate supervisors as well as the EMPCo Safety, Health and Environment and the OCC in Houston. In the absence of the next level of EMPCo supervision or management, pipeline personnel are expected to assume the responsibilities of their supervisor and continue the notification sequence. A list of all EMPCo response personnel and other key notification contacts is provided in each Zone Plan Section 12. The first on-site EMPCo representative may also be required to contact local firefighters, law enforcement officials, and emergency medical personnel as dictated by the incident circumstances.

EMPCo personnel have the authority and obligation to terminate any operation in response to an abnormal, threatening, or hazardous situation. OCC or local operations personnel should be contacted directly prior to other notifications to maintain a safe situation. The overall emergency notification responsibilities for EMPCo personnel are summarized in Table 5-3.

If a reportable spill or release occurs, notification to the appropriate regulatory agency(s) and/or local authorities must be made **IMMEDIATELY**, unless instructed otherwise. **Notify SHE in Houston immediately to begin the external notification process. The Area Supervisor or designee is responsible for ensuring that SHE is notified. If for some reason SHE cannot be reached then the Area Supervisor is responsible for initiation of the external notification process. During this process continue to attempt to notify SHE.**

Required external notifications generally involve a variety of federal, state, and local governmental agencies/organizations. Highlights of key federal notification requirements and lists of the types of state agencies and local authorities that may require notification are provided below. Figure 5-4 illustrates the external notifications that are often required for various types of incidents. Additional details on state and local notification requirements are provided in the EMPCo Spill/Release Notification Guide.

Federal

EPA and **DOT Office of Pipeline Safety** regulations require that any spill or other incident that meets the following criteria must be reported by telephone to the **National Response Center at 800-424-8802**:

a. Causes a death or personal injury requiring hospitalization, or

b. Results in a fire or explosion, or

c. Causes estimated damage exceeding $50,000, or

d. Results in pollution of any stream, river, lake, reservoir, or similar body of water that violates applicable water quality standards, causes a discoloration of the surface of the water or adjoining shoreline, or deposits a sludge or emulsion beneath the surface of the water (i.e., a sheen or greater) or upon adjoining shoreline, or

e. In the judgment of the operator was significant even though it did not meet the above criteria.

[Hazardous waste related fire, explosion, or other release that threatens human health or the environment outside the facility.]

The National Response Center is responsible for making all other necessary federal notifications.

Other federal agencies may include, but are not limited to, the:

- Occupational Safety and Health Administration (OSHA)
- U.S. Environmental Protection Agency (EPA)
- U.S. Coast Guard (USCG)
- U.S. Army Corps of Engineers (ACOE)
- Office of Pipeline Safety (DOT)
- US DOI Mineral Management Service (GOM Region)

The state and local agencies that often require or may request that they be notified are listed in Vol. 2, and generally include, but are not limited to:

State

- State police
- State environmental agencies
- State Department of Transportation
- State Emergency Response Commission
- Emergency management agency
- State railroad commission
- State air and/or water quality agencies

Local/Other

- Police/sheriff department (911)
- Fire department (911)
- Emergency medical service (911)
- Rescue squad (911)
- Local emergency planning commission (LEPC)/emergency services
- CHEMTREC/CHEMNET/CHLOREP 800-424-9300 (24 hrs)
- Disaster agency (ESDA)
- Port authority

- Water department
- Public works department
- Public health department
- Public officials
- Utilities
- Hospitals/ambulances
- Media (television, radio, newspaper)
- Customers and others affected by the emergency.

External Reporting Procedures

In reporting a spill to a regulatory agency or government authority, the EMPCo representative should be prepared to provide as much of the following factual information as available:

- Your name, address, and telephone number
- Name of party or individual responsible for incident
- Mailing address of responsible party
- Telephone number of responsible party
- Date and time the incident occurred or was discovered
- Specific location of the incident
- Name of material released
- Source of the released material
- Cause of the release
- Total quantity released
- Media affected (was material released to air, ground, water, or subsurface)
- Amount released into water
- Description of cleanup action taken and future plans
- Number and types of injuries or fatalities
- Other agencies that you have notified or plan to immediately notify

Spill Notification Forms (Vol. 2) can be used to record much of the above information and to provide a reference when making multiple notifications. This form can also be faxed to the EMPCo Incident Commander and/or Deputy Incident Commander to advise them as to the details that have been provided to the agencies.

When making the various notifications, it is essential to document who was contacted and at what time to ensure that all essential parties are notified. **Voice mail or answering machines do not qualify as contacting an individual or agency.** Telephone reports should be documented on the Notification Record form provided in Figure 5-2.

Follow-up External Notifications

Upon completion of the initial notifications and the implementation of the initial response actions, periodic follow-up notifications should be made to the National Response Center and state agencies to provide updated information on the incident including:

- Name of pipeline operator
- Time of release
- Location of release
- Name of material involved
- Reason for release
- Estimated volume of release
- Weather conditions on-scene
- Actions taken by personnel on-scene
- Actions planned by personnel on-scene

This information is similar to that required for the initial notification to the NRC. The notification form can also be used when making follow-up notifications. The SHE Manager or designee will be responsible for making the follow-up notifications.

Safety and Health/Incident Assessment

In addition to the safety and health concerns addressed by the preliminary assessment, a safety and health/incident assessment should be conducted to further evaluate the safety and health hazards including:

- Identification of material involved
- Physical and chemical characteristics of the involved material
- Determine liquid/vapor size and movement.
- Identification of communities and sensitive resources at risk
- Fire and explosion

Safety and Health Guidelines

Crude oil, petroleum products, chemicals, HVLs, and other materials transported or handled by EMPCo generally possess two key intrinsically hazardous properties:

- Flammability
- Toxicity (and/or may cause asphyxiation)

With the exception of hydrogen sulfide and a few other chemicals, the flammability of these materials usually presents a far greater hazard to field personnel than toxicity because fires and explosions are often difficult to protect against and can result in catastrophic consequences. The hazards associated with the inhalation of petroleum and chemical vapors and direct contact with many of the commodities handled by EMPCo should not, however, be overlooked.

EMPCo's Safety and Health Responder Manual provides guidelines for assessing the vapor and explosion hazards and determining the appropriate personal protection equipment (PPE) that should be used when conducting the assessments for releases of various commodities. The manual includes guidelines for responses to releases of:

- Acetone
- Benzene
- Butadiene
- Crude oil, gasoline, turbo fuel, and diesel
- Crude oil containing methyl mercaptan
- Liquid petroleum gas
- LPG-butane
- LPG-propane

Additional information on PPE, vapor monitoring, and fire and explosion hazards are provided in subsequent sections.

General Considerations

The general safety and health considerations for a spill/release response activity include:

- All employees/contractors must receive a safety orientation on the EMPCo Site Safety and Health Plan prior to the initiation of supplemental response procedures.
- All response personnel must have completed the appropriate HAZWOPER training and all support/non-response personnel shall have completed the training required for their position.
- No employee/contractor shall engage in any activities without the appropriate PPE.
- Operations during spills shall be conducted in accordance with EMPCo's, Site Safety and Health Plan.

- All injuries, no matter how minor, must be reported immediately to an EMPCo supervisor.
- Developments affecting safety may occur frequently; regular hazard/air monitoring is required.

Facts to remember during a spill/release response include:

- Cold weather may inhibit vapor production in spilled petroleum products. Even a slight warming trend may cause concentrations of vapors that are explosive.
- Downwind, low-lying areas could contain harmful accumulations of vapors or low oxygen concentrations.
- The sense of smell is not an adequate indication of the presence (or absence) of harmful vapors or gases.
- If a vapor cloud is visible, do not enter the cloud. Remember the actual vapor area is many times larger that the visible cloud (up to 3 to 5 times larger).

Identifying Safety Concerns and Prevention

Introduction and Objectives

During cleanup operations the physical working environment for employees must be continually evaluated. Exposure to either hot or cold weather conditions along with long working hours will adversely affect both the psychological and physiological conditions of those involved. Continued exposure may result in physical discomfort, loss of efficiency, and a higher susceptibility to accidents and injuries.

This section discusses the most common causes of accidents and injuries and identifies appropriate preventive measures to ensure a safe working environment and attitude.

<u>Buddy System:</u> Communication is critical in working groups. Always stay in visual contact with your team and talk to or observe your buddy frequently. Use of the team approach and/or buddy system assures:

- Emergency assistance is always available
- Observation for signs of overexposure
- Periodic checks of personal protective equipment

<u>Slips, Trips, and Falls:</u> Slips, trips, and falls comprise the major physical hazard to personnel. Most activities will be conducted in an environment and on surfaces that are not conducive to walking, namely wet and/or oily surfaces. Many of the walkways, steps, and ladders built for use in the marine environment and do not meet OSHA standards. This, combined with the wet, oily conditions, increases the risk for injury to the back, knees, and ankles from slips, trips, and

falls. Control measures must be taken by installing anti-slip surfaces, building adequate access ways, installing handrails, warning employees, and other similar steps to eliminate these hazards.

Slips

- Loss of traction is the leading cause of workplace slips.
- Slips can be caused by wet surfaces, spills, or weather hazards like ice and snow.
- Footwear with soft, flexible soles that fit well is a must.
- Practice safe walking skills:
  - on wet surfaces take short steps and keep your center of balance under you; point your feet slightly outward
  - be cautious of smooth surfaces
  - clean up floor spills immediately

Trips

- Make sure you can see where you are going.
- Keep work areas well-lit.
- Keep work area clean; don't clutter aisle, stairs, or foot paths.
- Arrange equipment so it does not interfere with your walk path areas.
- Extension or power tools can be dangerous tripping hazards.
- Eliminate hazards due to loose footing on stairs, steps, and floors.
- On loading docks, store gangplanks and ramps properly.

Falls

- Falls are a leading cause of injury-producing accidents.
- Avoid jumping.
- Repair or replace broken stairs or handrails that are loose or broken.
- Do not store items on stairs or in aisles.
- Wear good shoes. Non-skid soles are a good choice.
- Inspect all ladders for defects before you begin climbing.
- Do not over reach from a ladder or stand on the top step of the ladder.
- Hoist tools or materials up to you after you reach the top of the ladder.

<u>Strains:</u> Strains can also be a major accident cause. Pulling of boom, handling oil waste materials, securing boats, handling hoses, and overexertion are examples of sources for strains. Slips, trips, and falls also result in strains. The most common will be back strain, although any muscle group may be affected.

Effective measures to eliminate strains include use of mechanized lifting equipment, employee education, and assuring that sufficient assistance is available to prevent overexertion.

- Lift with your legs and not your back.
- Don't try to lift too much-get help or use machinery.
- Pulling of anchors or hoses on beaches is a common source of back strains, etc.

Temperature/Health Concerns: Ambient temperatures can substantially affect work conditions and worker safety. All personnel should remain alert to changing conditions affecting their safety. Some temperature concerns are:

Heat Stress

- During rest periods, remove/open protective clothing to facilitate body cooling.
- Adjust work/rest regimens as required.
- Force fluids! Sense of thirst is not an adequate indicator of the need for fluids!

Hypothermia

- Layered clothing generally protects against cold better than single "heavy" garments.
- Be aware of the mobility restraints when wearing multiple layers of clothing.

Noise: Harmful noise levels can be prevalent in oil spill activities. Sources of noise include boats, generators, pumps, aircraft, winches, and other commonly used equipment. Impact noise (sharp or explosive inputs of energy) will exist in some of these operations. High noise levels as determined by field surveys and monitoring may require hearing protection.

Hearing protection will be provided to minimize exposures. If noise monitoring and surveys determine a noise hazard exists, those operations will require full-time use of hearing protection.

Eye Safety: Splashing of liquids (oil, oil materials, salt water, transfer of liquids), vapors (from the spill, fumes from the equipment), welding, grinding, and other operations may pose risks of eye injury and irritation.

Wind, heat or cold, and reflective sunlight dry the eyes and appropriate action must be taken to minimize eye irritation.

- Suitable eye protection must be worn in all work areas. Safety glasses are a minimum. Boat decks, barge decks, staging areas, etc., are considered work areas.
- For those involved in beach washing/spraying activities, consideration should be given to face shields or goggles. If contact lenses are worn on the work site, goggles are required instead of safety glasses.

- Proper eye protection is required for welding, grinding, cutting, and burning. This includes welding hood, face shield, and colored goggles, respectively. Do not watch welding operations even from a distance unless you have proper eye wear.
- If oil or any material enters eyes, flush thoroughly with eyewash solution or clean fresh water and have eye examined by medical personnel.

<u>Boat/Water Safety:</u> Boat usage has many risks to employees working from them. Potential hazards are: unsafe operation; embarking or disembarking; line handling; and horseplay. Fueling, pulling loads, poor sea conditions, lack of communications, inadequate boat or motor for sea conditions, and improper safety gear all create additional hazards to personnel.

Water operation will be governed by these minimum requirements:

- All boats will comply with Coast Guard regulations for their size and class. Operators of vessels used to transport personnel will be properly trained and meet all USCG requirements.
- Radio equipment on all boats and vessels shall be in good working order and compatible with ExxonMobil and/or contractor communication networks.
- All boats used to transport personnel will be outfitted with the necessary navigation equipment to assure safe transportation. At a minimum, the following navigational equipment, in addition to communication equipment, will be on-board and in good working order: compass, radar, and depth finder.
- Boats without navigational aids (radar) will not travel at night or in a fog.
- When personnel are going from a boat to another vessel, boat to shore, or working where there is a danger of falling into the water, they will wear USCG approved personal flotation devices (PFDs), Type V suits, or Type III jackets. Your supervisor will inform you of the type of PFD required for the work you will be conducting.
- Handle anchors and anchor ropes carefully. A common accident is catching the hand between the boat side and anchor rope.
- Extreme care is needed when beaching the boat due to waves and potentially strong underwater currents and underwater obstructions.
- To assure safe boat operations, personnel will be instructed <u>not</u> to:
  - Stand up or move around in small boats while they are underway.
  - Overload the boat or distribute loads unevenly.
  - Decelerate suddenly, allowing the stern wake to overtake and swamp the boat by washing over the transom.
- In handling gasoline for small outboard motors:
  - \- Always fuel boat in good light. Fill all portable tanks on the dock, not

while in the boat.

- - Do not smoke, light matches or lighters, or operate electric switches.
- - Stop engines, motors, fans, and anything else that may cause a spark.
- - Guard against spillage. If fuel spills, wipe it up immediately. Do not let vapor get below the deck.
- - After fueling air out the boat for 5 minutes.

<u>Boom Handling Safety:</u> Boom launching and deployment can be a hazardous procedure. The boat operator must be immediately informed of any problems during deployment that would damage the boom or injure personnel. Remember that boat operators may not be able to see the boom storage area, and their primary concern is the safe operation of the boat.

When towing boom it is important to note that a tow line is a potential danger to anyone near if it breaks and whips forward. The tow line should be attached to the tow vessel so that it can be easily cast off or cut loose if necessary. Other boom towing concerns include:

- Never tie a tow line to an off-center stern cleat as it is dangerous and can make steering difficult.
- Never allow anyone to hold a tow line while towing boom.
- Initiate towing slowly and pull boom at a steady and reasonable speed to avoid exerting a strain on the vessel, tow line, and/or boom.
- Anticipate the effects of wind and current on the boom as it is towed.
- Ensure the boom and tow line have sufficient strength to withstand towing forces.
- Do not hold onto boom anchors by the shank or flukes during deployment.

<u>Aviation Safety:</u> Aircraft present many potential hazards to both passengers and ground personnel. Standard aviation programs address many of these safety concerns. The following points highlight aviation safety:

- All air traffic will comply with FAA regulations and ExxonMobil command directives.
- No one will board or exit any aircraft unless directed by pilot; the aircraft and its passengers are under the control of the pilot.
- When traveling in helicopters or amphibious aircraft, approved PFDs must be worn.
- Seat belts are required to be worn at all times.
- When entering or exiting a helicopter, walk straight to it from the side or front, never from the rear. The tail rotor can cause severe injuries.

- When entering or exiting winged aircraft, approach from the side or rear under direction of pilot or designated personnel.
- When entering helicopters, watch foot placement in order to protect the emergency pop-out flotation pontoons. Stepping on the pontoons may puncture them.

Pressure Washing and General Equipment Safety: Pressure washing techniques can result in hazards to operators. Any persons operating such equipment must be specifically instructed in safe use of such equipment by their supervisors. Training will include:

- Orientation to the pressure system, relief valves, and pressure gauges.
- Special instruction in routine operation and maintenance of equipment.
- Special precautions to protect eyes, face, and skin from contacting pressure wash stream.
- Proper use of all personal protective equipment (eye protection, hard hat, coveralls, boots, gloves, slicker suits, hearing protection, personal flotation devices, face shields, etc.)
- Do not wear jewelry, loose clothing, or loose long hair around operating equipment.

Equipment will not be operated without proper training.

Fire and Explosion: The fuels used to support oil clean-up equipment pose a potential exposure to fire if not properly handled.

Accumulated debris, oil waste, trash, and other fuels will be present in all operations to add to the fire danger. Strict control and isolation of these fire sources will be exercised to avoid their accumulation in inhabited areas. The following guidelines should be observed:

- Care must be taken around hydrocarbon and fuels: gasoline storage and transfer must be per codes and a fire extinguisher must be readily available.
- Fuel handlers will be trained in safe handling techniques.
- Fire suppression equipment will be readily available.
- Smoking is not allowed near flammable materials.
- Welding and burning require hot work permits where hydrocarbon mixtures may exist (i.e., vessels, tanks, etc.) The safety department will issue work permits.
- Warming fires for employees also become a source of ignition for oil clothing, wastes, and other debris.
- All fires will be completely extinguished before leaving the work site.

Summary

- Make safety your first step in every job. This includes proper use of personal protective equipment, hazard recognition, watching your buddy, injury reporting, keeping shorelines free of debris, proper decontamination, and all other elements of this program.
- Do not operate equipment unless you have been trained in its use.
- If you are a supervisor, you have a responsibility to protect the people working for you.
- By following the procedures outlined in this program, you should be able to protect yourself and your fellow workers from hazards and to perform your work in a safe and healthy manner.

Physical and Chemical Characteristics of EMPCo Commodities

The EMPCo system transports various types of commodities including:

- Crude oil (including condensates)
- Refined petroleum products (gasoline, diesel, fuel oils, heating oil etc.)
- HVLs (butane, propane, ethane, ethylene, LPGs, etc.)
- Gases (oxygen, nitrogen, etc.)
- Chemicals (benzene, acetone, resins, etc.)

The key chemical and physical characteristics of each of these commodities are listed in Table 5-4.

Personal Protective Equipment (PPE)

To ensure the protection of all cleanup workers and other response personnel, PPE will be required for specific response activities or during transit between sites. Certain items of PPE are mandatory and others are optional depending on the circumstances, e.g., potential for vapors. Actual PPE requirements will be determined by the Safety and Health Responder, the SHE Manager or his designate. Most EMPCo personnel have been issued their own PPE and keep it close to their normal work areas. Additional PPE is available at the EMPCo field offices and stations.

General PPE to be used for activities with potentially elevated levels of exposure (i.e., cleanup and waste handling) are as follows:

- Face and eye protection
- Hard hats
- Oil-resistant gloves
- High top, oil-resistant boots
- Protective outer wear/rain suits, Tyvek suits, and/or fire-proof (Nomex) overalls or undergarments
- Personal flotation device (Type III PFDs or better)
- Respiratory protection (if required)

Air purifying respirators can only be used under the following conditions:

- Total organic vapor concentrations are less than 1,000 ppm and/or benzene concentrations less than 50 ppm.
- Identity and concentration of the contaminant are known.
- Oxygen content in the air is at least 19.5 percent.
- Periodic air monitoring of the work area is conducted.(At least every 4 hours)
- Respirator assembly is approved for the specific contaminant and concentration level.
- Type of respirator being used has been successfully fit-tested on the wearer.

If respiratory protection is required, NIOSH approved half-face, air-purifying respirators with organic vapor cartridges (color coded black) will be on hand and worn whenever total airborne hydrocarbon or benzene levels in the breathing zone exceed 100 parts per million (ppm) or 1.0 ppm, respectively. For sustained readings of greater than 10 ppm total hydrocarbons, a digital readout indicator utilizing a Draeger CMS or Ultra_Rae test kit should be performed for the presence of benzene. Respiratory protection should be provided at benzene concentrations greater than 0.5 ppm. Supplied air respirators should be used whenever organic vapor concentrations exceed 1,000 ppm, benzene is greater than 25 ppm or the oxygen content in the air is less than 19.5 percent.

In some instances it may be advisable to control personnel exposure to vapors by other means. If practical, workers should be positioned upwind from vapor emissions. A large industrial-type ventilation fan can be directed to blow vapors away from the workers' breathing zone.

Vapor Plume Dispersion Monitoring

Organic vapors may be released during a spill event which pose a toxicity or a flammability hazard. The monitoring of vapor hazards created by spills of oil or petroleum products or releases of HVLs will be conducted by qualified personnel (i.e., HAZWOPER Hazmat Tech or above). Most hazard monitoring involves using a 3 gas monitor type instrument(s) to monitor for potentially explosive vapor accumulations, toxic vapors and/or oxygen-deficient atmospheres. Once initial monitoring has been completed, the general response area should be rechecked, not to exceed every four hours, to ensure that the conditions have not changed and that hazards have not increased. If vapor levels are consistently low or non-detectable, vapor monitoring may be discontinued or the frequency reduced. (10 or more sets of consecutive data show the PELs have not been exceeded)

Passive organic vapor monitors (badges) can also be worn near the breathing zone of personnel potentially exposed to environments containing hazardous organic vapors. The monitors measure time-weighted average (TWA) concentrations over a measured time interval. (Should be replaced, if necessary, every 8 hours) The gas and vapor limits where response activities should proceed with caution or be terminated are listed in Table 5-5.

Plume Migration

A vapor plume (an elongated and usually mobile column or band of vapor) generated by HVL, chemical, or light petroleum product spills can migrate or spread over considerable distances from the site of the release creating remote fire, explosion, and toxicity hazards. Plume migration and dispersion are generally driven by the local winds although most hydrocarbon vapors are heavier than air and, in the absence of wind, may migrate downgradient along surface contours and accumulate in natural depressions. High winds will often rapidly disperse vapor plumes, thus minimizing potential safety and health hazards. Very light winds can, however, transport a vapor plume a significant distance with little dispersion effect.

Government sponsored emergency response agencies usually have available (from NOAA, US-EPA, or the National Safety Counsel) a computer software program known as Computer Aided Management of Emergency Operations (CAMEO). Within CAMEO is an air dispersion modeling application called ALOHA and a digitized mapping application called MARPLOT. Cameo can (with incident specific user inputs) conduct extensive automated hazard analysis and graphically model the estimated "footprint" and concentration of the vapor plume plotted to scale on an area map. Most state HazMat Teams and fire departments use this computer aided system.

Plume Monitoring

If a spill or release is suspected to present a toxic or explosive vapor hazard, monitoring should begin a safe distance upwind of the release area and work toward the source, continually monitoring the atmosphere. If vapors in the release area are found to be below 10 percent LEL, it is still advisable to monitor areas downwind, particularly if they are populated or frequented by the public. In this case it is often advisable to begin at the potentially affected downwind area, provided it is greater than 200 to 300 yards away, and again work toward the source. Readings should be documented at regular intervals or distances from the source and rechecked periodically.

Hydrogen Sulfide

Some of the crude oils transported in EMPCo pipelines contain hydrogen sulfide (H_2S). If enough H_2S is present in the oil, it is termed to be a "sour" crude. But, even though a crude may not be called "sour," it can still contain sufficient H_2S to require special precautions when handling. A H_2S vapor meter should be used for all crude oil spills and whenever H_2S is suspected in the spill material. If concentrations greater than 10 ppm are measured, personnel at the site should use self-contained breathing apparatus or airline respirator, with escape-pack, until indicated otherwise by subsequent personnel monitoring. Should the presence of H_2S be suspected prior to monitoring, evacuation of the immediate area is recommended.

Some of the physical properties of H_2S are:

- It is a colorless, extremely toxic gas which has a "rotten egg" odor at extremely low concentrations but which deadens the sense of smell at slightly higher concentrations (odor fatigue).
- It causes respiratory paralysis.
- When mixed with air from 4.3 percent to 46 percent by volume, the mixture is EXTREMELY EXPLOSIVE. Ignition can occur at 500° F. Catalytic converters and exhaust manifolds on cars and trucks operate at or above 500° F. Other sources of ignition would be matches, sparks, cigarettes, etc.
- H_2S is heavier than air. Try to stay uphill or upwind of the source.

Chemical protective clothing, nitrile gloves, rubber boots, and goggles should be worn by all personnel working on the cleanup of oil containing H_2S. This precaution will minimize skin contact with H_2S gas, although currently no known hazards exist from skin contact with this substance.

Benzene

Exposure to benzene may result in a variety of health effects depending on level and duration of exposure. These effects can include:

Low concentrations
- Eye irritation

Short term high exposures (>2000 ppm)
- Nausea, dizziness, unconsciousness, death

Prolonged exposure (even at relatively low levels)
- Blood related disorders - anemia,
- Genetic effects - bone marrow, lymphocytes
- Cancer - leukemia (ANLL) / other blood related cancers

Benzene is a naturally occurring component of crude oil, natural gas liquids and natural gas condensate and is found in refined hydrocarbon products such as gasoline; however, airborne concentrations can vary depending upon the composition of the material. Product Benzene and other high percent Benzene streams such as the Dripolene and Picco Resin lines are also transported in liquid form through selected EMPCo pipelines.

The OSHA permissible exposure limits (PELs) are 1.0 ppm as an 8-hour time weighted average (TWA) and 5.0 ppm as a 15-minute short term exposure limit (STEL). The OSHA action level is 0.5 ppm as an 8-hour TWA. The ExxonMobil Occupational Exposure Limit (OEL) is more restrictive than the OSHA PELs. The OEL followed at ExxonMobil for Benzene exposures is as follows:

8-HR TWA LEVEL	STEL (15 MINUTE) LEVEL
0.5 ppm	2.5 ppm

Fire and Explosion

HVL releases and, under certain circumstances, crude oil, chemical, and petroleum product spills may present a fire or explosion hazard. In initial evaluation of any spill, the following rules should always be considered:

- Until otherwise established, all spills should be considered potential fire hazards. This is particularly true in the case of large, continuous spillage and refined product spills.
- Any spills involving confined airspace in which vapors may accumulate (inside structures, under docks or bridges, etc.), particularly those involving light crude oils and/or refined products, should initially be considered as potentially explosive situations.

Note: Aggressive responses to large aquatic spills involving gasoline is not recommended due to extreme fire hazard. Similarly, aggressive responses to large terrestrial gasoline, diesel, jet fuel, and other petroleum product spills is also not recommended without the assistance of the local fire department.

Fire and explosion hazards are generally evaluated based on visual observations and combustible gas indicator of lower explosive limit readings. The LEL is the minimum vapor concentration where flame propagation will occur in the presence of an ignition source. There is also an upper explosive limit (UEL) above which explosions will not occur due to the excessive vapor concentrations and lack of oxygen. Many combustible gas meters will drop to 0 or below when the UEL is reached.

Guidelines for entry to conduct response operations in the presence of potentially explosive vapors are provided in Table 5-5.

Fire hazard will normally diminish rapidly with time and distance from the source. Prevailing weather conditions can also influence fire hazard. A hot day with little or no wind could accentuate vapor buildup. Conversely, winds tend to disperse vapors.

All crude oils are listed as flammable liquids. Generally, the fuel source for any initial fire or explosion would be the vapors given off by the liquid. This ignition of the vapors would then cause the liquid to burn. To determine if an explosive or ignitable atmosphere exists, combustible gas indicators should be used. These limits have been set to determine necessary personal protection and prohibited atmospheres.

Ignition may be caused not only by the more obvious sources, such as fire, but also by an electrical system, the hot exhaust of an internal combustion engine, by sparks from electrical equipment, mechanical or friction sources, hot flying particles from burning embers, welding and cutting equipment, and the discharge of static electricity. Great care must be taken to eliminate all possible sources of ignition.

Floating debris in spilled oil may act as a wick increasing the ignitability of heavy petroleum oils. Therefore, care must be taken to ensure that spilled oil is not accidentally ignited.

Equipment used in an ignitable atmosphere must be explosion-proof. If explosion-proof equipment is not available, work should be allowed to proceed only when tests with a combustible gas indicator show that the area is safe. Once again, the danger is highest in confined and poorly ventilated areas.

Site Safety and Health Plan Template

Federal OSHA regulations (29 CFR 1910.120) require that a Site Safety Plan be prepared for spill response operations. A copy of the EMPCo Site Safety and Health Plan is presented in Appendix D. It is designed as a "fill-in-the-blank" or template format so site-specific plans can be quickly developed for each emergency incident. A site-specific plan must be developed as early as possible during the incident, reviewed with EMPCo and contract personnel, and be readily available at the site for review/inspection.

Spill Assessment

Spill Size, Classification, and Movement

Spill Size

Early in a spill response, total spill volume determines, in part, the equipment, logistics, manpower, and disposal requirements. Actual spill volumes are often unavailable or inaccurate so even rough field estimates are valuable. A few quick methods, as discussed below, can be used to provide working approximations of spill size.

Pipeline Losses

If a spill occurs during a transfer operation, the total spill volume can be estimated by multiplying the pump rate by the elapsed time between leak commencement and transfer shutdown plus the contents of the line between the two closest valves or isolation points for a total pipeline failure.

- Volume loss (bbl) = Pump rate (bbl/min) x Elapsed time (min) + Line contents (bbl)

Spills resulting from flange or hose leaks will likely occur at a significantly lower rate. Tank overfills can be calculated in the same manner as pipeline ruptures except there is no line volume to consider. The best source of spill volume data in the Operations Control Center.

Breakout Tank Losses

Estimates of losses from breakout tanks through leaks or failure of external piping can be determined by gauging the tank. If initial contents or volume are not known, the tank should be assumed to have been full, unless it is obvious that a far smaller amount has been spilled.

A working estimate of spill volume on water can be made by a visual assessment of the surface area and thickness of the slick. Slick dimensions can also be estimated from the air using surveillance electronics and occasionally from the water surface using radar. Figure 5-5 can be used to estimate spill volume based on the appearance of the slick. Slick thicknesses greater than 0.25 mm (0.001 inch) cannot generally be differentiated by appearance.

Classification
In certain situations it may be desirable to classify a spill based on the volume discharged. The National Contingency Plan provides criteria for classifying inland and coastal oil spills provided below. It is important to note that these classifications are intended to serve as criteria for actions to be undertaken by the Federal On-Scene Coordinator and do not relate to a degree of hazard to the public or the environment. EMPCo, however, tends to base their response actions on the spill's hazard potential as well as the size.

	Coastal Waters	Inland Waters
Minor spill	Less than 10,000 gallons	Less than 1,000 gallons
Medium spill	10,000 to 100,000 gallons	1,000 to 10,000 gallons
Major spill	Over 100,000 gallons	Over 10,000 gallons

Aquatic (Water) Spill Surveillance
Surveillance of large aquatic spills should begin as soon as possible after discovery of a spill to enable the Incident Commander or Deputy Incident Commander and other response personnel to track movements and develop and implement an effective response plan. Spill trajectory estimates are also a critical component of response planning and implementation, particularly with respect to the protection of sensitive areas.

Spill surveillance is best accomplished through the use of helicopters or small planes. Helicopters are preferred due to their superior visibility and maneuverability and the ability to land or hover close to the water or ground to confirm observations made from higher altitudes. If fixed-wing planes are to be used, the high-wing types provide considerably better visibility than low-wing. Over-flights should be conducted hourly during the first few days to track spill movements and all significant observations should be documented both in writing and with photographs and/or videotapes. Topographic maps or nautical charts should be used as base maps to record aerial observations. In reduced visibility conditions, such as dense fog or low cloud cover, other methods of surveillance will be required. If the spill does not involve gasoline or HVLs, boats may be used to patrol the area and document the location and movements of the spill. Vehicles may also be used to observe the water from various vantage points, although reduced visibility will also tend to limit the effectiveness of this method.

Oil Movement on Land
Oil discharged from an underground source, such as a buried pipeline, usually reveals itself at the surface of the ground (though not necessarily at the leak location) except where certain geological subsurface structures exist. The direction of the flow is governed by the topography and the area covered depends on the volume and the properties of the discharged material. Low viscosity liquids, such as gasoline and turbine fuel, may be expected to penetrate dry sandy-type soils, thus reducing surface spread but increasing the problem of subsurface soil reclamation.

Conversely, viscous liquids resist infiltration of clay-type or water-saturated soils which increases the surface coverage.

The amount of oil retained in the soil as it travels downward is typically between 0.5 to 1.2 quarts per cubic foot and depends on the properties of the soil and discharged oil. Surface spills involving most pipeline transported commodities can be expected to saturate no more than the top 4 to 8 inches of topsoil. The downward movement may, however, continue until the oil spill volume retained by residual saturation of the overhead subsoil, is stopped by an impenetrable layer, or reaches the groundwater level.

The shape of the body of the liquid in the subsoil depends on the type of soil, the properties of the liquid and the subsurface water movements. In a homogeneous subsoil without fissured rock or flowing groundwater, the shape of the body of the liquid is ellipsoid, while a rapid groundwater horizontal flow may produce an elongated shape spread in the direction of the water flow. However, most soils are heterogeneous, which cause irregular and unpredictable-shaped bodies of saturated subsoil.

Spreading rates vary in the subsoil. Typically 40 percent to 70 percent of the final spread is obtained in the first 24 hours, with 60 percent to 90 percent being reached in one week. The spreading process can continue for long periods, but eventually the residual capacity of the soil is reached and spreading ceases. Any further movement of the liquid results from displacement by water, which can lead to a slow migration in the direction of the groundwater flow.

The reappearance of oil in the vicinity of a leak usually is associated with a period of heavy rainfall or melting snow and can continue for some time, depending upon the distance between the discharge location and the point of reappearance.

Oil Movement on Water

The movement of oil spilled on water depends primarily on the effects of local winds and surface currents. **Surface currents will dominate spill movement unless winds are very strong.** When currents and winds are absent, slick spreading will determine the probable location of shoreline contact. However, slick movement will be dominated even by weak surface currents.

Estimates of oil slick movements by on-scene personnel can be accomplished by vector addition of the two main motive forces that apply:

- Surface current speed and direction
- Wind speed and direction

Observations from actual spill incidents have shown that surface water currents will cause a slick to move at about the same speed and direction as the water, whereas wind will cause an oil slick to move at about 3 percent of the wind speed and in the same general direction.

Vector addition is used to estimate slick movements when both wind and current components are present. Figure 5-6 gives an example of the vector addition method for a 0.3-knot northerly water current and a 10-knot northwesterly wind. The general methodology is:

1. Determine wind and current speeds and directions. Obtain a base map, compass, and ruler.

2. Determine the spill location or present position on a map and draw water current and wind component vectors in their relative directions and lengths from that point (length of vector represents velocity: 1/2 inch = 0.1 knot). Remember wind directions are always stated as "from the _____," and the vector line points 180° to that orientation.

3. Draw a line parallel to the wind vector starting from the tip of the current vector and measuring the exact length of the wind vector as shown in Diagram 2 of Figure 5-6.

4. Draw a line from the point of origin (present oil slick position) to the tip of the parallel wind vector line drawn (Diagram 2) as shown in Diagram 3 of Figure 5-6. This final line is the resultant vector that gives the direction and speed of slick movement (i.e., east-northeast at 0.24 knot). The direction can be measured using the cardinal points of a compass. The speed is determined by the length of the resultant vector relative to the scale used in drawing the component vectors.

Wind velocity is generally available from the local office of the National Weather Service. Current speeds and directions may have to be estimated at the time of the spill by pacing off a 100-foot section of shoreline, throwing a stick or other floating object into the water upcurrent of the section, and timing how long it takes the object to traverse the 100-foot area. The direction of the object movement will also approximate the surface current direction combined with the effects from local winds, if present. The time required (in seconds) for the object to move 100 feet is divided into 100 to estimate current speed in feet per second (fps). The resulting fps is then multiplied by 0.5921 to convert the speed into knots.

Selected conversions are provided below:

- 0.25 knot = 240 seconds/100 feet (0.42 fps)
- 0.5 knot = 120 seconds/100 feet (0.83 fps)
- 1.0 knot = 60 seconds/100 feet (1.67 fps)
- 1.5 knot = 40 seconds/100 feet (2.5 fps)

Tidal Water

The periodic change in the speed and direction of water movement or surface currents must be considered when deploying booms in a tidally influenced environment. Oil spills in tidal waters create a special problem due to the movement of water in two or more directions. As the tidal forces change throughout the day, the general movement of water changes direction, which, in turn, can change boom deployment strategies. Local tide tables should be consulted to assist in developing daily response plans. Some sources for tide tables include: daily newspaper, marinas, U.S. Coast Guard, and libraries.

Sampling and Testing

In defining an acceptable response to a spill incident, it is necessary to know certain physical and chemical characteristics of the spill material. If positive identification of the spilled material can be made without testing, product data may be obtained from a material safety data sheet (MSDS), product specification information, and/or records of product physical and chemical properties.

Occasionally a spill may occur in which the spilled material is not readily identifiable. Typically, laboratory analytical data for spill event samples will not be instantaneously available during an emergency. Therefore, it is necessary and desirable to field-categorize oils as the product reacts and changes in the environment. Although varying widely in physical and chemical properties, oil products have common basic features that permit their grouping for predictive evaluation of environmental effects and determination of control actions. In addition, as petroleum products react and change (e.g., weather) when exposed in the environment, the laboratory data may not be representative of "real-time" conditions; rather the data may instead reflect the chemical characteristics of the spilled material(s) at the time of sample collection.

Natural Resource Damage Assessment

NRDA Background Information

The Natural Resource Damage Assessment (NRDA) process was established by the Oil Pollution Act of 1990 (OPA90) with the goal of restoring damages to natural resources which have resulted from spills/releases of oil or hazardous substances. The lead federal agency providing NRDA regulatory guidelines is the National Oceanic and Atmospheric Administration (NOAA).

NRDA is directed toward quantifying injuries to natural resources and their services, and identifying restoration alternatives. Natural resources include land, fish, wildlife, biota, air, water, and other resources belonging to, managed by, or controlled by the United States, state or local government or Indian tribes.

This restoration goal is achieved by determining damage to injured natural resources and returning injured resources to pre-spill conditions and compensating for interim losses from the date of the spill until recovery. Compensation is through restoration, rehabilitation, replacement or acquisition of equivalent natural resources and/or services. Compensation can be monetary or actual restoration of the natural resource. Responsible Parties (RP) are obligated to pay for all reasonable costs of an NRDA, including assessment, planning, and restoration costs. NRDA costs vary but can be 25% or more of the entire spill response cost.

The NRDA process is implemented by government trust agencies (trustees) following an oil spill where injuries to natural resources have occurred or are anticipated. Natural Resource

Trustees can consist of as many as 5 or more agencies. The RP will be invited to participate in the NRDA process, but only to the extent agreed by the NRDA trustees.

NRDA regulations require a highly structured process which involves three phases: pre-assessment (determine injury), restoration planning (assess injury & select restoration method), and restoration implementation. This process can take several years to complete.

EMPCo and ExxonMobil's NRDA Response Team Interaction

Because of the highly technical nature and associated legal liabilities of NRDA, EMPCo will rely on ExxonMobil Company Natural Resource Damage Assessment Group, which is a function of ExxonMobil's Environmental and Safety Department (ESD), to design and execute NRDA studies for EMPCo. EMPCo's Safety, Health and Environment Manager, in consultation with the affected Area Manager/Supervisor, will be responsible for determining the need for damage assessment monitoring and will contact ExxonMobil's NRDA Group as part of the initial internal notification process for selected incidents.

ExxonMobil's ESD has developed a "*NRDA Response Manual"* in March of 1998, to provide a basic understanding of the NRDA process, guidelines for NRDA response, and identification of roles and responsibilities of ExxonMobil response team members. However, the *NRDA Response Manual* was developed to address only the initial steps of NRDA activities for spills of oil.

Copies of ExxonMobil's *NRDA Response Manual* have been distributed to EMPCo and a copy can be accessed in electronic version on EMPCo's Local Area Network (LAN) computer system in directory E:\\Company on Epchouston \ Group \ ECNote \ Guidance Documents \ ExxonMobil NRDA Response Manual.

Key points addressed in the *NRDA Response Manual are:*

- EMPCo's role early in the process is vital and will be to evaluate the potential for NRDA activity resulting from an oil spill and to contact ExxonMobil's NRDA Team and contractors. All NRDA Team activities, beyond determining potential and early notifications of ExxonMobil's NRDA Advisor and contractors will be handled by ExxonMobil's NRDA Team.
- A critical part of a NRDA consideration is collecting environmental data of baseline conditions in the spill area prior to impact by oil, if possible. These data can include water and sediment chemistry, biology/wildlife, air quality, and oil chemistry. This data can possibly verify normal baseline damages which existed prior to the spill impact.
- A NRDA Team will be established within the first day of the incident. ExxonMobil's NRDA Advisor from (ESD) will assume responsibility of the NRDA process within the first day of the spill incident. The NRDA team will be a cooperative effort between ExxonMobil USA, contractors and Trustees. ExxonMobil will represent EMPCo's interest on the team. Some of these trustee

agencies are listed in Appendix A of ExxonMobil's *NRDA Response Manual*.

- Because the NRDA process can result in potentially large costs and liabilities, close coordination with EMPCo/ExxonMobil Law and Senior Management is required.
- Early in the process ExxonMobil Law Department will need to negotiate a Memorandum of Agreement (MOA) with NRDA Trustee Agency Legal staffs. The MOA basically sets forth the terms under which ExxonMobil will be responsible for the Trustee's costs and establishes an agreement to share data and information gathered.
- A flowchart in the *NRDA Response Manual* which is titled "ExxonMobil NRDA Contingency Plan" illustrates the ExxonMobil NRDA Response Process. The flowchart is also provided at the end of this section in Figure 5-7.

EMPCo's NRDA Response Actions

EMPCo published and circulated an Environmental Compliance Notification (ECNote) memo in April of 1998 addressing EMPCo 's NRDA Guidelines for Oil Spills. The ECNote explains the planned interactions established between EMPCo and ExxonMobil for initiating a NRDA response and implementing the processes referenced in the ExxonMobil *NRDA Response Manual.*

The NRDA ECNote provides guidance on critical first steps outlined in ExxonMobil's *NRDA Response Manual* which must be taken by EMPCo when an oil spill is likely to cause natural resource damage activity. These steps must begin immediately as facts of the spill's impact become known.

These steps include: 1) identifying potential for NRDA activity, 2) notification of ExxonMobil NRDA Advisor, and 3) collection of important "ephemeral" data (defined in the *NRDA Response Manual*) to be used in subsequent NRDA activities. This data collection will be conducted by dedicated NRDA contractors, identified in Appendix A of the *NRDA Response Manual*.

Copies of EMPCo's NRDA ECNote can be accessed in electronic version on EMPCo's Local Area Network (LAN) computer system in directory E:\\Company on Epchouston \ Group \ ECnote \ Guidance Documents \ NRDA Guidelines for Oil Spills.

The initial EMPCo NRDA response actions which are fully described in the above mentioned reference documents are summarized in the following three steps:

1st Step → Following a spill event, EMPCo's Area Supervisor, or designee, in consultation with the EMPCo's Safety, Health and Environment (SHE) Manager will **evaluate the spill incident circumstances for the potential of a NRDA Activity**.

There are no definitive guidelines by agencies which describe when an NRDA action will be initiated. However, the size of the incident and activities by Trustee agencies can be used to gauge whether an NRDA response might be necessary. Basic questions that may be asked to evaluate NRDA potential include:

- Did the spill leave EMPCo's property? or;
- Will sensitive wildlife or wildlife habitats be impacted? or;
- Will clean-up require more than one or two days? or;
- Are Trustees evaluating damages to natural resources? or ?

2nd Step →

After determining that the spill incident indicates a potential for NRDA action, EMPCo's SHE Manager or designee must **make the following notifications immediately**:

- ExxonMobil NRDA Coordinator/Advisor
- NRDA Contractors (pre-identified)

Appendix A of ExxonMobil *NRDA Response Manual* provides telephone numbers for the ExxonMobil NRDA Advisor and Coordinator, and NRDA contractors.

3rd Step →

Collection of Ephemeral Data: Immediately after it has been determined that a NRDA potential exist, and prior to the arrival of ExxonMobil's NRDA Team, incident information must be collected which is imperative to NRDA activities. This information can be gathered by NRDA Contractors and should include:

- Aerial over-flight reports, including aerial photo documentation;
- Photo and video documentation of the spill movement and coverage;
- General information on environmentally sensitive and human use areas;
- Physical, chemical and biological site characteristics of the spill area;
- Initial oil sampling;

- Initial air and water column sampling.

Site Security and Control

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Control Zones

The first function that must be performed is to determine the extent of the hazardous area and all possible access points to this area. Size of the hazardous area should be determined by visual inspections and by use of a three or four gas monitor. Size of the area should also consider the potential for wind shifts. All unnecessary and unauthorized traffic shall be excluded from this area. In addition, all possible hazard migration routes should be determined and measures taken to seal off the routes. Response personnel will then establish Control Zones which identify "hot," "warm," and "cold" zones.

Hot (Exclusion) Zone

The Hot Zone is the isolation area immediately surrounding a hazardous materials incident. It extends far enough to prevent adverse effects from hazardous materials releases to personnel outside the zone. This zone is also referred to as an "exclusion zone."

The Hot Zone is the area where contamination does or could take place. It is also the area where cleanup operations will be performed. The boundary between the Hot Zone and the Warm Zone should be clearly indicated by some physical means, such as lines, hazard tape, equipment barriers, and the like. Movement of personnel from one zone to another must be tightly regulated and supervised in order to minimize contamination. This will allow for greater control of the operations within the zone.

Warm Zone

The Warm Zone is where personnel and equipment decontamination and Hot Zone monitoring take place. It includes control points for access to the Hot Zone and thus assists in reducing the spread of contamination. It is also known as the decontamination, contamination reduction, or limited access zone. Further details on personnel and equipment decontamination are presented in the following section, Decontamination Procedures.

One of the purposes of the Warm Zone is to reduce the likelihood of contaminating the Cold Zone. The intensity of hazard in the warm zone should decrease as one approaches the Cold Zone. An access corridor refers to a defined path between the Hot and Cold zones where decontamination of personnel and equipment takes place. There may be a need for several access corridors at very large incidents. The access corridors must be tightly controlled and supervised so that movement between zones is regulated. Persons entering the Warm Zone from the Cold Zone must be wearing appropriate personal protective equipment.

Cold Zone

The Cold Zone contains the command post and other support functions that are deemed necessary to control the incident. This is also referred to as the Clean or Support Zone.

It might appear that there is no outer boundary to the Cold Zone, but this is not the case. One might equate the outer boundary at a hazardous materials incident with the fire lines that are often established at a major fire or emergency that are usually controlled by the police department. The public at large would not have access to the Cold Zone under most circumstances.

Decontamination Procedures

Personnel responding to release incidents may become contaminated in a number of ways, including:

- Contacting vapors, gases, mists, or particulates in the air
- Being splashed by materials while sampling or opening containers
- Walking through puddles of liquids or sitting or kneeling on contaminated soils
- Using contaminated instruments or equipment

Protective clothing and respirators help prevent response personnel from contacting or inhaling contaminants. Even with these safeguards contamination may occur. Hazardous materials can be transferred to clean areas, exposing unprotected personnel. During removal of contaminated clothing, personnel may contact contaminants on their clothing or inhale them. To prevent such occurrences, methods to reduce contamination and to decontaminate clothing and equipment must be developed and established before anyone enters a site and must continue (modified when necessary) throughout site operations.

Decontamination procedures should strive to remove all oil from work clothing to prevent direct skin contact and secondary oiling of other garments and clean areas. Exact procedures will vary according to locations, activities conducted, and the level of oil contact. Actual procedures will be determined by EMPCo's SHE Manager or his safety designate. It is the responsibility of the SHE Manager or his designate to establish decontamination facilities; however, EMPCo will generally depend on response contractors to provide decontamination equipment. Decontamination areas should be clearly marked and contain the necessary supplies and equipment to complete either partial or full decontamination.

Partial Decontamination

All personnel will be required to undergo partial decontamination before they enter a break area. Partial decontamination should consist of hand and face washing to avoid inadvertently ingesting or spreading petroleum products to otherwise protected areas of the body. Partial decontamination facilities can include the following:

- Soap, water, paper towels, waterless hand cleaner, and/or other materials for hands and face washing
- An impermeable surface to sit on during breaks
- Refuse containers
- An eyewash station
- Sanitary facilities

Full Decontamination

At least one full decontamination facility should be established to service response operations. This facility should be located in an area that will minimize the exposure of uncontaminated personnel or equipment to contaminated personnel or equipment. Full decontamination will be required for all personnel at the end of each shift before they leave the site. These facilities will also be available should an employee become excessively contaminated with oil at any time during his/her shift.

Each facility should have a designated "dirty" zone, "transition zone," and "clean" zone. The "dirty" zone will be used for removal of contaminated protective clothing, minimizing contamination of clean clothing or body areas. Next, each person will move to the "transition" zone where work clothes can be removed and full body cleaning facilities are available. From there, each person moves to the "clean" zone to put on clean clothing and either leave the site or put on clean protective clothing and return to the work site.

Equipment Decontamination

Facilities separate from personnel decontamination will be established for the decontamination of response equipment, including hand tools and re-usable protective clothing. Approved solvents and/or other cleaning aids will be used to return the equipment to its preused condition.

All materials and equipment used for decontamination must be disposed of properly. Contaminated clothing, tools, buckets, brushes, and all other equipment must be secured in drums or other containers and labeled. Clothing not completely decontaminated on-site should be secured in plastic bags before being removed from the site. Proper waste handling and disposal of contaminated materials and clothing is addressed in the section entitled “Waste Management”.

Traffic Control

In an emergency situation there will very likely be a need to limit the vehicle and pedestrian traffic in the area surrounding the facility. Unrestricted traffic will not only introduce unwanted ignition sources, but could also endanger anyone in the area. For these reasons it will be necessary to erect barricades to prevent the unwanted traffic.

The Area Supervisor or his designate should request assistance from local emergency service providers, such as the fire and police departments, for traffic control. A safe and efficient traffic pattern and a designated parking area should then be developed. These areas shall be well marked. Traffic patterns should be designed to limit backing where possible. All heavy equipment should be equipped with back-up warning devices. Traffic shall not be allowed to block the access route for emergency vehicles.

If the response and mitigation work continues into the night, adequate lighting must be provided. The lights should be situated so as not to blind drivers. All lighting in the hazardous area must be explosion-proof. Care must also be taken in the placement of portable generators. These devices are ignition sources and must be kept a safe distance from any hazardous area. Portable generators will require a hot work permit, if within 35 feet of a Division 1 location that could ignite explosive atmospheres.

Coordination with Local Emergency Services

Meetings should be conducted with all local emergency services departments. If possible, a single source of contacts with these departments should be appointed. Lines of communication to this source must be determined to allow quick contact. If the situation is expected to be of longer duration, off-duty police or security personnel may be required to assist. These people will be very useful in traffic control including ingress and egress from the site, and preventing unauthorized personnel from entering the area.

To ensure coordination between Fire, Police, and other appropriate Public Officials is possible during an emergency, the Area Supervisors are responsible for establishing liaisons with public officials to learn their responsibilities and resources for responding to an emergency. Field

Operations are encouraged to involve local officials in drills/training programs, where appropriate.

EMPCo Field Operations personnel will coordinate with local emergency services officials as necessary to:

1. Provide the officials with current information on all EMPCo facilities within their jurisdiction
2. Exchange information about responsibilities and resources (both for EMPCo and the officials) available for responding to hazardous liquid pipeline emergencies, and to discuss (preplan) possible responses to be made during potential emergency situations
3. Ensure that the names, addresses, and telephone numbers for the officials are current

Crude Oil/Refined Products Response Procedures

Containment and Recovery

This section contains general information on the response techniques that can be used to contain and recover terrestrial and aquatic oil spills. Details of the specific techniques can be found in *Exxon Oil Spill Response Field Manual*.

General

Containment and recovery refers to the techniques or methods that can be employed to contain and recover petroleum spills on water or the containment of petroleum spills flowing overland. Recovery of terrestrial spills is often very similar, or uses the same techniques as shoreline cleanup.

The following considerations should be taken into account when planning or implementing containment and recovery operations:

- Containment is most effective when conducted near the source of the spill where the oil has not spread over a large area and the contained oil is of sufficient thickness to allow effective recovery and/or cleanup.
- Feasibility is generally dependent on the size of the spill, available logistical resources, implementation time, and environmental conditions or the nature of the terrain in the spill area.
- Aquatic (water) containment is primarily conducted through the use of oil spill

containment booms.

- Skimmers are usually the most efficient means of recovery of aquatic spills, although pumps, vacuum systems, and sorbents can also be effective, particularly in smaller waterways.
- Terrestrial (land) containment typically involves berms or other physical barriers.
- Recovery of free petroleum from the ground surface is best achieved by using pumps, vacuum sources, and/or sorbents.

A containment and recovery operation implementation guide is shown in Figure 5-8. The terrestrial containment and aquatic containment and recovery techniques applicable to most areas along the pipeline routes are summarized in Table 5-6.

Terrestrial (Land) Spills

Containment and recovery of terrestrial spills is usually best achieved by using earthen containment berms, trenches, or physical barriers within a natural or manmade drainage area.

Containment within drainage courses is generally more effective as the petroleum is already partially contained and concentrated. The presence of existing drainage courses or containment structures is often critical to the effective containment of large terrestrial spills as most containment techniques for flat surfaces do not provide a significant amount of storage capacity.

Technique Selection - Terrestrial Containment and Recovery

The primary factors influencing terrestrial containment and recovery are:

- **Size** - Most containment techniques provide limited storage capacity.
- **Slope** - Berms and barriers are generally less effective on steeper slopes and accessibility may be limited.
- **Surface texture** - Rough surfaces with natural ridges and depressions enhance containment and should be taken advantage of whenever possible.
- **Substrate permeability** - Highly permeable sediments will allow rapid penetration of oil into the substrate, thus complicating containment and recovery.
- **Existing drainage courses** - Oil is more easily contained and recovered if it is flowing within, or can be diverted to, existing natural or manmade drainage structures.
- **Stormwater runoff** - Runoff generally requires the containment of larger quantities of liquids and complicates oil recovery.

A terrestrial containment and recovery technique selection guide is provided in Figure 5-9.

Aquatic (Water) Spills

Effective containment and recovery of aquatic spills depends, in part, on the release circumstances, how quickly the techniques can be implemented, and the prevailing environmental conditions. Regardless of the size of the spill, containment is most effective if conducted at or near the source before the spill migrates a significant distance downstream. The larger the area covered by the spill, the more equipment and manpower will be required. Containment at or near the source is also often associated with thicker layers of oil within the containment booms which, in turn, increases the efficiency of most skimmers. Away from the source, the oil will spread to very thin layers or a sheen, making recovery difficult, even with sorbents.

The prevailing environmental conditions can affect containment and recovery both in terms of effectiveness and deployment of equipment. In high winds and/or currents, equipment deployment is difficult and even unsafe. Wind and currents can add significant tension on containment booms, making it difficult to deploy and anchor the booms in place or connect sections of boom together in the water. Strong currents can also cause entrainment of oil in the water stream flowing beneath the boom, resulting in ineffective containment. Shallow water can cause the boom to "lay down," which also allows oil to pass underneath.

Technique Selection - Aquatic Containment and Recovery

Selection of an appropriate aquatic containment and recovery technique depends on a number of factors including:

- **Current speed** - Surface currents greater than 1 knot can cause boom failure or entrainment of oil beneath the boom when the boom is deployed perpendicular to the current. If deployed at an angle, boom can generally be effective up to 2-3 knots.
- **Water depth** - Depths greater than 50 feet can complicate boom anchor placement, whereas depths less than 2 feet can preclude effective boom use.
- **Channel width** - Widths of more than 200 to 300 feet will generally preclude using booms to completely contain oil floating in the waterway, particularly if strong currents are present.
- **Slick thickness** - Recovery effectiveness with pumps/vacuum systems and skimmers decreases as slick thicknesses decline, becoming relatively ineffective for very thin slicks or sheens.
- **Shoreline access** - Obstacles (rocks, debris, man-made structures, etc.) in the water or steep or densely vegetated shorelines could restrict access and present safety and operational problems.
- **Anchor points** - Soft bottom substrates can complicate boom anchor placement.
- **Safety** - High currents and winds, large obstacles, and other dangerous conditions could present safety hazards and preclude certain techniques.

Based on the above factors, a containment and recovery technique selection guide has been prepared and is shown in Figure 5-10.

Sensitive Area Protection

This section contains general information on the response techniques that could be used to protect environmentally sensitive or economically important areas downstream or down gradient of EMPCo's pipeline systems. Specific sensitive areas located along the pipeline ROWs are identified in Vol. 2 and the applicable Area Contingency Plan or Geographic Response Plan, if they have been identified. In cases where Geographic Response Plans (GRPs) exist, EMPCo will use the GRP as part of the overall strategy. Where specific GRPS do not exist the guidelines below will be used to develop strategies as part of the overall Incident Action Plan.

General

In the event of an oil or product spill to a major area waterway, it may be necessary to protect downstream sensitive areas if it appears that local containment and recovery efforts will not be sufficient to control the entire spill.

Protection refers to the implementation of techniques or methods to prevent oil from making contact with a shoreline or aquatic area that is determined to be sensitive for environmental, economic, cultural, or human use reasons. Implementation of sensitive area protection techniques must consider a number of factors, several of which are included in Figure 5-11.

The common protection techniques are summarized in Table 5-7 and detailed descriptions of each technique are provided in Appendix A. Selected containment and recovery techniques (e.g., diversion and narrow channel containment booming and sorbent barriers) can also be used for protection purposes, and are identified in this section.

Prioritization of Sensitive Areas for Protection

It is seldom possible to protect large sections of shoreline following a major spill. Limitations of time, manpower, equipment, water currents, and weather conditions will often restrict the number of areas that can be protected. Therefore, if more than one sensitive area is threatened, the setting of protection priorities becomes an important element of a rapid and effective response.

The need to protect a particular sensitive area or section of shoreline is directly related to the following variables:

- Degree of sensitivity
- Potential degree of spill impact
- Potential spill residence time
- Feasibility of effectively implementing a protection technique prior to spill contacting the shoreline

Figure 5-12 illustrates how these variables can be combined into general decision guide for selecting relative protection priorities. Explanations of how each variable influences prioritization are provided below.

Sensitive Features

In addition to the sensitive areas identified in Vol. 2, the applicable Area Contingency Plan will indicate local areas that may possess certain features that are also considered sensitive. Resource constraints, time constraints, and various other response constraints limit the amount of areas, which can be protected during a major oil or HAZMAT spill. The following list provides a prioritization of the types of areas, which should be protected during an incident (this list is a typical example of what can be found in Area Contingency Plans).

1. Public Health
    - Public drinking water intakes, public utility water intakes, and storm drains
2. Threatened and Endangered Species
3. Habitat and Species Concentrations
    - Designated wildlife refuges and game management areas
    - Wildlife concentrations (which may vary seasonally)
    - Vegetated wetlands and shorelines
    - Public oyster seed grounds
    - Commercial and recreational fisheries management areas
    - Coastal restoration projects
4. Other Sensitive Public Lands
5. Cultural and Historical Sites
6. Exposed Tidal Flats
    - Shell beaches, rip-rap, and all other beaches
7. Sheltered Rocky Shores and Sea Walls
8. Private Recreational Areas and Facilities

9. Marinas

10. Private and Industrial Raw Water Supplies

Potential Degree of Impact

The potential for oil to make contact with a section of shoreline can be estimated using the information included in the section entitled “Spill Assessment”. The amount of oil that reaches a shoreline depends in part on the size of the waterway, the quantity released, and the cohesiveness of the slick. In larger waterways, if the quantity released is large, the slick does not break into patches or streamers, and it is headed directly at a section of shoreline, the potential degree of impact would be high. Conversely, if the slick has dispersed into patches, the potential degree of impact could be low. The potential is best determined by trajectory estimates which are subsequently confirmed through aerial reconnaissance. For smaller waterways, moderate to major spills will likely impact both shorelines relatively equally.

Potential Residence Time

The potential oil residence time is primarily dependent on:

- Degree of impact
- Type of shoreline sediments
- Level of exposure to the elements

In general, higher degrees of impact, coarser sediments, and lower levels of exposure to wind, waves, currents, and natural flushing will increase the residence time of the oil on the shoreline. The sediment type can have the greatest effect on residence time, as coarser grained sediments usually permit the oil to penetrate deeper into the shoreline but also allow for greater natural flushing and degradation. Finer grained sediments typically inhibit penetration, but if oil does become incorporated into the sediments, it can persist for long periods of time.

Lower levels of exposure, such as in protected backwater areas or dead-end sloughs, will increase the residence time due to the decreased natural flushing action by wind- and vessel-generated waves and currents. Protected areas may also be shaded and calm, which would tend to inhibit evaporation and photo-oxidation.

Protection Technique Effectiveness

The probable effectiveness or success of protecting a particular area should be evaluated at the time of a spill and is primarily dependent on:

- Current and wind conditions
- Availability of the required equipment, manpower, and logistics
- Accessibility of shoreline
- Time available to implement the technique prior to shoreline contact

Typically, the probable effectiveness would decrease if 1) high winds and currents were present, 2) only limited manpower, equipment, and logistical support were available, 3) the shoreline was relatively inaccessible, and 4) little time was available prior to shoreline contact. Therefore, if one or more of these factors is associated with a particular area, it may be more prudent to focus on protecting other sensitive areas that have a higher probability of success.

Protection Technique Selection

Selection of an appropriate protection technique depends on a variety of factors including:

- **Current speed** - Surface currents greater than 1 knot can cause boom failure or entrainment of oil beneath the boom when the boom is deployed at right angles to the current. If deployed at an angle, booms can generally be effective in currents up to 2-3 knots.
- **Water depth** - Depths greater than 50 feet can complicate boom anchor placement, whereas depths less than 2 feet can preclude effective boom use.
- **Shoreline access** - Obstacles (rocks, debris, man-made structures, etc.) in the water or steep or densely vegetated shorelines could limit access and present safety and operational problems.
- **Anchor points** - Soft bottom substrates can complicate boom anchor placement.
- **Safety** - High currents, winds, large obstacles, and other dangerous conditions could present safety hazards and preclude certain techniques.

Based on the above factors, a protection technique selection guide has been prepared and is shown in Figure 5-13.

Shoreline and Terrestrial Cleanup

This section contains general information on the response techniques that could be used for cleanup of shoreline and terrestrial areas affected by an EMPCo spill. An implementation guide is provided in Figure 5-14.

General

In the event that terrestrial sediments do become oiled or that petroleum contacts and becomes stranded on a shoreline, cleanup operations should be undertaken to minimize the environmental effects of the petroleum. In most instances, cleanup efforts are not subject to the same time constraints as containment, recovery, and protection operations. As a result, better planning and greater attention to detail is possible. The exception is where there is a high probability of stranded oil becoming remobilized and migrating to previously unaffected areas. In this case, cleanup operations should be implemented immediately. If time does permit, the following items should be considered in detail:

- Documentation of the location, degree, and/or extent of oil conditions
- Evaluation of all environmental, cultural, economic, and political factors
- Cleanup technique selection
- Mitigation of physical and environmental damage associated with cleanup technique implementation
- Cost-effectiveness

The shoreline or terrestrial oil conditions can range from those which require immediate and thorough cleanup to lightly oiled areas where no action may be the most environmentally sound option. The amount and type of oil, shoreline sensitivity, substrate or shoreline type, intrusive nature of the candidate techniques, and shoreline exposure are all factors that influence technique selection and whether or not cleanup will be required.

Several shoreline and terrestrial cleanup techniques have been developed that include both intrusive and non-intrusive methods. Only those techniques that are likely to be used for a release from EMPCo operations are included in this ERP. A summary of these techniques is included in Table 5-8.

Shoreline Cleanup Priorities

The probability that terrestrial spills will affect large and diverse areas is extremely low and, as such, their prioritization for cleanup will not be included in this discussion. In the case of large aquatic spills, however, a variety of shorelines may be impacted to various degrees which may require that cleanup operations be prioritized. The priority ranking for each shoreline segment, or area, is dependent on several factors including:

- Degree of sensitivity
- Degree of oil impact
- Potential for remobilization of oil
- Spatial distribution (position relative to current direction)

A decision guide to assist in establishing shoreline cleanup priorities is provided in Figure 5-15.

Degree of Sensitivity

The specific sensitive areas that may be impacted by a spill from pipeline operations are identified in Vol. 2. Any of these areas would receive a high value rating in the decision guide. The sensitivity of other shoreline areas would be evaluated depending primarily on their biological value. The designation of a "high" or "low" value rating will depend on the Planning staff's consultation with the regulatory agencies and local residents or experts that are familiar with the affected shorelines.

Degree of Oil Impact

The shoreline oil conditions for most spills in a river environment will usually consist of a continuous, narrow band of oil along the water line, although it may become discontinuous at a distance from the spill. Wetlands or marshes may also become oiled, in which case the oil conditions may also consist of a narrow band at the waterline but cover a large portion of the wetland area. Continuous oil conditions will generally receive a "high" value and discontinuous a "low" value. Any wetland that is affected by an oil spill will receive a "high" value.

Remobilization Potential

In some instances, stranded oil may not be particularly harmful or threaten any sensitive features but could be a threat to other downstream shorelines if remobilized by rising water levels, currents, or winds. In general, the remobilization potential would be "high" if:

- Strong currents are present adjacent to the shore.
- Significant quantities of petroleum are trapped by natural barriers, vegetation, or debris along the water line.
- Water levels are expected to rise significantly.

Spatial Distribution

The spatial distribution, or the position of the shoreline area relative to the current direction and other areas, has been included in the prioritization guide to account for the potential for remobilization or for oil escaping during cleanup operations and impacting downstream/downcurrent areas. Therefore, upstream areas with otherwise similar sensitivities would be given a higher priority than their downstream counterparts.

The Incident Commander and Planning staff can use the final priority rankings as a guide to select where and when to implement cleanup measures. As conditions change or new information becomes available, the Planning staff can use the decision guide to reorder the cleanup priorities as required.

Cleanup Technique Selection
Shoreline

The selection of an appropriate shoreline cleanup technique is primarily dependent on the following factors:

- **Substrate type** - Finer-grained sediments typically require different techniques than coarse-grained sediments.
- **Oil conditions** - Heavier oil conditions and larger areas may require more intrusive or mechanical methods, whereas lighter conditions may not require any form of cleanup.
- **Shoreline slope** - Heavy equipment may not be usable on steeper shorelines.

- **Shoreline sensitivity** - Intrusive techniques may create a greater impact than the oil itself.
- **Oil penetration depth** - Significant penetration can reduce the effectiveness of several techniques.

A shoreline cleanup technique selection guide is provided in Figure 5-16. Figure 5-17 is a matrix showing applicability of candidate cleanup techniques to oiled substrate conditions. Figure 5-16 and Figure5-17 should only be used as a guide to identify the most appropriate techniques and not a definitive list of techniques that can be used for selected situations.

Terrestrial

The selection of an appropriate terrestrial cleanup technique is primarily dependent on the following factors:

- **Size** - Larger areas will generally require the use of mechanical methods, whereas manual techniques can be used for smaller areas.
- **Slope** - The use of heavy equipment is often restricted to gradually sloped areas, and manual techniques may be considered unsafe if used on steep terrain.
- **Sediment type** - Softer sediments may reduce trafficability for heavy equipment and the presence of coarser sediments and bedrock could also restrict the use of certain types of heavy equipment.
- **Oil penetration depth** - Significant penetration may require the use of heavy equipment or special subsurface remediation techniques.
- **Impacted groundwater** - Special subsurface remediation techniques would likely be required.

A terrestrial cleanup technique selection guide is provided in Figure 5-18. A matrix showing the applicability of candidate cleanup techniques to selected oil conditions is provided in Figure 5-19. Figures 5-18 and 5-19 should only be used as a guideline or starting point since the actual technique that is most applicable to a given situation may differ due to the number of variables in a typical spill response.

Potential Impacts From Cleanup Techniques

Oil that comes in contact with a shoreline or terrestrial area has the potential to adversely affect biological and physical processes. Consequently, various cleanup techniques have been developed to mitigate these impacts, but often create impacts of their own. In some situations, particularly if used improperly, the cleanup techniques can cause greater impacts than the oil itself. The environmental and physical consequences of using the various cleanup techniques should be considered during technique selection and implementation. The key potential impacts associated with each cleanup technique were presented in Table 5-8.

The major physical impacts of cleanup usually result from sediment removal. Large-scale removal from a shoreline or steeply sloped terrestrial area can destabilize the bank or hill and result in erosion or landslides. Other techniques, such as flooding, flushing, spot washing, manual removal, etc., can also cause physical impacts, including:

- Substrate disturbance and vegetation trampling caused by extensive human activity
- Recontamination by oil that is mobilized but not effectively recovered
- Increasing turbidity and sedimentation by flushing fine sediments from a shoreline and into the water
- Deeper oil penetration from flushing and spot washing on shorelines and trenching and berm construction on terrestrial areas

The biological impacts from cleanup can include:

- Biota removal through sediment excavation, flushing, spot washing, etc.
- Extension of toxic effects due to re-oiling
- Habitat disruption by cleanup equipment, waste handling, or cleanup crews
- Trampling of shoreline vegetation from human and mechanical methods

Cleanup techniques can indirectly affect organisms and vegetation outside the treatment area if appropriate measures are not taken to contain and recover the removed oil. Similarly, equipment and worker traffic can transport oil to clean areas or push it deeper into the substrate within the affected area.

If shoreline oil conditions are light to very light and exposure to the elements is high, natural recovery (no cleanup) should be considered as it may have the least overall physical and biological impact. This consideration is, however, very site- and circumstance-specific and often requires regulatory approval.

Non-Mechanical Response Options

Non-mechanical response options that could be used in responding to a spill from the EMPCo pipeline system include:

- Chemical treatment (dispersants),
- Bioremediation, and
- In-situ burning

Although the physical control and recovery of spilled oil is advocated and generally preferable, such actions are not always possible or practical because of factors including safety hazards, remote spill sites, or weather. When non-mechanical methods can result in reduced human hazard or environmental damage, consideration of their use is appropriate but will require regulatory approval.

The applicability of these response options and approval for their use will vary depending on the option and type of environment involved. Most chemical treatment methods are only applicable to spills to marine environments where water depths exceed 10 meters which would preclude their use for most of the EMPCo facilities. Other chemical treatment agents, such as herders and gelling agents, have potential application in many inland and coastal areas and are considered potential response tools for the purposes of this plan.

Bioremediation is applicable to most areas but may be limited by the type and concentration of material spilled. Regulatory approval is required in most cases and particularly if the addition of special microbes is considered. In addition, some fertilizers used to enhance bioremediation can be relatively toxic and may also require special approval for use.

In-situ burning is primarily applicable to remote areas and spills of sufficient thickness and flammability to sustain ignition. Consequently, the rapid spreading and volatilization characteristics of most EMPCo commodities limit the feasibility of in-situ burning to the first few days following a spill. In-situ burning is generally not applicable to shallow and/or confined water bodies or populated areas. Approval from the appropriate regulatory agencies must be obtained.

Dispersants

Introduction

Chemical treatment has proven to be an effective means of mitigating damage associated with many oil spills. The use of dispersants is considered a viable and, when appropriate, a preferred countermeasure during the early stages of a spill. Consideration for this option must be pursued immediately following a spill due primarily to the effectiveness being limited to the first few days. The use of dispersants shall be conducted in accordance with applicable guidance, including but not limited to, the Area Contingency Plan (ACP), National Contingency Plan (NCP), timely feedback and approval from the Regional Response Team (RRT) and, if applicable, an OSC Preapproved Dispersant Use Manual (published by the cognizant RRT).

A dispersant is a chemical that lowers the interfacial tension between floating oil and water, ideally to near zero. Under these conditions the formation of discrete oil droplets is facilitated. Once formed, these droplets can be dispersed and degraded at a much faster rate than would occur naturally for a cohesive surface slick.

Criteria For Use

Consideration of dispersant use during a spill must account for all aspects of the situation including the:

- Nature of the oil
- Resources at risk
- Adequacy of cleanup techniques
- Natural dispersion
- Time
- Logistics
- Economics
- Chemical dispensability of the oil
- Nature of the oil/dispersant mixture

Special considerations such as threatened or endangered species, critical habitats, historical or cultural sites, and other structures must also be considered in the decision process.

The following questions should be addressed when considering dispersant use:

1. Is the discharge of significant size or posing a threat to human life, welfare, the environment?

   Factors to consider are: distance from shore, environmentally sensitive areas, quantity and type of oil spilled, pros and cons of mechanical cleanup compared to dispersant use, rate of evaporation, weather conditions such as seas, winds, currents, and direction in which the oil is heading.

2. Is the oil dispersible?

   The main factor to consider is the oil viscosity. Typically, oils with a viscosity below 2000 centistokes are readily dispersible, while oils with a viscosity greater than 10,000 centistokes are almost impossible to disperse. Volatilization or weathering also increases oil viscosity and consequently, oil which has been discharged for 24 hours or more will be more difficult to disperse.

3. Given the dispersants that are available in the area, are they on the NCP product schedule, and are they appropriate for use on the discharged oil?

4. Are weather conditions favorable for dispersant use and is visibility good enough for aircraft and vessels to apply dispersant?

5. Is equipment available for the application of dispersants?

Airborne Support, Inc. working through the Clean Gulf Associates has equipment for the aerial application of dispersants.

6. Is the oil thickness appropriate for dispersant use?
7. Are other countermeasures available and will they be effective?
8. Will the cost be less to mitigate the spill if dispersants are used?

Approval Process

All pre-approved dispersants are found in the NCP product schedule. This list is updated on a monthly or bimonthly basis. When considering dispersant use, only a product on this list may be used except during an emergency situation such as an immediate threat to human life. The Federal On-Scene Coordinator (FOSC) may authorize the use of dispersants when concurrence has been received by the RRT. In the case where dispersants are necessary due to an immediate threat, the FOSC may authorize their use and inform the RRT of the action by the most rapid mean of communication available.

The FOSC is preauthorized by the Region VI RRT to employ dispersants in responding to any oil pollution located in offshore waters off Texas and Louisiana which are not less than 10 meters in depth and at least three nautical miles from the nearest shoreline. Certain special management areas are excluded. In this dispersant preapproval process there is no requirement for the Responsible Party (RP) to complete any forms. Instead, the information required from the RP is recorded by the FOSC's representative during the initial telephone contact with the RP. For post-response reporting, the FOSC may require more detailed information from the RP at a later date. In order to assist in providing all necessary information during the initial telephone contact between the RP and the FOSC, and to have detailed information available if latter requested, the form found in Figure 5-20 should be completed and retained.

The request and information should be made available to the FOSC as soon as possible, because dispersant use should commence within 6 hours of oil being released into the environment. This preapproval procedure is available only for requests for aerial spraying of dispersant. Spreading of dispersant by any other means (such as by boat) requires that the FOSC obtain approval from the RRT.

To request use of dispersants in situations that do not meet pre-approval criteria (i.e., less than 10 meters in depth and/or less than three nautical miles from shore), the form found in Figure 5-20 should be completed and submitted to the FOSC.

Monitoring

All aspects of dispersant treatment operations should be monitored and documented. The effectiveness of the treatment and the potential adverse effects on surface and near-surface waters (aquatic spills) and soil and groundwater (terrestrial spills or shoreline cleanup) due to the application of dispersant should be evaluated. After the completion of the appropriate treatment, sediment and/or water samples from the impacted area should be collected and analyzed for the residuals of oil and dispersing agent. A groundwater monitoring program should also be conducted when appropriate.

Resources

Further information on the use of chemical dispersants is compiled in the following locations:

1. Subpart J, National Contingency Plan (40 CFR 300.900)
2. Applicable Area Contingency Plan
3. Preapproved Dispersant Use Manual (If applicable in Region)
4. Clean Gulf Associates Operations Manual
5. *Exxon Oil Spill Response Field Manual*, Chapter 7
6. Other ExxonMobil dispersant reference materials

A summary of dispersant stockpiles is located in Table 5-9.

In-Situ Burning

Introduction

When mechanical recovery of spilled oil is not feasible, in-situ burning should be considered as a potentially viable option. Since burning presents a potential safety and air pollution hazard to the surrounding area, approval from appropriate regulatory agencies is required.

In-situ burning alters the composition of the spilled oil by eliminating anywhere from 90 to 99 percent of the original volume of oil provided it is controlled within a fire resistant boom or other containment system. A portion of the original oil is released into the atmosphere as soot and gaseous emissions. Solid or semi-solid residues typically remain following a burn but are relatively easy to retrieve. They can be further reduced in volume through repeated burns, and ultimately are collected and removed from the marine environment.

In January, 1994, an in-situ burn plan developed by the Marine Spill Response Corporation (MSRC) was approved by the RRT and preapproval was granted to Coast Guard predesignated FOSCs within Region VI. **The preapproval allows FOSCs to permit responsible parties to employ the plan seaward of 3 miles of the coasts of Louisiana and Texas, with areas excluded offshore in the vicinity of certain reefs and an area off Grand Isle, Louisiana**. This provision for preapproval is in accordance with the National Contingency Plan, 40 CFR Part 300.910. The MSRC plan may also be employed inshore of 3 miles, including bays, lakes, sounds, and rivers, but incident specific RRT approval must be granted in all such cases.

In-situ burning will be used as a response option only after appropriate consideration of potential environmental impacts, public safety, worker safety, and the need for disposal of burn residue. The facts concerning these and other pertinent matters will be transmitted to the FOSC using the "Oil Spill Response Checklist: In-situ Burning" form in Figure 5-21. In-situ burning is covered under the Clean Air Act (42 USCA 7401 through 7626) and various state/local codes.

The *Exxon Oil Spill Response Field Manual*, (Chapter 8) provides guidance concerning equipment and techniques employed in in-situ burning. Chapter 8 also discusses other issues and considerations in employing this method.

Evaluation

The potential for implementing a successful burn of spilled oil depends upon the knowledge and experience of those responsible for the assessment of the spill situation. Review of the spill conditions, together with the above spill checklist, will ensure that the safety issues, the benefits, and the environmental impacts will have been examined carefully. While steps may be taken to move critical equipment into position for a possible burn, there will be no attempt to ignite spilled oil without prior authorization from both Federal and/or State On-Scene Coordinators.

Before a spill on water is ignited, several factors must be considered:

- Oil type, amount, and condition
- Environmental conditions
- Availability of personnel and equipment
- Timing
- Human safety
- Danger of fire spreading
- Presence of explosive vapors
- Damage to nearby habitats that may prolong natural recovery

If the oil is fresh, it can be ignited using any appropriate technique. For terrestrial spills involving weathered oil (i.e., the volatile constituents have evaporated), a propane weed burner or flame thrower may be used. Helitorches suspended from helicopters can also be used to ignite floating oil.

Ignition of an open spill is unlikely to result in an explosion; however, when there is no wind, explosive vapors may collect in a confined area to form an explosive mixture. Under these conditions, the potential secondary effects of a blast must be considered.

Once the operational constraints and key issues influencing the feasibility of conducting a safe and effective burn have been evaluated, the decision guide in Figure 5-22 can be used to identify the most important issues influencing the decision to burn. It should be recognized that a failure to meet one or more of the constraints (i.e., a "No" answer) in the guide does not necessarily lead to a "No-burn" decision. The decision to burn must include a careful assessment of the feasibility of all other response activities (i.e., mechanical removal, dispersants, etc.).

Approval Process

For in-situ burning within the State of Texas, the FOSC/SOSC will consider existing regulations which prohibit outdoor burning, except in the following cases:

1. Oil Spills (Title 30, Texas Administrative Code, Section 111.213): Hydrocarbon burning from a pipeline break and oil spills may be allowed upon proper notification of the local regional office of the Texas Natural Resources Conservation Commission (TNRCC) and appropriate local air pollution control agencies, and if the Executive Director determines that the burning is necessary to protect public welfare.

2. Coastal salt marsh management: Burning may be conducted in Aransas, Brazoria, Calhoun, Chambers, Galveston, Harris, Jackson, Jefferson, Klebery, Matagorda, Nueces, Orange, Refugio, and San Patricio Counties if certain criteria are met (Title 30, Texas Administrative Code, Section 211) (refer to the Code).

When a request for an in-situ burn within and/or affecting the State of Texas, the FOSC/SOSC will consult with the TNRCC, who may consider the following criteria:

- The burn must be outside the corporate city limits, except as deemed necessary by the local fire department.
- Wind direction should move the smoke away from the city and/or populated areas.
- Burning must be at least 300 feet from any adjacent properties.
- Burning should commence between the hours of 9:00 am and 5:00 pm of the same day.
- Wind speed should be between 6 and 23 mph during the burn period.
- Burn should not be conducted during persistent atmospheric thermal inversions.

Similar considerations and restrictions would generally apply to burning in other states.

Monitoring

In order to accommodate the short time frame available for the effective use of in-situ burning, pre-planning for an effective monitoring plan is often required. Three general types of monitoring may be considered:

- Operational monitoring

- Burn performance monitoring
- Worker safety monitoring

Environmental impact and damage assessment monitoring will be accomplished by the appropriate state and federal resource agencies.

Operational Checklist

An operational checklist for in-situ burning is provided in Figure 5-23.

Fire Boom Inventories

A summary of fire boom inventories is provided in Table 5-10.

Bioremediation

General

Bioremediation is the process of applying nutrients (fertilizer containing nitrogen and phosphorus) or genetically engineered bacteria to oiled terrestrial or shoreline areas to accelerate the natural biodegradation process. During this process, micro-organisms (bacteria) oxidize hydrocarbons, ultimately converting them to carbon dioxide and water. Biodegradation occurs primarily at the oil/water or oil/air interface and is limited by oxygen, moisture, and nutrient availability. It is also sensitive to temperature; the lower the ambient temperature, the lower the rate. If nutrients are used, they must be supplied in such a way that they will not be washed away by tides or any water runoff.

In general, there has been a historical reluctance to use genetically engineered bacteria in an uncontrolled environment. Most areas have indigenous bacteria that are capable of degrading hydrocarbons. For this reason, **the use of products containing non-native bacteria is currently not recommended**. Nutrient additions in liquid and granular form have demonstrated success in the in the past. Bioremediation appears most beneficial in treating mid-range petroleum materials. It is most commonly used in applications where only light oil conditions are present, as a final treatment step after completing conventional treatment, or where other forms of treatment process are either not possible or not recommended. In cases where surface oiling is high or moderate, bulk oil removal is recommended as a first step. For subsurface oil, bioremediation may be considered without additional treatment.

Evaluation

The decision to use bioremediation treatment should be based on the type of spill, the character of the area impacted, and the local political jurisdiction. In some cases, other forms of cleanup may be required in conjunction with nutrient addition to achieve the desired enhancement rate. Extensive efforts to achieve more acceptance of this technology are underway. As in the case of other oil spill response chemicals, approval must be obtained from the FOSC and SOSC before the nutrients are applied and the products must be listed on government product schedules where required. An expert should be consulted.

Regulatory Approval Requirements

The use of biological additives is regulated under Subpart J of the NCP (40 CFR 300.900). Under the NCP, options for the authorization of biological agents are outlined, including a provision for conditional preapproval for use under certain conditions and in certain locations. Consult with the FOSC to determine whether an applicable preauthorization has been approved. The current application and approval procedure includes state approval and does not preempt the states from having their own testing criteria.

The Incident Commander will be responsible for providing the FOSC and SOSC with incident-specific information needed to approve the conduct of bioremediation operations.

Monitoring

All aspects of bioremediation operations should be monitored and documented. The effectiveness of the treatment and the potential adverse effect on surface waters (aquatic spills) and soil and groundwater (terrestrial spills and shoreline cleanup) due to the application of bioremediation agent(s) should be evaluated.

The monitoring program includes the collection and analysis of oil, water, and soil samples. The degree of biodegradation may be assessed by microbiological and chemical criteria. Oil samples should be analyzed for the composition of various components present as a measure of the amount of degradation. The toxicity associated with the application of bioremediation agents should be measured on the most sensitive species. Nutrient loading in the water should be measured to address the potential for stimulating algal growth. Groundwater should also be monitored for nutrient content.

LPG/HVL/Gas/Chemical Response Procedures

General Information

Selected EMPCo pipelines transport various gases and highly volatile liquids (HVLs). HVLs are defined under 49 CFR 195 as a liquid commodity which will form a vapor cloud when released to the atmosphere and which has a vapor pressure of 40 psia or greater at 100°F. Liquefied petroleum gases (LPGs) are classified as HVLs. Most HVLs will volatilize or evaporate completely immediately or shortly after their release to the atmosphere. Gases are defined in 49 CFR 192 as natural, flammable, or those which are toxic or corrosive.

The primary concern for incidents involving the release of gases or HVLs is the possible effect of the vapor cloud on human health and the possibility of fire. **Priority must be given to stopping the gas escape and to the warning and evacuation of persons in the danger area.** The majority of gases and all HVLs transported by EMPCo are highly flammable and some of the HVLs are toxic. The gases themselves are not particularly toxic but most are classified as asphyxiants due to their tendency to displace oxygen and cause unconsciousness, injury, or death.

The handling of, and regulatory requirements for, emergency situations involving gas or HVL releases is much the same as with the release of vapors from crude oil or petroleum product spills although the response will not generally involve the containment and recovery of liquids. Unlike liquid spills, a gas release will not contaminate the soil or have much impact on nearby surface waters. HVLs may, however, remain in liquid form for a short time before completely volatilizing and can leave residual concentrations in the soil or surface waters. HVL or gas releases may, however, cause defoliation of nearby vegetation. Cleanup of residual materials is conducted in the same manner as for oil spills. EMPCo Operations Support and SHE are available for consultation on technical and environmental aspects of such situations.

EMPCo also transports non-oil commodities that are not categorized as LPG's or HVL's, but do have properties that need special care in handling when released. We call these commodities "Chemicals". They can be non-flammable like Nitrogen and Oxygen or a carcinogenic chemical such as Benzene. They can be liquids that do not dissipate or evaporate quickly when released to the atmosphere such as Resins. They are not necessarily flammable or explosive in nature but can still be hazardous to health and/or harmful to the environment. Very early in a chemical release incident, we must identify the released chemical and know the material's characteristics which may cause a hazardous condition to people, property or the environment.

Proper identification of the chemical or chemicals in an incident is extremely important. A material's physical and chemical properties should be evaluated once the material has been identified. Identification of the release will allow the appropriate personal protective equipment to be selected and also dictate which preventative and corrective actions can be safely taken.

The primary concern for incidents involving the release of chemicals is the health exposure to people. Exposure to chemicals can be divided into two categories:

- Injuries from direct contact to body parts, such as acid burns or inhalation of toxic vapors.
- Potential injury due to gross contamination on clothing and/or equipment.

Release Detection, System Shutdown, and Isolation

The importance of LPG/HVL/Gas/Chemical release detection and rapid shutdown to prevent or minimize the potential harmful impacts cannot be overemphasized. In general, most large releases will be detected by the hi-low pressure and flow monitors installed on most pipelines which exercise local control or transmit data to the Operations Control Center (OCC) or both. Smaller releases may be detected by routine patrols, third party observations, or over-the-line leak surveys with gas detectors that are made on pipelines transporting non-odorized gas as required by regulations.

The affected pipeline section will automatically or manually shut down immediately following detection by the OCC or pressure or flow monitors, observations by an EMPCo employee, or where a release is suspected but cannot be confirmed. In some cases the pumps on the suction side of the release location may remain in operation for a short period to reduce pressure in the line and remove as much of the contents as possible. Once the system is shutdown, valves will be closed on either side of the leak to isolate the affected section. Portable flaring equipment will generally be dispatched to the site to further reduce pressure and the contents in the line.

Notifications

An employee receiving a report of a release or other hazardous condition will determine as much information as possible either by an on-scene inspection or from the person making the report and will immediately relay that information to the Area Supervisor or his immediate supervisor. Additional information regarding internal EMPCo notifications are provided in this volume and in Volume 2.

The conditions and instructions for reports of hazardous gas releases to the Department of Transportation are included in 49 CFR 191 regulations and the EMPCo Spill/Release Notification Guide. Reporting requirements for HVL releases are the same as for crude oil. These reporting procedures are addressed in both this volume and Volume 2.

Hazard Assessment and Initial Response

Immediately following release detection, system shutdown, segment isolation, and the completion of initial notifications, an assessment of the hazards created by the release must be conducted. Hazard assessment and initial response methods should follow a disciplined approach that consists of five main elements:

Situation Analysis

The first step is to analyze the situation. This includes defining the problem, understanding the modifying conditions, and identifying potential damage/losses and available control measures.

- Identify the commodity and quantity released

Identification of Critical Issues

The key step is to define the critical issues: what life, property, or environment needs to be protected from what hazards. The incident severity (*personal health/injury, public disruption, exposures, environment, etc.)* should be considered in the development of the critical issues. After the critical issues are identified, they must be prioritized.

- Determine the potential safety and health hazards associated with the released commodity (refer to EMPCo's S&HR manual or MSDS for guidelines)
- Evaluate the direction(s) and distances of vapor migration (plume size)

<u>Strategy and Tactical Response Selection</u>

For each identified critical issue to be addressed appropriately, preventive and/or mitigation strategies need to be developed. Effective tactical action plans are developed based on realistic expectations, available resources, and time.

- Determine the need for isolations and evacuations of the potentially affected areas, buildings, etc. Determinations are based on atmospheric monitoring and/or emergency response guidelines, e.g., refer to DOT's North American Emergency Response Guidebook.

<u>Initial Response</u>

After the strategies and tactics are established, they must be safely and timely implemented in the order of prioritization of the incident action plan.

- Estimate and activate the personnel and equipment resources required

<u>Feedback</u>

Periodically, the results of the implementation need to be assessed for improvements, and any changes in the situation need to be re-assessed and the whole cycle repeated.

Commodity Identification

In most cases, the commodity released will be identified based on the pipeline involved as most LPG/HVL/Gas/Chemical lines are dedicated to particular commodities. Identification of commodities released from multiple service pipelines will be facilitated primarily by odor or by contacting the OCC to determine what commodity was in the affected line segment at the time of the release.

NOTE: Be very cautious when responding to an unfamiliar spill/release location or an area where multiple pipelines might exist. Do not make assumptions about commodity identification, particularly when the source of the release has not been determined.

Safety and Health Hazards

Once the released commodity has been identified, the initial responders should determine the safety and health hazards presented by the material released. In general, fire and explosion is the primary hazard of concern for most products transported by EMPCo although some gases are also toxic and/or are classified as asphyxiates. Volume 1,Table 5-4 provides a summary of the hazards presented by each of the commodities transported by EMPCo. Similar information is provided in Volume 2 but is restricted to only those commodities transported by pipelines within the particular response zone. For more information refer to MSDS and EMPCo's Safety and Health Responder Manual.

Vapor Plume Migration/Dispersion

For any incident involving LPG/HVL/Gas/Chemical releases, it is very important to conduct vapor monitoring to determine the direction(s) and distance that the resulting vapor plume has migrated. The concentration of the vapors within the affected area must also be determined to evaluate the potential for fires and explosions as well as the potential for exposure to toxic vapor concentrations. Any monitoring activities should begin at a safe distance and upwind from the release location and proceed slowly towards the release. **All HVL/gas release incidents should be considered hazardous (explosive and toxic) until determined otherwise by comprehensive monitoring and/or testing.**

To assist in determining plume size, shape, concentration, and migration, computer programs are available to model the hypothetical vapor plume's "foot print" and migration. Government agencies usually have available such a program known as "CAMEO".

Information on vapor monitoring procedures and instrumentation are particularly relevant to LPG/HVL/Gas/Chemical releases. Attention is also directed to actions and precautions included in Section 2 - "Preparation for Repairs" and Appendix "B" of the EMPCo Pipeline Repair and Modification Manual.

Evacuation Requirements

Evacuation consideration must be made as early as possible to be effective because evacuations require much time and coordination.

Evacuation is a special item which should never be overlooked or taken for granted. The decision on whether or not to evacuate will depend on many factors. Among the items considered should be:

- The nature of the material involved-
  - Is it highly volatile, toxic, or flammable?
  - Has a large volume been released?
  - Is there a fire and large volumes of smoke?

- The environment factors at the scene-
  - Is the wind blowing towards a populated area?
  - What is the wind speed?
  - Is the vapor plume rising or maintaining a low height, indicating little dispersion?
  - What adverse effects will the topography have on the movement? (e.g., low areas do trap heavy vapor plumes, bodies of water usually indicate low areas)

- Threatened areas-
  - What are these areas proximity to the spill?
  - Are there sensitive components in threatened areas, i.e., such as nursing homes, schools, hospitals, and other institutions?

Once the actual or potentially affected area has been identified, a determination for the need to evacuate must be made. Evacuation procedures must be implemented if there are residences, businesses, or public areas or buildings (i.e. roads, parks, schools, churches, hospitals, etc.) within the potential impact area. Because EMPCo personnel do not have the authority to order people to leave an area or public building, the local authorities (fire department, police/sheriff department, or local emergency management department) must be contacted immediately to implement the evacuation.

The Area Supervisor or his designate is generally responsible for notifying the local authorities unless populated areas are in imminent danger in which case the initial responder should make the local notifications directly. Names and phone numbers for the local authorities for each response zone are included in Volume 2.

Response Resource Requirements

In addition to the above assessments, an estimation should be made of the types and quantities of response equipment and the number of personnel that will be required to secure the area of impact, control the source, and monitor the vapor plume. This estimate should be provided to the employees immediate supervisor or Area Supervisor when making the initial notification.

Response Procedures

All HVL or gas releases should be considered explosive and toxic until proven otherwise and should be approached from an upwind direction as discussed above. Once the actual or potentially impacted area is determined, a regulated or secured work area should be established to exclude unauthorized personnel and minimize safety and health hazards to personnel involved in the response. Once the area has been secured, various response actions should be implemented to control the source, limit exposure, initiate evacuations if determined necessary, and continue to monitor vapor plume migration as discussed below.

(b) (3), (b) (7)(F)

[redacted]

Response Equipment, Personnel, and Procedures

The same EMPCo response organization and resources that are used for responses to spills of crude oil and refined products will generally be utilized to respond to releases of HVLs or gases. The initial response procedures and internal and external notifications apply to HVL and gas releases as well as oil spills and other types of emergencies. The response procedures and information provided below are, however, primarily applicable to HVL and gas releases.

Initial Response

The initial response would involve dispatching EMPCo initial responders to the incident site with explosion meters or other vapor monitoring equipment to establish the regulated areas mentioned above. These personnel will also work with local authorities to keep unauthorized personnel out of the dangerous areas and to initiate evacuation programs where appropriate.

Equipment

For most incidents involving HVLs or gases, the equipment mobilized to the site will include:

- Portable flaring equipment
- Emergency repair fittings
- LEL/O_2 monitors (explosion meters)
- Boats (if incident involves a waterway)
- Respiratory equipment (breathing air trailer, multiple air packs, and/or respirators)

- Site control equipment (barricades, signs, flagging, lights, etc.)

Releases to Waterways

Following the completion of release verification and pipeline shutdown procedures, the following actions/steps are to be taken:

1. Notify EMPRT initial responders and dispatch them to the incident site.
2. Eliminate sources of ignition.
3. Test the environment and establish a regulated area as discussed above and initiate evacuation programs, if appropriate.
4. Notify the U.S. Coast Guard through the National Response Center so that local waterborne traffic can be stopped or diverted away from the regulated areas.
5. Notify local emergency response officials.
6. Take the necessary steps to reduce the volume of material in the leaking line section. This can be achieved by taking suction on the line at a downstream pump station, installing temporary flares at nearby block valve locations, and tapping and stoppling the line.
7. Notify any additional EMPRT response personnel and state agencies and local authorities.
8. Temporarily patch or repair the leak if possible.
9. Totally remove the contents of the affected segment of the line.
10. Follow up with permanent repairs and restoration of service.

NOTE: If a fire has started, allow it to continue to burn under controlled conditions to prevent explosive re-ignition. The surrounding area should be continuously quenched with water to prevent the spread of the fire. Small fires can be extinguished with foam or dry chemical. Disperse vapors with water fog/spray and cover released liquid accumulations with foam.

Releases to Land

Following the completion of release verification and pipeline shutdown procedures, the following actions/steps are to be taken:

1. Notify EMPRT initial responders and dispatch them to the incident site.

2. Eliminate sources of ignition.

3. Test the environment and establish a regulated area as discussed above and initiate evacuation programs, if appropriate.

4. Take the necessary steps to reduce the volume of material in the leaking line section. This can be achieved by taking suction on the line at a downstream pump station, installing temporary flares at nearby block valve locations, and tapping and stoppling the line.

5. Notify local emergency response officials.

6. Notify any additional EMPRT response personnel and state agencies and local authorities.

7. Temporarily patch or repair the leak if possible.

8. Totally remove the contents of the affected segment of the line.

9. Follow up with permanent repairs and restoration of service.

Note: See special note above under "Releases to Waterways".

Detection of Gas/HVL Vapors In or Around Buildings

The following steps should be taken immediately by the first EMPCo employee to arrive on scene.

1. Initiate evacuation of building and surrounding area, through local authorities.

2. Shut down power to building and eliminate sources of ignition.

3. Notify EMPRT initial responders and dispatch them to the incident site.

4. Notify local emergency response officials

5. Test the environment and work with local emergency officials in establishing a regulated area as discussed above.

6. Take the necessary steps to reduce the volume of material in the leaking line section. This can be achieved by taking suction on the line at a downstream compressor station, installing temporary flares at nearby block valve locations, and tapping and stoppling the line.

7. Notify any additional EMPRT response personnel and state agencies and local authorities.

8. Temporarily patch or repair the leak if possible.

9. Totally remove the contents of the affected segment of the line.

10. Follow up with permanent repairs and restoration of service.

Waste Management

This and other sections cover emergency procedures for hazardous waste related fires, explosions, releases, or other emergencies. This section also covers procedures for treating, storing or disposing of recovered waste; contamination soil or other cleanup media; or other material that results from a release of hazardous waste.

Hazardous Waste Emergency Procedures

Whenever there is an imminent or actual emergency situation involving a release of hazardous waste which threatens human health or the environment, the Qualified Individual (Emergency Coordinator) or his designee must immediately:

- Activate internal facility alarms or communications systems to notify all facility personnel.
- Notify appropriate state and local emergency response agencies if their assistance is needed.
- Identify the character, exact source, amount and aerial extent of any released materials.
- Assess possible hazards to human health or the environment that may result from the release, including direct and indirect effects (fire, explosion, noxious gases, water runoff, surface or ground water contamination, etc.).

If the emergency coordinator determines that the facility has had a release that threatens human health or the environment outside the facility, he must report his findings as follows:

- If evacuation of local areas may be advisable, notify appropriate local authorities.
- Notify the National Response Center at 800-424-8802 and state environmental/emergency response agencies

During an emergency, the emergency coordinator must take all reasonable measures necessary to ensure that fires, explosions, and releases do not occur, recur or spread to other hazardous waste (including shutting down processes/operations, containing/collecting released materials, isolating/removing waste containers, etc.). If the facility stops operations in response to a release, the emergency coordinator must monitor for leaks, pressure buildup, gas generation, or ruptures where appropriate. General emergency procedures are discussed in Section 5.0 of this plan.

Immediately after an emergency, the emergency coordinator must provide for treating, storing or disposing of recovered waste, contaminated soil or water, or other materials. No waste that may be incompatible with the released material may be treated, stored or disposed of in the release area until cleanup operations are completed. All site emergency response and cleanup equipment must be cleaned and fit for its intended use before operations are resumed (USEPA and the state must be notified that this requirement has been satisfied before site operations resume).

The emergency coordinator must note in the site operating record the time, date and details of any hazardous waste related incident that requires implementation of the emergency response plan. Within 15 days, he must submit a written follow up report to USEPA and the state (contact SHE for assistance).

General

Spill recovery and cleanup operations typically generate recovered oil, oily wastes, and debris which require proper handling, storage, transportation, and treatment/disposal. Other wastes including unoiled trash and garbage may be generated by the response operation. Some waste materials may be considered hazardous depending on the types and concentrations of the material involved. Oily wastes and debris often consist of recovered oil and oily water, sorbent pads/boom, protective clothing, soil, shoreline sediments, logs, vegetation, trash, oil/water mixtures, and, in some cases, animal carcasses. The management of recovered oil and oily wastes generally includes:

- Waste handling
- Interim storage
- Waste characterization
- Transportation
- Treatment/disposal/recycling

The SHE Manager is responsible for all waste management activities and will ensure compliance with standards set forth in relevant state and federal regulations. A general guide to waste management and disposal is provided in Figure 5-24.

Waste management must also be conducted with the overall objective of ensuring:

- Worker safety
- Waste minimization
- Cost-effectiveness
- Minimization of environmental impacts
- Proper treatment/recycling/disposal
- Minimization of present and future environmental liability

Waste Management/Planning

Waste management must not be overlooked in the early stages of a response. This oversight could result in cessation of recovery operations and delays in re-deploying response equipment. Key waste management planning considerations for a spill response include:

- Prepare a site safety and health plan and implement appropriate PPE and waste-handling procedures to protect the health and safety of waste handling personnel.
- Ensure that no incompatible wastes are mixed, or treated, stored, or disposed in common areas.
- Conduct a thorough review of the applicable laws and regulations and coordinate activities with the appropriate local, state, and federal agencies to ensure regulatory compliance and minimize impacts on local waste disposal facilities.
- Estimate quantities of liquid and solid waste that will likely be generated both on a daily basis and over the expected duration of the response operations.
- Arrange for the handling, interim storage, transportation, and ultimate disposal of the wastes and ensure that adequate equipment and personnel are available.
- Ensure that waste segregation is implemented to allow optimum disposal of each type of waste.
- Minimize the risks of subsequent pollution incidents from waste handling operations.
- Document all waste collection, handling, transportation, and disposal activities to enable adequate tracking and ensure regulatory compliance.
- Dispose of all waste streams in a safe manner in compliance with applicable regulations, and at approved disposal, treatment, or recycling facilities.

All of the above considerations should be incorporated into a waste management plan. Once prepared, the plan should be distributed to key personnel. State agencies may also require that a waste management plan be submitted for approval

Regulatory Review

Federal

Federal regulations have been promulgated to ensure proper handling and disposal of oil, oily wastes, hazardous chemicals, and other wastes recovered during a response to a release. Applicable federal regulations are provided in Table 5-11.

The responsible party for a release must immediately collect and remove the spilled material and contaminated debris and/or soil. Depending on the type and/or concentration of the material/oil, the recovered material may be classified as hazardous or non-hazardous. The waste classification is based primarily on the following characteristics:

- Ignitability
- Corrosivity
- Reactivity
- Toxicity

In the case of oil, as it weathers (volatizes, dissolves, emulsifies, etc.) or degrades, it may become less toxic or flammable and could be downgraded from a hazardous to a non-hazardous waste. Sampling and testing are required to best determine the appropriate handling and disposal methods.

State

Non-hazardous or hazardous state waste management regulations and/or those established by the federal government (EPA) must be followed. Where state waste management regulations have not been promulgated or where the states have adopted the federal regulations, the requirements outlined in this section and Table 5-11 will apply. The ExxonMobil Pipeline Company **"Waste Management Plan"** must be consulted and followed. For additional information or assistance on waste management regulatory requirements, contact SHE.

Waste Characterization

The primary objective of waste characterization is to ensure employee safety, proper waste identification and handling and waste disposal in accordance with applicable state and federal regulations. Each waste must be characterized on a case-by-case basis through laboratory analysis of representative samples or process knowledge. In certain circumstances special exemptions may be obtained from the cognizant state agency and EPA if the waste does not present a significant threat to human health or the environment.

Proper waste identification (hazardous/non-hazardous, recyclable, burnable, treatable, etc.) can reduce the quantity of waste requiring disposal and increase the opportunities for recycling and treatment.

NOTE: Liquid crude or products that are recovered from a spill and returned to the pipeline are not considered waste.

Prior to obtaining analytical results, an initial waste characterization can be done qualitatively based on the type of hazardous material spilled. As a general rule, these initial characterizations are as follows:

- Gasoline, jet fuel, and some chemicals and light distillates - These wastes may be characterized as hazardous due to their relatively low flash point (ignitability) and toxicity but it will depend primarily on the presence of free liquids, the concentration of volatile hydrocarbons and/or water content (oil/water mixtures may not have a flash point). Spill cleanup debris from a release of pure benzene is hazardous waste regardless of ignitability or toxicity (i.e., it is a listed hazardous waste.)
- Crude, diesel, and mid- to heavy fuel oils - These wastes may be characterized as non-hazardous, with the possible exception of diesel, which depends on the hydrocarbon concentration and/or water content and degree of weathering.

Characterization of spill wastes may vary somewhat depending on the material spilled. The characterization of wastes containing petroleum products or crude oils will generally involve taking representative samples and submitting them to an accredited laboratory for toxicity characteristic leaching procedure (TCLP) analysis, with the benzene concentration being the primary contaminant of concern. A flash point test may also be required for lighter products if free liquids are present. In addition, consideration should be given to taking background samples of uncontaminated contiguous areas so that baseline condition can be established.

Additional characterization may be required by prospective disposal, recycling, or treatment facilities. Most facilities will require that the waste be profiled, which can involve obtaining MSDS information or conducting a number of additional analytical and physical tests. The type and number of tests required are dependent on the facility, waste type, and the potentially hazardous nature of the material.

Waste-Handling Guidelines

Proper waste handling is important in protecting the safety and health of response personnel and preventing contamination of previously cleaned or unaffected areas. General guidelines or considerations for proper waste handling are:

- Eliminate ignition sources close to the handling and temporary storage area
- Do not mix incompatible wastes, segregate hazardous wastes from nonhazardous wastes
- Review site and safety and health plan prior to initial handling of wastes
- Require PPE as necessary:
  - Approved respiratory protection
  - Chemical goggles or safety glasses
  - Hard hat
  - Impervious rubber gloves
  - Rubber boots
  - Tyvek suits
  - Nomex coveralls

NOTE: The appropriate types of PPE will be identified by the incident's Safety Officer, Lead Safety and Health Responder or SHE Manager.

- Obtain any necessary permits and approvals.
- Handle, store, and transport wastes in appropriate containers/tanks.
- Place synthetic liners under storage containers where appropriate to provide secondary containment and prevent soil contamination.
- Obtain soil and groundwater samples on a "before and after" basis at off-site storage sites to identify pre-existing contamination and to ensure adequate cleanup after completion of storage operations.
- Test, inventory, label, and manifest wastes as required by regulations or the waste management plan.
- Provide security to prevent unauthorized dumping and to ensure storage activities do not impact other parties.

Liquid Oily Waste Handling

Liquid oily wastes can be generated from skimming and other aquatic oil recovery operations and may also be generated from equipment cleaning and storm water runoff collection from waste and equipment storage areas. Large aquatic recovery operations may involve field separation of oil and water to reduce the cycling of trucks or barges between the recovery site and the interim storage site and to remove debris and sludge. Procedures that are generally followed when performing large aquatic or shoreline recovery operations are:

- Transfer oil/water mixtures from skimmers or other recovery equipment into barges/vessel tanks (aquatic) or into fixed or portable tanks (shoreline) and allow to gravity separate. If the oil is too weathered or emulsified to pump, use vacuum trucks stationed on the barge or shoreline for off-loading recovery devices.

- Decant water off the bottom into a separate barge or tank for interim storage and/or transport to approved treatment facility.
- Transfer "clean oil" (no water, debris, sludge, etc.) into a separate barge or tank for interim storage prior to return to pipeline system and/or transfer to approved facility for reprocessing.
- Periodically filter out debris and remove sludge and solid accumulations for transfer to an approved treatment or disposal site.

If the spill involves crude oil and the recovered and separated oil contains very little water and debris, it can be reinjected back into the pipeline or pumped into a breakout tank. Recovered refined products (mogas, diesel, etc.) can be put back into crude oil pipeline systems.

Solid Oily Waste Handling

Solid oily wastes are largely composed of sorbent boom, sorbent pads, snares, rags, sediments, solid or semi-solid weathered oils, soils and other debris. During initial recovery, most of these wastes can be placed in plastic bags to prevent pollution and facilitate handling. The bags are then consolidated and placed in larger containers for interim storage or transport. Larger waste items such as oiled driftwood and logs may be burned or treated on-site by washing or burning the oil off with weed burners. Any burning must be approved by regulatory agencies. If on-site treatment is not possible, these wastes may be transferred directly to storage containers or vessels for transport to a central processing area or directly to a disposal site.

Damaged containment booms and other spill response equipment will also require handling as a solid oily waste. Similarly, oiled animal carcasses are another form of solid waste but are handled separately from other wastes in accordance with regulatory requirements.

Oily wastes should be segregated into three basic categories:

1. Sand, gravel, vegetation, or asphaltic type materials (mousse patties, tar balls, weathered oil and sediment mixtures)

2. Other wastes such as oiled clothing, sorbents, gear, small debris, etc.

3. Large debris, logs, equipment

Guidelines for the collection and handling of these solid oily wastes are summarized below by category.

<u>Sand, Gravel, Vegetation, Asphaltic Materials</u>

- Place material in heavy duty plastic bags (preferably 6 mils minimum thickness and 5 feet tall by 3 feet wide). Wastes may also be placed directly into larger bags (Super Sacks) or lined containers as appropriate.
- Double bag heavy materials or very oily wastes to minimize leakage and bag failure.
- Limit bag weight to 30 to 50 pounds to facilitate manual handling.
- Transfer bags to lined containers or Super Sacks (approximately 1.5-cubic-yard capacity) situated on designated vessels or at temporary storage sites.
- Cover any open-top containers to minimize the accumulation of rainwater.
- Place bags, sacks, or other waste containers at central locations above the high tide line or 100 year flood zone if they are not to be transported directly off-site. The waste containers should be situated on impermeable liners and covered with a tarp pending off-site transport.

Sorbents, Oiled Clothing, Small Debris, Etc.

- Place material in heavy duty plastic bags as described above.
- Transfer bags to lined containers onboard vessels or trucks for transport to an interim storage area. Super Sacks may be used to consolidate the bags.
- Cover any open-top containers to minimize the accumulation of rainwater.
- Transport containers to an interim storage site above the high tide line or 100 year flood plain. Waste containers should be positioned on impermeable liners pending off-site transport.

Logs and Other Large Debris

- Treat or burn logs or debris on-site, if practical, but only with regulatory approval.
- If necessary, cut larger logs or debris into small sections to facilitate handling. Leave clean or very lightly oiled portions of the logs or larger debris on the shoreline.
- Place log/debris sections into lined containers on vessels or trucks for subsequent off-site transport.
- Cover any open-top containers to minimize the accumulation of rainwater.

Interim Waste Storage and Transfer

Interim or temporary storage of liquid and solid wastes collected during oil spill recovery and cleanup operations is often required for proper waste classification, segregation, and packaging in addition to making arrangements for recycling, treatment, or disposal. Small quantities of wastes can be stored in a variety of commercially available containers. Storage must be in accordance with applicable hazardous or nonhazardous waste regulations.

Interim storage of moderate to large quantities of wastes will typically involve the use of frac tanks, covered roll-off boxes, vacuum trucks, closed 55-gallon drums, barges, available storage tanks, and miscellaneous other closed/covered containers depending on the quantity of wastes generated and container availability. Secondary containment (berms or booms) should be provided for all interim storage containers.

Specific areas to be used for interim waste storage will be identified at the time of a spill. Areas at local EMPCo facilities currently used for temporary storage of hazardous and non-hazardous wastes would be the primary candidates for the interim storage of oil release related wastes if there is sufficient capacity. Other storage areas may include a paved or other impervious area, preferably with curbing and without storm drains. Proximity to ditches, gullies, streams, or other drainage courses should also be considered.

When considering a potential interim storage site, the following should be reviewed:

- Local geology
- Soil type
- Proximity to groundwater/surface water
- Flooding potential
- Containment berm
- Land use
- Access for response crews, equipment, vessels, and vehicles
- Public contact

Interim storage sites should be designed to use the best achievable technology to protect the environment and human health. These sites should be set up to prevent leakage, contact, and subsequent absorption of oil by the soil. This includes constructing a berm around the perimeter and installing impermeable liners in the floor of the site. The liner should consist of plastic or other synthetic material 6 to 10 millimeters or greater in thickness and without joints. In some cases, underlying pavement may be substituted. Where possible, soil samples should be taken prior to constructing a remote interim storage site to establish baseline levels of contamination.

In addition, other design considerations for interim storage sites could include:

- Weight edges of the liner with stones to prevent movement of damage by wind.
- Place a sand bed or an underfelt to prevent liner piercing.
- Provide reinforced access area for vehicles at the edge of the site.

- Cover oily debris with secured visqueen or tarps to prevent contact with, and subsequent leaching from, rain water.
- Install storm water runoff collection system for the size and location of the site
- Segregate site into two sections, oiled and unoiled.
- Include storage for both liquid and solid wastes.

In general, liquid (oil and water) materials will be transferred from the recovery equipment into vacuum trucks. Vacuum trucks will transport the materials to a re-injection point for return to pipeline system, to a treatment facility or, to an ExxonMobil Refinery for processing. Frac tanks or available tankage may also be used to temporarily store recovered oil and water.

In the unlikely event of a major spill to a large waterway, barges may be the most efficient means of interim storage of recovered oil and water wastes. Recovered oil can be pumped directly from the storage tank on-board the skimmer or attending vessel into the barge. Barges can be anchored at a central location to minimize skimmer/vessel travel and turnaround time. Once full, the barge can be towed to a dock where the oil can be offloaded into vacuum or tank trucks for transfer to the selected facility for separation, treatment, re-injection and/or reprocessing.

Roll-off boxes or half-high conexes can be used for the interim storage of solid wastes. They should be placed at the cleanup location(s) and be lined and covered. Once full, the boxes can be tested for waste characterization, segregated, and temporarily stored while arrangements are being made for recycling, treatment, or disposal. Lined dump trucks may also be used to haul large quantities of oiled sediment to an interim storage area.

Waste Transportation

Transportation of wastes is primarily regulated by DOT regulations 49 CFR Parts 170-180 and RCRA regulations 40 CFR Part 262 and 263. The specific requirements will vary depending on whether or not the wastes are characterized as hazardous. Hazardous wastes can only be transported by registered waste haulers and must follow relatively stringent packaging, marking, labeling, placarding, and manifesting requirements. Oily recyclable materials must be transported under a DOT shipping paper or bill of lading and also comply with many of the same packaging and placarding requirements as hazardous wastes, but the transporters do not have to be registered. The waste transportation guidelines are summarized in Figure 5-25.

Waste materials should always be covered during transportation to prevent blowing or spilling of loads. Containers such as roll-off boxes and dump trucks should be lined before loading to prevent contained materials from leaking during transport.

Waste containers must also be approved by the DOT if they are used to transport wastes or hazardous materials over public highways.

Manifest/Bill of Lading

A properly completed Uniform Hazardous Waste Manifest form must accompany each hazardous waste shipment to a treatment, storage, or disposal (TSD) facility. The manifest must also accompany non-hazardous wastes if they are transported to a hazardous waste facility or landfill. The TSD facility should be contacted to obtain the appropriate waste manifest forms. This is particularly important for out-of-state waste shipments. Waste manifests can be obtained from the state agency with hazardous waste oversight.

If the oily waste is characterized as non-hazardous and is not destined for a regulated TSD facility, it should be accompanied by a DOT shipping paper or bill of lading. Waste samples being shipped for testing and certain materials being sent for recycling that are not carried by a permitted transporter should also be transported under a bill of lading. If the waste consists of general non-oiled material (dumpster trash), no shipping papers are required.

> Note: A bill of lading can only be used for wastes not subject to hazardous waste requirements.

Labeling and Packaging

The designated TSD facility should be contacted to determine the appropriate packaging and labeling requirements. These requirements should be checked for consistency with 40 CFR Part 262 and 49 CFR Parts 170-180 to ensure the proper packaging and labeling is used.

Waste Shipment

If the waste is characterized as hazardous, it can only be transported by a registered waste hauler. Waste materials should always be placed in lined containers or truck bays and covered during transportation to prevent leakage or blowing losses.

In general, the recommended waste shipment procedures are:

- Select a registered waste transporter or transporters.
- Inspect shipping containers and truck placards for conformance with 49 CFR 170-180.
- Inspect transport labels for conformance with the appropriate hazardous materials guidelines and, for dangerous wastes, with the following requirements:
  - Hazardous waste label
  - DOT hazardous materials label
  - UP arrow
  - Bulk/tank car placards
- Observe transporter loading. An EMPCo representative should remain with the transporter until the waste has been properly loaded and is prepared to leave the site.

- Complete and review the manifest or bill of lading. The Incident Commander, SHE Manager, or designee must sign and date the documents at the time of shipping.
- Log out shipment and send copy of waste manifest/bill of lading to SHE Manager.

Waste Disposition

A number of alternatives are commonly available for waste management/disposal but are dependent on the type of waste and its hazardous or non-hazardous characterization. On-site recycling or treatment of liquid wastes (oil and oily water) is the option of choice with off-site recycling, treatment, or incineration of spill-generated solid wastes generally being preferable to landfilling. In the selection of one or more disposal options, consideration must be given to stipulations set by environmental regulations.

Waste management and disposal will be facilitated according to the following hierarchy:

1. Waste reduction (minimize/reduce amount generated for disposal)
2. Recycling/energy recovery
3. Physical, chemical, and biological treatment
4. Disposal (Incineration/landfilling)

In general, liquid oil wastes (i.e., oil, oil and water mixtures, and oily water) will be transported to an injection point for return to the pipeline system, or to an ExxonMobil refinery for reprocessing. Recovered crude oil/products may be reinjected into crude oil pipelines. Waste treatment options will be considered for solid wastes and may include biological treatment (landfarming), incineration (burning sorbent materials, boom, protective clothing, etc.), and others. Landfilling will be considered as a final option.

The disposal/treatment alternatives that are generally available for oily liquid and solid waste disposal are listed in Table 5-12 along with their logistical requirements, advantages and disadvantages, and other considerations.

A general discussion of waste recycling/treatment/disposal alternatives that are generally available for most waste management needs, including regulatory constraints, are presented below.

Wastes should only be shipped to pre-approved disposal/treatment/recycling facilities.

Landfarms/Bioremediation

Landfarming is a proven disposal method for oily soils and sediments. Small to moderate quantities of oily sediments can be treated at many commercial landfarms. Oily sludges or debris can also be landfarmed in some cases.

Reclaiming/Recycling

The reclamation and recycling of recovered oil will generally be conducted at an approved commercial facility or ExxonMobil refinery. Oily sediments and other solids that are not characterized as hazardous wastes can sometimes be recycled depending on their makeup and hydrocarbon concentration. An example is the use of oiled sand and gravel in asphalt production. If this is considered a viable option, local asphalt facilities should be contacted at the time of the spill to determine available capacity and acceptance criteria. These facilities must have appropriate regulatory approvals to process these materials.

Open Burning

Open burning is a method primarily used for disposal of combustible oiled debris like driftwood, vegetation, logs, etc. This technique is generally applicable only to remote areas and requires approval from the state OSC and the local air quality management agency. Air pollution produced by the burning can be reduced by stacking the material in high, small-diameter piles, and by supplying air to produce a higher hydrocarbon destruction rate.

Process Incineration/Energy Recovery

Energy recovery facilities generally utilize a rotary kiln to burn or desorb oily waste and use or recover the resulting energy value. Many of these facilities can accept items such as oil filters, sorbent pads and booms, oily rags, and most other burnable material generated during cleanup operations.

Incineration is typically only used for disposal of hazardous wastes and is a very costly process.

Portable Incineration

Portable incinerators can be used to increase the efficiency of burning oil or solid waste materials in the field as well as reducing overall disposal costs and long-term liability. These incinerators are generally limited to remote areas and the permitting process can be lengthy and costly.

Landfilling

In general, landfilling of large quantities of solid or solidified liquid wastes should only be considered after other alternatives have been evaluated. Because federal law prohibits the landfilling of any free liquids, heavily oiled sediments and other wastes may require some solidification prior to landfilling.

With local health department approval, non-burnable debris consisting of oiled sediments, plastics, organic material, etc., that are not considered hazardous can be disposed of at selected municipal landfills.

Fire Fighting, Prevention, and Protection

It is EMPCo's intention to comply with all applicable fire regulations. The objective of the EMPCo emergency planning and response program is to produce a favorable outcome at the incident with minimal risk to the public, EMPCo employees and contractors, and emergency responders. A favorable outcome is achieved when:

- The incident is mitigated with the lowest possible risk to the public, employees, and emergency responders.
- Environmental damage is prevented or minimized.
- Property damage is prevented or minimized.
- Business disruption is prevented or minimized.

Life safety shall be the highest priority of all EMPCo personnel.

Fire Potential Evaluation and Fire-Fighting Procedures

The procedures below describe the basic guidelines to be used by EMPCo personnel when responding to and operating at emergencies involving flammable liquid, such as a pipeline release or a breakout tank fire.

Reporting

All fires must be reported at once to the immediate supervisor who will then report the incident to the Area Supervisor, who in turn reports to the cognizant Crude/Refined Products or LPG/Chemical Area Managers, and the SHE Manager.

Equipment

All work crews should be equipped with at least one fire extinguisher.

Fire Fighting Procedures

When an Incident Command System is implemented for an EMPCo incident which has a potential for a fire, the incident's Safety Officer designee shall identify appropriate fire-fighting resources and document them in the Site Safety and Health Plan (i.e., local, county, volunteer, refinery, or mutual aid fire departments). The Area Supervisor shall contact applicable fire authorities and discuss with them the fire implications of the incident. If a fire should occur that is not extinguished in its incipient stage, then the Area Supervisor and the Safety Officer designee shall be contacted immediately by company radio or other means and all personnel shall be evacuated from the fire hazard area.

> NOTE: For additional information addressing emergency fire response to specific commodities, refer to DOT's *North American Emergency Response Guidebook.*

General Strategy

The general strategy for managing a pipeline or breakout tank fire beyond the incipient stage is to:

1. Shut down and isolate the source of the release/fire.

2. Eliminate and control ignition sources.

3. Call the local fire department for assistance as soon as possible.

EMPCo personnel will not engage in any major fire-fighting operations but will assist the fire department, as necessary. This assistance will focus upon the following activities:

- Isolating the facility and accounting for all EMPCo personnel, as necessary
- Serving as a technical resource for public safety agencies
- Notification of the proper public and regulatory authorities
- Coordinating logistics and material procurement, as appropriate
- Facility repair following the emergency response
- Incident cleanup, termination, and investigation

In most metropolitan areas where EMPCo operates, the fire department will usually have command of all initial fire and release control operations. The senior fire officer will serve as the governmental On-Scene Coordinator (OSC). It should be noted that the individual acting as the OSC may change as other senior fire officers respond during the course of the emergency.

The senior on-scene EMPCo representative (Field Supervisor, Area Supervisor, Area Manager, or Operations Manager) will serve as a liaison and technical advisor to the OSC and participate in all strategy sessions and major decision making processes. However, in rural areas where advanced emergency services may not be available, the role of the on-scene EMPCo representative may be much broader and include providing specific instruction to emergency responders with respect to site safety, fire and release control operations, and cleanup activities.

During the course of an emergency, there will be a continuous need for coordination and communication between the on-scene EMPCo representative and the fire department or other governmental OSC. These efforts should focus upon the transfer of timely and accurate information, and the availability of EMPCo resources (people, contractors, supplies, and equipment) to handle or supplement the emergency response effort.

Fire Prevention

- Accumulated debris, oil waste, trash, and other potential fuels can be present in all operations and will add to the fire danger. Strict control and isolation of these fuel sources should be exercised to avoid their accumulation in inhabited areas.
- Gasoline storage and transfer should follow applicable codes. A fire extinguisher should also be made readily available.

- Smoking is not allowed near flammable materials.
- Welding and burning require a hot work permit where hydrocarbon mixtures may exist, i.e., vessels, tanks, pipelines, etc., which may contain explosive mixtures or atmospheres.
- All fires should be completely extinguished before fire-fighting personnel leave the work site.

Wildlife Protection and Rehabilitation Strategies

General

This section describes strategies for wildlife protection and rehabilitation. The information provided focuses on the planning for, rather than the execution of, wildlife protection and rescue activities. Details on the specific tactics that will be used to protect and clean up oiled wildlife will be generated on a day-to-day basis in response to events as they unfold in the field and under the direction of the appropriate regulatory agencies.

Special Status Wildlife Populations

In the event of an oil spill and subsequent cleanup activities, special consideration should be given to the protection and rehabilitation of threatened and endangered species and their habitats as identified by the U.S. Fish and Wildlife Service and by state wildlife agencies. A wildlife rehabilitation consultant should be considered if wildlife have been affected by the spill. Wildlife consultants available to assist EMPCo are listed in Volume 2.

Collection and Rehabilitation of Oiled Wildlife

Initial Site Surveys

In the early stages of a spill, a wildlife rehabilitation consultant should work cooperatively with regulatory agency personnel to quickly assess the spill's impact on wildlife and other sensitive resources. The initial response taken by this consultant should involve the following elements:

- Establish communications with the SHE Manager to ensure that the appropriate jurisdictional authorities are notified and provided with accurate and pertinent data.
- Mobilize the response planning process for wildlife rehabilitation.
- Participate in initial spill site surveys to properly assess wildlife impacts and rehabilitation needs.
- Include jurisdictional authorities and experts/consultants in site survey and development of plans as much as possible.
- Develop an appropriate response plan. Focus initially on protection of endangered/ threatened species and sensitive environmental resources. Seasonally sensitive habitats should also be noted. Consider hazing tactics to keep birds and wildlife away from impacted areas.

- Implement a search and rescue plan and rehabilitation plan, if appropriate. These plans should consider:

1. Permitting requirements and procedures, and

2. Public communications: ensure communication of plans to the Public Affairs Coordinator and public. It is anticipated that community volunteers will request information regarding search and rescue and rehabilitation plans as well as opportunities for volunteer involvement. Have a clear and appropriate response prepared. It is important to communicate that it may be illegal to handle wildlife without express authority from appropriate agencies.

Search and Rescue Plan

In any spill, the initial wildlife program should be left up to the appropriate agencies; they have the personnel, equipment, and training to immediately begin capturing any oiled birds. EMPCo involvement should be limited to offering logistical assistance as needed or requested by the agencies.

Prior to initiating any organized search and rescue plan, authorization must be obtained from the U.S. Fish and Wildlife Service (USFWS) and/or appropriate state agency. However, with or without authorization it must be anticipated that unauthorized volunteer citizens will retrieve distressed, oiled birds of their own accord if found. Thus, provisions should be made to engage the support of a wildlife rehabilitation. No support should be given to any unauthorized volunteer rescue efforts. (This should be left to the responsibility of the appropriate regulatory agency.) The regulatory agencies and response personnel should be provided with the name and location of a qualified rehabilitator in the event oiled birds are captured; no public announcement should be made.

Rehabilitation Plan

Rehabilitation plans are developed after appropriate agencies have determined the need. Agencies and consultants should prepare these plans and should coordinate these activities through the spill response organization.

Wildlife Hazing

To reduce potential exposure of wildlife, scare techniques and camouflaging may be employed to minimize contact. These activities must be coordinated by the SHE Manager with federal and state agencies . Techniques include:

- Bird Hazing Systems - These are used to deter birds from entering the spill area and becoming oiled. Human activity during cleanup will deter most birds, so bird scare equipment should be deployed in areas of least human disturbance. Equipment can include electronic sound devices, pyrotechnics, and propane cannons. The number of propane cannons required is usually 4 to 5 units/mile shoreline, or 1 to 2 units/acre. Passive systems such as scare-eye balloons can also be employed.

- Covers - May be employed over small spills to camouflage the area as well as present a barrier to contact with wildlife.

Other Emergency Response Procedures

Aviation Support Plan

ExxonMobil has developed proprietary procedures for utilization of aircraft in an oil spill response.

Threatening Communications and Suspicious Correspondence

EMPCo has developed procedures to be used in responding to bomb threats, identifying strangers in the work place, or other suspicious communications, some of which may be related to acts of terrorism or abductions.

Hurricane/Severe Weather Preparedness

EMPCo has developed guidelines to protect against damage to EMPCo's facilities and operations due to tropical storm and hurricane, events. These same guidelines are also, with some modifications, applicable to severe weather events such as tornadoes, dust storms, floods, and even earthquakes. In general, these guidelines are primarily applicable to EMPCo's operations in the coastal areas of Texas and Louisiana, although they could also be applied in other geographic areas.

Post Incident Critique

The post-incident critique (PIC) is designed to evaluate the effectiveness and efficiency of emergency response actions implemented by EMPCo personnel. Since a wide variety of emergency response activities may occur, this program can assist with evaluating training needs, communication issues, emergency response planning, response equipment, and overall management. A PIC will evaluate what actions were conducted properly as well as actions or procedures that could be improved. This type of information is very useful in the further development of this response plan and organization by eliminating or modifying response procedures that are less effective and emphasizing those that are highly successful. This approach is also applicable for evaluating training drills and exercises. The procedures for implementing a PIC and methods for corrective action are described below.

A PIC must be conducted for all Hazwoper incidents (an incident that involves an uncontrolled release of a hazardous substance and requires a response) following the completion of all emergency response work. It can include representation from the ExxonMobil Pipeline Response Team (EMPRT) and other ExxonMobil response teams (ELIRT or NARRT) as appropriate. For larger incidents utilizing the unified command system, representatives from applicable agencies should also be invited to participate. Findings of the PIC typically are published within two weeks after the tie-in work is completed. Figure 9-5 can be used to document the Post Incident Critique.

Post Incident Critiques should typically be led by the Incident Commander using the following protocol:

- Designate a scribe to document all information and findings
- Assure the participants that it is not a fault finding session
- Review overall incident response
- Create effective dialogue between participants
- Recognize when the system performed adequately and when it did not
- Identify action items
- Offer corrective action plans for identified items
- Confirm that the corrective action plans will be addressed by the responsible parties

Once the critique session has been completed, the Incident Commander or designee will summarize the PIC findings and submit them to the SHE Manager. The SHE Manager will submit the findings to appropriate management for further review and comment. A formal action plan will be developed. The SHE Manager will then make any necessary changes to this response plan and follow up on required actions.

TABLE 5-1

Removed, Please see Section 12 of the Zone Plans.

Response Action[1]	Person Taking Action (Initials)	Date/Time Action Taken
Immediate Response Actions - From Safe Distance		
1. QUICKLY ASSESS INCIDENT AND SAFETY HAZARD - Use SPSA Process, Assess, Analyze, Act. Note all of the following. Size, rate, type, cause, fire/explosion hazard, spill/vapor movements, and health risk, establish a safe perimeter, evaluate appropriate PPE, and consider site isolation and/or public evacuations. Call Fire Dept. and Police Dept. Develop initial Site Safety and Health Plan (SSHP) using forms in Appendix D.		
2. ELIMINATE IGNITION SOURCES - Shut off motors, electrical pumps, electrical power, open flames, welding, etc. in hazardous areas.		
3. IF SAFE, CONTROL SOURCE - Shut down pumps, close valves, etc.		
4. IMMEDIATELY NOTIFY PIPELINE Operations Control Center		
5. ENSURE PERSONNEL SAFETY - Sound alarm, evacuate if necessary, account for all personnel, and secure release area.		
6a. INITIATE SPILL/RELEASE CONTROL (On land-if applicable) - Block storm drains (if present), construct containment/diversion berms, apply sorbents, etc.		
6b. INITIATE SPILL /RELEASECONTROL (On water-if applicable) - Deploy additional boom, deploy skimmer, track spill movements, etc.		
Supplemental Response Actions		
7. RE-ASSESS INCIDENT PARAMETERS AND RESPONSE - Estimate discharge volume/rate, effectiveness of source/ spill control operations, air monitoring, spill/vapor movements, safety/environmental concerns, weather/hydrographic conditions, etc.		
8. CONTINUE MITIGATION/CONTAINMENT ACTIONS, including ongoing revisions of the written SSHP.		
Notification/Documentation		
9. NOTIFY APPROPRIATE EMPCo PERSONNEL (OCC, SHE, AM, etc.)		
10. NOTIFY APPROPRIATE REGULATORY AGENCIES - NRC, state environmental/emergency response, and others as necessary.		
11. NOTIFY THREATENED SENSITIVE AREAS Water intakes, highways, schools, hospitals, recreational areas, etc.		

Response Action[1]	Person Taking Action (Initials)	Date/Time Action Taken
12. NOTIFY/ACTIVATE RESPONSE CONTRACTORS, MUTUAL AID, OR SUPPORT SERVICES as required.		
13. ACTIVATE NATURAL RESOURCE DAMAGE ASSESSMENT (NRDA) STUDIES, if required.		
14. INITIATE DOCUMENTATION PROCEDURES - Document all response actions taken, including notifications, and agency/public interactions.		
Major Spill/Release Response Actions		
15. ESTABLISH COMMAND POST/COMMUNICATIONS CENTER, set up a communications network including a public affairs alignment.		
16. INITIATE TRACKING AND SURVEILLANCE OPERATIONS - Helicopters, fixed-wing aircraft, vehicle, or vessel, if safe (consider information transfer processes including photo documentation).		
17. IDENTIFY PROTECTION MEASURES FOR THREATENED SENSITIVE AREAS		

Major Response Actions		
18. IDENTIFY EQUIPMENT, PERSONNEL, AND LOGISTICAL SUPPORT REQUIREMENTS FOR SPILL/RELEASE OPERATIONS - Containment, protection, recovery, and cleanup.		
19. DEVELOP AN INCIDENT ACTION PLAN - Maximize utilization of available equipment, personnel, and logistics to limit the area affected by the spill/release and the associated impacts. Establish clear objectives, strategies and prioritize tactical actions.		
20. IMPLEMENT INCIDENT ACTION PLAN - In the established order of priority. Also plan for the effective utilization of additional equipment and supplies as they are required and become available.		
21. ESTIMATE WASTE HANDLING AND INTERIM STORAGE REQUIREMENTS - Based on quantity released, recovery capacity, areas affected, degree of impact, etc.		

22. ARRANGE FOR INTERIM SOLID AND LIQUID WASTE HANDLING AND STORAGE - Pumps, barges, portable tanks, available tankage at facility, debris boxes, interim waste storage cells, heavy equipment, hauling/towing, permits, etc.		
23. INITIATE LOGISTICAL SUPPORT FOR RESPONSE OPERATIONS - Transportation, lodging, meals, supplies, portable toilets, communications equipment, additional office space, etc.		
24. ARRANGE FOR TRANSPORTATION, TREATMENT, AND/OR DISPOSAL OF RECOVERED MATERIALS AND WASTES - Determine characterization, and transportation requirements for the candidate treatment/disposal facilities.		
25. COMPLETE CLEANUP OPERATIONS AND OBTAIN CLEARANCE FROM REGULATORY AGENCIES - Obtain written agency clearance for each section of contaminated areas as cleanup is completed.		
1 - Numbers do not represent a priority of response action. Response actions will vary depending on the circumstance of the release.		

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TABLE 5-3

EMERGENCY NOTIFICATION RESPONSIBILITIES

Step 1 **A.** Reported to field location: Field location employees notify the Field Supv. or Area Supv., **OR**
B. Reported to OCC: OCC notifies Area Supervisor or Field Supervisor

Step 2 Field location employees notify the local emergency services as needed:
- Fire department
- Local police
- State police (SHE Manager or Designee will notify, where required by regulation)
- Ambulance

Give your name, phone number, nature of emergency, exact location, and number of injuries, if applicable.

Step 3 Field location employees notify the following local utilities involved, if applicable:
- One-call system
- Gas company
- Electric company
- Water authority

Step 4 Field Supv., Tech Leader, or On-Scene Lead notifies the OCC Supv., and designates a main "point communications contact" (typically the first FS/TL on site)

Step 5 Area Supervisor or designee notifies the following:
- Initial company response personnel
- Applicable Area Manager (C/R Prod. or LPG/Chem) or Ops. Manager
- Response resources (equipment & contractors)-If assistance requested, alternate person will be designated by Area Manager or Operations Manager
- SHE Manager or Designee
- Applicable state, federal and local regulatory agencies, if the spill is reportable, or delegates to SHE Mgr.

Note: If Area Supervisor cannot be contacted, immediate supervisor is responsible for insuring that SHE Manager has all information necessary to notify applicable federal and state regulatory agencies.

Step 6 SHE Manager or designee:
- Notifies applicable federal, state, and local regulatory agencies, if delegated by Area Supervisor
- Submits follow-up written reports to federal, state, and local regulatory agencies

NOTE: OSHA reporting requirements given below, if OSHA Reportable Accident is involved.

Step 7 OCC Supervisor:
- Contacts OCC Manager, Ops. Manager, and EMPCo President
- Prepares and submits the Significant Incident Report (SIR)

Step 8 Area Managers (C/R Prod. Manager(s) or LPG/Chem) or Ops. Manager contact staff support groups

OSHA REPORTING OF ACCIDENTS

OSHA requires the nearest OSHA Area Office be notified within 8 hours, orally by telephone or in person, after the death of any employee or the hospitalization of 3 or more employees from a work related incident. The SHE Manager, Safety Advisor, or OSHA Advisor is responsible for making this report.

For more information about notification responsibilities see EMPCo's Spill Reporting/Notification Guide.

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TABLE 5-4
Summary of Commodity Characteristics

Common Name	MSDS Name	Health Hazard	Flash Point	Special Hazard	Reactivity	Health Hazard Warning Statement
Acetone	Acetone	1	3	----	0	17 Causes eye, skin, and respiratory irritation.
Benzene	Benzene	2	3	C	0	4 Contains benzene, may cause cancer; blood system damage.
Butadiene	Butadiene (Crude & Refined)	2	4	C	2	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite. 21 Liquid causes severe frost bite or burn.
Butane	Butane (Normal & Iso)	1	4	A,P	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Butylene	Butylene Butene	1	4	----	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Condensate (Sweet)	Condensate (Sweet)	1	3	C	0	2 Long term, repeated exposure may cause cancer and blood and nervous system damage.
Condensate (Sour)	Condensate (Sour)	1	3	C,H_2S	0	5 Contains hydrogen sulfide (H_2S), inhalation of H_2S is fatal. 2 Long term, repeated exposure may cause cancer and blood and nervous system damage. 4 Contains benzene, cancer hazard.
Crude Oil (Flash Point 100F)	Crude Oil (Sweet)	1	3	C	0	3 Long term, repeated exposure may cause skin cancer. 4 Contains benzene, cancer hazard
Crude Oil (Flash Point 100-200F)	Crude Oil (Intermediate)	1	2	C	0	3 Long term, repeated exposure may cause skin cancer. 4 Contains benzene, may cause cancer, blood system damage.
Crude Oil Sour (Flash Point 100-200F)	Crude Oil (Sour)	1	2	C,H_2S	0	5 Contains hydrogen sulfide (H_2S), inhalation of H_2S is fatal. 3 Long term, repeated exposure may cause skin cancer. 4 Contains benzene, cancer hazard

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TABLE 5-4
Summary of Commodity Characteristics

Common Name	MSDS Name	Health Hazard	Flash Point	Special Hazard	Reactivity	Health Hazard Warning Statement
Diesel Fuel	Diesel Fuel	0	2	C	0	3 Long term, repeated exposure may cause skin cancer.
Distillate - Heavy Plant	Distillate	0	2	C	0	3 Long term, repeated exposure may cause skin cancer.
Distillate - Light Plant	Distillate	0	2	C	0	3 Long term, repeated exposure may cause skin cancer.
Ethane	Ethane	1	4	A	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Ethane - Propane Mix	EP Mix	1	4	A, P	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Ethylene	Ethylene	1	4	A	2	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Fuel Oil	Fuel Oil	1	2	C, T	0	16 May form hydrogen sulfide (H2S) when heated, inhalation of H2S may be fatal.
Gasoline	Appropriate Product Name	1	3	C	0	18 Long term, repeated exposure may cause cancer, blood, kidney and nervous system damage, contains benzene.
Heating Oil	Appropriate Product Name	0	2	C	0	3 Long term, repeated exposure may cause skin cancer.
Hydrogen	Hydrogen	0	4	A	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite. Invisable flame
Natuarl Gas	Methane	1	4	A	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite. Invisable flame

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TABLE 5-4
Summary of Commodity Characteristics

Common Name	MSDS Name	Health Hazard	Flash Point	Special Hazard	Reactivity	Health Hazard Warning Statement
Natural Gas Liquids (NGL)	Natural Gas Liquids	1	3	C	0	2 Long term, repeated exposure may cause cancer and blood and nervous system damage. 4 Contains benzene, may cause cancer, blood system damage.
Nitrogen	Nitrogen	1	0	A, P	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Oxygen	Oxygen	1	0	OX, P	0	21 Liquid causes severe frost bite or burn.
Pentane	Normal Pentane	1	4	----	0	--------
Propane	Propane	1	4	A, P	0	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Propylene (Poly, Dilute, and Chemical Grade	Propylene	1	4	A, P	1	1 Asphyxiant, material reduces oxygen available for breathing, prolonged contact may cause frostbite.
Raffinate	Raffinate	1	4	----	0	17 Causes eye, skin, and respiratory irritation.
Petroleum Resins Concentrate	Resins	4	4	A, C	4	17 Causes eye, skin, and respiratory irritation.
Tertiary Butyl Alcohol (TBA)	Tertiary Butyl Alcohol	1	3	----	0	--------
Turbo Fuel A (TFA-1)	Turbo Fuel	0	2	C	0	3 Long term, repeated exposure may cause skin cancer.
Varsol	Varsol					

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TABLE 5-4
Summary of Commodity Characteristics

Common Name	MSDS Name	Health Hazard	Flash Point	Special Hazard	Reactivity	Health Hazard Warning Statement

Health Hazard	4 = Extremely Hazardous 3 = Hazardous 2 = Warning 1 = Slightly Hazardous 0 = No Unusual Hazard	**Fire Hazard (Flash Point)**	4 = Below 73°F, 22°C 3 = Below 100°F, 37°C 2 = Below 200°F, 93°C 1 = Above 200°F, 93°C 0 = Will Not Burn
Special Hazard	A = Asphyxiant C = Contains Carcinogen W = Reacts with Water Y = Radiation Hazard COR = Corrosive OX = Oxidizer H_2S = Hydrogen Sulfide P = Contents under Pressure T = Hot Material	**Reactivity Hazard**	4 = May Detonate at Room Temperature 3 = May Detonate with Heat or Shock 2 = Violent Chemical Change with High Temperature & Pressure 1 = Not Stable if heated 0 = Stable

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TABLE 5-5

GAS & VAPOR LIMITS
ExxonMobil Pipeline Company

% LEL	% Oxygen	Entry Status
0	19.5 - 23.5	Entry allowed without respirator protection Equipment. Hot work permitted.
1 - 9	>23.5	Entry allowed with frequent monitoring. Respiratory protection equipment may be required. Hot work permitted.
10+	<19.5 or >23.5	Enter only if breathing equipment and standby are present AND only with EMPCo Management approval (normally for rescue only). Hot work is not permitted.

H_2S (ppm)	THC (ppm)	Benzene (ppm)	Entry Status
0 - 9	0 - 99	<0.5	Entry allowed without respiratory protection equipment.
10+	100+	= 0.5 or above	Entry allowed only if respiratory protection equipment is worn per EMPCo Respiratory Protection Manual requirements and with a "buddy" present.

Notes:			
	LEL	=	Lower Explosive Limit
	H_2S	=	Hydrogen Sulfide
	THC	=	Total Hydrocarbons
	>	=	greater than
	<	=	less than

Data provided here must be consistent with latest version of EMPCo's *Safety Manual and the EMPCo's Respiratory Protection Program Manual*

TABLE 5-6

Summary of Containment and Recovery Techniques

Technique	Description	Primary Logistical Requirements	Use Limitations[2]	Potential Environmental Effects
Spills on Land				
A. Containment/ Diversion Berms	Construct earthen berms ahead of advancing surface spill to contain spill or divert it to a containment area.	Equipment * 1 backhoe, bulldozer, front-end loader, or set of hand tools Personnel 4-8 workers	• Steep slopes • Porous substrate	• Disturbance to surface soils and vegetation • Increased oil penetration
B. Storm Drain Blocking	Block drain opening with sediments, plastic sheet, boards, etc. and secure to prevent oil from entering drain.	Equipment * misc. Hand tools 1 board, plastic sheet, mat, etc. Personnel 1-2 workers	• May be advantageous for oil to enter drain • Heavy precipitation	• Increased oil penetration • Oil can spread to other areas
C. Blocking Dams	Construct dam in drainage course/stream bed to block and contain flowing oil. Cover with plastic sheeting. If water is flowing, install inclined pipes during dam construction to pass water underneath.	Equipment * 1 backhoe, bulldozer, front-end loader, or set of hand tools 1 plastic sheeting roll Personnel 4-6 workers	• Upstream storage capacity • Flowing water	• Increased oil penetration
D. Culvert Blocking	Block culvert opening with plywood, sediments, sandbags, etc. to prevent oil from entering culvert	Equipment * misc. Hand tools misc. Plywood, sandbags, etc. Personnel 3-4 workers	• Upstream storage capacity • Flowing water	• Increased oil penetration
E. Interception Trench	Excavate ahead of advancing surface/ near-surface spill to contain oil. Cover bottom and downgradient side with plastic.	Equipment * 1 backhoe, or set of hand tools misc. Plastic sheeting Personnel 3-6 workers	• Slope • Depth to near-surface flow	• Increased oil penetration • Disturbance to surface soils and vegetation

TABLE 5-6 (Cont'd)

Summary of Containment and Recovery Techniques

Technique	Description	Primary Logistical Requirements	Use Limitations[2]	Potential Environmental Effects
Spills on Water				
G. Diversion Booming	Boom is deployed from the shoreline at an angle towards the approaching slick and anchored or held in place with a work boat. Oil is diverted towards the shoreline for recovery.	<u>Equipment *</u> 1 boat 3 anchor systems (min.) 100 ft boom (min.) <u>Personnel</u> 3 workers plus boat crew	• Currents >2-3 kts • Waves >1-2 feet • Water depth >50 feet (anchoring) • Sensitive shorelines	• Minor substrate disturbance at anchor points • Heavy oiling at shoreline anchor point
H. Narrow Channel Containment Booming	Boom is deployed across entire river channel at an angle to contain floating oil passing through channel.	<u>Equipment *</u> 1 boat, vehicle, or winch 1-2 booms (1.2 x channel width each) 2-10 anchor systems <u>Personnel</u> 2-3 workers	• Currents >2-3 kts • Water depths >50 feet (anchoring) • Sensitive shorelines	• Minor substrate disturbance at anchor points • Heavy shoreline oiling at downstream anchor point
I. Sorbent Barriers	A barrier is constructed by installing two parallel lines of stakes across a channel, fastening wire mesh to the stakes, and filling the space between with sorbents.	<u>Equipment</u> * (per 100 feet of barrier) misc. Hand tools 1 boat 20 fence posts 200 feet wire mesh 200 ft^2 sorbents misc. Fasteners, support lines, additional stakes, etc. <u>Personnel</u> 2-3 workers	• Water depths >5-10 feet • Currents >0.5 kts • Soft substrate	• Minor substrate disturbance at post and shoreline anchor points • High substrate disturbance if boat is not used

TABLE 5-6 (Cont'd)

Summary of Containment and Recovery Techniques

Technique	Description	Primary Logistical Requirements	Use Limitations[2]	Potential Environmental Effects
Spills on Water (Cont'd)				
L. Exclusion Booming	Boom is deployed across or around sensitive areas and anchored in place. Approaching oil is excluded from area.	Equipment * (per 500 feet of boom) 1 boat 6 anchor systems 750 ft boom (min.) Personnel 3 workers plus boat crew	• Currents >1-2 kts • Waves >1-2 feet • Water depth >50 feet (anchoring)	• Minor substrate disturbance at anchor points
M. Deflection Booming	Boom is deployed from the shoreline away from the approaching slick and anchored or held in place with a work boat. Oil is deflected away from shoreline.	Equipment * 1 boat 5 anchor systems boom (200 feet) Personnel 3 workers plus boat crew	• Currents >2-3 kts • Waves >1-2 feet • Water depth >50 feet (anchoring) • Onshore winds	• Minor substrate disturbance at anchor points • Oil is not contained and may contact other shorelines
N. Inlet Dams	A dam is constructed across the inlet or channel using local shoreline sediments to prevent oil from entering inlet. Dam can be covered with plastic to minimize erosion.	Equipment * 1 backhoe, bulldozer, front-end loader, or set of hand tools 1 plastic sheeting roll Personnel 2-6 workers	• Water outflow • Inlet depth >5 feet • Excessive inlet width	• Sediment/vegetation disturbance at borrow areas • Inlet substrate disturbance • Increases suspended sediments • Water in inlet can become stagnant
O. Debris/Ice Exclusion	Install fence barrier upstream of containment site to exclude debris/ice	Equipment * (per 100 ft of barrier) misc. Hand tools 1 boat 10 fence posts 100 feet cyclone fence Misc. Fasteners, support lines, etc. Personnel 2-3 workers	• Water depths > 5-10 ft. • Currents > 3-4 kts • Soft substrate	• Minor substrate disturbance at post and anchor points

TABLE 5-6 (Cont'd)

Summary of Containment and Recovery Techniques

Technique[1]	Description	Primary Logistical Requirements	Use Limitations[2]	Potential Environmental Effects
Releases of LPG/HVL/Gases to the Atmosphere				
P. Controlled burn	Allow the material to consume itself in a safe and controlled manner. If flammable material is not burning may want to consider a **controlled ignition**.	Equipment * Flares/torches Personnel A trained ignitor from a safe distance	• Managing the fire and heat • Damaging force of ignition	• Damages of fire and heat on exposures
Q. Vapor Suppression	Apply water spray/fog over the released liquid to reduce the formation of vapors.	Equipment * Fire truck (water pumper) Foam generator unit Foam tanker or trailer Personnel 1 operational crew per unit	• Limited reductions • Fire/explosive hazard. • Water may cause material to spread	• Temporary flooding • Minor disturbance to surface soils and vegetation
R. Dissipation or dispersion	Apply a medium (air/gas/chemical) to disperse, dissolve, diffuse or in any way dissipate the density of the released material.	Equipment * Fans/blowers/air movers Nitrogen generator trucks Personnel 1 operational crew per unit	• Minimal effectiveness • Fire/explosive hazard.	•

1 - Techniques A through I appeared on Table 5 5-1 in Volume 1 as appropriate techniques for containment and recovery These techniques have been assigned the same letter designation as Table 5 5-1 for consistency
2 - In addition to implementation time and accessibility
*** - Need to establish a safe perimeter and follow safety precautions as appropriate before work begins, i.e., TGSM, JSA, and Hot Work Permit procedures.**

TABLE 5-7
Summary of Aquatic Protection Techniques

Technique[1]	Description	Primary Logistical Requirements	Use Limitations[2]	Potential Environmental Effects
G. Diversion Booming	Boom is deployed from the shoreline at an angle towards the approaching slick and anchored or held in place with a work boat. Oil is diverted towards the shoreline for recovery.	<u>Equipment</u> 1 boat 3 anchor systems (min.) 100 ft boom (min.) <u>Personnel</u> 3 workers plus boat crew	• Currents >2-3 kts • Waves >1-2 feet • Water depth >50 feet (anchoring) • Sensitive shorelines	• Minor substrate disturbance at anchor points • Heavy oiling at shoreline anchor point
H. Narrow Channel Containment Booming	Boom is deployed across entire river channel at an angle to contain floating oil passing through channel.	<u>Equipment</u> 1 boat, vehicle, or winch 1-2 booms (1.2 x channel width each) 2-10 anchor systems <u>Personnel</u> 2-3 workers	• Currents >2-3 kts • Water depths >50 feet (anchoring) • Sensitive shorelines	• Minor substrate disturbance at anchor points • Heavy shoreline oiling at downstream anchor point
I. Sorbent Barriers	A barrier is constructed by installing two parallel lines of stakes across a channel, fastening wire mesh to the stakes, and filling the space between with sorbents.	<u>Equipment</u>(per 100 feet of barrier) misc. hand tools 1 boat 20 fence posts 200 feet wire mesh 200 ft^2 sorbents misc. fasteners, support lines, additional stakes, etc. <u>Personnel</u> 2-3 workers	• Water depths >5-10 feet • Currents >0.5 kts • Soft substrate	• Minor substrate disturbance at post and shoreline anchor points • High substrate disturbance if boat is not used
L. Exclusion Booming	Boom is deployed across or around sensitive areas and anchored in place. Approaching oil is excluded from area.	<u>Equipment</u> (per 500 feet of boom) 1 boat 6 anchor systems 750 ft boom (min.) <u>Personnel</u> 3 workers plus boat crew	• Currents >1-2 kts • Waves >1-2 feet • Water depth >50 feet (anchoring)	• Minor substrate disturbance at anchor points
M. Deflection Booming	Boom is deployed from the shoreline away from the approaching slick and anchored or held in place with a work boat. Oil is deflected away from shoreline.	<u>Equipment</u> 1 boat 5 anchor systems boom (200 feet) <u>Personnel</u> 3 workers plus boat crew	• Currents >2-3 kts • Waves >1-2 feet • Water depth >50 feet (anchoring) • Onshore winds	• Minor substrate disturbance at anchor points • Oil is not contained and may contact other shorelines

TABLE 5-7 (Cont'd)

Summary of Aquatic Protection Techniques

Technique[1]	Description	Primary Logistical Requirements	Use Limitations[2]	Potential Environmental Effects
N. Inlet Dams	A dam is constructed across the inlet or channel using local shoreline sediments to prevent oil from entering inlet. Dam can be covered with plastic to minimize erosion.	Equipment 1 backhoe, bulldozer, front-end loader, or set of hand tools 1 plastic sheeting roll Personnel 2-6 workers	• Water outflow • Inlet depth >5 feet • Excessive inlet width	• Sediment/vegetation disturbance at borrow areas • Inlet substrate disturbance • Increases suspended sediments • Water in inlet can become stagnant
O. Debris/Ice Exclusion	Install fence barrier upstream of containment site to exclude debris/ice	Equipment (per 100 ft of barrier) misc. hand tools 1 boat 10 fence posts 100 feet cyclone fence Misc. fasteners, support lines, etc. Personnel 2-3 workers	• Water depths > 5-10 ft. • Currents > 3-4 kts • Soft substrate	• Minor substrate disturbance at post and anchor points

1 - Techniques G through I previously appeared on Table 5.5-1, as appropriate techniques for containment and recovery. These techniques have been assigned the same letter designation as Table 5.5-1 for consistency.
2 - In addition to implementation time and accessibility.

TABLE 5-8

Summary of Shoreline and Terrestrial Cleanup Techniques

Technique	Description	Primary Logistical Requirements[1]	Use Limitations[2]	Potential Environmental Effects
Removal				
1. Manual Removal	Hand tools (scrapers, wire brushes, shovels, cutting tools, wheel barrows, etc.) are used to scrape oil off surfaces or recover oiled sediments, vegetation, or debris where oil conditions are light or sporadic and/or access is limited.	Equipment misc. hand tools Personnel 10-20 workers	• Poor access • Highly sensitive areas	• Sediment disturbance and erosion potential • Trampling of vegetation and organisms • Foot traffic can work oil deeper into soft sediments
2. Mechanical Removal	Mechanical earthmoving equipment is used to remove oiled sediments and debris from heavily impacted areas with suitable access.			
2a. Motor Grater/Elevating Scraper	Used to recover heavily oiled surface sediments on relatively flat areas using motor grader to form windrows for pickup by elevating scrapers	Equipment 1 motor grader 1 elevating scrapers Personnel 2-4 workers plus equipment operators	• Poor trafficability • Limited access • Highly sensitive areas • Light or sporadic oil conditions	• Removes upper 2 to 6 inches of sediments • Removes shallow organisms but recolonization is typically rapid • Excessive sediment removal can cause erosion
2b. Motorized Grader/Front-end Loader	Used to recover lightly to heavily oiled sediments on relatively flat areas using a motor grader to form windrows for pickup by front-end loader.	Equipment 1 motor grader 2 front-end loaders Personnel 2-4 workers plus equipment operators	• Poor trafficability • Limited access • Highly sensitive areas • Light or sporadic oil conditions	• Removes upper 2 to 6 inches of sediments • Removes shallow organisms but recolonization is typically rapid • Excessive sediment removal can cause erosion

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2c. Bulldozer/Front -end Loader	Used to recover moderately to heavily oiled sediments using a bulldozer to push sediments into piles for pickup by front-end loader. Front-end loader may work alone to recover sediments directly.	Equipment 1 bulldozer 2 front-end loaders Personnel 2-4 workers plus equipment operators	• Very poor trafficability • Limited access • Highly sensitive areas • Light or sporadic oil conditions	• Removes upper 2 to 12 inches of sediments • Removes shallow organisms but recolonization is typically rapid • Excessive sediment removal can cause erosion
2d. Backhoe	Used to recover surface or subsurface oiled sediments on flat or steeply sloped areas by scooping up sediments and placing directly into dump trucks or in piles for subsequent removal.	Equipment 1-2 backhoes 4-6 dump trucks Personnel 2-4 workers plus equipment operators	• Limited access • Highly sensitive areas • Unstable slopes • Light or sporadic oil conditions	• Removes minimum of 6 to 12 inches of sediments • Removes shallow organisms but recolonization is typically rapid • Can cause erosion and slope instability

Technique	Description	Primary Logistical Requirements[1]	Use Limitations[2]	Potential Environmental Effects
3. Sorbent Use	Sorbents are applied manually to oil accumulations, coatings, sheens, etc. to remove and recover the oil.	Equipment misc. hand tools misc. sorbents Personnel 2-10 workers	• Poor access • Highly sensitive areas • Heavy oil conditions	• Sediment disturbance and erosion potential • Trampling of vegetation and organisms • Foot traffic can work oil deeper into soft sediments
4. Vacuum/Pumps/ Skimmers	Pumps, vacuum trucks, skimmers are used to remove oil accumulations from land or relatively thick floating layers from the water.	Equipment 1-2 50- to 100-bbl vacuum trucks w/hoses 1-2 nozzle screens or skimmer heads Personnel 2-6 workers plus truck operators	• Poor access • Thin oil accumulations or light sheens • Highly sensitive shoreline areas • Excessive suction lift required	• Typically does not remove all oil • Can remove some surface organisms, sediments, and vegetation

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Washing				
5. Flooding	High volumes of water at low pressure are used to flood the oiled area to float oil off and out of sediments and back into the water or to a containment area where it can be recovered. Frequently used with flushing.	Equipment 1-5 100- to 200-gpm pumping systems 1 100-ft perforated header hose per system 1-2 200-ft containment booms per system 1 oil recovery device per system Personnel 6-8 workers per system	• Highly permeable substrate • Highly sensitive areas • Poor access • Highly weathered oil or thin films or coatings • Typically does not remove all oil	• Can impact clean downgradient areas • Can displace some surface organisms if present • Sediments transported into water can affect water quality

Technique	Description	Primary Logistical Requirements[1]	Use Limitations[2]	Potential Environmental Effects
6. Flushing	Water streams at low to moderate pressure, and possibly elevated temperatures, are used to remove oil from surface or near-surface sediments through agitation and direct contact. Oil is flushed back into the water or a collection point for subsequent recovery. May also be used to flush out oil trapped by shoreline or aquatic vegetation.	Equipment 1-5 50- to 100-gpm/ 100-psi pumping systems with manifold 1-4 100-ft hoses and nozzles per system 1-2 200-ft containment booms per system 1 oil recovery device per system Personnel 8-10 workers per system	• Highly permeable substrate • Highly sensitive areas • Poor access • Highly weathered oil or thin films or coatings • Typically does not remove all oil	• Can impact clean downgradient areas • Will displace many surface organisms if present • Sediments transported into water can affect water quality • Hot water can be lethal to many organisms • Can increase oil penetration depth

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7. Spot (High Pressure) Washing	High pressure water streams are used to remove oil coatings from hard surfaces in small areas where flushing is ineffective. Oil is directed back into water or collection point for subsequent recovery.	Equipment 1-5 1,200- to 4,000-psi units with hose and spray wand 1-2 100-ft containment booms per unit 1 oil recovery device per unit Personnel 2-4 workers per unit	• Poor access • Highly sensitive area • Safety hazard from high pressure water stream • Relatively soft or unconsolidated substrates	• Will remove most organisms if present • Can damage surface being cleaned • Can affect clean downgradient or nearby areas
In Situ				
8. Passive Collection	Sorbent/snare booms or other sorbent materials are anchored at the waterline adjacent to heavily oiled areas to contain and recover oil as it leaches from the sediments.	Equipment 1,000-2,000 ft sorbent/snare boom 200-400 stakes or anchor systems Personnel 4-10 workers	• Poor access • High currents/waves • Lightly oiled sediments • Oil removal process is slow	• Significant amounts of oil can remain on the shoreline for extended periods of time

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Technique	Description	Primary Logistical Requirements[1]	Use Limitations[2]	Potential Environmental Effects
9. Sediment Tilling	Mechanical equipment or hand tools are used to till lightly to moderately oiled surface sediments to maximize natural degradation processes.	Equipment 1 tractor fitted with tines, dicer, ripper blades, etc. or 1-4 rototillers or 1 set of hand tools Personnel 2-10 workers	• Poor access • Heavily oiled area • Highly sensitive area • Oil can be mixed deeper into substrate	• Significant amounts of oil can remain on the shoreline for extended periods of time • Disturbs surface sediments and organisms
10. In Situ Bioremediation	Fertilizer is applied to lightly to moderately oiled areas to enhance microbial growth and subsequent biodegradation of oil.	Equipment 1-2 fertilizer applicators 1 tilling device if required Personnel 2-4 workers	• May cause algal bloom and short-term water quality problems • Heavily oiled areas	• Significant amounts of oil can remain on the shoreline for extended periods of time • Can disturb surface sediments and organisms
11. Log/Debris Burning	Oiled logs, driftwood, vegetation, and debris are burned to minimize material handling and disposal requirements. Material should be stacked in tall piles and fans used to ensure a hot, clean burn.	Equipment 1 set of fire control equipment 2-4 fans 1 supply of combustion promoter Personnel 2-4 workers	• Local air quality regulations • Close proximity to populated areas • High wind conditions • Heavy precipitation	• Heat may impact local near-surface organisms • Substantial smoke may be generated • Heat may impact adjacent vegetation
12. Natural Recovery	No action is taken and oil is allowed to degrade naturally.	None required	• Heavy oil conditions • Highly sensitive shorelines • High oil remobilization potential	• Oil may persist for significant periods of time • Remobilized oil or sheens may impact other areas • Higher probability of impacting wildlife
1 - Per 1000 feet of shoreline or oiled area 2 - In addition to fire and explosion hazard				

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Table 5-9

Dispersant Stockpiles - Summary Table

Organization	Location of Dispersant	Type of Dispersant	Method of storage	Amount Gallons
East Coast Region				
Delaware Bay & River Co-op Lewis, DE - Eugene Johnson (302) 645-7861	Slaughter Beach, DE	COREXIT 9527	55 GAL Drums	1,650
Clean Harbors Co-op Edison, NJ - Dennis McCarthy (732) 225-2300	Perth Amboy, NJ	COREXIT 9527	55 GAL Drums	1,375
MSRC Edison, NJ - Austin Smith (732) 417-0500 (732) 346-2450	Edison, NJ	COREXIT 9527	55 GAL Drums	24,640
Clean Caribbean - Paul Schuler - Skip Przelomski (954) 983-9880	Ft. Lauderdale, FL Ft. Lauderdale, FL Ft. Lauderdale, FL	COREXIT 9527 COREXIT 9527 COREXIT 9500	55 GAL Drums 5,000 GAL Tanks 55 GAL Drums	4,070 5,000 21,340
Gulf Coast Region				
Clean Gulf Associates New Orleans, LA - Mr. Dick Armstrong (504) 566-5759	Sugarland, TX Houma, LA at Airborne Support	COREXIT 9500 COREXIT 9527	55 Gal. Drums 55 Gal. Drums	28,985 6,665
Airborne Support Houma, LA - Howard Barker (504) 851-6391	Houma, LA	COREXIT 9527	55 Gal. Drums	2,500
Loop, Inc. New Orleans - Cassandra Cooper-Gates (504) 363-9282	Houma, LA at Airborne Support Houma, LA Fourchon, LA	COREXIT 9527 COREXIT 9500 COREXIT 9527	2,000 Gal. Tanks 2,000 Gal. Tanks 2,000 Gal. Tanks	24,000 2,000 17,500

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Organization	Location of Dispersant	Type of Dispersant	Method of storage	Amount Gallons
Gulf Coast Region (Cont'd)				
NALCO/EXXON Chemical Co. - Call Abasco (A division of Boots & Coots) (800) 242-7745	Sugarland, TX Sugarland, TX	COREXIT 9500 COREXIT 9500	Raw materials only 5 Gal. Drums	11,000 11,000
MIRG - Jim O'Brien (504) 368-9845	Houma, LA at Airborne Support	COREXIT 9527	55 Gal. Drums	16,500
West Coast Region				
Clean Coastal Water Co-op Long Beach, CA - Christopher Gregory (310) 432-1415	Long Beach, CA	COREXIT 9527	55 GAL Drums	6,575
Clean Bay Co-op Concord, CA - Steve Ricks (925) 685-2800	Richmond, CA	COREXIT 9527	55 GAL Drums	15,000
Hawaiian Independent Refinery/Clean Islands Council Honolulu, HI - Kim Beasely (808) 845-8465	Honolulu, HI Honolulu, HI	COREXIT 9527 COREXIT 9500	55 GAL Drums 55 GAL Drums	4,015 3,080
Clean Seas Co-op Carpenteria, CA - Darrel Waldron (805) 684-3838	Carpenteria, CA (Co-op use only)	COREXIT 9527	55 GAL Drums	20,000
Clean Sound Co-op, Inc. Raineer Beach, WA - Roland E. Miller (425) 744-0948	Ferndale, WA	COREXIT 9527	300 GAL DOT Containers	6,250

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Organization	Location of Dispersant	Type of Dispersant	Method of storage	Amount Gallons
Servs Alyeska Co-op - Jeff Merrill (907) 834-6923 or 6901	Anchorage, AK Lowehouse, AK Valdez, AK	COREXIT 9527 COREXIT 9527 COREXIT 9527	55 GAL Drums Bulk Bulk	9,240 60,000 6,000
Cispri (Ciro) Cook - Victoria Askin (907) 776-5129 (907) 776-7406 Direct (907) 776-7402	Nikiski, AK Anchorage, AK Nikiski, AK	COREXIT 9527 COREXIT 9527 COREXIT 9550	55 GAL Drums 55 GAL Drums 55 GAL Drums	9,295 11,275 2,255

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TABLE 5-10

EXISTING FIRE BOOM INVENTORIES

Gulf Coast Region

Owner and Location	Quantity and Description
Texas General Land Office (512) 463-5195 Austin, TX	1500 feet of Kepner Firegard Boom
Marine Spill Response Corp. (MSRC) (800) 645-7745 or (800) 259-6772 Galveston, TX	500 feet of Fire Boom + 400 feet of Guide Boom
Marine Spill Response Corp. (MSRC) (800) 645-7745 or (800) 259-6772 Pascagoula, MS	500 feet of Fire Boom + 400 feet of Guide Boom
Marine Spill Response Corp. (MSRC) (800) 645-7745 or (800) 259-6772 Miami, FL	500 feet of Fire Boom + 400 feet of Guide Boom
Marine Spill Response Corp. (MSRC) (800) 645-7745 or (800) 259-6772 St. Croix	500 feet of Fire Boom + 400 feet of Guide Boom

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TABLE 5-11

Federal Waste Handling/Disposal Regulations

Regulatory Agency	Regulation	Description
U.S.EPA	40 CFR Part 261 • Subpart C • Subpart D	Identification and Listing of Hazardous Waste • Characteristics of Hazardous Waste • Lists of Hazardous Waste
U.S.DOT	49 CFR Parts 171-179 • (171,173-177) • (172) • (173,178,179)	Transportation of Hazardous Materials • Operation Rules • Material Designation and Hazard Communication • Packaging Requirements
U.S.EPA	40 CFR Part 262 • Subpart A • Subpart B • Subpart C • Subpart D	Hazardous Waste Generators • Waste Determination and EPA I.D. Numbers • Manifesting • Pre-transportation requirements • Recordkeeping and Reporting
U.S.EPA	40 CFR Part 265 • Subpart B • Subpart C • Subpart D	Hazardous Waste Treatment, Storage, Disposal • Personnel Training • Preparedness and Prevention • Contingency Plan and Emergency Procedures
U.S.EPA	40 CFR Part 266	Standards for Materials being Recycled or Reused
U.S.EPA	40 CFR Part 268	Land Disposal Restrictions
U.S.EPA	40 CFR Part 273	Universal Waste Management Standards
U.S.EPA	40 CFR Part 279	Used Oil Management Standards

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TABLE 5-12

Waste Disposal Methods

Disposal Method	Disposal Rate	Uses	Auxiliary Equipment	Advantages	Disadvantages	Comments
Landfill	• Depends on local capacity and access constraints as well as governmental restrictions	• Disposal of oily solid wastes	• Earth-moving equipment and trucks	• Useful for a wide variety of debris types • Can be implemented rapidly	• Can be costly disposal method • Can cause future liability	• Total volume of debris accepted per site may be small • Be sure landfill is permitted to accept oily waste • Be sure landfill is on the state or federal approved site list
Landfarms	• Application rates for crude oils are typically 300 bbls/acre, 2 to 3 times per year	• Disposal of liquids and oil mixed with sand or sediment	• Transport trucks • Tillers • Fertilizing and irrigation equipment	• Proven technology • Oil degrades rapidly • Can be implemented quickly	• Requires large surface area • Not suited for large oily debris • Periodic maintenance required to fertilize, till, spread oil • End product may require removal or capping	• Local officials and refinery operators are useful sources of information • The location should be on the contingency plan list of approved facilities
Open Burning	• The rate of disposal depends on the volume of oil • As a rough guide the rate will likely be less than 1 ton per hour	• Disposal of bulky combustible debris (e.g., oiled logs)	• Earth-moving equipment and trucks • Fire fighting equipment • Air blowers	• Useful in remote area • Eliminates contaminated waste permanently • Can be quickly implemented	• Air emissions may be a problem • Requires governmental permission in most locations • Can cause contamination of underlying soils • Incomplete combustion may leave residue requiring disposal	• A recommended safety procedure is to cover residue with a thin layer of dirt to prevent smoldering embers from prematurely igniting the next load being dumped in a pit • Air blowers may be required to improve combustion and to control smoke emissions

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Disposal Method	Disposal Rate	Uses	Auxiliary Equipment	Advantages	Disadvantages	Comments
Portable Offshore Burners (liquids)	• Up to 15,000 bbls/day	• Incineration of pure oil and emulsions either offshore on platforms and barges or on land	• A method to mount the burner away from heat sensitive areas (e.g., tower, boom, shielding) • Air Compressor • Oil pumps (high pressure) and hoses • Water pumps for water shroud • Note: Auxiliary equipment will probably be supplied with the burner	• Proven method of oil disposal • High rates of disposal • Useful in remote areas	• Can be expensive • Requires time to set up(unless already mounted on a platform or barge) • Significant amounts of diesel or other solvents may be required to reduce viscosity of emulsions to make them pumpable • Requires debris-free oil or emulsions	• These systems can typically be supplied by well-testing equipment suppliers

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TABLE 5-12 (Con't.)

Waste Disposal Methods

Disposal Method	Disposal Rate	Uses	Auxiliary Equipment	Advantages	Disadvantages	Comments
Portable Air Curtain Incinerators	• Oily debris, 1 to 2 tons/hour • Oil emulsions up to 600 bbls/day	• On land disposal of liquids and oily debris	• Earth-moving equipment to form earthen incinerator pit • System to load debris or liquids • Above ground combustion chamber (optional in some cases)	• Portable systems for disposal of waste in the field • High disposal rates • Permanent disposal of waste • Accepts both liquids and solids	• Requires time to set up	• Several types of air curtain incinerators are manufactured. Some are designed to be used only with above ground chambers, others with in ground trenches, and some with either. Manufacturers include Driall (US) and Trecan (Canada)
Rotary Kiln/Other Portable Incinerators	• Oily debris, 40 to 70 tons/day • Oiled sediments 100 tons/day • Maximum about 1 ton/hour oil basis	• Disposal near the source of oily sorbents, etc. • Remediation of contaminated soils near the source	• Size reduction equipment (shredder or chipper) may be needed, depending on the incinerator type and debris size	• High disposal rate • Permanent disposal of waste oil, solid gear, and spend sorbents • May accept both liquids and solids	• Requires time to construct/mobilize • Air emission permit may be needed (should be easier to permit than some of the above options	•
Process Incineration	• Typically up to several hundred bbls or a few tons/hour	• Disposal of both liquids and solids	• An efficient storage and transportation network	• Permits usually already in place • Quick to implement if close to cleanup site • Controlled emission release	• High cost • Most incinerators are designed to burn a narrow range of products	•
Source: Exxon Oil Spill Response Field Manual, Exxon Production Research Company, 1992						

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FIGURE 5-1
INITIAL RESPONSE ACTIONS

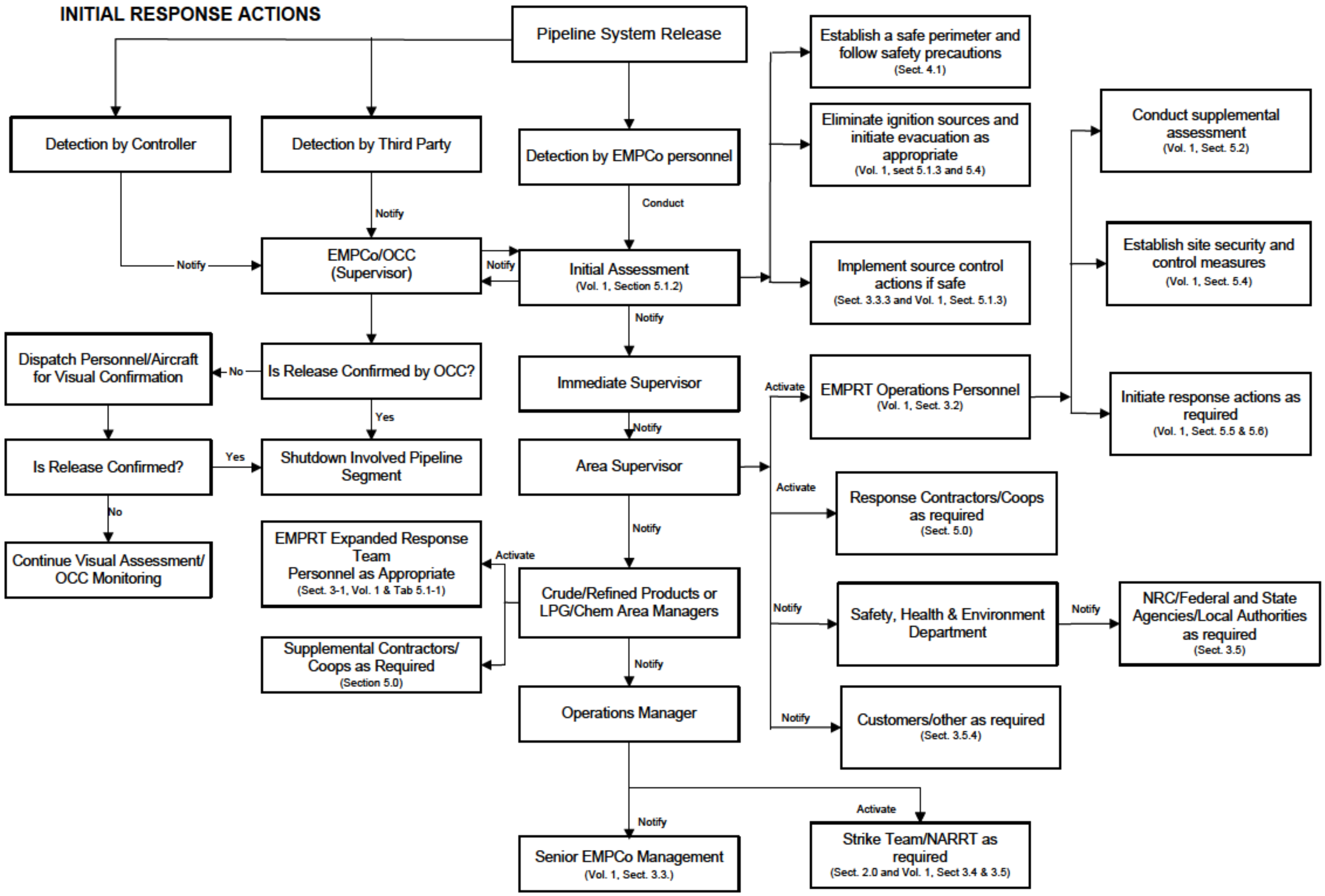

Figure 5-2
ExxonMobil Pipeline Company Spill / Release / Incident Report Form

Initial Report ___ Supplemental Report ___ Final Report ___ Date: ____________

Date **and** Time Spill / Release Discovered : ________________________________

Spill / Release Discovered by : ________________________________

Date **and** Time Spill / Release Reported to SHE : ________________________________

Spill / Release Reported to SHE by : ________________________________

Pipeline, Station or Terminal : ________________________________

Spill / Release / Incident Location : ________________________________

City / Parish or County / State : ________________________________

Nearest Town / City : ________________________________

Driving Directions : ________________________________

Product Spilled / Released : ________________________________

Volume Spilled / Released : ________________________________

Line Size / Description : ________________________________

Volume Recovered : ________________________________

Interstate: ☐ Intrastate: ☐ Regulated : ________________________________

Cause of Spill / Release : ________________________________

Fire: Yes ☐ No ☐ Explosion: Yes ☐ No ☐ Evacuations: Yes ☐ No ☐

Env. Impact: Air ☐ Water ☐ Soil ☐ Number of Injuries: ____ Number of Deaths: ____

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Area Manager : ____

Area Supervisor : ____

Field Operations Supervisor / FLS : __________________________________

Legal Description : ____

Land Description : ____

Landowner Notified : ____

Nearest Occupied House : ______________________________________

Nearest Main Road / Intersection : ___________________________________

Net Volume Lost : ____

Pipe Wall Thickness : ______________ Specification : _______________________

Seam Type : ________________ MOP : ______________________________

Pressure at Time of Spill / Release : ______________ SMYS : _______________________

Weather Conditions : ____

Area of Spill / Release : _________________________ Media Coverage: Yes ☐ No ☐

Spill Costs (in whole dollars):

Public / Private Property Damage	_____________
Cost of Emergency Response Phase	_____________
Cost of Environmental Remediation	_____________
Value of Product Lost	_____________
Value of Operator Property Damage	_____________
Other Costs	_____________
Total Cost	_____________

Describe Other Costs: ____

Livestock / Wildlife Impacted: ____________________________________

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If Water Impacted, Name : ____

Repair Method Used: ____

Method of Clean-up: ____

Next Remediation Steps: ____

Did Spill / Release Reach an HCA: Yes ☐ No ☐ Could It Reach Water: Yes ☐ No ☐

Is Leak / Release on a Segment Identified as a "Could Affect" Segment: Yes ☐ No☐

Is Pipe Configured for In Line Inspection Devices: Yes ☐ No ☐

Date of Last In Line Inspection: ____________ Type of Tool: ___________________

Cathodically Protected: Yes ☐ No ☐ Type of System: _________________________

Year Installed: _____ Has a CIS Been Performed: Yes ☐ No ☐ Year of Last CIS: ______

Agency / EMPCo Telephonic and / or Verbal Notifications			
Agency or Company	**Name of Person Taking Report**	**Time of Notification (24 hr format)**	**Assigned Incident or Report Number**

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Written Reports / Notification Letters		
Agency or Company	**Due Date**	**Date Mailed**

Additional Comments:

____
____
____
____

* - GPS Coordinates are Required

Instructions / Pointers for EMPCo Spill / Release / Incident Report Form

- The first seventeen lines (highlighted in yellow if completing form on computer) are items needed for initial reporting to agencies and should be provided as soon as possible. Some of the initial items may not be readily known when first notification(s) are made to SHE, so should be provided at a later time when the information can be obtained. For any given spill / release / incident, not every information item will be applicable. Skip those items or enter "N/A".

- If completing this form on a computer, there is default text in some of the data entry fields (with the exception of the notification tables), provided as an example of the data needed. The data entry fields are gray shaded, and as data is entered into the fields, the default text will disappear.

- GPS coordinates are now required. They tie in to spill tracking by the National Pipeline Mapping System (NPMS) and American Petroleum Institute (API). The format does not matter, it can be converted in SHE if necessary. GPS coordinate formats may look like the following:

  1. 13 695512E 4705010N (UTM format)
  2. 42.4728°N -102.6216°W (DD.DDD format)
  3. 42° 28' 22" N -102° 37' 18" W (DMS format)
  4. 42° 28.37' N -102° 37.30' W (DD MM.MM format)

- For some items, it may be necessary to consult with Corrosion Technicians, Facility Engineers, Field ERST Techs / Field Regulatory Specialists or others to obtain the information.

Figure 5-3
INCIDENT NOTIFCATION CHART

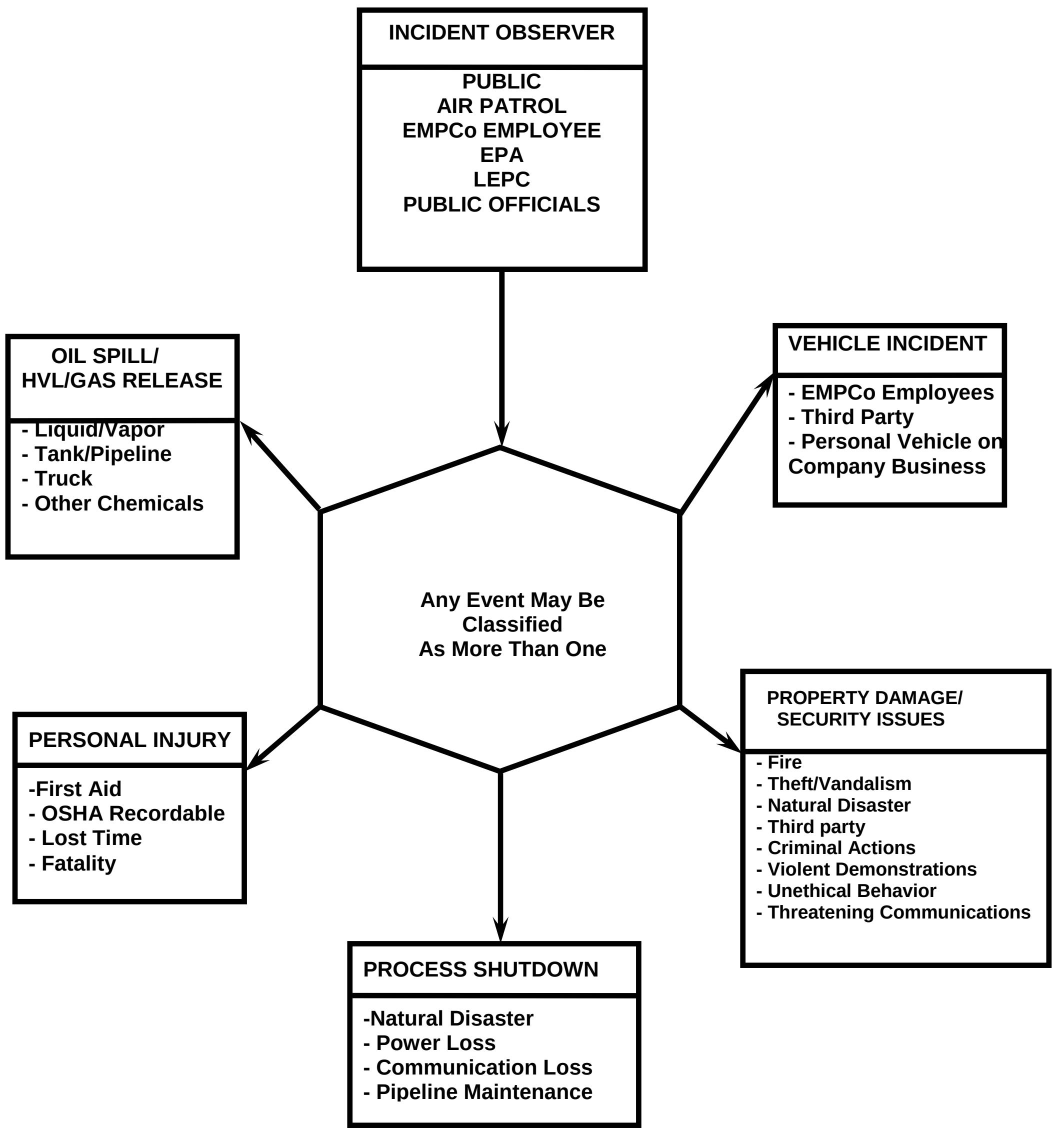

Figure 5-4
OVERVIEW OF EXTERNAL NOTIFICATIONS
FOR MAJOR PIPELINE INCIDENTS

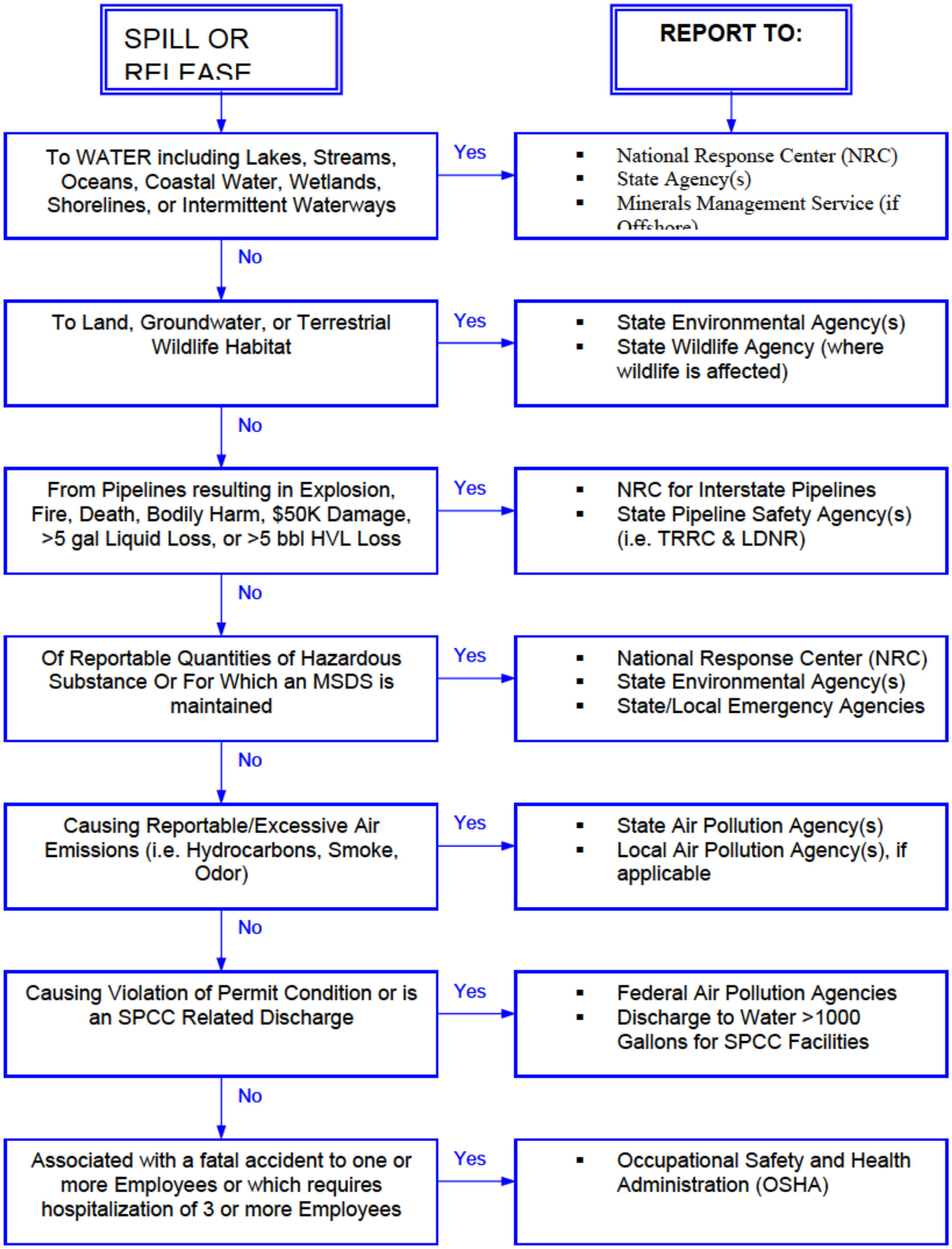

FIGURE 5-5

VOLUME AND SLICK THICKNESS ESTIMATION

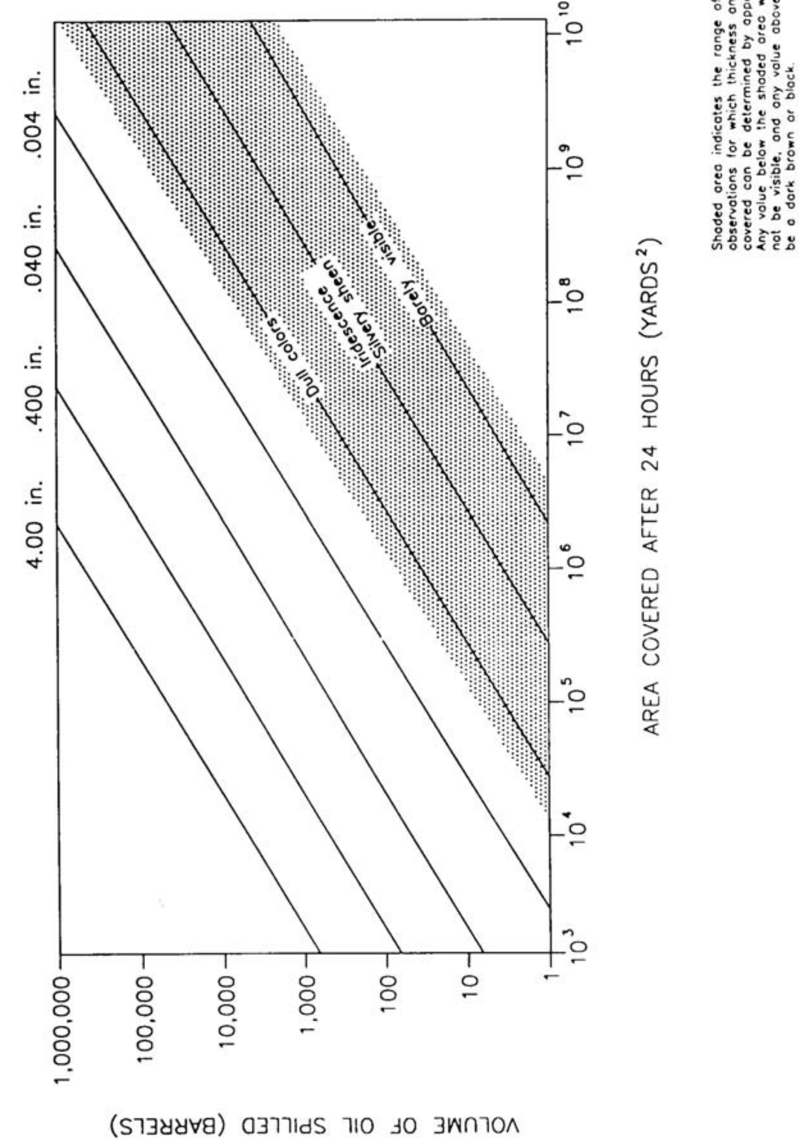

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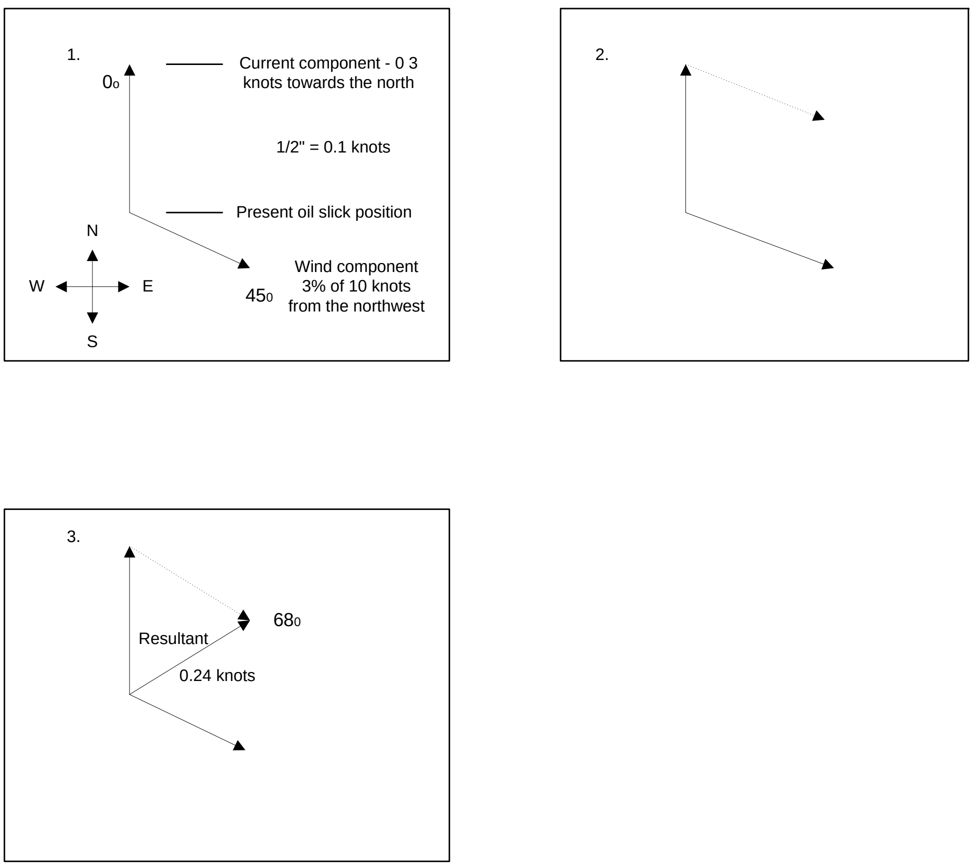
FIGURE 5-6

VECTOR ADDITION METHOD FOR SPILL TRAJECTORY PREDICTION



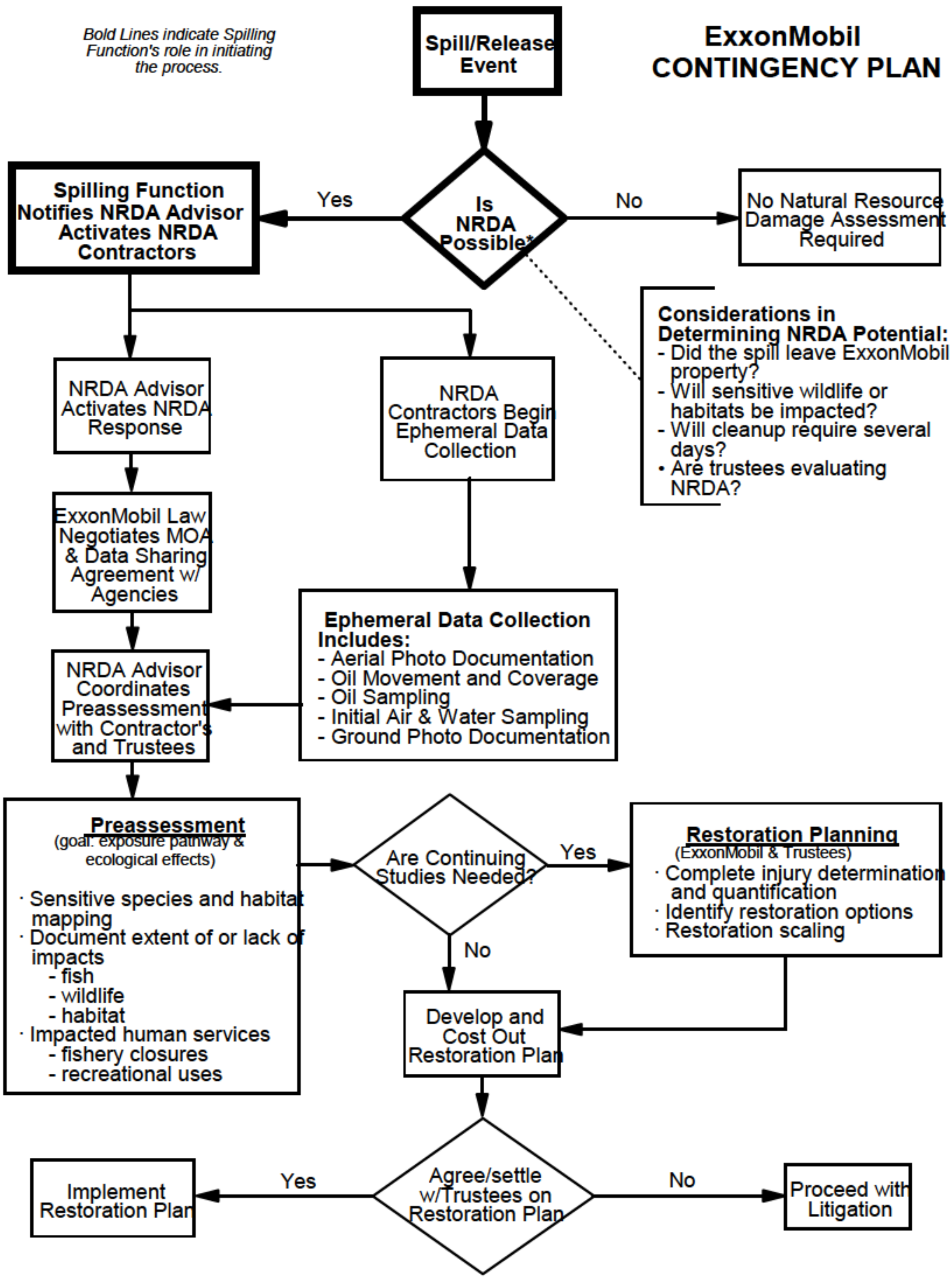

Bold Lines indicate Spilling Function's role in initiating the process.
Spill/Release Event
ExxonMobil CONTINGENCY PLAN
Is NRDA Possible*
Yes
No
Spilling Function Notifies NRDA Advisor Activates NRDA Contractors
No Natural Resource Damage Assessment Required
Considerations in Determining NRDA Potential:
- Did the spill leave ExxonMobil property?
- Will sensitive wildlife or habitats be impacted?
- Will cleanup require several days?
• Are trustees evaluating NRDA?
NRDA Advisor Activates NRDA Response
NRDA Contractors Begin Ephemeral Data Collection
ExxonMobil Law Negotiates MOA & Data Sharing Agreement w/ Agencies
Ephemeral Data Collection Includes:
- Aerial Photo Documentation
- Oil Movement and Coverage
- Oil Sampling
- Initial Air & Water Sampling
- Ground Photo Documentation
NRDA Advisor Coordinates Preassessment with Contractor's and Trustees
Preassessment
(goal: exposure pathway & ecological effects)
· Sensitive species and habitat mapping
· Document extent of or lack of impacts
- fish
- wildlife
- habitat
· Impacted human services
- fishery closures
- recreational uses
Are Continuing Studies Needed?
Yes
No
Restoration Planning
(ExxonMobil & Trustees)
· Complete injury determination and quantification
· Identify restoration options
· Restoration scaling
Develop and Cost Out Restoration Plan
Agree/settle w/Trustees on Restoration Plan
Yes
No
Implement Restoration Plan
Proceed with Litigation

FIGURE 5-8

CONTAINMENT AND RECOVERY IMPLEMENTATION SEQUENCE

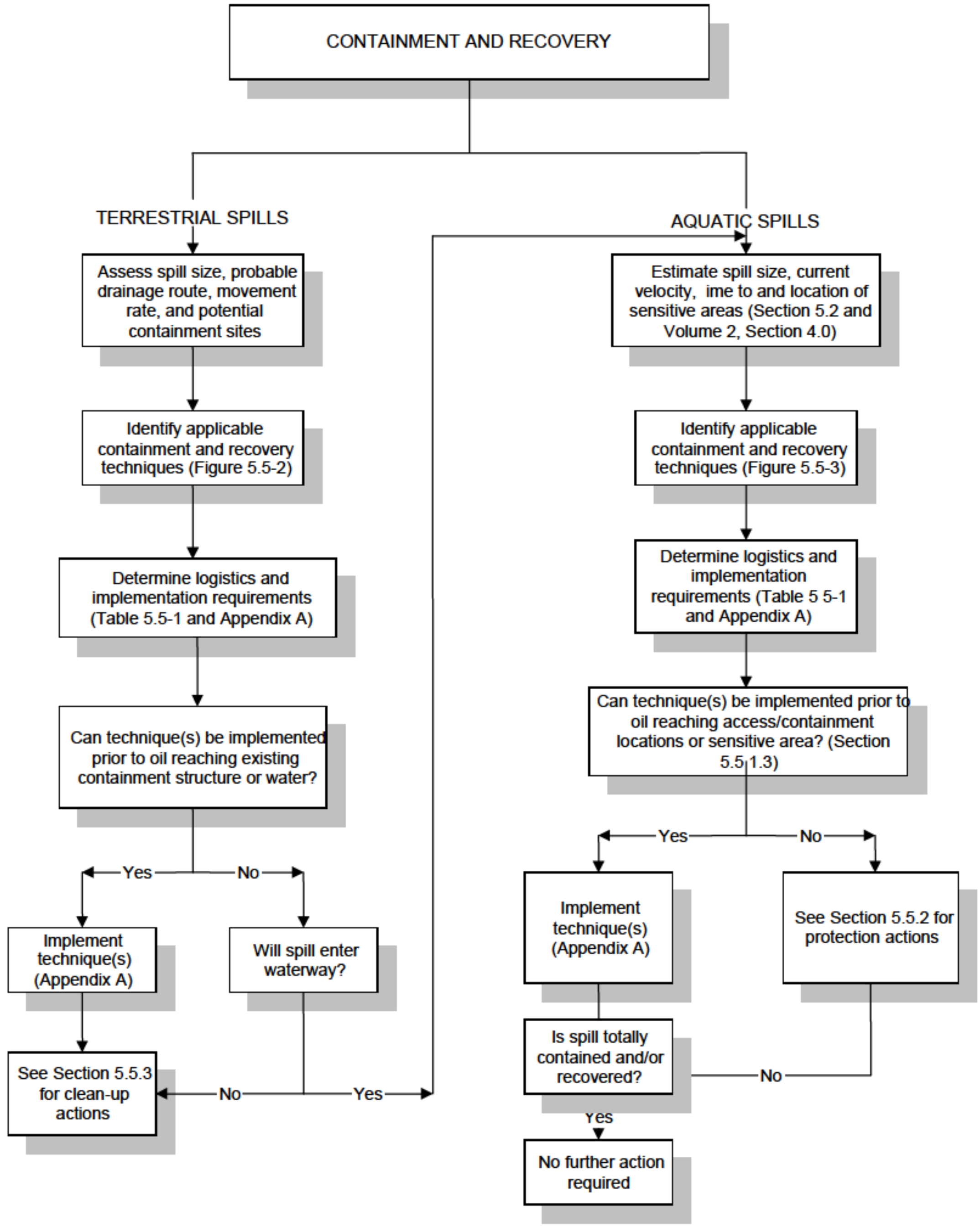


FIGURE 5-9

TERRESTRIAL SPILL CONTAINMENT TECHNIQUE SELECTION GUIDE

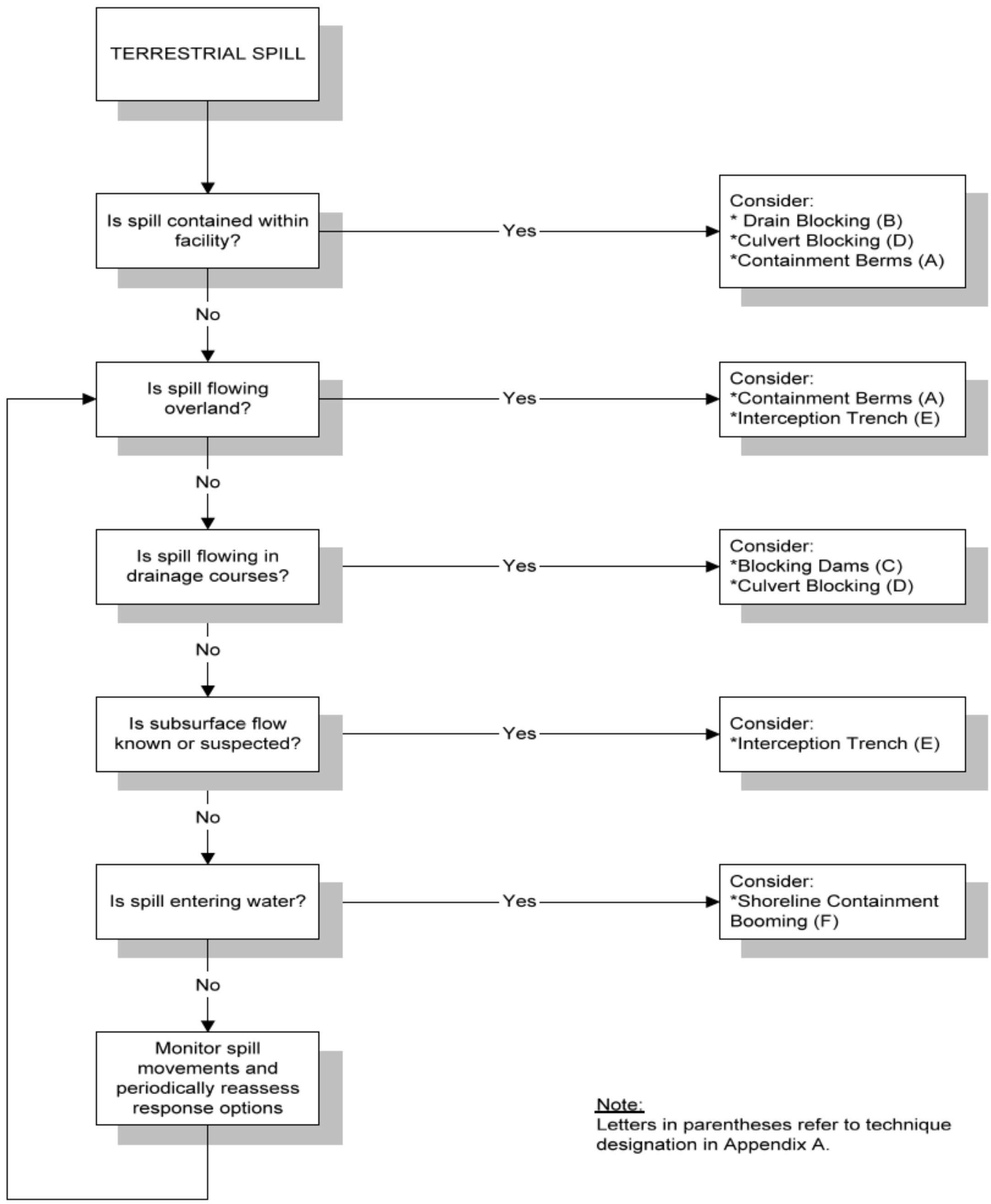
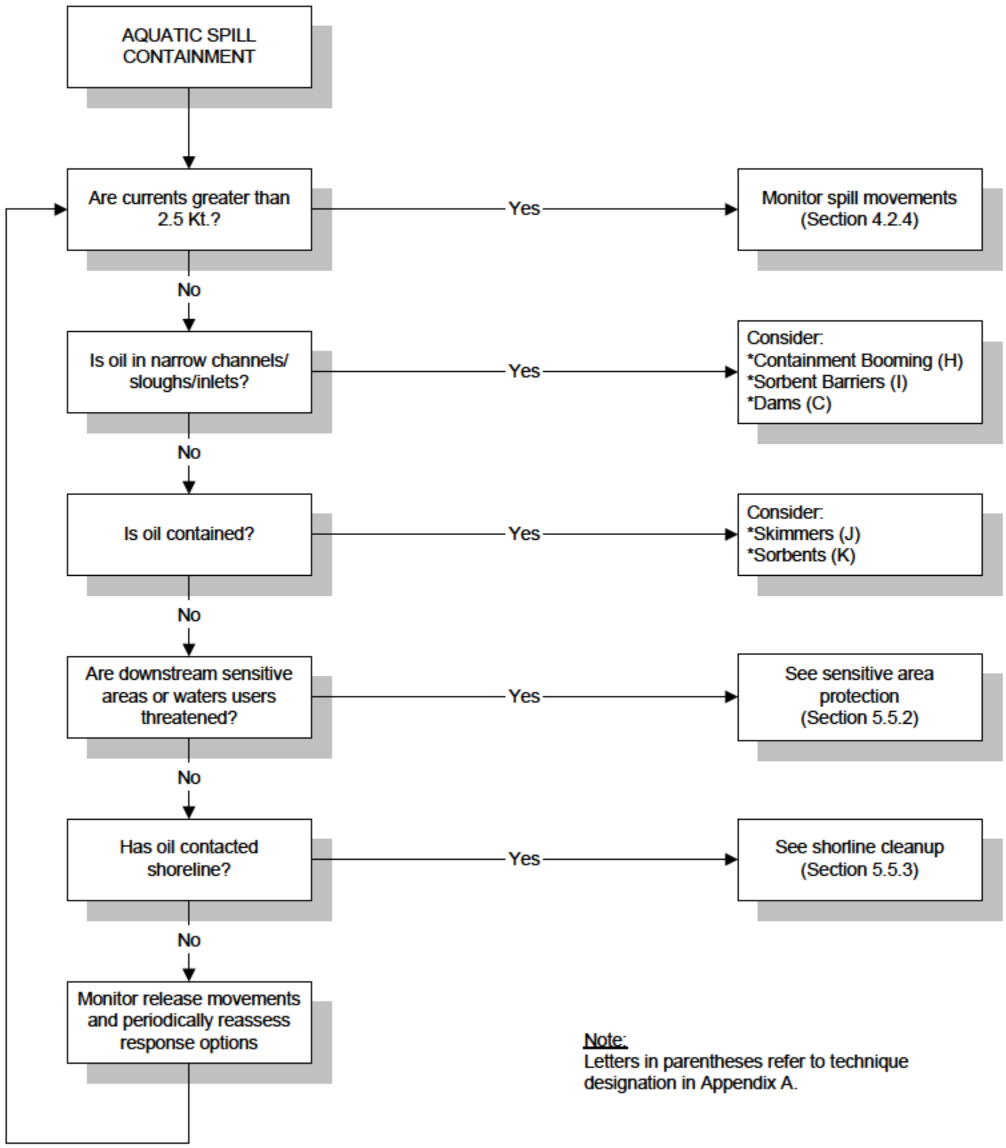


FIGURE 5-10

AQUATIC SPILL CONTAINMENT AND RECOVERY TECHNIQUE SELECTION GUIDE



Note:
Letters in parentheses refer to technique designation in Appendix A.

FIGURE 5-11

SENSITVE AREA PROTECTION IMPLEMENTATION SEQUENCE

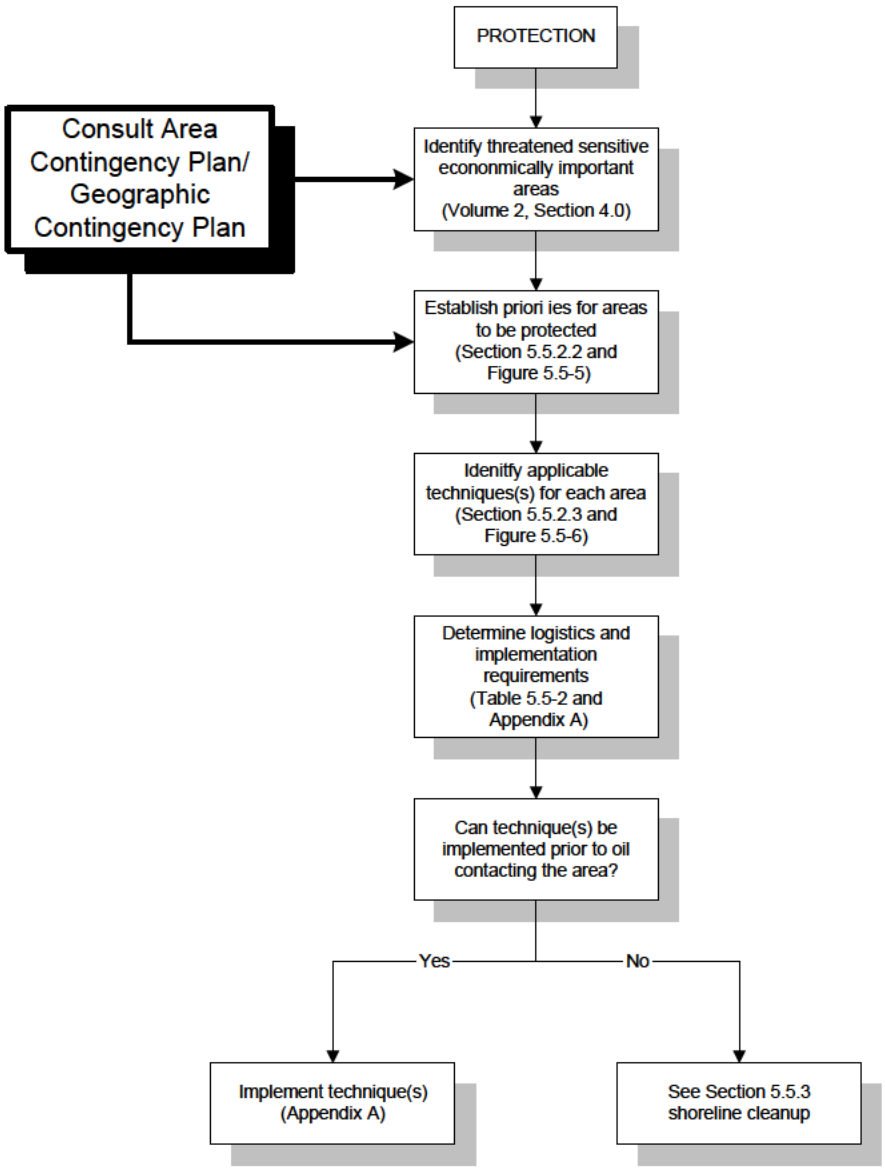


FIGURE 5-12

PROTECTION OPERATION PRIORITIZATION GUIDE

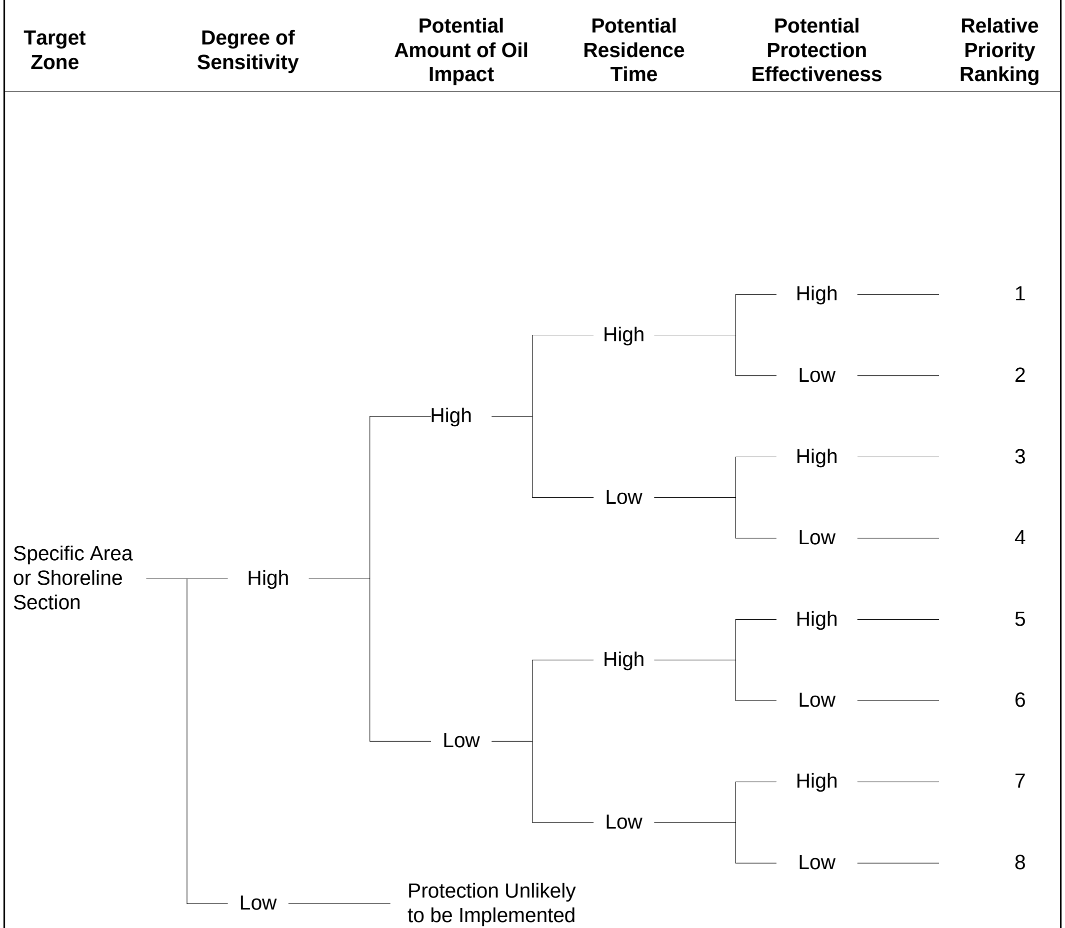


FIGURE 5-

PROTECTION TECHNIQUE SELECTION GUIDE

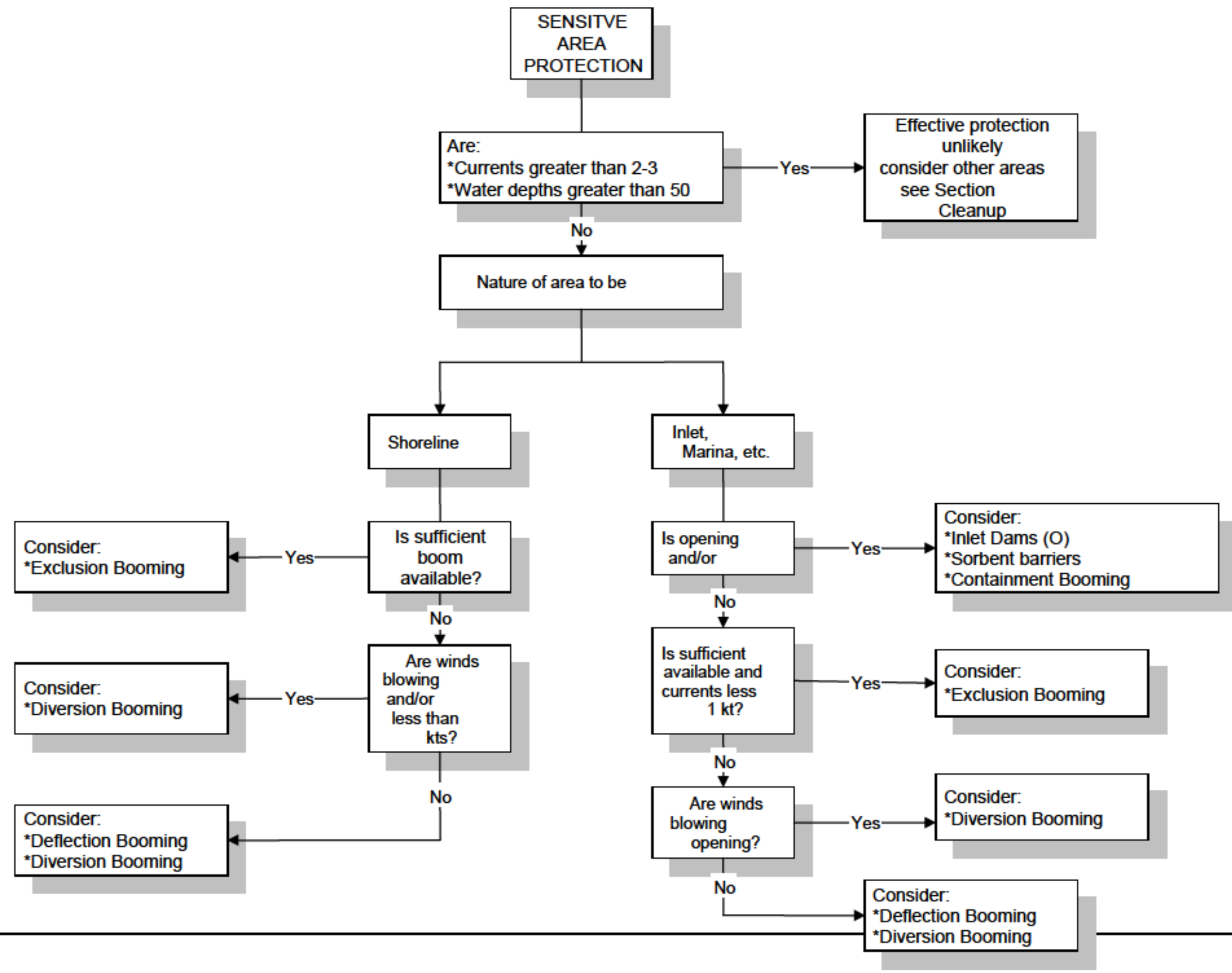


FIGURE 5-

CLEAN-UP IMPLEMENTATION

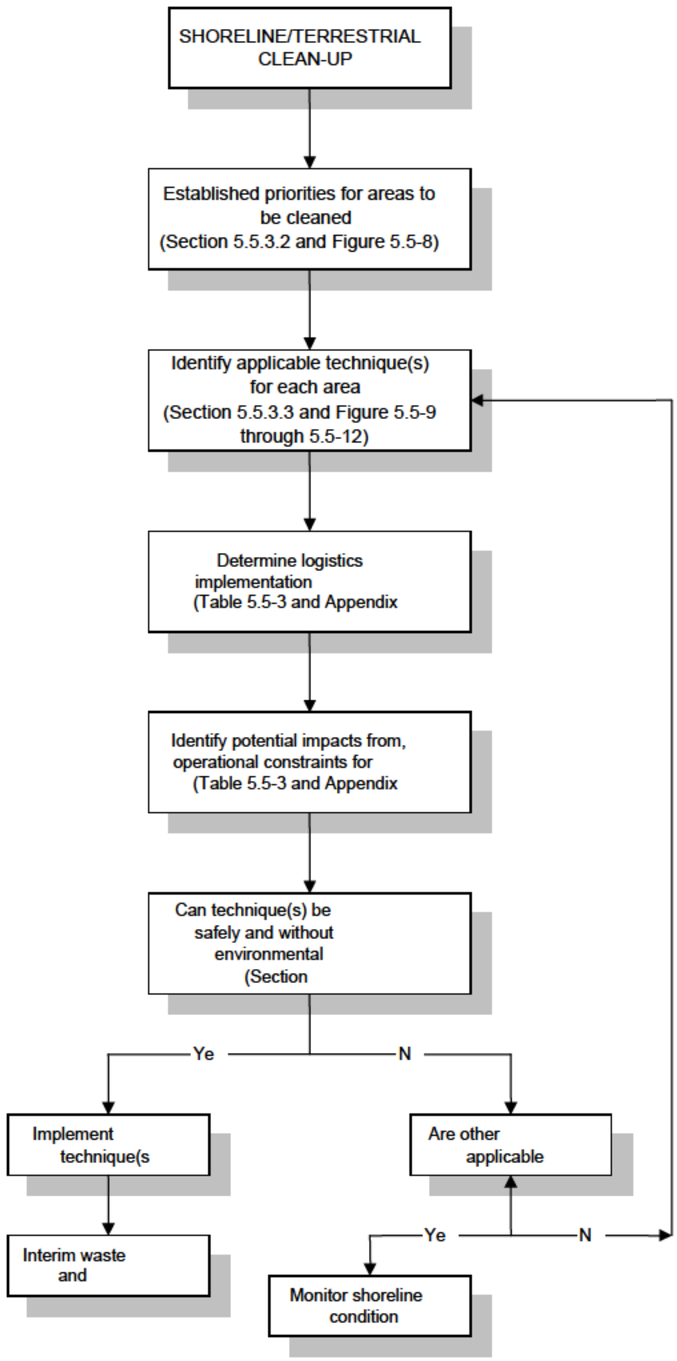


FIGURE 5-15

CLEANUP OPERATION PRIORITIZATION GUIDE

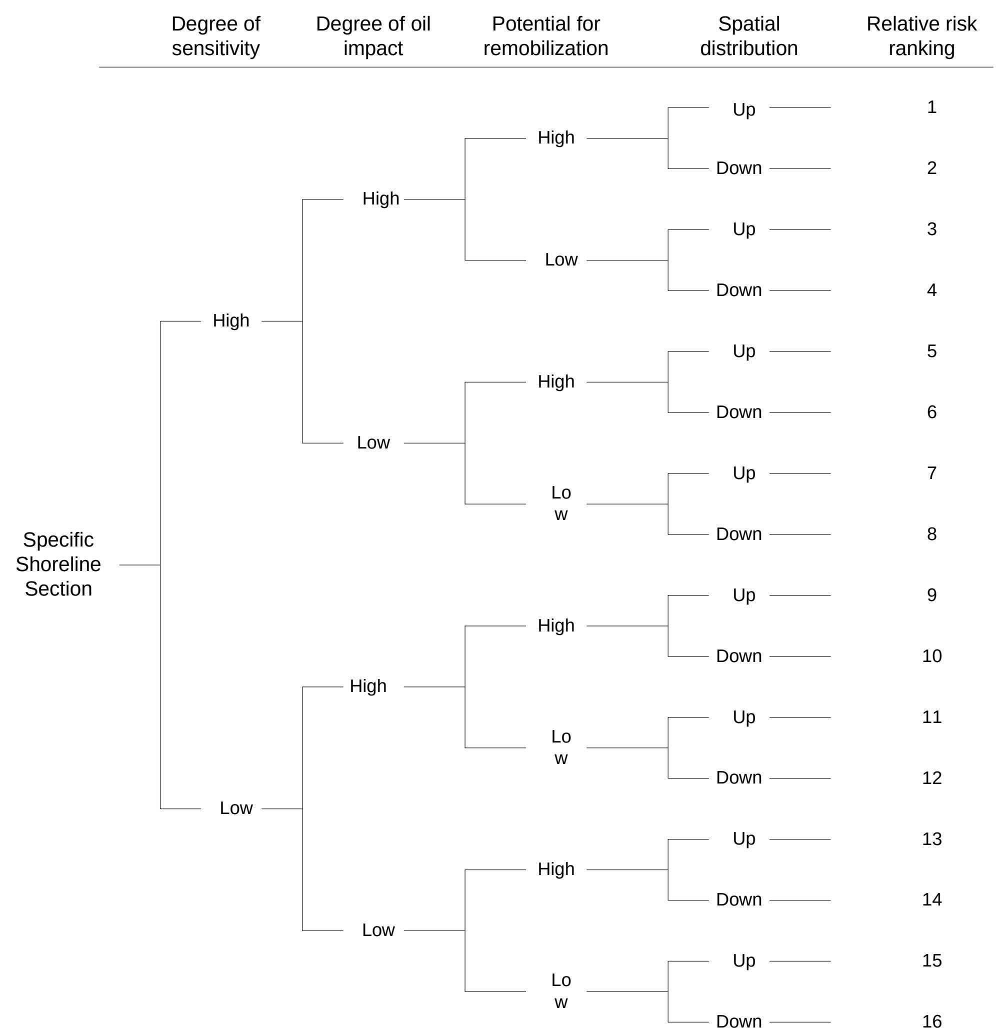


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FIGURE 5-16

SHORELINE CLEANUP TECHNIQUE SELECTION GUIDE

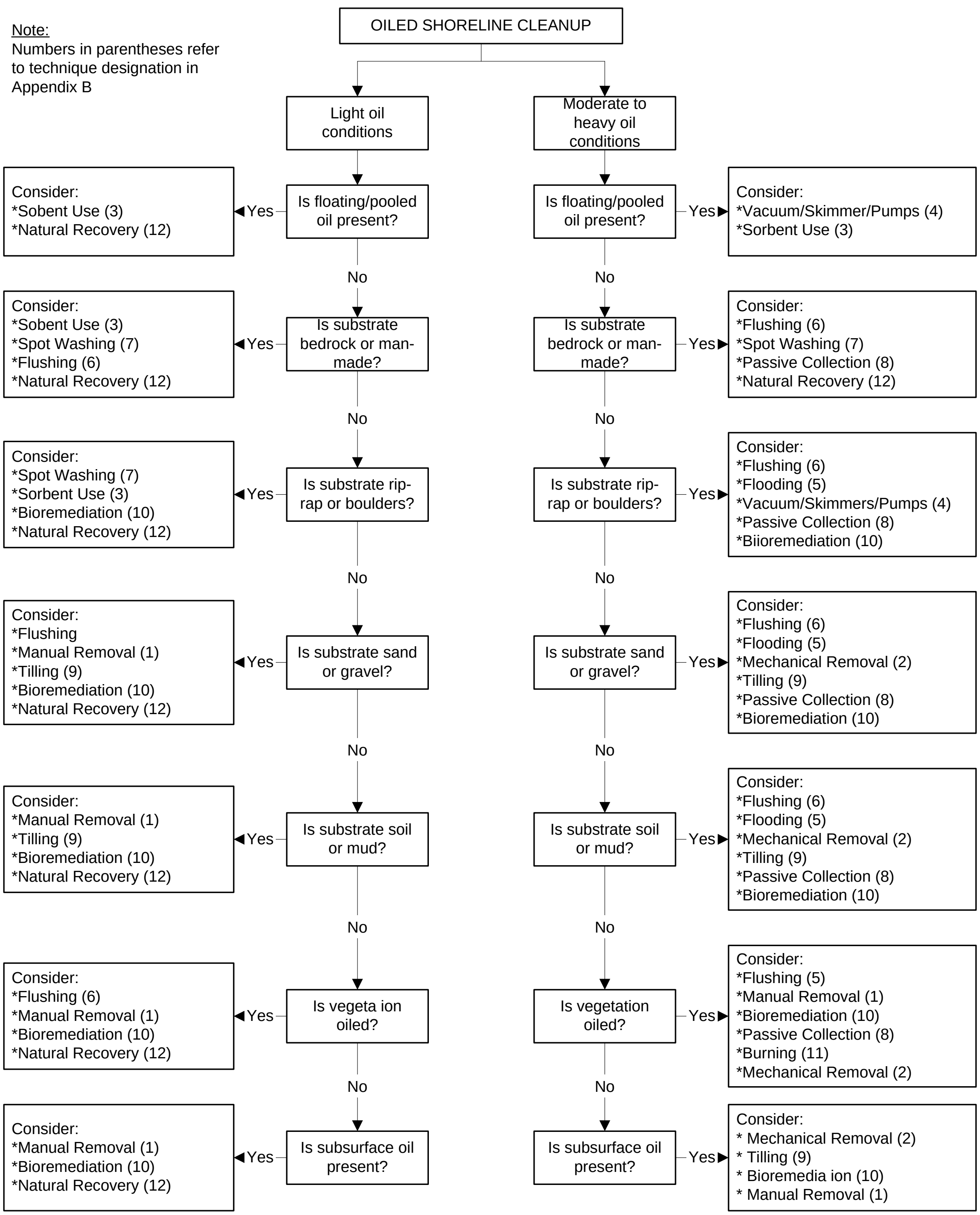


FIGURE 5-17

SHORELINE CLEANUP TECHNIQUE APPLICABILITY MATRIX

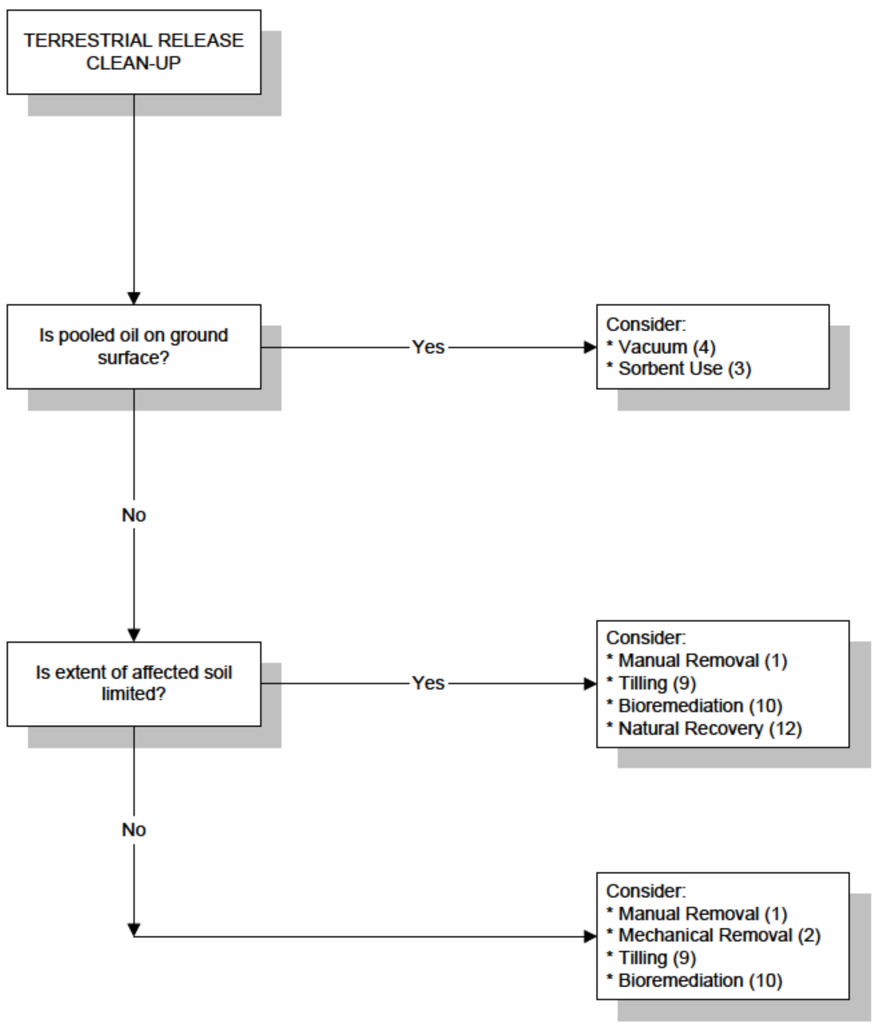
LEGEND
P = Preferred
V = Viable under most circumstances
N = Not advisable in most cases
A = Avoid in all cases

* Numbers refer to technique designations in Volume 1, Appendix B

Shoreline Type/Oil Conditions	Cleanup Technique *											
	1. Manual Removal	2. Mechanical Sedi-ment Removal	3. Sorbent Use	4. Vacuum/ Skimmers/Pumps	5. Flooding	6. Flushing	7. Spot Washing (High Pressure)	8. Passive Collection	9. Sediment Tilling	10. In Situ Bioremediation	11. Log/Debris Burning	12. Natural Recovery
Light/Sporadic Oil Conditions Sand Shore	P	P	N	N	P	V	A	V	P	V	V	V
Sand Flats	P	V	N	N	V	N	A	V	V	V	V	V
Gravel Shore	V	P	V	N	P	P	N	V	V	V	V	V
Earthen/Mud Shore	P	P	N	N	V	N	A	V	P	V	V	V
Mud Flat	V	N	N	N	V	N	A	V	N	V	A	V
Rocky Shore	N	A	P	V	V	P	P	N	A	V	N	V
Rip-Rap Shore	N	N	P	V	P	P	P	V	A	V	N	V
Vegetated Shore	P	N	V	V	P	N	A	V	A	V	A	V
Marsh/Wetland	V	A	V	V	P	N	A	V	N	V	A	V
Light/Sporadic Oil Conditions Sand Shore	V	P	N	N	P	V	A	V	N	V	V	V
Sand Flats	V	P	N	V	V	N	A	V	N	V	V	V
Gravel Shore	V	P	V	V	P	P	N	V	V	V	V	V
Earthen/Mud Shore	V	V	N	N	V	N	A	V	N	V	V	V
Mud Flat	N	N	N	V	V	N	A	V	N	V	A	V
Rocky Shore	V	A	V	N	P	P	P	V	A	N	N	V
Rip-Rap Shore	V	N	V	V	P	P	P	V	A	V	N	V
Vegetated Shore	V	V	V	N	P	V	A	V	N	V	A	V
Marsh/Wetland	V	A	V	V	P	V	A	V	A	V	A	V

FIGURE 5-18

TERRESTRIAL SPILL CLEAN-UP TECHNIQUE SELECTION GUIDE



Note:
Numbers in parentheses refer to technique designation in Appendix B

FIGURE 5-19

TERRESTRIAL CLEAN-UP TECHNIQUE APPLICABILITY GUIDE

LEGEND
P = Preferred
V = Viable under most circumstances
N = Not advisable in most cases
A = Avoid in all cases
-- = Not applicable

* Numbers refer to technique designations in Appendix B

Oil Conditions/Disposition	Clean-up Technique *						
	1. Manual Removal	2. Mechanical Sedi-ment Removal	3. Sorbent Use	4. Vacuum Pump	9. Tilling	10. Bioremediation	12. Natural Recovery
Light/Sporadic Oil Conditions Surface Soils	P	P	N	A	P	P	P
Pooled Oil	P	A	P	V	N	N	N
Subsurface Soil	V	V	N	A	N	V	V
Moderate to Heavy Oil Conditions Surface Soils	V	P	N	A	N	N	A
Pooled Oil	V	A	V	P	A	A	A
Subsurface Soil	N	V	A	--	N	V	N

FIGURE 5-20

DISPERSANT USE INFORMATION FORM

NOTE: The intent of this form is to provide information as quickly as possible to the OSC to aid in making dispersant-use decisions.

Instructions

1. Fill in all available information. Some information shown on the form may not be available, but this should not delay transmittal of the form to OSC.

2. Send the completed form in accordance with Section 4 to the OSC. The form should be transmitted promptly, even if some of the blanks have not been filled.

General

The information in this form is needed to guide a dispersant-use decision. Note that there are three categories of information:

(A) The spill (what material was spilled, volume location).

(B) Factors that will affect the spill trajectory, how the oil will spread, and how the oil will weather. These factors include currents, wind, and weather.

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(C) Details of the dispersant use plan.

Dispersant Use Request

Has use of dispersants been requested? ____

If so, show: Name ____

Company/Organization ____

Phone ____

A. DETAILS OF SPILL

(INFORMATION TO BE PROVIDED AT TIME OF SPILL BY SPILLER (IF KNOWN) OR HIS AGENT OR BY THE OSC.)

1. SPILL DATA

a. Circumstances (fire, grounding, collision, etc.) ___________________
b. Location of spill (report all available details) _____________________

FIGURE 5-20 (Continued)

DISPERSANT USE INFORMATION FORM

1. SPILL DATA (Con't.)

   Distance and direction from the nearest port ________________

   Latitude and Longitude ________________________________

   Block ____

   Water depth, ft. (also shown in Section B.2.c of this form) ______

   c. Time and date of spill ______________________________
   d. Potentially responsible party ___________________________
      Name of company __________________________________

      Address ____

      Individual of contact ________________________________

      Phone ____

   e. Product spilled (the name or type of product spilled may be useful in establishing answers requested in Sections A.2 and A.3 below)
      Name of crude or product (if known) ______________________

      Type of product (crude or refined product) _________________

      Volume released (if known) ____________________________

   f. Type of release (instantaneous, continuous, intermittent, etc.) ___
   g. Total potential volume of release (if still leaking) _____________

2. PROPERTIES OF THE SPILLED OIL (IF KNOWN) (NOTE: General oil property information may be available from the files maintained as part of the Region VI Oil Spill Contingency Plan, Subpart H or Upper Texas Coast Dispersant Plan.)
   a. Specific gravity ________ -OR- API gravity _____________

b. Viscosity, cst. ____________ at temperature, °F _____________
c. Pour point, °F _____________
d. Sulfur content, %w ___________

3. IS OIL EXPECTED TO BE DISPERSIBLE? (circle one)

Easily Moderately With difficulty

How was this estimate made? (e.g., from known oil properties, from field trials, from laboratory tests, etc.) ___________________________________

____

B. <u>SPILL TRAJECTORY AND WEATHER</u>

(INFORMATION TO BE PROVIDED AT TIME OF SPILL BY NATIONAL WEATHER SERVICE OR NOAA. NOTE: Some of this information may be available from the spiller, the OSC, or other interested parties.)

FIGURE 5-20 (Continued)

DISPERSANT USE INFORMATION FORM

B. SPILL TRAJECTORY AND WEATHER (Con't.)

1. Weather conditions and forecast
   a. Air temperature ____________ c. Wind direction _________________
   b. Wind Speed _______________ d. Visibility, miles _________________
2. Sea conditions and forecast
   a. Wave height, ft. ____________ d. Water temperature, °F ___________
   b. Swell, height. ft. ____________ e. Salinity (if known) or possible presence of _______________
   c. Water depth, ft. (also see A.1.b) fresh water (e.g., from river runoff)
   ________________________ _____________________________
3. Currents - tidal and longshore
   a. Speed, knots ______________ b. Direction ______________________

4. Oil spill trajectory information - forecasts should be made for at least 48 hours and

preferably 96 or 120 hours.

a. Surface trajectory forecast

Expected position of center of spill on

Day 1 _____________________ Day 4 ___________________________

Day 2 _____________________ Day 5 ___________________________

Day 3 _____________________

NOTE: The leading edge of the spill may be as much as one to five miles in advance of the center of the spill, depending on spill site, time, and wind speed.

Expected landfall (when, where, and how much) ____________________

____

b. Dispersed oil trajectory forecast
Expected position of center of dispersed oil cloud at end of

Day 1 _____________________ Day 4 __________________________

Day 2 _____________________ Day 5 __________________________

Day 3 _____________________

5. Spreading, weathering, dispersion
   a. Surface area of slick (see page ???, tool to be added) at end of
   Day 1 _____________________ Day 4 ___________________________

   Day 2 _____________________ Day 5 ___________________________

   Day 3. _____________________

   b. Amount lost by weathering, % (see page ???, tool to be added) at end of
   Day 1 ______________________ Day 4 __________________________

   Day 2 ______________________ Day 5 __________________________

   Day 3. ______________________

FIGURE 5-20 (Continued)

DISPERSANT USE INFORMATION FORM

B. SPILL TRAJECTORY AND WEATHER (Con't.)

Is emulsion (mousse) formation expected? **Y / N**
Immediately or after weathering? ______________________________

C. DETAILS OF DISPERSANT PLAN

(INFORMATION TO BE PROVIDED AT TIME OF SPILL BY SPILLER (IF KNOWN) OR HIS AGENT OR BY THE OSC.)

1. Dispersant to be used
   Name ____
   Source of supply ____
   Amount available, gallons ____________________________________
2. Equipment to be used for applying dispersant
   Type (boat spray, helicopter, airplane) _______________________________
   Available from: Name ____
   Address ____
   Phone ____
   Name of equipment (if known) ______________________________________
   Time needed for transport to the spill site, after make-ready (hrs) __________
3. Has equipment been calibrated for use with dispersants (if known) __________
4. Planned rate of application (gal/acre) _________________________________
5. What means will be used to monitor and observe the application?
   ____
6. What means will be used to guide the application? ______________________
7. How effectively will the oil be removed from the water surface (estimate only, taking into account type of oil which was spilled, oil weathering, sea conditions, type of dispersants, logistics, etc.)? ________________________________
   ____

FIGURE 5-21

OIL SPILL RESPONSE CHECKLIST: IN-SITU BURNING

The following checklist is provided as a summary of important information to be considered by the Federal On-Scene Coordinator (FOSC) in reviewing any request to conduct in-situ burning in response to an offshore oil spill in the Gulf of Mexico.

1. SPILL DATA (To be completed by the Responding Party and submitted to FOSC)

A. Name of incident: ____

B. Date and time of incident: Month/Day/Year___________ Time _____________

C. Incident: Grounding _______ Transfer Operations _______ Collision ________
Blowout _______ Pipeline Rupture _______ Explosion _______ Other _______

D. Did spill source ignite? Yes _______ No _______
Is source still burning? Yes _______ No _______

E. Spill Location: Latitude __________ Longitude __________

F. Distance (in miles) and direction to nearest land: _________________________

G. Product(s) released: ____

H. Product(s) easily emulsified? Yes ______ No ______ Uncertain______

I. Product(s) already emulsified upon release? No _____
Light emulsion (0-20%) ___________ Moderate emulsion (21-50% _________
Heavy emulsion (>50%) _________ Unknown ________

J. Estimated volume(s) of product released: __________ gals / bbls
__________ gals / bbls

FIGURE 5-21 (continued)

K. Estimated volume(s) of product that could still be released:
_____________ gals ______ bbls ______
_____________ gals ______ bbls ______

L. Release status: Continuous _____ Estimated rate _________
Intermittent _____ Estimated rate _________
One time only ("batch" spill); flow now stopped ____

M. Estimated area of spill:
Approx. Date/Time _____ Surface area ______ Sq. mile (Stat ____ Naut. _____
Approx. Date/Time _____ Surface area ______ Sq. mile (Stat ____ Naut. _____
Approx. Date/Time _____ Surface area ______ Sq. mile (Stat ____ Naut. _____

2. WEATHER AND WATER CONDITIONS AT TIME AND LOCATION OF SPILL (To be completed by responding party and submitted to FOSC)

A. Temperature: Air ______(deg F) Water ______ (deg F)

B. Weather: Clear ______ Partly cloudy _______ Heavy Overcast _______
Rain _______ (heavy _____ moderate _____ light _____
Fog ________ (type and amount at spill source _________)
(type and amount at burn site _________)

C. Tidal condition: Slack tide _____ Flood _____ Ebb _____

D. Dominant surface current (net drift):
Speed __________ (knots)
Direction (to) _______ (true compass heading)

E. Wind speed: _______ knots Wind direction (from) ________

F. Expected transition time between on-shore & off-shore breeze ______________

G. Sea State: Flat Calm ______ Light Wind-Chop ______
Wind-Waves: <1 ft _____ 1-3 ft _____ >3 ft _____
Swell (est height in ft) _____

FIGURE 5-21 (continued)

H. Water Depth (in feet): ___________

I. Other Considerations:
General Visibility ____
Rip Tides/Eddies ____
Floating Debris ____
Submerged Hazards ____

Notes: See Section II Part I for weather and water conditions forecast (to be completed by NOAA Scientific Support Coordinator).

See Section III Part II for predicted oil behavior (to be completed by NOAA SSC).

Responding party has option of also submitting information on predicted oil behavior to FOSC.

3. PROPOSED BURNING PLAN (To be completed by party responding to spill)

A. Location of proposed burn with respect to spill source: _______________________

B. Location of proposed burn with respect to nearest ignitable oil slick(s)
____

C. Location of proposed burn with respect to nearest land _____________________

D. Location of proposed burn with respect to commercial fishing activity, vessel traffic lanes, drilling rigs and/or other marine activities/facilities:
____
____
____

FIGURE 5-21 (continued)

E. Risk of accidental (secondary) fires: ________________________________

F. Risk of reducing visibility at nearby airstrip(s) or airport(s) ___________________

G. Distance to, location and type of nearest population center(s) (e.g., recreational site, town, city, etc.): ____

H. Methods that will be used (prior to ignition) to notify residents in areas where smoke could conceivably drift into or over such areas: ____________________________

I. Type of igniter proposed for use: _________________________________

J. Helicopter(s) needed to deploy igniters? No _______ Yes ______
Name of company and type of helicopter to be used: _________________________

FAA approval already granted to company for use of igniter:
Yes ________ No ________

Awaiting FAA approval or verification of prior approval _________

K. Burning promoters or wicking agents proposed for use?
Yes ________ No ________
If yes, give type and amount: _____________________________

L. Describe proposed method of deployment for igniter(s): ______________________
Burning promoter(s): ______________________________
Wicking Agent(s): _________________________________

M. Describe method for oil containment, if any: _____________________________

FIGURE 5-21 (continued)

N. Proposed location of oil containment relative to spill source: ___________________

O. Proposed burning strategy:
______ Immediate ignition at or near source
______ Ignition away from source after containment and movement to safe location
______ Ignition of uncontained slick(s) at a safe distance
______ Controlled burning in boom or natural collection site at/near shore
______ Possible need for multiple ignition attempts

P. Estimated amount of oil to be burned: ___________________________________

Q. Estimated duration of each burn: ___________
Total possible burn period : ________________

R. Estimated smoke plume trajectory: ______________________________________

S. Method for collecting burned oil residue: ______________________________

T. Proposed storage and disposal of burned oil residue:
____
____
____

4. WEATHER ANS WATER CONDITION FORECAST FROM TIME OF SPILL (To be completed by NOAA SSC)

A. Wind Speed (knots):
24 hour projection: ________________________
48 hour projection: ________________________

B. Wind Direction (from):
24 hour projection: ________________________
48 hour projection: ________________________

FIGURE 5-21 (continued)

C. Sea Conditions:
24 hour projection:
Flat Calm ______ Light Wind Chop ______
Wind-Waves: <1 ft ______ 1-3 ft ______ >3 ft ______
Swell (est. height in ft ______

49 hour projection:
Flat Calm ______ Light Wind Chop ______
Wind-Waves: <1 ft ______ 1-3 ft ______ >3 ft ______
Swell (est. height in ft ______

D. Tidal Information:
Date ______ High (time/height) ________/________
Low (time/height) ________/_________
Date ______ High (time/height) ________/________
Low (time/height) ________/_________
Date ______ High (time/height) ________/________
Low (time/height) ________/_________

E. Predicted Dominant Current (net drift):
Speed (knots): ________ Direction (to): ________

5. PREDICTED OIL BEHAVIOR (To be completed by NOAA SSC)

A. Unburned oil forecast:
Estimated trajectory (attach sketch if necessary): _________________________

B. Expected area(s) and time(s) of land fall:
Location _______________________ Date/Time _______________
Location _______________________ Date/Time _______________
Location _______________________ Date/Time _______________
Location _______________________ Date/Time _______________

C. Estimated percent naturally dispersed and evaporated:
Within first 12 hours: ___________________

Within first 24 hours: ____________________
Within first 48 hours: ____________________

6. RESOURCES AT RISK (To be completed by resource agencies)

A. Habitats

Sheltered Tidal Flats ______________________
Coastal Marshes ______________________
Etc. ______________________

B. Biological Resources

Are marine animals, turtles, or concentrations of birds noted in the burn area?

Yes ________ No ________

Endangered/Threatened Species
Non-Endangered/Threatened Species

C. Historic and Archaeological Resources

D. Commercial Harvest Areas

7. FEDERAL ON-SCENE COORDINATOR'S EVALUATION OF RESPONSE OPTIONS (To be completed by FOSC)

A. Is in-situ burning likely to result in the elimination of significant volumes of spilled oil?

Yes __________ No _________

B. Will the use of in-situ burning interfere with (or in any way reduce the effectiveness of) mechanical recovery and/or dispersant application?

Yes __________ No _________

If yes, do the potential benefits outweigh the potential reductions in effectiveness of mechanical/dispersant use?

Yes __________ No _________

C. Can in-situ burning be used safely, and with an anticipated overall reduction in environmental impact (compared with the decision not to burn)?

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Yes __________ No _________

8. FEDERAL ON-SCENE COORDINATOR'S DECISION REGARDING IN-SITU BURNING (To be completed by FOSC)

A. ______ Do not conduct in-situ burn
B. ______ In-situ burn may be conducted in limited or selected areas
C. ______ In-situ burn may be conducted as requested

Note: If the FOSC approves of in-situ burning, local media and residents in areas within the potential smoke plume trajectory must be notified prior to initiating the burn.

Signature of FOSC: ____________________________

Printed name of FOSC: __________________________

Time and Date of Decision: _______________________

FIGURE 5-22

DECISION TREE

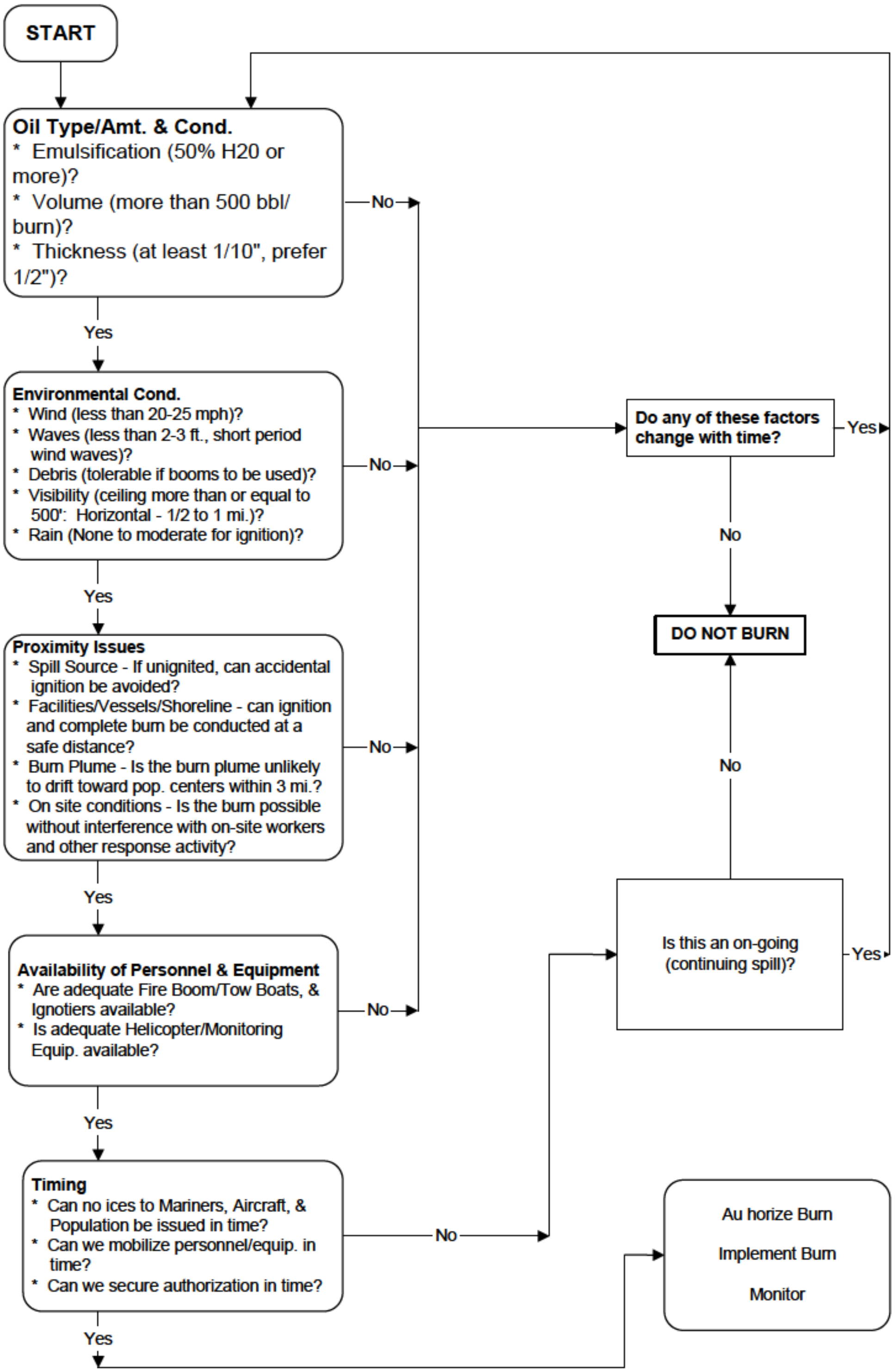


FIGURE 5.23 Operational Checklist: In-Situ Burning

The Following list is provided as a condensed "checklist" of critical conditions, concepts or pieces of equipment that will be considered by the responsible party, prior to the initiation of an is-situ burn in the Gulf of Mexico.

Approval and Notification Considerations:

_____ Approval "checklist" completed and submitted to federal and state RRT and FOSC.

_____ Any other burn plan or permit/approval requests completed and submitted to appropriate agencies.

_____ All approvals received from federal, state and local organizations.

_____ U.S. Coast Guard notified regarding Notice to Mariners for proposed burn time and locations in which no unauthorized vessels would be allowed.

_____ FAA notified regarding Notice to Aviators for proposed burn time and locations in which no unauthorized aircraft would be allowed.

_____ Local public radio and television announcements of intent to burn, along with information on estimated times, duration of burn(s), potentially affected areas, possible health effects, and unauthorized zones for public use.

_____ State or local emergency services groups on standby for any possible assistance in notifying or evacuating certain populations.

Oil and Environment Conditions:

_____ Oil Type and Condition - sufficiently combustible under existing weather conditions.

_____ Visibility - suitable for vessels and aircraft in carrying out burn. Consideration given to number of number of daylight hours left to initiate burn.

_____ Sufficient time available to mobilize response personnel, transport and deploy equipment, ignite, and complete burn(s).

FIGURE 5-23 Operational Checklist: In-Situ Burning (Continued)

_____ Timing and conditions appropriate for consideration of night-time burn(s). Possibility of night0time oil collection with burns initiated at daybreak.

_____ Burning operations safe and practical in light of spill status, (ignited versus non-ignited, proximity to shore, mobile, or fixed structures.

_____ Burning safe and practical in light of vessel traffic lanes.

_____ Burning safe and practical in light of spill source stabilization efforts.

_____ Burning safe and practical in light of any personnel evacuation efforts.

_____ Burning compatible with mechanical cleanup operations.

_____ Burning compatible with dispersant application techniques.

_____ Burning compatible with shoreline protection and cleanup activities.

Personnel Requirements:

_____ All personnel trained and qualified for burning operations.

_____ All personnel briefed and familiar with burn plan.

_____ Full response team(s) and supervisor(s) for vessels on location or enroute.

_____ Qualified Pilot and support personnel for aerial support functions on location or enroute (e.g., reconnaissance, Heli-torch operations, etc.)

_____ Backup Fire Control Team on location or enroute.

_____ Everyone has protective clothing, respirators, flotation devices, etc.

Vessel Requirements:

_____ Two fire boom towing vessels available for each U-configuration.

_____ One fire control vessel available for each burn region. More than one vessel possibly needed should individual burns be widely separated.

_____ Backup support vessel(s) as needed for personnel transport; refueling operations; recovery and storage of burn residue; transport, deployment and recovery of fire boom, boom towing vessels, etc.

FIGURE 5-23 Operational Checklist: In-Situ Burning (Continued)

Aircraft Requirements:

_____ Helicopter(s) as appropriate for number of burns anticipated, modes of ignition to be employed, and distances to be covered from staging area(s) to assigned region(s) of coverage.

_____ Fixed-wing aircraft as appropriate to supplement helicopter operations involving oil reconnaissance missions, direction of vessels to collection sites, monitoring of smoke plume trajectories, etc.

Fire Boom and Igniter Requirements:

_____ Inspected and ready-to-deploy fire containment boom (typically 500 ft to 1,000 ft per U-configuration), along with long tow lines (typically 500 ft to 800 ft per tow vessel), towing bridles, and anchoring systems as appropriate.

_____ Backup fire containment boom 500 ft to 1,000 ft long per U-configuration) along with additional lengths of boom for any modes of deployment (e.g., containment at spill source, deflection booming into designated nearshore burn sites, exclusion booming, etc.

_____ Inspected and ready-to-deploy Heli-torch(es) as needed for any aerial ignition activities (backup drums available for rapid turn-around.

_____ Batch mixers for gelling large quantities of fuel mix for Heli-torch(es) if necessary (backup fuel supplies such as Jet-A, gasoline or crude oil, and gelling mix.

_____ Supply of hand-held igniters (at least 10 per vessel and helicopter) for potential use (backup supply of at least 200 igniters or a means of acquiring/constructing additional units on short notice).

Communication Requirements:

_____ Dedicated radio links (and equipment) with specific frequencies for air-to-air and air-to-surface communications.

_____ Dedicated radio links (and equipment) with specific frequencies for vessel-to-vessel and vessel-to-command communications.

_____Repeater stations as appropriate for distant or blocked communication paths.

Fire Safety Considerations:

_____ Possible use of dedicated personnel/vessels with vapor emission monitoring equipment (explosimeter).

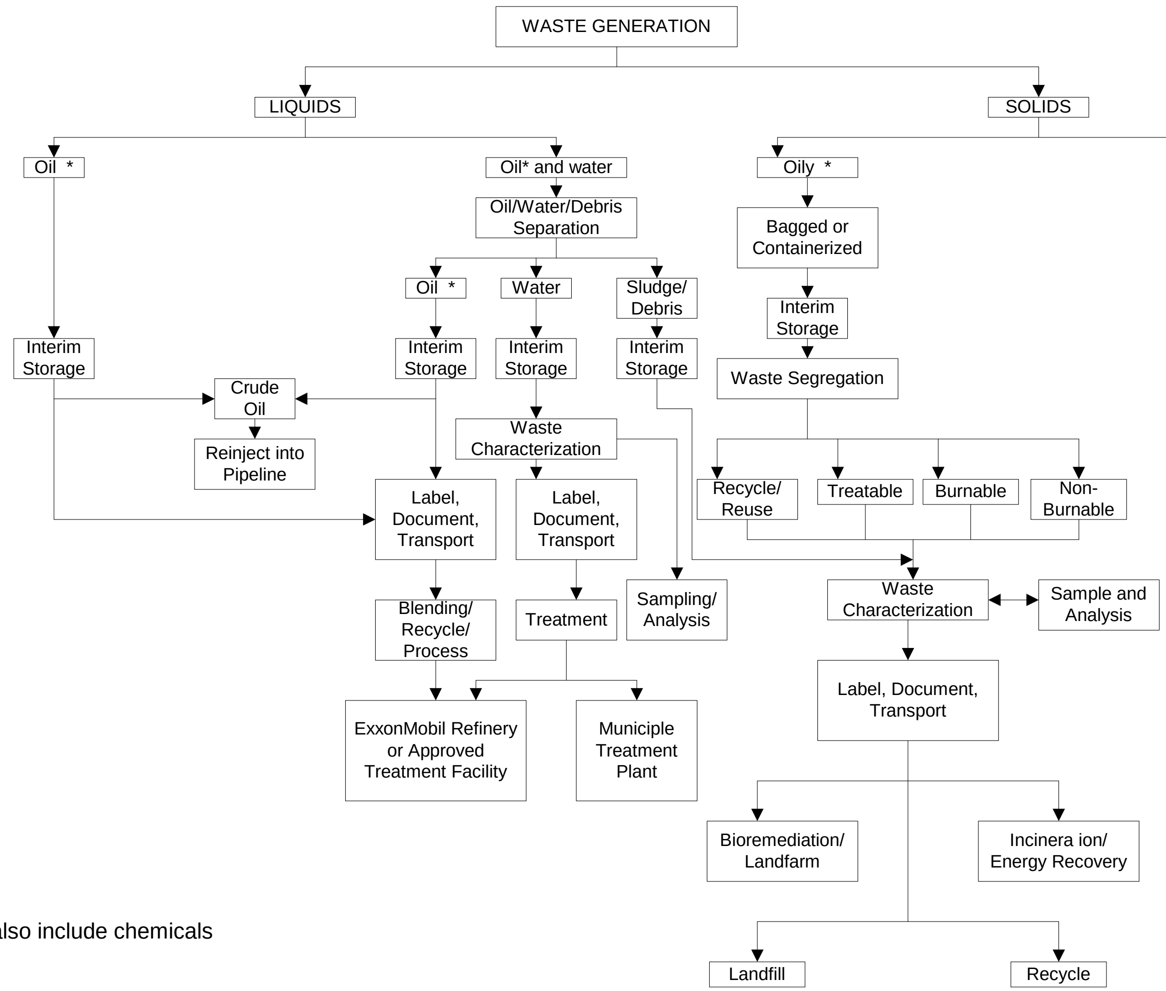
_____ Backup fire fighting vessels (if necessary) for unique situations involving a burning spill source and/or unusual potential exposures of personnel/vessels to burning oil.

_____ Small fire fighting packages (extinguishers, monitors, foam, etc.) aboard the boom towing boats for backup use in the event of an emergency on or near one of the response vessels.

Fig 5-24

FIGURE 5-24

GENERAL WASTE MANAGEMENT GUIDELINES

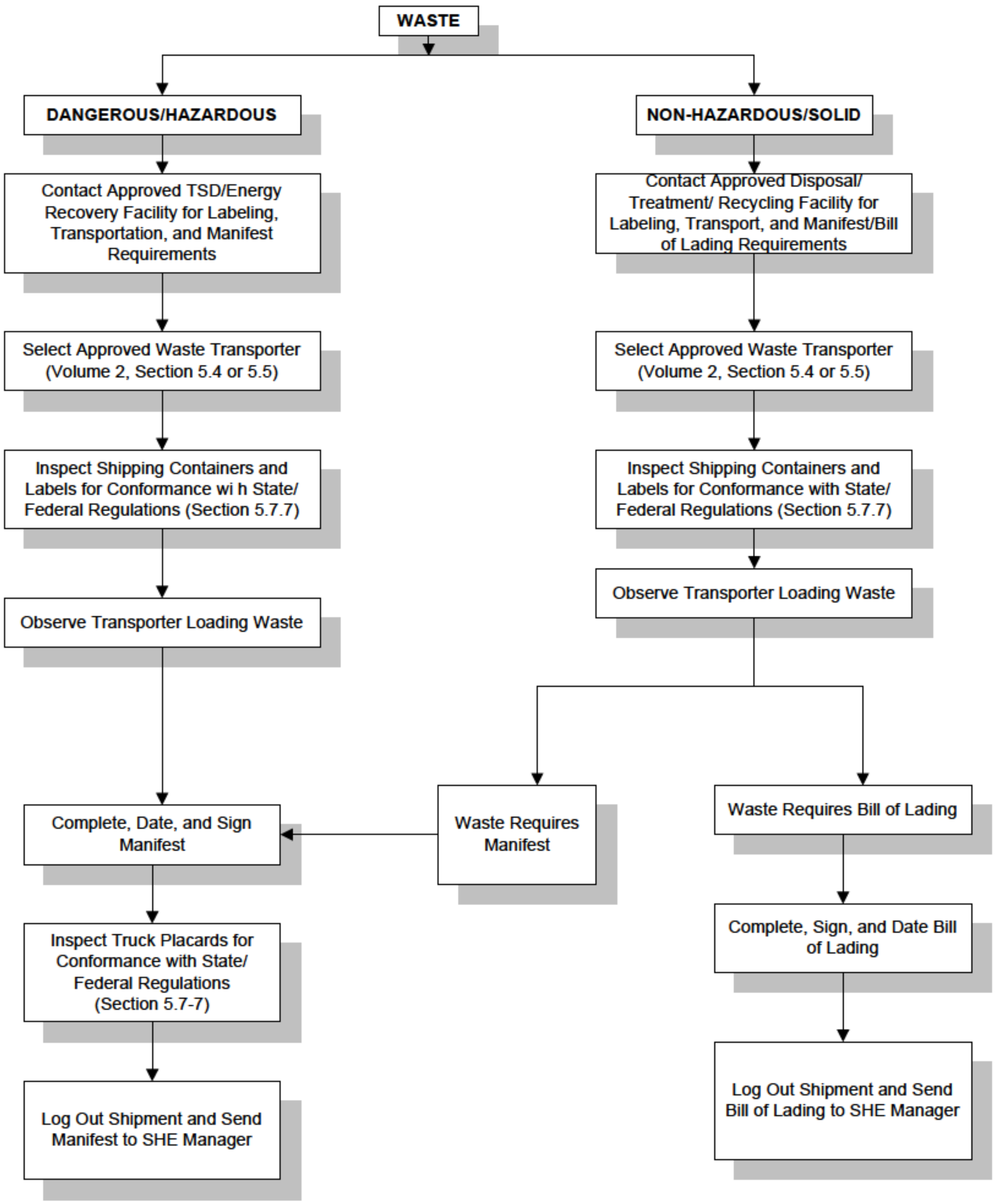


* May also include chemicals

PHMSA Sequence Number 848

FIGURE 5-25

GENERAL WASTE TRANSPORTATION GUIDELINES



Section 6. Response Resources

In This Section

RESPONSE RESOURCES

General

The response resources that will be utilized by EMPCo in the event of a spill or release will consist primarily of EMPCo and contractor equipment and personnel. These resources will be supplemented as necessary by equipment and personnel from regional response contractors, cooperatives, ExxonMobil Strike Teams including ExxonMobil Chemical's Emergency Response (HazMat) Team, and by spill/release management personnel from the ExxonMobil North America Regional Response Team (NARRT).

EMPCo's utilization of the various sources of response equipment and personnel will depend on the nature and circumstances of the incident. In general, the available resources will be utilized as follows:

- **Primary Response (Small spills/releases contained near the source)** - EMPRT Initial Responders and equipment with assistance provided by local response contractors as necessary.
- **Category 1 (Small to moderate spills/releases with potential for off site impacts)** - EMPRT Initial Responders and Expanded Response group and equipment with assistance provided by local contractor/cooperative personnel and equipment.
- **Category 2 (Moderate to Large spills/releases impacting off site properties)** - Initial response by EMPCo and local contractor/cooperative personnel and equipment. Supplemental resources provided by regional contractors and Strike Teams.
- **Category 3 (Very Large Spills/releases significantly impacting off site properties)** - Initial response by EMPCo and local contractor personnel and equipment. Supplemental resources provided by regional/national contractors, cooperatives, and Strike Teams with additional personnel potentially provided by the NARRT.

EMPCo and ExxonMobil Resources

EMPCo Resources

The response resources available from EMPCo consist primarily of strategically located fully operational response trailers (FORTs) and containment action response trailers (CARTs) as well as quantities of containment boom, pumps, skimmers, sorbents, and some pipeline repair equipment at selected EMPCo facilities. The FORTs and CARTs are maintained at EMPCo facilities within each response zone in proximity to the areas with the greatest number of pipelines, highest level of spill risk, or closest proximity to sensitive areas.

In general, one or more FORTs and/or CARTs can be mobilized to any location along the EMPCo system within 6-12 hours to meet the federal Tier 1 response planning requirements. Vacuum truck contractors can also respond to most locations along the pipeline system within 6 hours and regional response contractors can respond to any location within 30-36 hours to meet the Tiers 2 and 3 response requirements.

Representative response equipment contained in the FORTs and CARTs include:

FORT (Fully Outfitted Response Trailer)

- 4000-6000 Watt Portable Generator
- Portable FAX machine
- Mounted cellular phones
- Portable cellular phones
- EMPCo base radio
- Strike Team base radio
- EMPCo portable radios with charging unit
- Strike Team portable radios with charging unit
- Portable marine radios
- Radio headsets
- First aid kit
- Fire extinguishers

- Safety equipment (goggles, hard hats, rubber and leather gloves)
- Skimmers
- 1000' containment boom (12-18")
- Boom anchors
- Rope (1/4 and 1/2")
- Miscellaneous hand tools
- Sorbent boom and pads

CART (Containment Action Response Trailer)

- 500 - 1000' containment boom (12-18")
- Boom anchors
- 20 gallon trash cans
- Trash bags (50 each)
- Rope (1/4 and 1/2")
- Miscellaneous gardening tools
- Safety equipment (goggles, glasses, hard hats, rubber and leather gloves)

More specific information on the equipment and capabilities available from EMPCo is provided in Volume 2, and information on the number of EMPCo response personnel and their duties and responsibilities is provided in Section 3.0.

ExxonMobil Strike Teams

The Strike Teams located near various ExxonMobil operations across the United States, of which the following four are available to EMPCo's operations:

- Southeastern Strike Team
- Lower Mississippi River Strike Team
- Houston Ship Channel Strike Team
- Yellowstone River Strike Team

Each Strike Team consists of a large spill management staff of trained response personnel. The Strike Teams utilize significant inventories of response equipment including containment booms, skimmers, pumps, response vessels, communications equipment, and sorbents, and other resources which are available within the Strike Team resource inventory and/or through local and regional response contractors.

Personnel staffing of the Strike Teams is provided by ExxonMobil functions and affiliates within a particular geographic region. EMPCo is a participating affiliate and has individuals that are designated to staff selected positions on the various Strike Teams. Team members are trained in a particular expertise. Many of the team members have experience in actual spills or release responses. Some Strike Teams also include HAZMAT resources available from ExxonMobil Chemical’s Emergency Response Team.

ExxonMobil North America Regional Response Team (NARRT)

The NARRT is a national response team available to provide management support and technical expertise to major spill or release incidents. NARRT personnel are oil spill and emergency response specialists from ExxonMobil functions and affiliates. Activation of the NARRT is not expected for EMPCo spills.

Contractors and Cooperatives

EMPCo has response agreements with a number of contractors within each response zone as well as selected response cooperatives and mutual aid associations. These contractors and/or cooperatives will be activated on an as-needed basis and typically only if the incident requires resources beyond those available from EMPCo. In certain areas, a response contractor may be used preferentially over local EMPCo resources if they are closer to the incident location and can mobilize resources to the site more rapidly than EMPCo. For most smaller incidents and those that involve terrestrial spills, local contractors will generally be utilized. Cooperatives and regional spill response contractors will typically be used for larger aquatic spills.

Equipment Maintenance and Testing

EMPCo's spill/release response equipment is inspected periodically in accordance with the schedule set up by EMPCo’s computerized maintenance system entitled SAP PM which schedules, documents, and tracks equipment maintenance. Detailed inspection procedures for boats, CARTs, FORTs, breathing air trailers, and other response equipment are provided in the SAP PM system protocols. Some areas manually maintain equipment maintenance calendars and logs.

To initiate an inspection, a maintenance work order is generated and given to a designated EMPCo field operations technician by the Area Supervisor. Upon completion of the inspection, the inspector enters the appropriate data into the electronic database system.

EMPCo will conduct annual equipment deployment exercises of EMPCo owned equipment. During these exercises, facility response equipment will be deployed to simulate a local response to a spill/release occurring at EMPCo facilities. Deployment will include strategies in this response plan for protecting sensitive areas. The EMPRT will deploy a representative amount of response equipment annually including 1000 feet of boom and one (1) of each skimming systems listed in the plan. Records of the equipment deployed, personnel involved, and other information regarding the exercise will be documented in the Equipment Deployment Exercise form provided in Section 9.0 of this Plan. These records will be maintained for a period of at least three (3) years.

Annual equipment deployment drills are also required of Oil Spill Removal Organizations (OSRO's) in addition to facility-owned equipment deployment drills.

Section 7. Communications System

In This Section

COMMUNICATIONS SYSTEM

General

Effective spill response depends on good communication at all levels, from the initial detection of a spill until final restoration efforts are completed. Information from the initial observation of a spill must be quickly brought to the attention of spill responders and specific government agencies. Spill response managers must be able to communicate with individuals and teams in the field as well as government authorities. Coordination of transportation, material support, equipment repair, and other logistical matters also requires good communication.

Spill response related traffic, during even a moderate size spill, can overwhelm an existing communications network. A number of telephone and facsimile lines are usually required along with numerous portable radios and base stations. Portable radios are generally required for the various response team supervisors and other key response personnel, contractor supervisors, agency representatives, aircraft pilots, etc. Because portable radios often have ranges that are limited to line-of-site, one or more portable repeaters may be required if a large area is affected. Cellular phones are also an essential method of communications, particularly for field supervisors where clear, concise person-to-person communication is needed.

Because of the heavy volume of radio traffic associated with a moderate to major spill response operation, one or more control base stations and digital scanning receivers could be established at a Communications Center at or near the incident's Command Post. Assigning specific frequencies or phone lines to particular operations can increase the effectiveness of a communications system. Separate frequencies are often assigned to management, operations, and logistical support functions.

Key phone and facsimile numbers should not be publicly listed and should be made available only on a need-to-know basis to avoid flooding of communication systems by requests from the media, the public, prospective contractors, suppliers, consultants, and others who will attempt to get involved in the spill response.

EMPCo Communications System

The communications system used by EMPCo for normal operations consists of standard phone lines, cellular phones, satellite phones and selected VHF radio frequencies. Normal communications with pump stations and terminals are typically conducted over standard phone lines. Two-way radios can be deployed for communications with field maintenance and operations personnel. In the event of an emergency, additional equipment can be cascaded in as needed. Depending on the circumstances, either the telephones or the two-way radios, including push to talk cellular phone systems, would be considered the primary means of communications for emergency notification purposes while the other would be considered the secondary means of communications.

As a supplement to the normal Field Operations communications system, EMPCo also maintains emergency communications equipment on their Fully Outfitted Response Trailers (FORTs) which are stationed at strategic locations within the EMPCo pipeline areas. These locations include:

- Webster Station
- Waco Station
- Corpus Christi Area Office
- Baytown HSC-Strike Team area at the Refinery (2)
- Longview Area Office
- Sunset Area Office
- Raceland Area Office
- Anchorage Office

The FORTs can be mobilized quickly to almost any incident location to establish a remote communication center. Although a local power source is preferred, the FORTs are equipped with a portable generator as a backup power supply. The types of the communications equipment contained in the FORTs are listed in Section 6.0. The FORTs are equipped to communicate with incident responders and interface with company-wide communications systems.

In addition to the FORTs, there are also significant inventories of communications equipment available from the various Strike Teams and ExxonMobil. The communications equipment available from the Strike Teams will vary depending on the particular Strike Team and, consequently, is not listed herein. Additional equipment is also generally available from EMPCo's response contractors and local suppliers.

GETS and WPS

EMPCo also has access to the Government Emergency Telecommunications Service (GETS) and the Wireless Priority Service (WPS) for certain individuals in key positions around the EMPCo Operations Areas. These two Government provided services give EMPCo access to hardwire and wireless communications systems in times of disasters when normal access to communications is overwhelmed with high communications traffic.

Spill Response Communications

Terrestrial/Minor Aquatic Releases

For most terrestrial releases and minor aquatic spills, the normal EMPCo radio communications system will be used. These types of spills are not expected to require a separate communications center.

Moderate to Major Aquatic Releases

EMPCo radio communications system would be used in the initial response to a moderate to major release, although additional equipment may be required to establish an effective communications network. Typically, a communications network for a significant incident will include:

- • UHF portable or mobile radios and base stations
- • Digital scanning receivers
- • Fixed and/or portable repeaters
- • VHF marine portable and mobile radios
- • Fixed and cellular telephones
- • Satellite telephones
- • Facsimile machines
-

For these larger incidents, a Communications Center will typically be established at both the closest EMPCo facility and/or the Command Post near the incident location.

Incident Command Post

Command Post Background

Command Post (CP) is the name used by the Incident Command System to identify a facility which provides an incident with a central location at which the primary command functions are performed. All incidents must have a designated location established as the incident's Command Post. A CP could either be a permanent facility or a mobile unit brought to the scene of an incident. The Incident Command will determine the location of the CP. The Incident Commander will be located at the CP. There will only be one incident Command Post for each incident, including multi-agency or multi-jurisdictional incidents operating under a single or a unified Incident Command System.

Command Post Locations

EMPCo has determined Command Post (CP) locations within each operating area where adequate resources are available to command an incident. In response to most of EMPCo incidents, a CP is established at existing ExxonMobil facilities. In the event of a significant incident for which ExxonMobil facilities are not adequate, a more appropriate Command Post location must be selected based on the incident circumstances. Possible sources of other CP locations would include appropriate governmant, public, and commercial facilities available for CP purposes. Local governments usually maintain facilities which have been pre-designated for CP purposes. These facilities are often prescribed in Area Contingency Plans and/or local governments' Emergency Operations Plans.

Command Post Characteristics

- • Initial CP location should consider the nature and expected duration of the incident. The location is a safe area usually near the incident. The CP can be moved if necessary, although once established, it will normally not be relocated.
- • The CP should have the ability to provide security and controlled access.
- • The CP should be large enough to provide adequate working room for all assigned personnel, including agency representatives.
- • The CP should provide the resources necessary to manage the incident, e.g., meeting rooms, communications equipment, documentation equipment, materials and supplies needed to support the command function, etc.
- • The incident Communications Center, if established at an incident, is often located with or adjacent to the CP.

Spill Response Communications Considerations

Response Management

Management communications are essential to exchange information and provide direction quickly and decisively with field managers, support staff, technical personnel, and government agencies. To accomplish this, management, operations, and technical functions should have priority use of available channels. For smaller incidents, a single channel may be used for all communications, whereas for larger incidents involving extensive communication needs, a separate channel will likely be assigned for the exclusive use of response management functions.

When multiple channels are used, a portable scanning receiver may be installed at the Communication Center. This will enable the emergency response management personnel to monitor conversations on the key response channels.

Response Operations

Response operations communications for small incidents will be conducted along with other response communications on the normal EMPCo operations frequency. Larger incidents involving aquatic spills are often divided into three categories:

1. Offshore (marine) operations (e.g., skimmers, tugs, barges, supply vessels, boom boats) and

2. Onshore (shoreline) operations (e.g., cleanup, waste disposal, and restoration).

3. Onshore (terrestrial) operations (e.g. containment, recovery, cleanup, waste management, and restoration).

Marine/aquatic communications generally utilize 25-watt, VHF marine band digitally tuned base stations with high gain antennas and 5-watt portable radios. The 80-channel VHF marine band digitally tuned portable radios provide the greatest flexibility by automatically monitoring USCG channel 16 and providing the ability to switch to a number of working frequencies. VHF radios are available in the FORTs, from ExxonMobil, or local communications system suppliers (see Volume 2).

Cleanup and work boat crews generally use UHF portable radios. The radios available from ExxonMobil or outside sources are generally rated at 3 to 5 watts. Headsets with only one ear piece and a boom mike are recommended for workboat operations and for cleanup foremen. This allows the freedom of movement necessary to conduct operations while maintaining continuous direct contact with management.

Logistics

As with response operations communications, logistics communications will be conducted on a common EMPCo channel for small incidents but may require dedicating a separate channel or switching to cellular phones in the event of a large spill. This will maximize the operating range so that logistics personnel can be contacted while at the incident scene, in town picking up supplies, or at an EMPCo facility.

Communications Practices

Good communications practices will be the responsibility of the Logistics Section Chief or designee. For small spills, the Area Supervisor of the EMPRT will be responsible for ensuring that response personnel follow proper communications practices. Fixed or cellular telephones should be used where available to reduce UHF/VHF radio congestion. The following guidelines should also be considered in a spill response:

- • A Communications Center should be isolated away from high activity or noisy areas. If this is not possible, the Communications Center should be moved to a quiet area, such as a separate office or conference room with an intercom system connecting it to the Command Post.
- • The Communications Center radio and telephone operators must communicate with accuracy, clarity, and brevity. All operators must log messages sent and received.
- • The Logistics Section Chief should participate in planning meetings to determine communication requirements.
- • The Logistics Section Chief should maintain a detailed map of the response area showing the locations of various equipment and activities. This will aid in relaying messages and requests for additional resources and ensuring that adequate communications coverage is maintained. The key locations, equipment, and activities that should be tracked include:
  - Response boats
  - Skimmer systems
  - Cleanup crews
  - Deployed oil boom
  - Oil slicks

- Impacted shorelines
- Command Post
- Communication Center
- Heliports
- Logistic staging areas
- Boat docks, launch ramps, and loading areas
- Interim storage sites
- Environmentally sensitive areas

Section 8. Public Affairs

In This Section

PHMSA Sequence Number 848

PUBLIC AFFAIRS

Introduction

As a leader in the pipeline industry, ExxonMobil Pipeline Company and its operations are of interest to the news media of the nation. As one of the primary means of informing the public regarding our operations, the news media are important to ExxonMobil Pipeline Company. It is, therefore, the policy of the Company to disseminate information of interest promptly to the media in emergency response and other situations of interest or concern to the public.

Policies and Procedures

Release of News on Accidents, Fires, and Other Emergencies

Accidents involving serious injuries or loss of life, fires, or explosions involving substantial property losses, oil spills of magnitude and other emergencies are matters of broad public interest and, therefore, constitute significant news. To ensure that accurate information is quickly disseminated in such circumstances, it is important that information of community interest be promptly released to news media concerning Company employees, operations, and property involved.

The following procedures should be observed:

- Immediately following an event that is assessed as having possible community impacts, the senior ExxonMobil Pipeline Company representative in charge of the operation (Incident Commander) is initially responsible for making information of interest to the community available as quickly as possible to the news media. This information should include:

  - **What Happened?** (Example: "At about 9:00 a.m. today a backhoe struck and ruptured the ExxonMobil Pipeline Company 18" crude oil pipeline in _______ City, State")
  - **How did EMPCo respond?** (Example: "The pipeline was immediately shut down and employees were sent to the scene to contain the oil and to start cleanup operations.")
  - **What is the current status of the event?** (Example: "The fire has been extinguished and brought under control.")
  - **What are the safety, health, environment and other community impacts? (** Example: Identify whether there have been injuries, need for evacuations or other community action, etc.)

EXCEPTIONS: The names of people injured or killed should NOT be released UNTIL their next of kin have been notified. NO speculation should be made as to the causes of the incident. NO dollar amount of damage should be given or speculated on.

- Ongoing responsibility for communication with the news media concerning emergencies is assigned to the Operations Manager. It will be his or her responsibility to ensure that the Public Affairs Coordinator is kept fully informed. The Operations Manager may designate the Public Affairs Coordinator or another official spokesperson to communicate with the news media and the general public.
- News photographs, both still and movie, should be allowed if appropriate and within the limits of safety, common sense, and good taste. News people and photographers should be escorted by EMPCo personnel at the emergency site.

Other Guidelines

- The designated Information Officer (Public Affairs Coordinator) on scene should have discretion to:
  - Set up communication facilities for handling news media.
  - Where appropriate, establish a Joint Information Center under a Unified Command structure to coordinate the flow of incident information.
  - Provide regular briefings to the media.
  - Monitor press and TV coverage and forward reports to headquarters.
  - Forward all written statements to headquarters for any additional approvals deemed necessary by the Incident Commander.

- Helpful Hints: During an emergency, while working with the news media, emergency officials, and the public, remember to:
  - Express ExxonMobil's efforts to minimize the impacts of any incident upon public safety, health, the environment, and property.
  - Be visible, prepared and authoritative (Be the "Expert").
  - Be caring and cooperative.
  - Emphasize actions being performed by EMPCo to respond to the spill.

- DO NOT SPECULATE as to the cause of the spill, the cost of the repair or cleanup, or other issues that require further assessment.
- If contractor employees were involved in the incident, you may refer media to the contractor for information on their employees.

More detailed Public Affairs emergency response plans, including communications templates, are incorporated in the ExxonMobil Supply & Transportation Emergency Response Reference Documents and Communications Guidelines.

PHMSA Sequence Number 848

ExxonMobil Pipeline

Volume I, Section 8, Public Affairs

PHMSA Sequence Number 848

Section 9. Training and Drills

In This Section

ExxonMobil Pipeline

TRAINING AND DRILLS

General

The EMPCo response personnel are trained to qualify them for their assigned responsibilities. The ExxonMobil Pipeline Response Team (EMPRT) initial responders periodically review emergency response procedures and their associated role(s) and participate in selected response drills (notification, tabletop, and equipment deployment) conducted by EMPCo in accordance with the National Preparedness for Response Exercise Program (PREP). These team members are responsibilities include spill containment, recovery, protection, and cleanup operations. Some EMPRT team members have attended oil spill training schools and participate in Strike Team and NARRT spill management team drills. All EMPRT members satisfy HAZWOPER training requirements.

HAZWOPER Regulatory Requirements

Initial Certification

Regulations governing Hazardous Waste Operations and Emergency Response (HAZWOPER) mandated by the federal Occupational Safety and Health Act set minimum training and competency requirements for personnel involved in responses to spills/releases. Training requirements for **emergency response** are based on levels of emergency response recognized by the hazardous materials handling industry.

Emergency Response and Post-Emergency Response are distinct operations as defined in OSHA 29 CFR 1910.120 and have distinct training requirements, which are outlined in the EMPCo Training and Education Guide. Below are the levels of Emergency Response Training in which employees may be certified:

- **First Responder/Awareness Level, 4 hours:** Persons who may witness or discover a release or impending release of a hazardous substance. Responders trained to this level should be able to:
  - Identify a hazardous substance release
  - Initiate an emergency response sequence (evacuate - phone call)
  - Notify proper authorities

- **First Responder/Operations Level, 8 hours:** Persons trained to contain a release from a safe distance.
    - Take defensive action
    - Protect people, property and the environment
    - Prevent exposures and spreading

- **Hazardous Materials Technician Level, 24 hours:** Persons trained to aggressively mitigate the release and demonstrate competency in a variety of areas including:
    - Stopping the release
    - Take aggressive (offensive) role
    - Approach the point of release to stop it
    - Function in ICS
    - Implement ER Plan
    - Use monitoring equipment
    - Develop a Site Safety and Health Plan

- **Hazardous Materials Specialist Level, 24 hours plus specialty:** Persons trained to the level of Hazardous Materials (HAZMAT) Technicians, but designated to provide specific support services versus direct mitigation involvement.
    - Implementing the local emergency response plan
    - Classify, identify and verify hazardous substances using advanced survey instruments and equipment
    - Know applicable state emergency response plan
    - Know how to select and use specialized chemical PPE

- **On-Scene Incident Commander Level, 24 hours plus Incident Commander Training:** Person who takes charge of the incident.
    - Know and be able to implement the employer's ICS
    - Know how to implement the employer's emergency response plan
    - Know and understand the hazards and risks of employees working in chemical protective clothing

- Know how to implement the local emergency response plan
- Know of the state emergency response plan and of the Federal Regional Response Team
- Know and understand the importance of decontamination procedures

- **Skilled Support Personnel:** Heavy equipment operators, tow truck operators, other such persons needed on a temporary basis to perform a specific task require only an on-scene briefing.

- **Specialist Employees:** Technical experts such as Industrial Hygienists, Safety Personnel, Engineers, Maintenance/Training Experts, Pipeline System Controllers require either training or some form of annual demonstration of competency in their field of specialization.

The point where a response changes from an emergency situation to a **post-emergency situation** is determined by the State or Federal On-Scene Coordinator or Incident Commander. It is typically associated with the transition from containment, recovery, and protection activities to cleanup and remediation operations. In many cases, however, it is still considered an emergency until cleanup is completed and restoration/remediation operations, if required, are initiated.

The federal regulations require all response personnel involved in **post-emergency operations** (cleanup or restoration) to complete 40 hours of HAZWOPER training <u>unless there is not a significant health risk to the workers</u>, in which case OSHA only requires 4 hours of training. For oil spills, the health hazard is no longer considered significant when the majority of volatile constituents have evaporated and the exposure of any of the toxic components and/or the oil itself is less than 50 percent of the permissible exposure limit (PEL). Often during spill response the majority of volatile constituents will evaporate over a period of time. This period of time varies depending on ambient temperature, wind, humidity, physical and chemical characteristics of the contaminants as well as other factors.

Refresher Training Requirements

Refresher training or a demonstration of competency is required annually to maintain qualification at all HAZWOPER levels. If a demonstration of competency is chosen over the refresher training, a record must be kept of the methodology used. HAZWOPER rules do not specify requirements on the content of refresher training sessions.

Response Personnel HAZWOPER Training Levels

EMPCo Response Personnel

Team members are required under state and federal regulations to have the proper up-to-date training level to function in their position. All of the initial EMPRT members have at least twenty-four (24) hours of HAZWOPER certification training; whereas, the expanded EMPRT members have anywhere from eight (8) to greater than twenty-four (24) hours of HAZWOPER certification training. Table 9-1 lists EMPCo's current training certification requirements for oil spill response personnel.

HAZWOPER training is documented by attendance sheets (refer to Figure 9-1) that employees sign at the time they receive the training. The HAZWOPER training is documented by a computer database system and maintained by the Operations Integrity Department.

Wallet size cards are issued to employees certifying that the training was completed as required by regulation.

Response Contractors

All contractors responding to an EMPCo spill/release will be required by their contracts with EMPCo to satisfy the HAZWOPER training requirements of 29 CFR 1910.120 for their position.

Other Response Personnel

Skilled Temporary Support Personnel

EMPCo and other response support personnel whose skills are needed temporarily to perform immediate emergency support work (such as truck drivers and crane operators) are not required to meet the training requirements discussed above. However, these personnel must be briefed on the potential hazards and the duties to be performed at the site before participating in response operations. They must also receive instruction in the use of any safety and personal protective equipment needed and be provided with all other appropriate safety and health precautions.

Specialist Employees

Specialist employees are experts who would provide technical advice or guidance during response to a spill incident. Examples of such specialists might include chemists, biologists, industrial hygienists, physicians, or others with skills useful during a spill response operation. Such persons must receive appropriate training or demonstrate competency in their specialty annually. There are no specific requirements on training content or hours of training for these persons except that it entails whatever is necessary to maintain competency in their specific area of expertise. Training and demonstration of competency for skilled support personnel and specialists should be documented.

Casual Laborers

Casual laborers will generally not be hired by EMPCo but may be employed by EMPCo's response contractors or other response organizations. Contractors will be responsible for providing the appropriate HAZWOPER training to these laborers prior to their involvement in response operations.

Volunteers

Volunteers are not utilized by EMPCo in spill response operations. They will generally be referred to the state or federal government agencies who may use them in wildlife rescue and rehabilitation operations. They may also be referred to the response contractors for utilization in non-oil contact operations. In either case, it will be the responsibility of the agencies or contractors to provide the required level of training to the volunteers.

EMPCo Emergency Response Training Program

Spill response training varies somewhat between EMPRT Initial Responders and Expanded Response personnel.

EMPCo initial response personnel are trained, both in on-the-job instruction, and at recorded monthly safety meetings and weekly "tailgate" meetings. These meetings include topics such as:

- The operation and maintenance of equipment to prevent and respond to oil discharges, and
- Environmental awareness training including applicable pollution control laws, rules, and regulations.

Records for the above mentioned safety meetings are maintained.

Many EMPRT team members also receive recommended supplemental training in other general topics pertinent to spill response. This training (usually annually) is accomplished by attending EMPCo seminars and training classes, cooperative training classes, external classes, and seminars. Timing of this training will vary based on availability of classes and will not be required for team members to perform their spill team job functions.

A summary of the types of instruction provided includes the following:

- Emergency Response Plan content and use
- Each individual's responsibility as identified in the Emergency Response Plan
- Procedures for 24-hour notification of EMPCo management personnel, qualified individuals and key governmental agencies such as the National Response Center
- Procedures for internal notification of management personnel for various types of spills, accidents, and emergencies
- Characteristics and identification of the hazards associated with the products transported by EMPCo, e.g., HAZCOM and HAZWOPER training including the Emergency Response Guidebook.
- Personal protective equipment.
- Critiques of recent drills and actual spill responses
- Conditions that can worsen emergencies and procedures to minimize potential safety and health hazards and environmental damage
- Firefighting procedures
- Use of air monitoring equipment and respiratory training
- Procedures for spill control, containment, recovery, and cleanup activities

EMPCo documents this training on Training Documentation Form, Figure 9-1. These forms are maintained by EMPCo Field Operations. Additional documentation is maintained as described in the section entitled EMPCo Response Personnel, a subsection of Response Personnel HAZWOPER Training Levels.

Response Drills

General

Response drills evaluate the effectiveness of the Emergency Response Plan and the preparedness of response personnel. Throughout the year, EMPCo conducts a variety of response drills at both manned and unmanned facilities in compliance with 49 CFR 194, Appendix A, Section 7(b) and the National Preparedness for Response Exercise Program (PREP). EMPCo will endeavor to participate in joint drills whenever possible and claim credits for actual spill responses. EMPCo risk assessment surveys are considered in the development of EMPCo's drill program.

"Qualified Individual" notification exercises, emergency response equipment deployment drills, and spill management team tabletop exercises will be conducted by the EMPRT in the initial response mode for each response zone. The EMPRT in the expanded response mode will participate in selected response zone tabletop exercises or those conducted by Strike Team or NARRT to satisfy the annual regional Spill Management Team exercise requirements.

EMPCo will utilize Qualified Individual (QI) notification exercises, Spill Management Team "tabletop" simulation exercises, emergency response Equipment Deployment drills and/or combination exercises to ensure that all plan components are appropriately exercised. The fifteen (15) core components of a plan are described in the PREP Guidelines and in a following subsection entitled Response Plan Core Components. During each triennial cycle, all components of EMPCo's response plan will be exercised at least once. EMPCo will identify those components, as described in the PREP Guidelines, that are applicable for a particular drill. Using PREP Guidelines, EMPCo conducts drills for LPG/Chemical systems as well as crude oil and product systems.

Emergency Response Exercise / Drill Program

Qualified Individual (QI) Notification Exercise

Each quarter, EMPCo will conduct an exercise to test QI notification procedures. Personnel receiving this notification will respond to the individual initiating the exercise. Verification of receipt of the notification will be documented. If equipment failure or problems resulted in notification being delayed or prevented, these problems will be identified and corrected prior to the next exercise. One of these notification exercises per year will be done during non-business hours. Notification response will be logged on the Notification Exercise form provided in Figure 9-2a and Figure 9-2b. Forms will be maintained at EMPCo's Field Offices for a period of at least three (3) years for MMS/PHMSA or (5) years for EPA plans.

ER Equipment Deployment Drills

EMPCo will conduct annual equipment deployment drills of EMPCo owned Emergency Response equipment. During these drills, facility response equipment will be deployed to simulate a local response to a spill/release occurring at EMPCo facilities. Deployment will include strategies in this response plan for protecting adjacent interests and sensitive areas. The EMPRT will deploy a representative amount of response equipment annually including 1,000 feet of containment boom and one (1) of each skimming systems listed in the plan. Records of equipment deployed, personnel involved, and other information regarding the exercise will be documented on the Equipment Deployment Exercise form provided in Figure 9-3 and when applicable, Figure 9-5 (EMPCo's Emergency Response Drill Critique and Lessons Learned Report). Forms will be maintained at EMPCo's Field Offices for a period of at least three (3) years for MMS/PHMSA or (5) years for EPA plans.

Annual equipment deployment drills are also required of Oil Spill Removal Organizations (OSRO's) in addition to facility-owned oil spill equipment deployment drills.

Spill Management Team Tabletop Exercises

EMPCo will conduct annually a regional Spill Management Team (SMT) Tabletop Exercise for the EMPRT in the expanded response mode, as indicated in this Plan. EMPCo will also conduct annually one SMT Tabletop Exercise of the EMPRT in the initial response mode for each response zone listed in this Plan. One of the SMT Tabletop Exercises in each zone will involve the zone's worst case discharge scenario during a three (3) year drill cycle. Tabletop Exercises will be documented on the Spill Management Team Tabletop Exercise Form provided in Figure 9-4 and when applicable, Figure 9-5. Forms will be maintained at EMPCo's Field Offices for a period of at least three (3) years for MMS/PHMSA or (5) years for EPA plans.

Unannounced Exercises/Drills

Annually, each Response Zone will ensure that either the SMT or an emergency response Equipment Deployment drill will be conducted **unannounced**. This is not a separate or additional exercise.

An unannounced exercise is where the exercise participants do not have prior knowledge of the exercise, as would be the situation in an actual spill incident.

Responses to actual spill incidents should be considered as credit for the unannounced exercise requirement. Exercise credit is achieved only if the response is properly evaluated, certified, and documented on form Figure 9-3, Figure 9-4, and/or Figure 9-5.

Exercise/Drill Self-Evaluation and Self-Certification

EMPCo drills will be self-evaluated and self-certified in accordance with the PREP Guidelines by EMPCo's Field Operations personnel and properly documented utilizing the exercise documentation forms previously referenced. Following the completion of required exercises/drills, EMPCo will conduct a self-evaluation review or critique. The review/critique will evaluate the effectiveness of the core components of the plan and key response activities to determine the lessons learned. Corrective measures or follow-up actions may be derived from the exercise/drill evaluation process. Lessons learned and follow-up action items including persons responsible for follow-ups are documented on form, Figure 9-5. EMPCo's Emergency Response Plan may require revisions as a result of this evaluation.

Regulatory Exercises

EMPCo will participate in agency sponsored/mandated drills as required. These drills may be initiated by the agencies as announced or unannounced. The regulatory agencies will also be invited to participate in the EMPCo Equipment Deployment drills and/or Spill Management Team Tabletop exercises.

Response Plan Core Components

The content of this section is an excerpt from OPA-90's National Preparedness for Response Exercise Program (PREP) Guidelines, Appendix B. It is included in this plan to provide a better understanding of the characteristics exercised as core components.

During each triennial cycle, all components of a plan holder's response plan must be exercised at least once. The purpose of this requirement is to ensure that all plan components function adequately for response to an oil spill.

The 15 core components listed below are the types of components that must be exercised. However, all these components may not be contained in each response plan. As such, the plan holder shall identify those that are applicable from this list, adding or deleting as appropriate.

1. **Notifications**: Test the notifications procedures identified in the Area Contingency Plan and the associated Responsible Party Response Plan.

2. **Staff Mobilizations**: Demonstrate the ability to assemble the spill response organization identified in the Area Contingency Plan and the associated Responsible Party Response Plan.

3. **Ability to Operate Within the Response Management System** as Described in the Plan:

   a. **Unified Command**: Demonstrate the ability of the spill response organization to work within a unified command.

      1) Federal Representation: Demonstrate the ability to consolidate the concerns and interests of the other members of the unified command into a unified strategic plan with tactical operations.

      2) State Representation: Demonstrate the ability to function within the unified command structure.

      3) Local Representation: Demonstrate the ability to function within the unified command structure.

      4) Responsible Party Presentation: Demonstrate the ability to function within the unified command structure.

   b. **Response Management System**: Demonstrate the ability of the response organization to operate within the framework of the response management system identified in their respective plans:

      1) Operations: Demonstrate the ability to coordinate or direct operations related to the implementation of action plans contained in the respective response and contingency plans developed by the unified command.

      2) Planning: Demonstrate the ability to consolidate the various concerns of the members of the unified command into joint planning recommendations and specific long-range strategic plans. Demonstrate the ability to develop short-range tactical plans for the operations division.

3) Logistics: Demonstrate the ability to provide necessary support of both short-term and long-term action plans.

4) Finance/Administration: Demonstrate the ability to document the daily expenditures of the organization and provide cost estimates for continuing operations.

5) Public Affairs: Demonstrate the ability to form a joint information center and provide the necessary interface between the unified command and the media.

6) Safety Affairs: Demonstrate the ability to monitor all field operations and ensure compliance with safety standards.

7) Legal Affairs: Demonstrate the ability to provide the unified command with suitable legal advice and assistance.

4. **Discharge Control**: Demonstrate the ability of the spill response organization to control and stop the discharge at the source.

5. **Assessment**: Demonstrate the ability of the spill response organization to provide initial assessment of the discharge and provide continuing assessments of the effectiveness of the tactical operations.

6. **Containment**: Demonstrate the ability of the spill response organization to contain the discharge at the source or in various locations for recovery operations.

7. **Recovery**: Demonstrate the ability of the spill response organization to recover the discharged product.

    a. On-Water Recovery: Demonstrate the ability to assemble and deploy the on-water recovery resources identified in the response plans.

    b. Shore-Based Recovery: Demonstrate the ability to assemble and deploy the shore side cleanup resources identified in the response plans.

8. **Protection**: Demonstrate the ability of the spill response organization to protect the environmentally and economically sensitive areas identified in the Area Contingency Plans and the respective industry response plans.

    a. Protective Booming: Demonstrate the ability to assemble and deploy sufficient resources to implement the protection strategies contained in the Area Contingency Plan and the respective industry response plan.

b. Dispersant Use: Demonstrate the ability to quickly evaluate the applicability of dispersant use for this incident and implement the protection strategies contained in the Area Contingency Plan and the respective industry response plan.

c. In-Situ Burning: Demonstrate the ability to quickly evaluate the applicability of in-situ burning for this incident and implement a pre-approved plan from the Area Contingency Plan or develop a plan for use.

d. Water Intake Protection: Demonstrate the ability to quickly identify water intakes and implement the proper protection procedures from the Area Contingency Plans or develop a plan for use.

e. Wildlife Recovery and Rehabilitation: Demonstrate the ability to quickly identify these resources at risk and implement the proper protection procedures from the Area Contingency Plan to develop a plan to use.

f. Population Protection: Demonstrate the ability to quickly identify health hazards associated with the discharged product and the population at risk from these hazards, and to implement the proper protection procedures from the Area Contingency Plan or develop a plan for use.

g. Bioremediation: Demonstrate the ability to quickly evaluate the applicability of bioremediation use for this incident, and implement a plan from the Area Contingency Plan or develop a plan for use.

9. **Disposal**: Demonstrate the ability of the spill response organization to dispose of the recovered material and contaminated debris.

10. **Communications**: Demonstrate the ability to establish an effective communications system for the spill response organization.

    a. Internal Communications: Demonstrate the ability to establish an intra-organization communications system. This encompasses communications within the administrative elements of field units.

    b. External Communications: Demonstrate the ability to establish communications both within the administrative elements and the field units.

11. **Transportation**: Demonstrate the ability to provide effective multi-mod transportation both for execution of the discharge and support functions.

a. Land Transportation: Demonstrate the ability to provide effective land transportation for all elements of the response.

b. Waterborne Transportation: Demonstrate the ability to provide effective waterborne transportation for all elements of the response.

c. Airborne Transportation: Demonstrate the ability to provide the necessary support of all personnel associated with the response.

12. **Personnel Support**: Demonstrate the ability to provide the necessary support of all personnel associated with the response.

a. Management: Demonstrate the ability to provide all administrative management of all personnel involved in the response. This requirement includes the ability to move personnel into or out of the response organization with established procedures.

b. Berthing: Demonstrate the ability to provide overnight accommodations on a continuing basis for a sustained response.

c. Messing: Demonstrate the ability to provide suitable feeding arrangements for personnel involved with the management of the response.

d. Operational and Administrative Spaces: Demonstrate the ability to provide suitable operational and administrative spaces for personnel involved with the management of the response.

13. **Equipment Maintenance and Support**: Demonstrate the ability to maintain and support all equipment associated with the response.

a. Response Equipment: Demonstrate the ability to provide effective maintenance and support for all response equipment.

b. Support Equipment: Demonstrate the ability to provide effective maintenance and support for all equipment that supports the response. This requirement includes communications equipment, transportation equipment, administrative equipment, etc.

14. **Procurement**: Demonstrate the ability to establish an effective procurement system.

a. Personnel: Demonstrate the ability to procure sufficient personnel and sustain an organized response. This requirement includes insuring that all personnel have qualifications and training required for their position within the response organization.

b. Response Equipment: Demonstrate the ability to procure sufficient response equipment to mount and sustain an organized response.

c. Support Equipment: Demonstrate the ability to procure sufficient support equipment to support and sustain an organized response.

15. **Documentation**: Demonstrate the ability of the spill response organization to document all operational and support aspects of the response and provided detailed records of decisions and actions taken.

Hazardous Waste Training

EMPCo field operations personnel receive extensive regulatory-required training in HAZWOPER, HAZCOM, emergency response, fire fighting, and other areas as described in this section and in EMPCo's Training and Education Guide. Employees at sites which generate hazardous waste receive additional orientation and training specific to hazardous waste regulatory requirements, and hazardous waste emergency response. Site emergency coordinators (qualified individuals) also receive additional training on incident command systems.

Hazardous waste management activities are directly overseen in the field by EMPCo's Field Env/Reg/Safety/Training (ERST) Technicians. In addition to the training described above, Field ERST Techs receive initial classroom or on-the-job hazardous waste training and annual hazardous waste refresher training. This training includes the following general elements:

- Hazardous Waste Regulatory Overview And Compliance Assurance
- Hazardous Waste Management Procedures
- Hazardous Waste Emergency Response Procedures, Equipment and Systems

Other employees at a site which hazardous waste may be present, but who are not directly involved in the handling or oversight of that waste, receive general awareness/orientation training on the waste in question from the Field ERST Tech.

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FIGURE 9-1
ExxonMobil Pipeline Company - Emergency Training/Drill/Plan Form

Response Zone Plan(s):		**Type of Drill or Exercise:**	
Training:		**Date:**	
Work Group/Location:			

By signing this form, I verify/certify attended the above referenced drill/exercise and/or received the above regulatory training on the date indicated.

NAME (*SIGNATURE*)	NAME (PRINTED)	COMPANY or AGENCY

INSTRUCTOR'S SIGNATURE: ____________________ Page ____ of ____

Retain this form and other documentation related to this exercise on file for a minimum of 3 years (for PHMSA) and send an electronic copy to the Emergency Preparedness and Response Advisor in the Houston Office.
Emergency Plan Review meets requirements of 49 CFR 195.403.

FIGURE 9-2a

ExxonMobil Pipeline Company
QI Notification Exercise

1. Date performed: ______________________________
2. Name of response plan/zone: ______________________________

3. Exercise or actual response? ______________________________

4. Vessel/Facility/Pipeline/Offshore Facility initiating exercise:

   ____

5. Name of person notified: ______________________________

   Is this person identified in your response plan as qualified individual or designee?

   ____

6. Time initiated: ______________________________

   Time in which qualified individual or designee responded: ______________

7. Method used to contact:

   _____ Telephone
   _____ Pager
   _____ Radio
   _____ Other: ______________________________

8. Description of notification procedure:

   ____
   ____
   ____
   ____
   ____

9. Identify which of the 15 core components of your response plan that were exercised during this particular exercise:

   _____ Notifications (#1)
   _____ Communications (#10)

____
Certifying Signature

Retain this form and other documentation related to this exercise on file for a minimum of 3 years (for PHMSA).

FIGURE 9-2b
ExxonMobil Pipeline Company
OSRO/CO-OP/Mutual Aid Notification Exercise

1. Date performed: ____________________
2. Name of response plan/zone: ____________________

3. Exercise or actual response? ____________________

4. Vessel/Facility/Pipeline/Offshore Facility initiating exercise:

____

5. Name of person notified: ____________________

   Is this organization identified in your response plan as an OSRO, St Co-Op or Mutual Aid? ____________________

6. Time initiated: ____________________

   Time in which organization responded: ____________________

7. Method used to contact:

   _____ Telephone
   _____ Pager
   _____ Radio
   _____ Other: ____________________

8. Description of notification procedure:

   ____
   ____
   ____
   ____
   ____

9. Identify which of the 15 core components of your response plan that were exercised during this particular exercise:

   _____ Notifications (#1)
   _____ Communications (#10)

____
Certifying Signature

Retain this form and other documentation related to this exercise on file for a minimum of 3 years (for PHMSA).

FIGURE 9-3
ExxonMobil Pipeline Company
Equipment Deployment Exercise (Facility Equipment)

1. Date(s) performed: ______________________________
2. Name of response plan/zone: ______________________________

____

3. Exercise or actual response? ______________________________
   If an exercise, announced or unannounced? ____________________

4. Deployment location(s):

____
____
____

5. Time started: ____________________
   Time completed: ____________________

6. Equipment deployed was:
   _____ Facility-owned
   _____ Oil spill removal organization-owned. If so, which OSRO? __________
   _____ Both

7. List type and amount of all equipment (e.g., boom and skimmers) deployed and number of support personnel employed:

____
____
____
____
____

8. Describe goals of the equipment deployment and list any Area Contingency Plan strategies tested. (Attach a sketch of equipment deployments and booming strategies):

____
____
____
____
____

Equipment Deployment Exercise (Facility Equipment) - (continued)

9. For deployment of facility-owned equipment, was the amount of equipment deployed at least the amount necessary to respond to your facility's average most probable spill?

____

____

Was the equipment deployed in its intended operating environment?

____

____

10. For deployment of OSRO-owned equipment, was a representative sample (at least 1000 feet of each boom type and at least one of each skimmer type) deployed?

____

____

Was the equipment deployed in its intended operating environment?

____

____

11. Are all facility personnel that are responsible for response operations involved in a comprehensive training program, and all pollution response equipment involved in a comprehensive maintenance program?

____

____

If so, describe the program: ______________________________

____

____

____

____

Date of last equipment inspection: ______________________________

12. Was the equipment deployed by the personnel who are responsible for its deployment in the event of an actual spill?

____

13. Was all deployed equipment operational? If not, why not?

____

____

____

____

____

Equipment Deployment Exercise (Facility Equipment) - (continued)

14. Identify which of the 15 core components of your response plan that were exercised during this particular exercise:

_____ Notifications (1)	_____ Protection (8)
_____ Staff Mobilization (2)	_____ Disposal (9)
_____ Ability to Operate within the Response Management System (3)	_____ Communications (10)
	_____ Transportation (11)
_____ Discharge Control (4)	_____ Personnel Support (12)
_____ Assessment (5)	_____ Equipment Maintenance & Support (13)
_____ Containment (6)	_____ Procurement (14)
_____ Recovery (7)	_____ Documentation (15)

15. Attach a description of lesson(s) learned and person(s) responsible for follow-up of corrective measures.

____
Certifying Signature

Retain this form and other documentation related to this exercise on file for a minimum of 3 years (for PHMSA).

CIC Regulatory Files

FIGURE 9-3.A
ExxonMobil Pipeline Company
Fire Department Equipment Deployment Exercise

1. Date(s) performed: ______________________________

2. Name of response plan/zone: EMPCo Core Manual

____

3. Exercise or actual response? ______________________________

   If an exercise, announced or unannounced? ______________________________

4. Deployment location(s):

____

____

____

5. Time started: ______________________________

   Time completed: ______________________________

6. Equipment deployed was:

   ______ Facility-owned

   ______ Local Fire Department owned

   ______ Both

7. List type and amount of all equipment (e.g., Hook and Ladder, Foam Tender, Rescue Unit) deployed and number of support personnel deployed:

____

____

____

____

____

8. Describe goals of the equipment deployment and list any Local OM&E strategies tested. (Attach a sketch of equipment deployments):

____

____

____

____

____

Fire Department Equipment Deployment Exercise - (continued)

9. For deployment of facility-owned equipment, was the amount of equipment deployed <u>at least</u> the amount necessary to respond to your facility's average most probable fire?

   ____

   ____

   Was the equipment deployed in its intended operating environment?

   ____

   ____

10. For deployment of Fire Department owned equipment, was a representative deployed?

    ____

    ____

    Was the equipment deployed in its intended operating environment?

    ____

    ____

11. Are all facility personnel that are responsible for response operations involved in a comprehensive training program, and all pollution response equipment involved in a comprehensive maintenance program?

    ____

    ____

    If so, describe the program: ______________________________

    ____

    ____

    ____

    ____

    Date of last facility equipment inspection: ______________________________

12. Was the equipment deployed by the personnel who are responsible for its deployment in the event of an actual fire? ______________________________

13. Was all deployed equipment operational? If not, why not?

    ____

    ____

    ____

    ____

    ____

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Fire Department Equipment Deployment Exercise - (continued)

14. Identify which of the 15 core components of your response plan that were exercised during this particular exercise:

______	Notifications (1)	______	Protection (8)
______	Staff Mobilization (2)	______	Disposal (9)
______	Ability to Operate within the Response Management System (3)	______	Communications (10)
		______	Transportation (11)
______	Discharge Control (4)	______	Personnel Support (12)
______	Assessment (5)	______	Equipment Maintenance & Support (13)
______	Containment (6)	______	Procurement (14)
______	Recovery (7)	______	Documentation (15)

15. Attach a description of lesson(s) learned and person(s) responsible for follow-up of corrective measures.

____
Certifying Signature

Retain this form and other documentation related to this exercise on file for a minimum of 3 years (for PHMSA).

CIC Regulatory Files

FIGURE 9-4
ExxonMobil Pipeline Company
Emergency Tabletop Exercise & Plan Review

1. Date(s) performed: ____________________

2. Name of response plan(s)/zone: ____________________

____

3. Exercise or actual response? ____________________

   If an exercise, announced or unannounced? ____________________

4. Location of tabletop: ____________________

5. Time started: ____________________

   Time completed: ____________________

6. Response plan scenario used (check one):

   ______ Average most probable discharge

   ______ Maximum most probable discharge

   ______ Worst case discharge

   Size of (simulated) spill __________ bbls.

7. Describe how the following objectives were exercised:

   a) Spill management team's knowledge of oil spill response plan:

   ____

   ____

   ____

   ____

   b) Proper notifications:

   ____

   ____

   ____

   ____

   ____

   c) Communications system:

   ____

   ____

   ____

   ____

   ____

Emergency Tabletop Exercise & Plan Review - (continued)

d) Spill management team's ability to access contracted oil spill removal organizations:

____
____
____
____
____

e) Spill management team's ability to coordinate spill response with On-Scene Coordinator, state, and applicable agencies:

____
____
____
____
____

f) Spill management team's ability to access sensitive site and resource information in the Area Contingency Plan:

____
____
____
____
____

8. Identify which of the 15 core components of your response plan that were exercised during this particular exercise:

______	Notifications (1)	______	Protection (8)
______	Staff Mobilization (2)	______	Disposal (9)
______	Ability to Operate within the Response Management System (3)	______	Communications (10)
		______	Transportation (11)
______	Discharge Control (4)	______	Personnel Support (12)
______	Assessment (5)	______	Equipment Maint. & Support (13)
______	Containment (6)	______	Procurement (14)
______	Recovery (7)	______	Documentation (15)

9. Attach a description of lesson(s) learned and person(s) responsible for follow-up of corrective measures.

____
Certifying Signature

Retain this form and other documentation related to this exercise on file for a minimum of 3 years (for PHMSA) and send an electronic copy to the Emergency Preparedness and Response Advisor in the Houston Office. DOT regulation references: 49 CFR 195.403 (a), (b), (c).

FIGURE 9-5
ExxonMobil Pipeline Company
Emergency Response Drill/Incident Critique and Lessons Learned Report

Location	Area:	Response Plan:	Incident Location:
Drill/Incident Date :		Name of Incident:	
Drill/Incident Type :		Report By :	

Demonstrated Strengths (Things Done Well) :	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Follow-up Action Items (Things To Improve) , Completion Dates, and Responsible Persons :

Item No.	Suggested Improvement	Target Completion Date	Assigned to:
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

TABLE 9-1

ExxonMobil Pipeline Company **HAZWOPER RESPONDER LEVEL ASSIGNMENTS**				
HAZWOPER Titles				
FIRST RESPONDER AWARENESS	**FIRST RESPONDER OPERATIONS**	**HAZARDOUS MATERIALS TECHNICIAN**	**HAZARDOUS MATERIALS SPECIALIST**	**INCIDENT COMMANDER**
Role Qualifications				
Witness or discover release; initiate response; Notify proper authorities	**Contain release from safe distance; Protect persons/property environment; Prevent exposures. (Also includes Awareness Level duties.)**	**Approach point of release to plug, patch, stop release. (Also includes Awareness & Operations Level duties.)**	**Support HazMat Techs; Conduct air sampling; Determine PPE needs; Develop site safety/control plan; Liaison with gov't. Agencies. (Also includes Awareness, Operations & HazMat Tech. Level duties.)**	**Assume control of incident scene; Establish command; Develop action plan. (Also includes Awareness & Operations Level duties.)**
EMPCo Equivalent Job Titles				
ASST. TECH. TRAINEE CLERKS ROW/CLAIMS COORD. PUBLIC AFFAIRS COORDINATOR ENGINEERS	TERMINAL OPERATORS ⇓	M/S TECHNICIANS - ASST. TECH. C - A TECH. C - A SR. TECH. C - A M/S ENGR. TECHS.. WELDER ASST. WELDER	SAFETY & HEALTH RESPONDERS	AREA MANAGERS AREA SUPERVISORS OPERATIONS MANAGER FIELD SUPERVISORS PROJECT / TECHNICAL LEADERS

PHMSA Sequence Number 848 **TABLE 9-2**

ExxonMobil Pipeline Company
HAZWOPER Training Requirements

Course	First Responder Awareness	First Responder Operations	Hazardous Materials Technician	Incident Commander
HAZWOPER (Initial Training)				
• Hazwoper Overview	X	X	X	X
• Emergency Response Guidebook	X	X	X	X
• Emergency Recognition & Response	X	X	X	X
• Initial Notification and Site Security	X	X	X	X
• PPE - Basic		X	X	X
• Emergency Response Plan		X	X	X
• Decontamination With Hands-on Exercise		X	X	X
• Basic Control, Confine & Contain		X	X	X
• Media Guidelines		X	X	X
• Toxicology Overview			X	X
• Chemical Exposure Routes			X	X
• Occupational Exposure Limits			X	X
• Material Data Safety Sheets (with Exercise)			X	X
• Site Characterization			X	X
• General LPG/NGL Emergency Response			X	X
• PPE During Emergency Response			X	X
• Air Monitoring Overview			X	X
• Air Monitoring Equipment Demo			X	X
• Site Management			X	X
• Incident Command System Overview			X	X
• Site Safety, Health & Incident Action Plan			X	X
• Site Safety, Health & Incident Action Plan			X	X
Exercise			X	X
• Hazwoper Wrap-up			X	X
• Incident Commander Training				X
Additional Training				
• Annual Equipment Deployment Drills			X	X
• Annual Tabletop Exercises			X	X
• Annual Hazwoper CBT Refresher	X	X		
Other related training				
• Respiratory Protection	#	#	X	#
• Respiratory Fit Test	#	#	X	#
• Oil Spill School			#	#

X = required
CBT = Computer Based Training
# = as needed

Section 10. EMPCo Reference Documents

In This Section

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EMPCo Reference Documents

Below is a listing of the EMPCo references that can be used by EMPCo personnel when handling an emergency situation:

Crude Oil and Refined Product Spills

EMPCo Hazard Communication Manual	General Reference
EMPCo Safety Manual	General Reference
EMPCo Respiratory Protection Program	General Reference
EMPCo Pipeline Repair and Modification Manual	Sections 2, 3, and 4 Appendices B, F
EMPCo PSM Manual (site specific, select facilities)	General Reference
DOT Part 195 - Regulatory Requirements	Subparts B, F for Liquid Pipelines
EMPCo Pipeline Welding Manual	General References
ANSI B31.4	451.6, Pipeline Repairs
EMPCo Louisiana Regulated Intrastate Pipelines	Pipeline Safety Regulations
EMPCo Regulations Reference Manual	General Reference
EMPCo DOT Liquids Manual,	Regulatory Reference
EMPCo's MSDS Manual	General Reference
Exxon Oil Spill Response Field Manual	General Reference
DOT's Emergency Response Guidebook	General Reference Response
ExxonMobil Chemical's ER Field Manual	General Reference
EMPCo Spill/Release Notification Guide	General Reference
API Publication 2219	General Reference

Oil and Hazardous Substances Pollution

EMPCo PSM Manual (site specific, select facilities)	General Reference
National Contingency Plan	General Reference
EPA Region I Inland ACP	General Reference
Maine & New Hampshire ACP	General Reference
Rhode Island & Southeastern Massachusetts ACP	General Reference
Plymonuth to Salisbury MA ACP	General Reference
One Gulf Plan	General Reference
• MSO New Orleans GRP	General Reference
• MSO Baton Rouge GRP	Sensitive Areas
• MSO Port Arthur GRP	Sensitive Areas
• MSO Houston/Galveston GRP	Sensitive Areas
• MSO Corpus Chriti GRP	Sensitive Areas
EPA Region VI Integrated Contency Plan	General Reference
RRT-VI In-Situ Burn Plan	General Reference
RRT-VI Preapproved Dispersant Use Manual	General Reference
EPA Region VII Intergrated Contingrncy Plan	General Reference
MSO Chicago ACP	General Reference
EPA Region Region VIII ACP	General Reference
National Preparedness for Response Exercise Program (PREP) Guidelines.	General Reference
EMPCo DOT Liquids Manual	Regulatory Reference

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EMPCo Spill/Release Notification Guide	General Reference
API Publication 2219	General Reference

Gas Releases

EMPCo PSM Manual (site specific, select facilities)	General Reference
EMPCo Safety Manual	General Reference
EMPCo Respiratory Protection Program	General Reference
EMPCo Pipeline Repair and Modification Manual	Sections 2, 3, and 4 Appendices B, F
EMPCo Pipeline Welding Manual	General Reference
ANSI B31.8	850, 851, 852
DOT Part 192 - Gas Pipelines	Subpart L
EMPCo Regulations Reference Manual	General Reference
EMPCo DOT Gas Manual	Regulatory Reference
EMPCo DOT Liquids Manual	Regulatory Reference
DOT's Emergency Response Guidebook	General Reference
ExxonMobil Chemical's ER Field Manual	General Reference
EMPCo Spill/Release Notification Guide	General Reference

HVL/LPG/Toxic Gases and other Hazardous Materials

EMPCo PSM Manual (site specific, select facilities)	General Reference
EMPCo Safety Manual	General Reference
EMPCo Safety and Health Responder Manual	General Reference
EMPCo Respiratory Protection Program	General Reference
EMPCo Pipeline Repair and Modification Manual	Sections 2, 3, and 4 Appendices B, F
EMPCo Hazard Communication Manual	General Reference
DOT Part 195 - Regulatory Requirements for Liquid Pipelines	Subparts B, F
EMPCo Pipeline Welding Manual	General Reference
ANSI B31.4	451.6 Pipeline Repairs
ANSI B31.8	872
EMPCo Regulations Reference Manual	General Reference
EMPCo DOT Liquid Manual	Regulatory Reference
EMPCo's MSDS Manual	General Reference
DOT's Emergency Response Guidebook	General Reference

Fire and Explosions

EMPCo PSM Manual (site specific, select facilities)	General Reference
EMPCo Safety Manual	General Reference
EMPCo Regulations Reference Manual	General Reference

Casualties

Occupational Safety and Health Act of 1970, Administrative Guidelines	Section IV-A
EMPCo Safety Manual	Section IX

Appendix A

Containment, Protection and Recovery Techniques

In This Section

General

Efforts to contain an oil spill and protect downgradient terrestrial areas or downstream shorelines from becoming oiled should be initiated immediately after the discovery of a spill. A rapid and effective response is necessary to limit the spread of oil and to minimize damage to the environment. The protection actions will depend primarily on the contamination potential, environmental and cultural sensitivities, and feasibility for effective implementation. The terrestrial and aquatic techniques most applicable to the ExxonMobil Pipeline Company operations and the downstream shorelines of the local waterways are listed below. It is important to note that some techniques are listed more than once as they may be applicable to more than one type of response operation It should also be noted that certain techniques, such as open water containment booming, are not applicable to all areas or situations.

Detailed procedures for the implementation of each technique are discussed in this appendix and include information on use, limitations, logistics, and descriptions of the conditions affecting deployment. In addition, diagrams depicting typical technique deployment configurations are also provided. Although each technique is discussed separately, spill circumstances may require the simultaneous use of several techniques.

Dispersant use and burning are also potentially viable protection and/or recovery techniques but are not included here as they require authorization for use on a case-by-case basis from several regulatory agencies. Dispersant use is generally unacceptable for inland water spills and, therefore, will not be discussed herein.

Containment Booms

The effective use of containment booms for many aquatic spill containment, recovery, and protection operations often depends on a working knowledge of the various boom types and their operation, selection, and deployment. Therefore, this section is intended to provide some general information that can aid in the use of containment booms when implementing several of the techniques discussed in this appendix.

Types

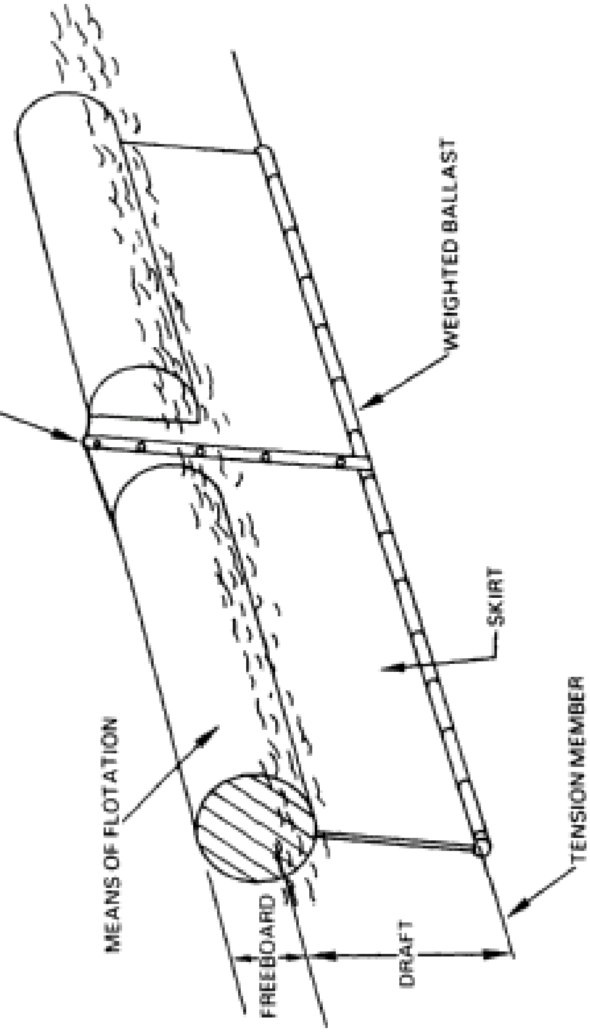
Oil spill containment booms are the best method available for containment and control of an aquatic oil spill. The boom is designed as a mechanical barrier that stops surface water and floating oil but allows subsurface water to pass. A diagram illustrating some generic boom components is provided in Figure A-1. Definitions of the components are as follows.

- Freeboard - Prevents oil from splashing or flowing over the top of the boom.

- Skirt or draft - Prevents oil from passing underneath.
- Tension member - Provides strength to resist loadings from wind, waves, and currents.
- Flotation - Maintains the boom at the proper level in the water.
- Ballast - Provides stability and maintains the boom in an upright position.

FIGURE A-1

BASIC COMPONENTS OF A CONTAINMENT BOOM



SOURCE: VALDEZ OIL SPILL TECHNOLOGY, 1990
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Containment booms can generally be divided into six types which are shown in Figure A-2. Types A and D are the most commonly used for spill response purposes whereas Type F is most often used in permanent installations such as around docks and in harbors. Types A, D, and most Es are known as curtain booms which have flexible skirts and are well suited to shallow water conditions or fluctuating water levels due to their ability to conform to the bottom of the waterway. They will also form a relatively good seal when anchored on a shoreline. Types B, C, and F are called fence boom because of their rigid or reinforced (with stiffeners) construction. They will not conform well to shallow bottoms.

Operation

There are two main forces that work against the performance of oil booms; current speed and wave action. As current speed increases, the speed of the water encountering the boom creates a downward suction which pulls the water and oil down and underneath the boom. This phenomenon is known as "entrainment" and occurs at a water speed of 1.0 to 1.3 knots.

The proper deployment of an oil boom is critical in the effective containment of oil. The effects of current action can be minimized if the boom is placed at the proper angle to the current flow which will reduce the pressure placed on the boom and allow the water and oil to slide along the boom to a recovery location. For currents above 2 to 3 knots, the angle at which the boom is set is usually too small to be of use and entrainment will occur anyway.

Splash-over due to wave action is even more difficult to control. A boom with a taller above-surface barrier (freeboard) will help reduce the effects of wave action; however, a taller barrier exposes more area to the wave forces which could then flatten the boom. Angling the boom to the waves will decrease the boom loadings and minimize splash-over.

Lightweight booms are generally used in protected waters where the effects of current and waves are reduced. The freeboard on lightweight booms is generally 4-6 inches in height and the below-surface barrier (skirt) is 6-18 inches. In currents above 1 to 2 knots, these booms are usually ineffective but will slow the flow of oil when used at the proper angle.

Heavier duty booms are designed for use in higher currents and open or rough waters. Typically the freeboard is 8 to 12 inches with a 12- to 24-inch skirt. These booms contain more ballast to maintain stability in rough seas, are made of stronger materials, and are generally more difficult to handle. Booms designed for higher currents may have heavy duty nylon netting along the bottom of the skirt to allow some water to pass through without reducing boom stability.

FIGURE A-2
CHARACTERISTICS OF SIX COMMON CONTAINMENT BOOM TYPES

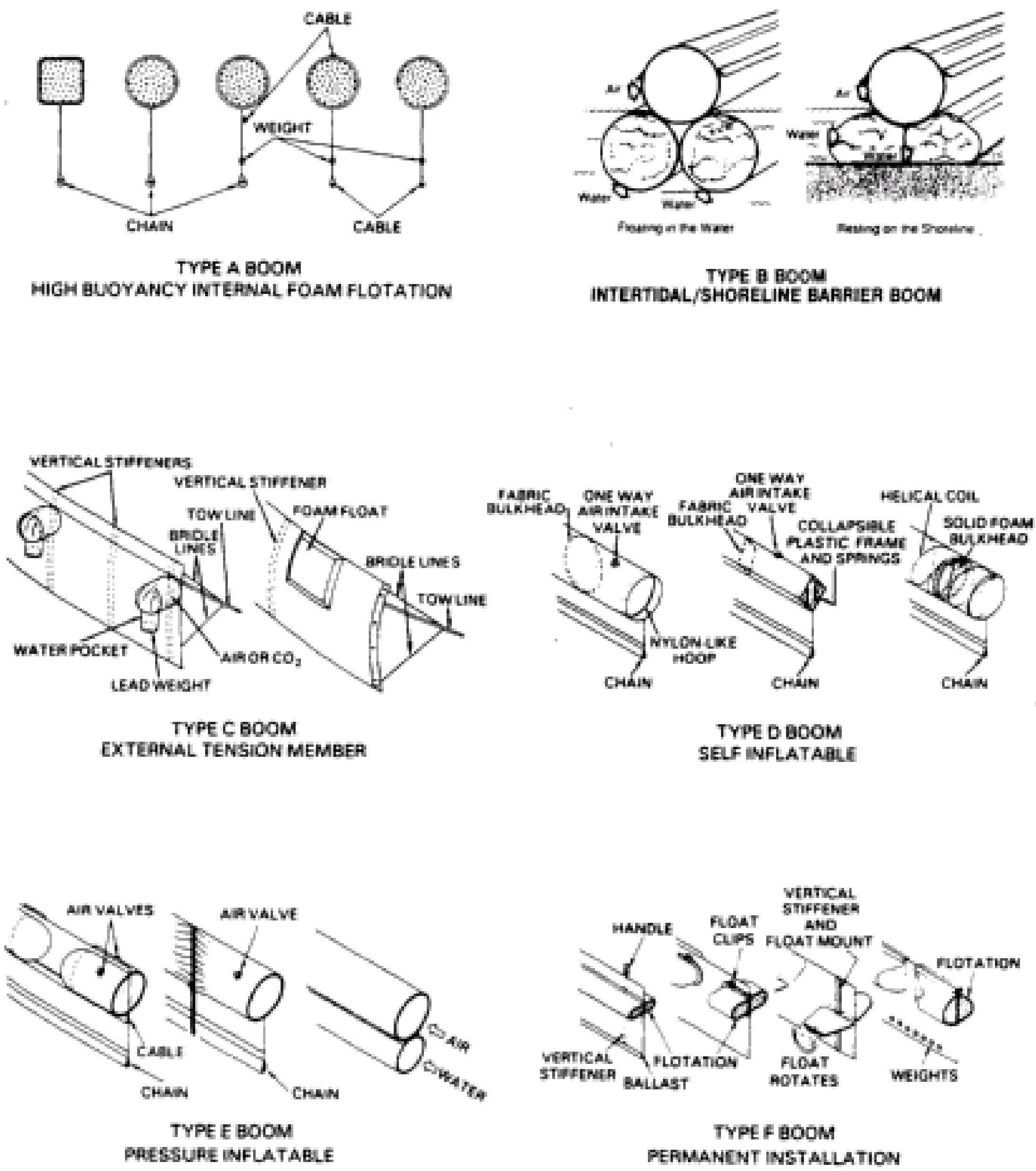


Figure 12. Characteristics of the six containment boom types identified in the Exxon Oil Spill Response Field Manual.

Source: Valdez Oil Spill Technology, Exxon, 1990.
Reprinted with permission from Exxon.

Boom Selection

The selection of a specific type of boom depends on the following three factors:

- It must operate and survive under the existing environmental conditions;
- It should have performance characteristics suited to the particular use; and
- It should have the desirable convenience features.

The matrix shown in Figure A-3 can be used to assist in the selection of a suitable boom type for a given situation. When using the matrix it is important to compare booms of the same approximate size, particularly when evaluating costs.

Boom Deployment

Oil spill booms do not work effectively when the relative velocity of the current exceeds 1 to 1.3 knots. At greater velocities, floating oil will likely be entrained beneath the boom by the current. The boom can be angled to the direction of the current in order to reduce the "effective velocity." The oil will then flow along the front of the boom toward the downstream end. If anchored to the shoreline, the downstream end should be sealed against the shore to ensure complete containment. The following is a table of the approximate angles (as measured from the shoreline) that booms must be deployed to the current to maintain a 1- to 1.3-knot "effective current velocity."

True Water Current Velocity (knots)	Angle of Boom to Reduce Effective Velocity to 1.3 knots (Degrees)
1.5	70
1.6	60
1.7	55
1.8	50
2.0	45
2.2	40
2.5	35
2.8	30

FIGURE A-3

BOOM SELECTION MATRIX

LEGEND:

1–GOOD 1•–LOW
2–FAIR 2•–MEDIUM
3–POOR 3•–HIGH

TYPE OF BOOM	ENVIRONMENTAL CONDITIONS: OPEN WATER (HS > 3FT; V < 1KT)	HARBORS (HS < 3FT; V < 1KT)	CALM WATERS (HS < 1 FT; V < 0.5FT)	HIGH CURRENTS (V > 1KT)	SHALLOW WATER (DEPTH < 1FT)	PERFORMANCE CHARACTERISTICS: OPERATION IN DEBRIS	EXCESS BUOYANCY	WAVE RESPONSE	STRENGTH	CONVENIENCE CHARACTERISTICS: EASE OF HANDLING	EASE OF CLEANING	COMPACTABILITY	COST/FT.
High Buoyancy Internal Foam Floatation	2	1	1	2⊕	1	1	2	2	2	2	1	3	1•
External Tension Member	1	2	2	1	3	3	2	1	1	3	3	2	3•
Self Inflatable	2	1	1	3	2	3	1	2	3	1	1	1	3•
Pressure Inflatable	1	1	1	2	2	2	1	1	1	2	1	1	2•
Semi-Permanent Installation (Fence)	3	2	1	3	3	2	3	3	1	2	1	3	2•

NOTES:
HS = SIGNIFICANT WAVE HEIGHT
V = VELOCITY OF SURFACE CURRENT
⊕ = SPECIALLY-DESIGNED HIGH-CURRENT MODELS MAY BE AVAILABLE (RIVER BOOM)

NOT ALL BOOMS OF A PARTICULAR GENERIC TYPE HAVE THE RATING SHOWN IN THE MATRIX, AT LEAST ONE OR MORE COMMERCIALLY AVAILABLE BOOMS OF THE GENERIC TYPE LISTED HAVE THE RATING SHOWN.

SOURCE: EXXON OIL SPILL RESPONSE FIELD MANUAL, 1992.
REPRINTED WITH PERMISSION FROM EXXON.

If a boom is anchored or held in place against a current or towed through the water in a catenary configuration, a considerable force can be created against the boom. The following load figures (worst condition at 90 degrees to current) show that a surprising force can be exerted against a 1500-foot boom.

Current Velocity/Tow Speed (kts)	**Load (lbs/kt)**	**Load (lbs/1500-ft)**
0.5	2.71	4,070
0.75	6.19	9,300
1.00	10.96	16,500
1.25	17.08	25,600
1.50	24.56	38,400
1.75	33.39	50,000
2.00	43.84	65,800

It has also been reported that in the case of a boom contained at both ends by anchors or vessels, the surge from a 4- to 5-foot wave can increase the current loading by a factor of five.

When towing boom in a catenary configuration to contain oil on the open water, the towing must be done at a speed less than 1.0 to 1.3 knots or entrainment beneath the boom will occur. Unless the towing vessels are closely matched in terms of power and minimum forward speed, it may be difficult to tow a boom at a constant speed. The length of boom used for catenary towing can range from a few hundred to a few thousand feet. Maneuverability is, however, greatly enhanced when boom lengths of 150 to 300 feet are used. Rope or bridles should also be used across the mouth of the booms to maintain the "V" configuration.

Booms may be towed linearly from one end at much higher speeds for fast and efficient deployment. When towed in this fashion there is only frictional drag along the boom, which is a function of boat speed. Although this type of towing typically requires little horsepower, a boat with at least a 50 horsepower motor is recommended.

For static booming, anchors should be placed every 50 to 100 feet along the length of the boom if deployed at an angle greater than 30 degrees to the direction of water flow. The anchors are attached to a buoy which is then tethered to the boom by a 5- to 10- foot line. The buoy minimizes the potential for boom submergence in high currents and allows relocation and retrieval of the anchor should waves or currents cause the anchor lines to tear away from the boom. An example of the proper boom anchoring system is shown in Figure A-4. For optimum boom positioning, particularly in high winds or currents, anchors should always be set first and then attached to the boom.

Boom deployment can be a very complicated matter. When a boom is deployed, no pockets should be formed which would trap oil instead of letting it flow to the cleanup point. Booms may also be anchored to shoreline areas as long as there is no seepage underneath the boom at the shoreline. In anchoring a boom, start upstream and let the boom float down to the anchoring point rather than working against the current.

Boom connections can also be difficult if different kinds of boom are utilized in a single operation. Most containment boom is available in 50- to 100- foot sections that must be connected together. Connectors for booms from different manufacturers are often incompatible and may require some ingenuity and items such as baling wire if they must be connected together. Even booms with "universal" connectors can be difficult to connect, particularly when the boom is under tension.

Lights are required on all oil booms that are placed in navigable waters in order to protect vessels from running into them at night. Booms and their attendant buoys usually have amber quick-flashing lights.

Skimmers

The primary means of recovering significant quantities of oil from the surface of the water is through the use of skimmers. Skimmers can be used in the advancing mode, often in conjunction with booms to increase sweep width, to recover oil on open water, or in the stationary mode to recover oil contained by booms or natural barriers.

Types

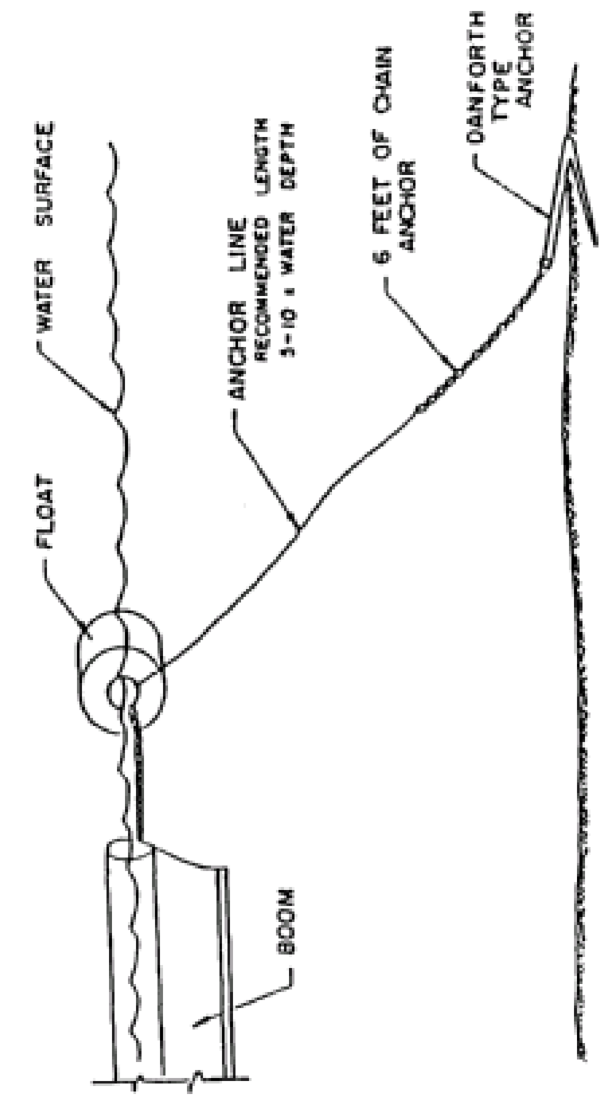
The most commonly used skimmers fall into several general categories, including:

- Weir (saucer, self-leveling, vortex, boom, suction head)

- Sorbent belt
- Disc/drum
- Rope mop

FIGURE A-4

TYPICAL BOOM ANCHORING SYSTEM



Descriptions of each of these skimmer types are provided below. Illustrations of selected examples are shown in Figure A-5.

Weir Skimmers

All weir skimmers use a slightly submerged barrier, or weir, which allows floating oil to flow over the top of the weir and into a collection sump while, at the same time, holding back water. With the exception of the weir boom skimmer, weirs are generally most effective when used in the stationary mode for recovering thicker concentrations of oil.

Standard Weir

Standard weir or saucer skimmers typically utilize a central weir and collection sump surrounded by several floats or circular serrated flotation. The floats are usually adjustable to control the depth of the weir which should correspond to the thickness of the floating oil layer (see Figure A-5a).

Vortex

The vortex weir skimmers utilize a rotating series of vanes or a propeller beneath the water to draw oil over or under a weir and into a vortex where the oil collects in a relatively water-free state. The oil is then transferred to storage using internal or external suction pumps (see Figure A-5b).

Weir/Boom

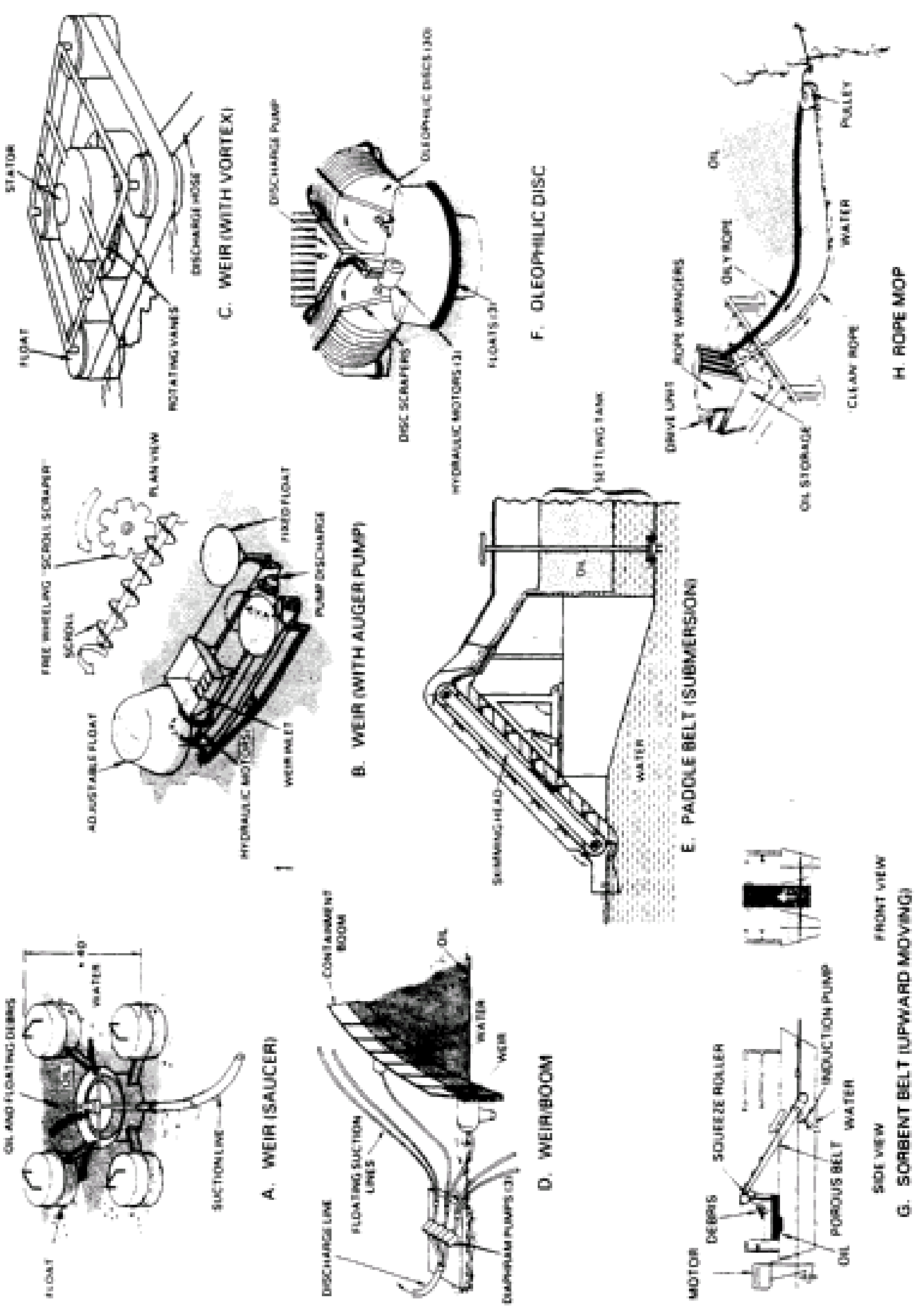
The weir/boom skimmers are used in the advancing mode and are designed to recover large spills in open water. A 35- to 40-foot-long weir section of boom can be deployed over the side of a vessel using outriggers or it may be located in the center of a longer boom towed between two vessels. Oil collected by the boom passes through a series of weirs situated within the front of the boom at the waterline and into sumps also within the boom. Pumps mounted on a raft behind the boom or within the boom itself are then used to transfer the oil to a vessel or barge for storage (see Figure A-5c).

Other Weirs

Other common weir skimmers are the self-leveling and suction head types. The self-leveling skimmers are rectangular in shape with the weir along one of the long edges. Flotation is internal with the weir depth controlled by the amount of fluid in the skimmer which, in turn, is inversely related to the pumping rate of an external suction pump. Higher pumping rates reduce the amount of fluid at the rear of the skimmer, causing it to tip forward and thereby lowering the weir depth and increasing fluid intake.

The suction head, or manta ray, skimmer floats on the water with radially displaced holes just below the surface. The suction, which is supplied by a pump, vacuum truck, or other source of vacuum, removes the surface layer of oil and water and transfers it to storage.

FIGURE A–5
EXAMPLES OF COMMON SKIMMER TYPES



Sour   aldez Oil Spill Technology, Exxon, 1989.
Repri   with permission from Exxon.

Disc/Drum Skimmers

These skimmers rely on the adhesion of oil to the surface of rotating discs or a drum which are partially submerged in the water. An array of discs or a single drum is rotated up through the oil/water interface where the oil adheres to the surfaces. The oil is then removed by static scrapper blades and channeled to an internal collection sump. The oil is transferred to storage via internal or external pumps. An example of a disc skimmer is shown in Figure A-5d. Most disc and drum skimmers are used in the stationary mode.

Sorbent Belt Skimmers

These skimmers utilize a moving, endless oleophilic belt suspended on rollers and angled down towards the front of the skimmer so that the bottom portion of the belt penetrates the water surface (see Figure A-5e). The belt selectively adsorbs oil and rejects water. Oil and floating debris are transported up the belt where the debris is scraped off into a bin and the oil is squeezed out of the belt and into a storage tank. Some belt skimmers use a downward moving belt angled toward the rear. In this case the oil is forced under the water and then allowed to rise into a collection well at the back of the skimmer. Oil adhering to the belt is also squeezed out by a series of rollers.

Most sorbent belt skimmers are built into a small vessel that includes onboard storage and a transfer pump (i.e. Marco and U.S. Navy skimmers). These skimming vessels are typically used in the advancing mode to recover large spills in open water and would not be applicable to spills from the Pipeline operations unless a large spill were to migrate into a large lake, river, or the Gulf of Mexico. Smaller versions of these skimmers can be used in the stationary mode, particularly if an induction pump is fitted behind the belt to draw oil into the skimmer.

Rope Mop Skimmers

Rope mop skimmers pull an endless, oleophilic standard rope along the surface of the water where it absorbs floating oil (see Figure A-5f). The rope mop is positioned in the water by one or more tail pulleys anchored to the shore or the river bottom. Outriggers may also be used to position the pulleys if deployed off the side of a vessel. Rollers within the skimmer unit wring oil from the rope mop as it passes through. The clean rope continues back into the water and oil in a continuous loop. Recovered oil drains to a collection sump at the base of the unit.

Rope mop skimmers are generally available as relatively small, portable units and used in a stationary mode. A few manufactures such as Oil Mop and CSI also make advancing vessel units which incorporate a catamaran type hull and have several rope mops rotating from bow to stern. The rope speed is matched to that of the vessel, resulting in a zero relative velocity which maximizes contact time between the mop and oil.

Effectiveness

Skimmer effectiveness will typically vary with the skimmer type, oil viscosity, slick thickness, and environmental conditions. In general, weir, disc and sorbent belt skimmers perform well with low viscosity oils such as diesel, jet fuel, gasoline, etc. Weir skimmers are better suited for recovering oil with thicknesses greater than 0.25 inches as otherwise they tend to recover large quantities of water along with the oil. Sorbent belt skimmers are best suited for medium to heavy viscosity oils and often require a special belt for use in recovering light, low viscosity oils. Belt, oil mop, and, to some extent, disc skimmers are less affected by waves and wind than most weir types.

Skimmer Selection

To assist the Operations Supervisor in selecting the most appropriate skimmer for the particular situation, the matrix shown in Figure A-6 can be referenced. The matrix lists the commonly available skimmers and the performance criteria by which they can be evaluated. Some judgement is required as the ratings are independent of the size of the skimmer with respect to some criteria but directly proportional to skimmer size for other criteria. A high rating in any given case means that a commercial version of that skimmer type is available that will provide the indicated performance.

FIGURE A-6

SKIMMER SELECTION MATRIX

Legend

1 – Good
2 – Fair
3 – Poor

Notes

cSt – Centistokes
Hs – Significant Wave Height
V – Velocity of Surface Current

Evaluation Criteria		Generic Type of Skimmer: Oleophilic Surfaces – Brush	Oleophilic Surfaces – Disc	Oleophilic Surfaces – Rope	Oleophilic Surfaces – Rope/Belt (Catamaran Mounted)	Oleophilic Surfaces – Sorbent Belt (Downward Moving)	Oleophilic Surfaces – Sorbent Belt (Upward Moving)	Weir – Advancing	Weir – Combination Weir/Boom	Weir – Saucer	Weir – Screw/Auger	Weir – Self-Leveling	Weir – Vortex	Vacuum Units – Vaccuum System with Weir Skimmer Head	Hydro-dynamic Devices – Hydrocyclone	Hydro-dynamic Devices – Submersion Plane	Hydro-dynamic Devices – Water Jet	Other Methods – Combination Trawl/Boom	Other Methods – Paddle Belt
Operating Environment	Open Seas Hs > 3 Ft.; V < 1 Kt.	2	2	1	1	1	1	2	2	3	3	3	2	3	3	3	3	1	3
	Harbors and Bays Hs < 3 Ft.; V < 0.7 Kt.	1	1	1	1	1	1	1	1	2	3	3	1	2	3	2	2	1	3
	Protected In-shore Hs < 1 Ft.; V < 0.5 Kt.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	High Currents < 2 Kt.	2	3	2	1	1	2	1	2	3	2	3	2	3	2	2	2	2	2
	Shallow Water (< 1 Ft.)	2	2	1	3	3	3	3	3	1	3	2	2	1	3	2	3	2	1
	Debris (Including Ice)	1	3	1	1	2	1	2	3	3	2	3	3	3	3	3	2	3	2
Oil Viscosity	High Viscosity (>1000 cSt)	1	2	2	2	2	1	2	2	2	1	3	2	2	3	2	1	1	1
	Medium Viscosity (100–1000 cSt)	1	1	1	1	1	1	1	1	1	1	1	1	1	3	1	1	2	1
	Low Viscosity (<100 cSt)	1	2	2	2	1	3	1	1	1	2	1	1	1	3	1	1	2	2
Skimmer Characteristics	O/W Pickup Ratio*	1	2	1	1	2	2	2	2	3	2	3	2	3	3	2	2	1	2
	Pickup Rate	2	2	3	2	2	2	2	1	2	3	3	2	3	2	2	3	2	2
	Ease of Deployment	1	1	2	1	1	1	2	3	1	2	1	2	1	2	3	2	3	2
Available as V.O.S.S. (Vessel of Opportunity Skimming System)		X	X	X			X		X	X	X	X	X					X	X
Available as an Advancing Skimmer		X			X	X	X	X	X						X	X		X	X
Available with Storage		X	X		X	X	X	X							X	X	X		X

* O/W Pickup Ratio = % Oil in Skimmed Products

Source: Exxon Oil Spill Response Field Manual, 1992.
Reprinted with permission from Exxon.

To use the skimmer selection matrix, the sequence of steps is as follows:

1. Identify the operating environment and select those skimmers that will perform well in that environment (rating of 1).

2. Identify the type of oil that the skimmer will have to recover (most refined products are considered low viscosity unless emulsified). From those chosen above in Step 1, select skimmers with a 1 rating for the viscosity of oil to be recovered.

3. From the skimmer characteristics listed, prioritize those that are most important to the user or most applicable to the situation. From those skimmers selected in Steps 1 and 2, chose the one(s) with the highest ranking in this step.

Technique Descriptions

Detailed descriptions of each of the containment, recovery, and protection techniques applicable to the Pipeline operations and downstream areas are provided in the following sections. The letter designations of each technique correspond to those given in the various response decision and technique selection guidelines in Section 4.0.

A. CONTAINMENT/DIVERSION BERMING

Common Applications

Low barriers are constructed of available materials (e.g., earth, gravel, sorbents, sandbags, etc.) and used to contain or divert surface oil flow on relatively flat or low-sloped terrain or wetlands.

General Instructions

Use earthmoving equipment or manual labor to construct containment berms by forming materials into windrows or ridges in a "horseshoe" configuration. The width of the containment opening should exceed that of the leading edge of the oncoming product. Berm height and the size of the containment area are dependent upon the quantity of the product and the slope of the area.

In areas with a high groundwater table or high soil permeability, the containment area may be flooded or at least wetted with water and/or lined with plastic sheeting to inhibit the oil penetration into the soil. This technique is shown in Figure A-7.

Diversion berms are constructed in the same manner as containment berms but with the purpose of diverting overland flow to a natural or artificial containment area. The containment areas could consist of natural depressions in the topography, raised roadways or rail beds, dry stream beds or drainage courses, sumps or drains, etc. Examples of diversion berming are shown in Figure A-8. Diversion berms are used primarily when the quantity of oil, nature or slope of the terrain, implementation time, or other influencing factors prevent the use of containment berms.

Logistics

The logistics for containment/diversion berming will depend on the size of the spill, nature of the terrain, equipment availability, and availability of berm materials. In general, implementation will require:

- Berm construction - heavy equipment (motor grader, bulldozer, front-end loader) or hand tools.

- Berm materials - soil, sand bags, sorbents, gravel, etc.
- Berm liners- plastic sheeting, geotextiles, pond liners, etc.
- Recovery equipment - pumps, vacuum trucks, skimmers, sorbents, storage containers, and/or heavy equipment for contaminated soils.
- Miscellaneous - hose, water source, water pumps, plastic bags, etc.

Limitations

- Potential fire and explosion hazard.
- Implementation time and accessibility.
- Highly permeable soils.
- Rugged terrain.
- Environmental damage inflicted by berm material excavation.

FIGURE A-7
Earthen Containment Berm

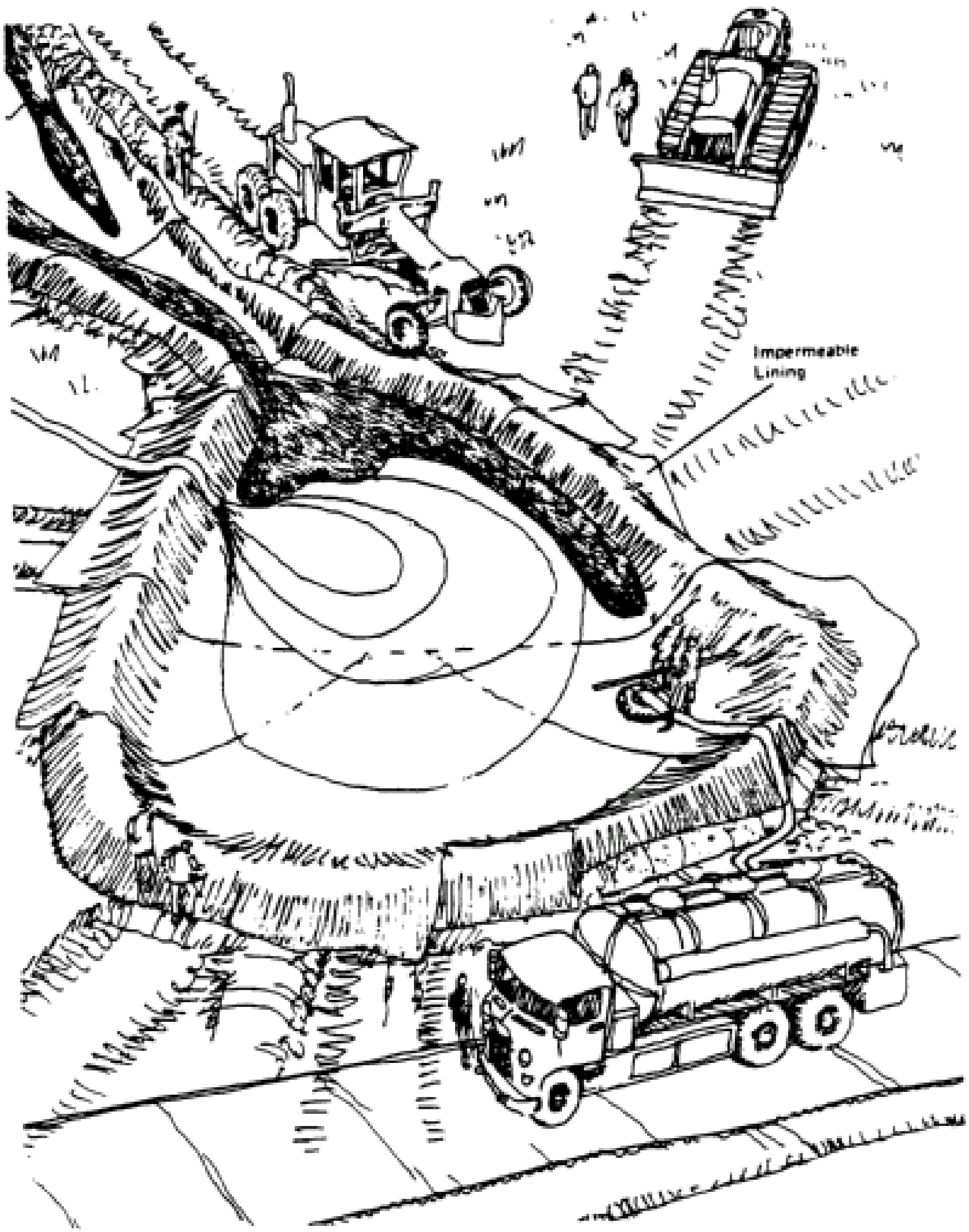
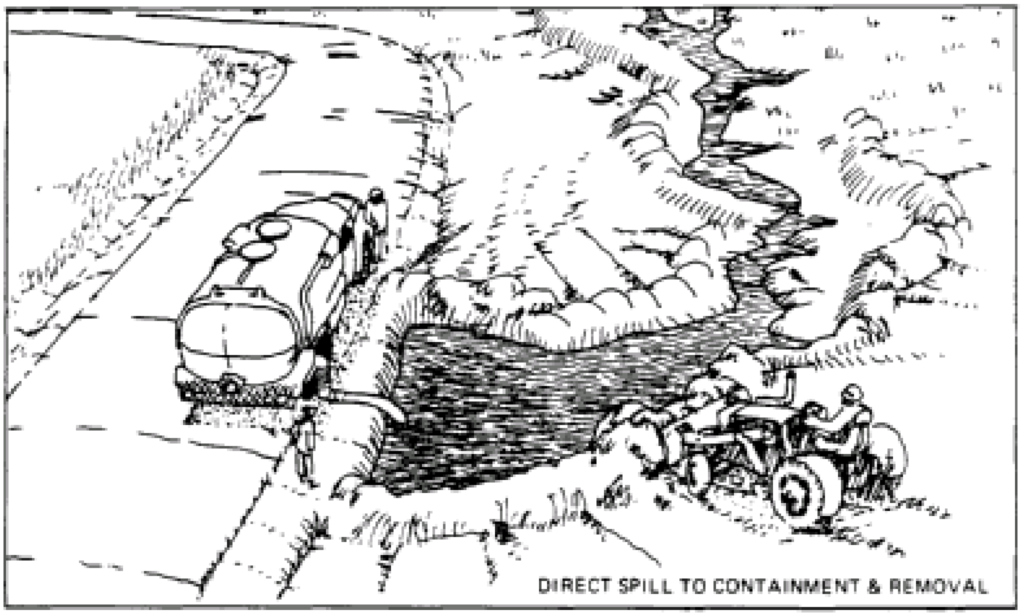
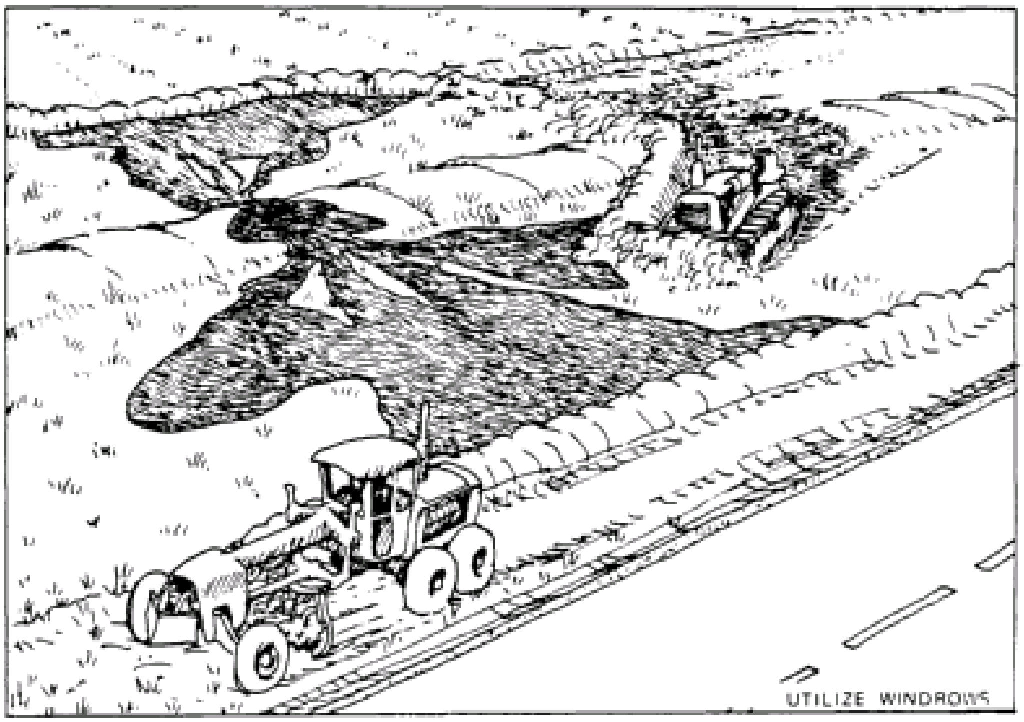


FIGURE A-8

EARTHERN DIVERSION BERMS





A-19

B. STORM DRAIN BLOCKING

Common Applications

Tarps, plastic sheeting, boards, sandbags, earthen materials, and/or specially constructed devices are used to block or minimize the flow of oil into storm drains.

General Instructions

For storm drains installed at grade and typically found within oil storage facilities, parking areas and on public streets, the drain inlet can be covered with an impermeable material (plastic sheeting, tarp, board, etc.) which is, in turn, covered with earthen materials or sandbags to seal the edges and secure in place. Specially constructed mats can also be used which generally provide better sealing. For curb inlets, if present, a board should be positioned over the opening and held in place with a sandbag or large rock. Both techniques are shown in Figure A-9.

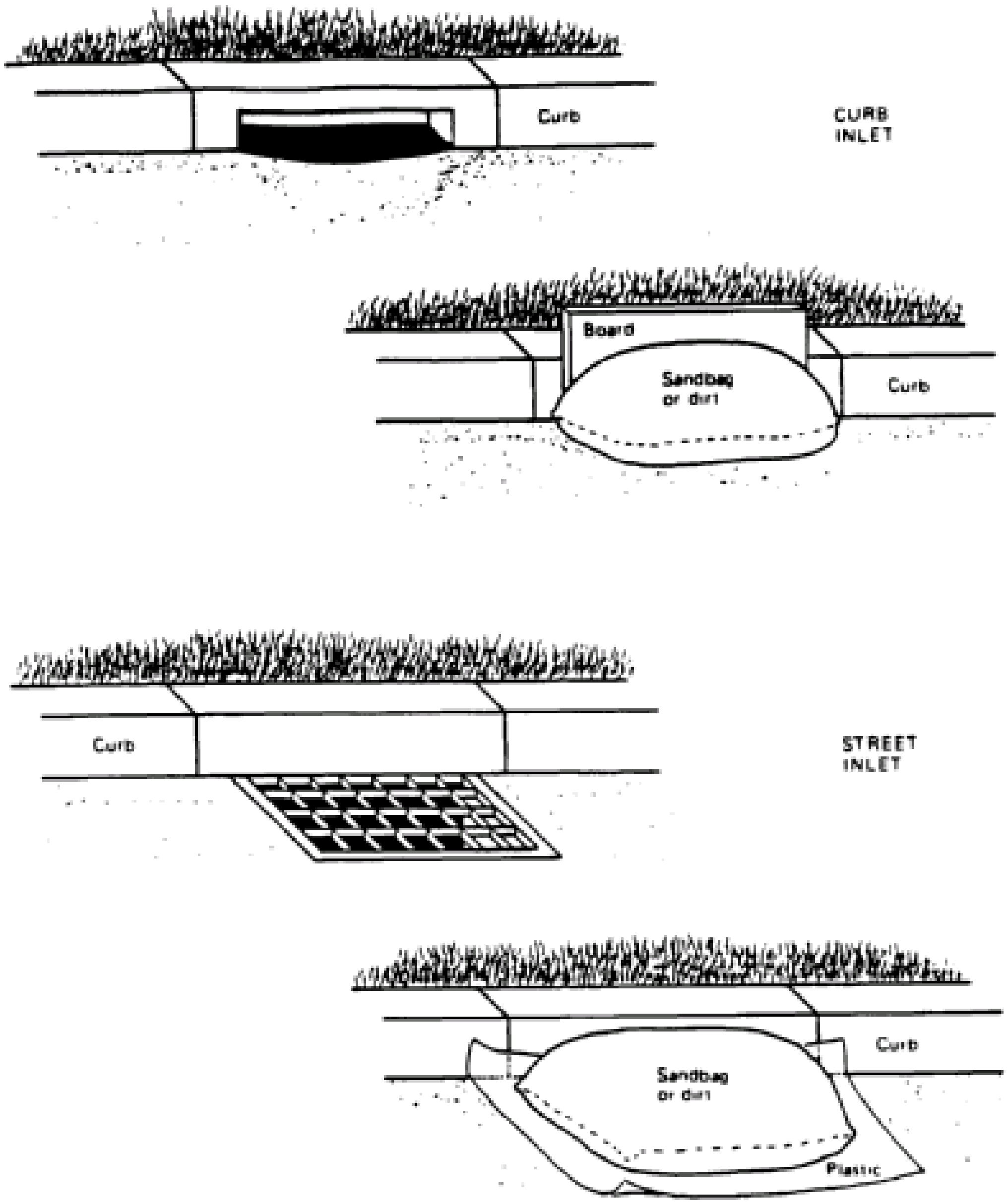
Logistics

- Blocking materials - tarps, plastic sheeting, boards, special mats, earthen materials, and/or sandbags.
- Equipment - hand tools.
- Cleanup - pumps, vacuum trucks, sorbents, and/or heavy equipment if contaminated soil is present.

Limitations

- Potential fire and explosion hazard.
- Implementation time and accessibility.
- Material availability.

FIGURE A-9
Storm Drain Blocking Techniques



A-22

C. BLOCKING DAMS

Common Applications

Dams are constructed across streambeds, ditches, or other drainage courses to block and contain flowing product while not obstructing any waterflow that may be present.

General Instructions

Dam locations should have high banks on the upstream side with the dam well keyed into the banks. Construct dam with on-site or nearby earthen materials, sandbags, plywood sheets, etc. Use heavy equipment or manual labor to excavate materials from the upstream side to increase dam storage capacity. If possible, cover the upstream side of the dam and storage area with plastic sheeting to minimize permeability (see Figure A-10) and/or flood with water or similar material.

If flowing water is present, an inclined pipe should be positioned through the dam to permit the water to pass through (Figure A-11). The pipe must have a flow capacity greater than that of the water and must be installed with the lower end on the dam's upstream side. The height of the raised end will determine the water level behind the dam as shown in Figure A-11a. In the event a suitable pipe is not available, water can be allowed to flow over the dam provided a boom has been positioned behind the dam to contain the oil and plastic sheeting has been used to prevent erosion of the dam (Figure A-11b). It is also possible to pump or siphon water over the dam (Figures A-11c and A-11d, respectively) but it can be extremely difficult to match the pump/siphon rate to the stream flow.

Logistics

The logistics required for dam construction will vary depending on the size of the drainage course, equipment and material availability, and the presence or absence of water. In general, the logistical requirements are:

- Dam construction - heavy equipment (bulldozer, backhoe, front-end loader) or hand tools.
- Dam materials - adjacent soils, sandbags, gravel, plywood, underflow pipe, etc.
- Dam liners - plastic sheeting, geotextile, or equivalent.

- Recovery - pumps, vacuum trucks, skimmers (if water is present), sorbents, product storage containers, and/or heavy equipment for contaminated soil removal.
- Miscellaneous - hoses, boom (if required), plastic bags, etc.

Limitations

- Potential fire and explosion hazard.
- Implementation time and accessibility.
- Storage capacity

FIGURE A-10
Sand Bag Blocking Dam

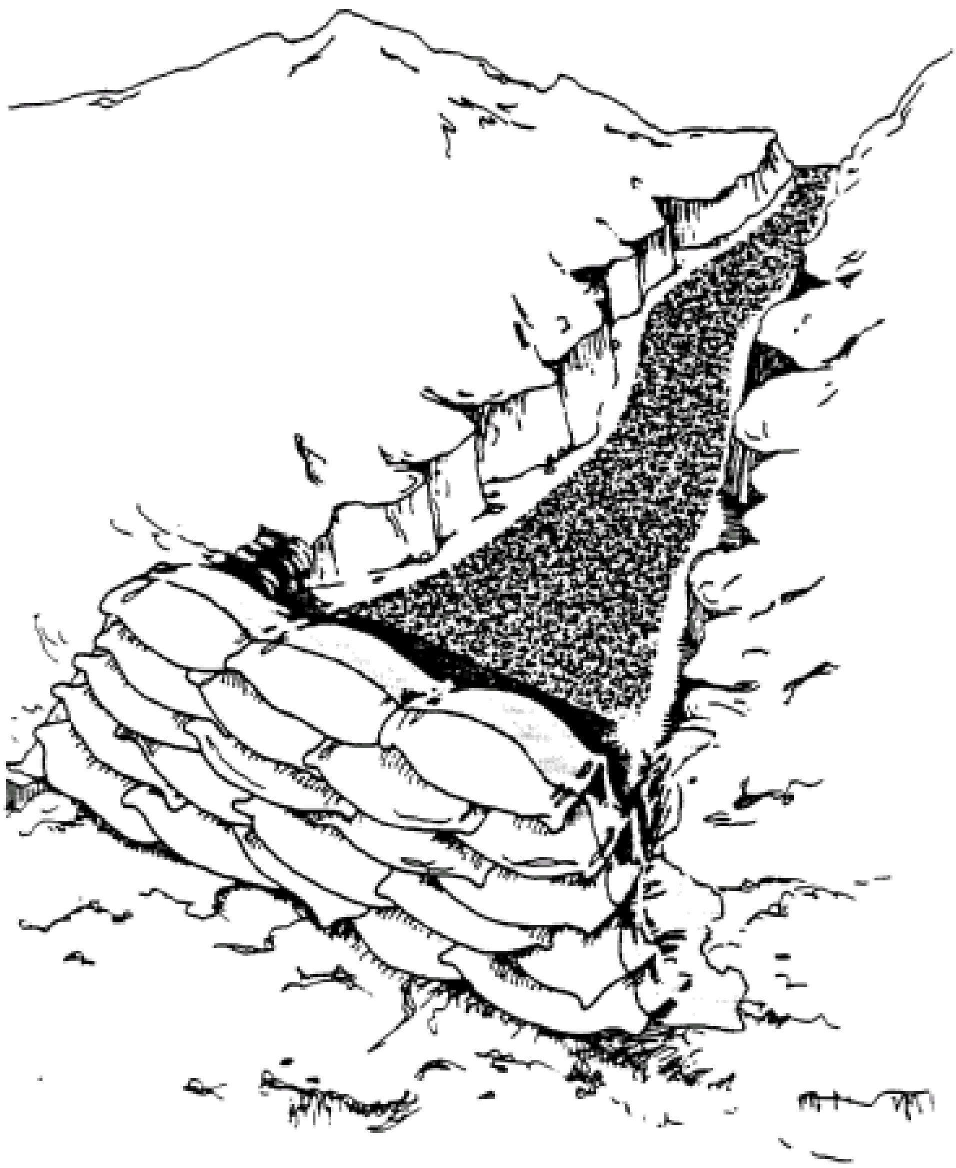
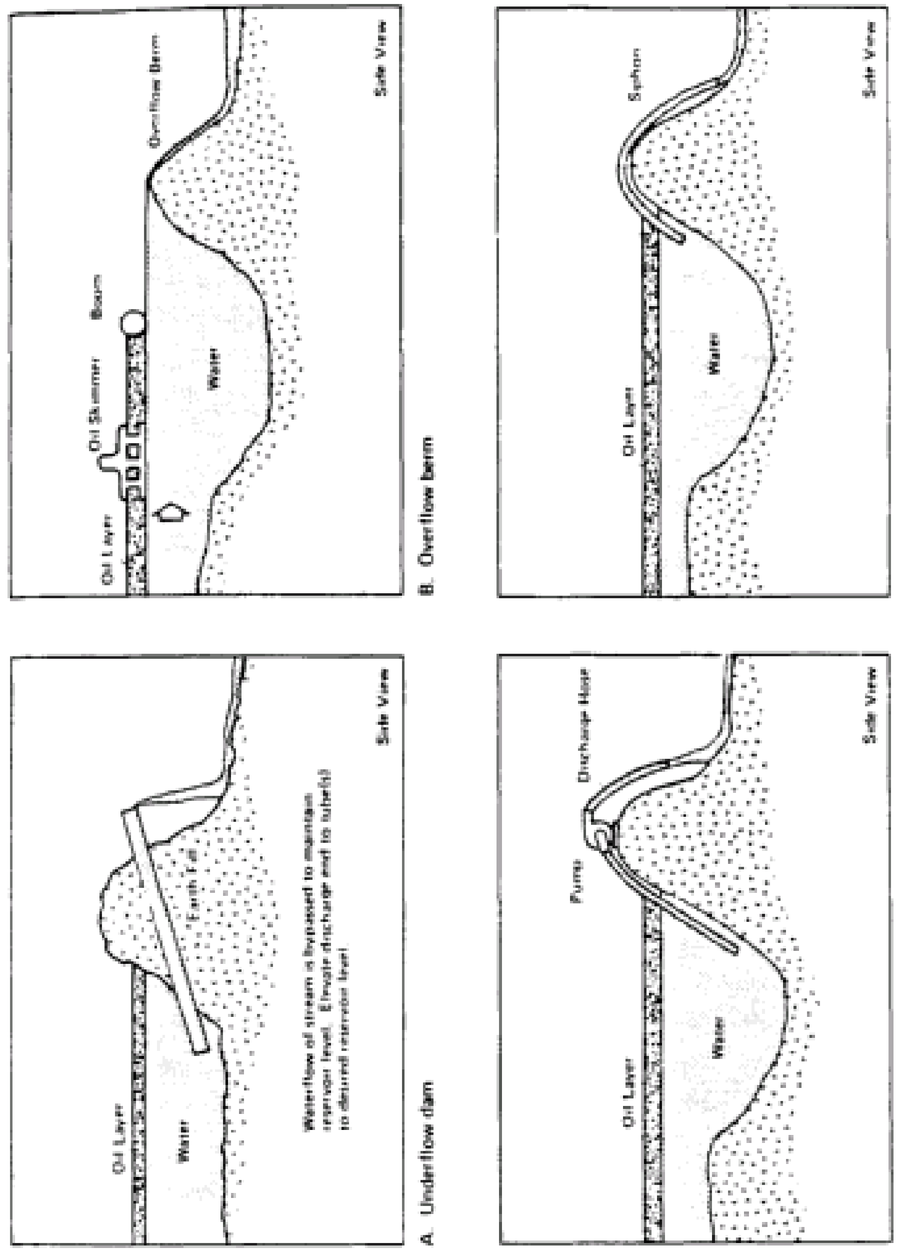


FIGURE A–11
FLOWING WATER BLOCKING DAMS



A. Underflow dam

B. Overflow berm

C. Overflow dam with pump

D. Overflow dam with siphon

D. CULVERT BLOCKING

Common Applications

Boards, earthen materials, sand bags, inflatable plugs, or similar materials are used to block culverts as a means of containing oil flowing in drainage courses that feed the culverts. Culvert blocking may also be used to prevent oil in a river from entering channels or backwater areas that are connected to the river through a culvert.

General Instructions

Block culverts by piling soil, gravel, or similar materials over the upstream end, thereby creating a containment dam. Sandbags or plywood are also effective (see Figure A-12), as are inflatable plugs, if available. Space permitting, an underflow pipe similar to that described for blocking dams (Technique C) can be installed within the culvert to allow water, if present, to pass through. The water can also be removed by pumping or siphoning.

If insufficient storage is available upstream of the culvert, it may be advantageous to allow the oil to flow through the culvert and contain it on the downstream side. Blocking dams or containment/diversion berms, Techniques C and A respectively, can be utilized to contain the product at locations with adequate storage capacity.

Logistics

The logistics required for culvert blocking will depend on the size of the culvert and the available materials. In general, the logistical requirements for culvert blocking are:

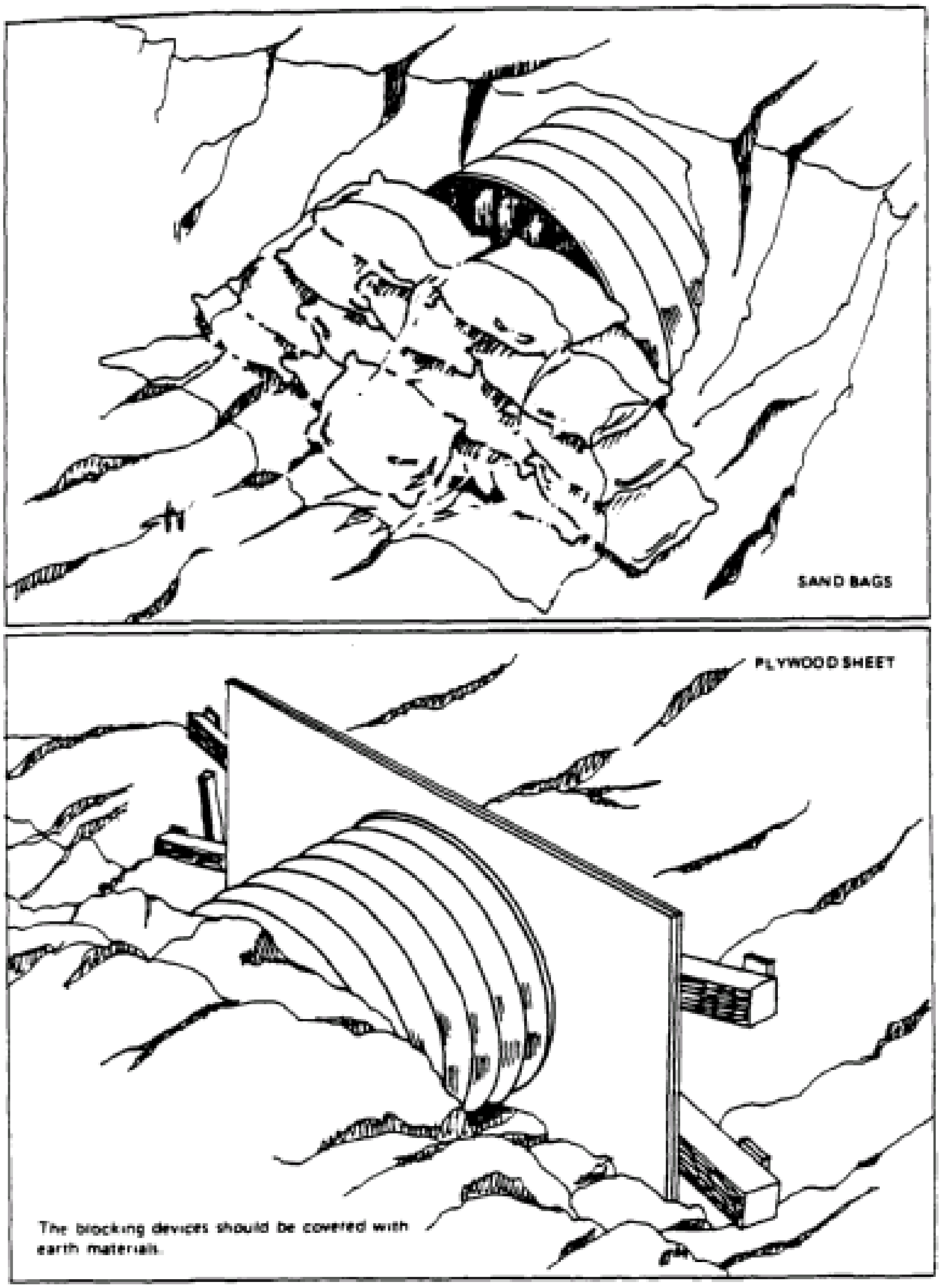
- Construction - heavy equipment (front-end loader, backhoe) or hand tools.
- Materials - plywood, earthen materials, or inflatable plugs are preferable but sandbags, sheetmetal, or other similar materials will suffice.
- Recovery - pumps, vacuum trucks, skimmers, sorbents, storage containers, and/or heavy equipment for contaminated soils.

- Miscellaneous - nails, stakes, rope, or other means of holding plywood in place; hose, fittings, plastic bags, personal protective equipment for recovery, etc.

Limitations

- Potential for fire or explosion.
- Implementation time and accessibility.
- Storage area behind culvert.
- Flowing water.
- Material availability.

FIGURE A-12
Culvert Blocking



The blocking devices should be covered with earth materials.

E. INTERCEPTION TRENCHES

Common Applications

Trenches are excavated downgradient of a spill to intercept and contain surface or subsurface oil flow.

General Instructions

Trenches should be excavated at right angles to the slope of the terrain and/or the oil flow. Local terrain may dictate that the trench be angled upslope at either end for complete containment. The trench depth and width (i.e., containment capacity) depends, in part, on the quantity of oil to be intercepted and the type of recovery device to be used. If groundwater is present, a skimmer would be the most effective means of recovery and may require that a portion of the trench be widened to accommodate the skimmer. If subsurface flow is involved, the trench should also extend 18 inches below the migrating oil. The downstream side and bottom of the trench should be covered with plastic sheeting or a similar impermeable material to inhibit penetration and continued downgradient migration. This technique is shown in Figure A-13.

If no surface flow is visible but subsurface oil migration is suspected, the direction of movement must be determined before a trench is excavated. Subsurface flow will typically follow the slope of the terrain, although a reconnaissance of the area should be conducted to identify potential indicators such as stained soil, dead or stressed vegetation, odor, or standing pools of oil. Exposed sides of gullies or other drainage courses should be checked for evidence of seepage.

Test pits or soil borings can also be used to positively identify the extent of flow and establish the optimum trench location.

Logistics

The logistics for the excavation of interception trenches or barriers will depend primarily on the method used, the size of the spill, presence of subsurface flow, and accessibility. In general the logistical requirements for this technique are:

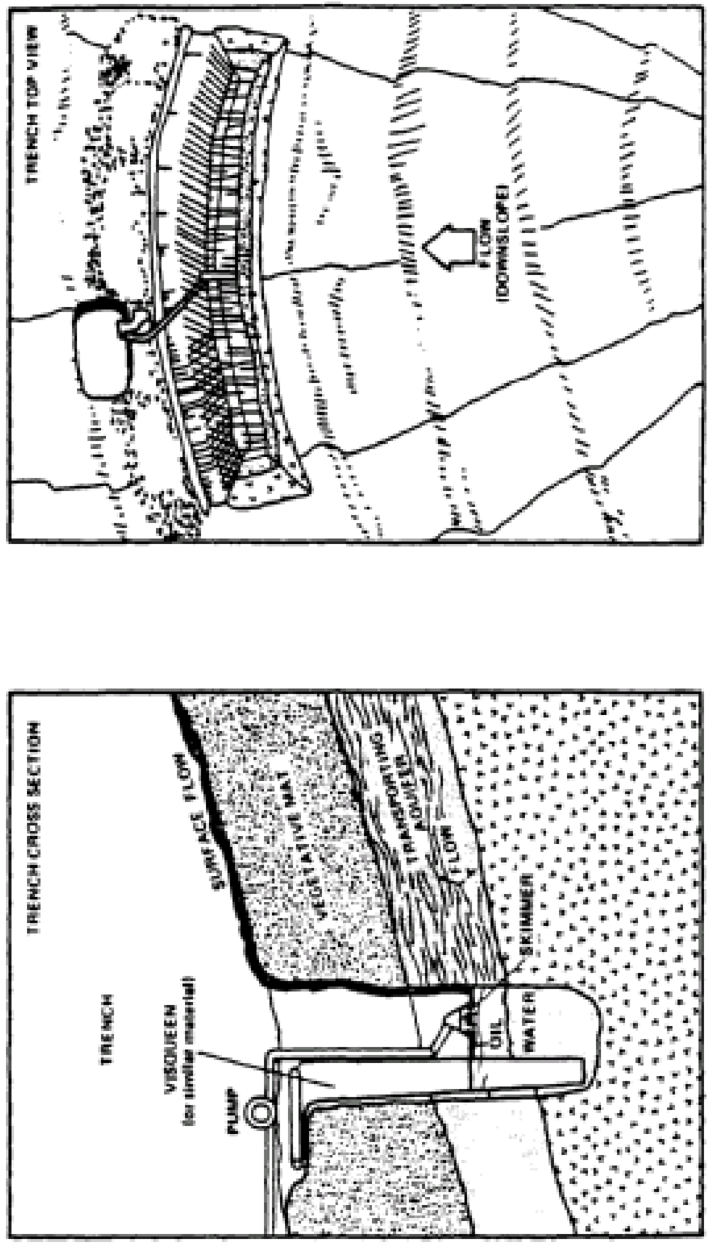
Construction - backhoe and/or hand tools or pneumatic hammers if barriers are to be driven into the ground (soft sediments only).

- Materials - plastic sheeting for trenches or plywood, sheet piling, or similar material for barriers.
- Recovery - pumps, vacuum trucks, sorbents, skimmers (if water present), storage containers, and/or heavy equipment for contaminated soils.
- Miscellaneous - hoses, fittings, plastic bags, additional supports for barriers, etc.

Limitations

- Potential fire or explosion hazard.
- Implementation time and accessibility.
- Highly permeable substrate.
- Availability of materials.
- Unknown direction of subsurface flow.
- Unconsolidated substrate and subsequent sloughing of trench walls.

FIGURE A–13
Interception Trench



F. SHORELINE CONTAINMENT BOOMING

Common Applications

Booms are deployed in a semi-circle along a shoreline to contain oil that is entering the water from an upgradient terrestrial spill.

General Instructions

Anchor one end of the boom to the shoreline downstream of the oil's entry point. Using a boat, pull the other end around the leading edge of the slick and anchor it to the shoreline upstream of the entry point. Additional anchors will likely be required along the boom to prevent currents and wind from pushing the boom against the shoreline and allowing oil to escape from underneath it.

In high current areas, the boom should be anchored in an elongated triangular configuration with the peak of the triangle slightly offshore of the product's entry point (see Figure A-14). This will minimize current related stress on the boom and facilitate recovery by diverting the product to the downstream shoreline anchor point. Anchors should be located every 50 to 100 feet depending on the currents. Anchor line length should be approximately 5 times the water depth. Floats should be attached to the anchor line 5 to 10 feet from the boom to prevent boom submergence in high currents and enable crews to locate the anchor should the anchor line separate from the boom. The anchors, with lines and floats, should be set in place prior to being attached to the boom to minimize the effects of currents and wind on anchor/boom placement.

Logistics

The logistics will vary primarily with the width of the spill at the entry point into the waterway and the wind and current speeds. Typically, the wider the entry point, the more boom that will be needed, and the higher the winds and currents, the greater the number of anchors that will be required. The general logistical requirements for shoreline containment booming are:

- Deployment - boat with adequate towing power, 2 to 3 workers.

- Equipment - minimum of 100 feet of boom, 3 anchors with the associated float(s) and anchor line, 2 to 3 workers, and hand tools.
- Recovery - skimmer, pump, vacuum truck, sorbents, hand tools and/or heavy equipment for contaminated soil removal.
- Miscellaneous (as required) - hoses and fittings for recovery equipment, boom towing bridles/lines, boom connectors (as required), plastic bags for oiled debris, storage containers, boom lights, personal protective equipment, etc.

Limitations

- Potential fire and explosion hazard.
- Implementation time and accessibility.
- Strong currents could preclude boom deployment and anchoring.
- Excessive water depths could adversely affect boom anchoring.

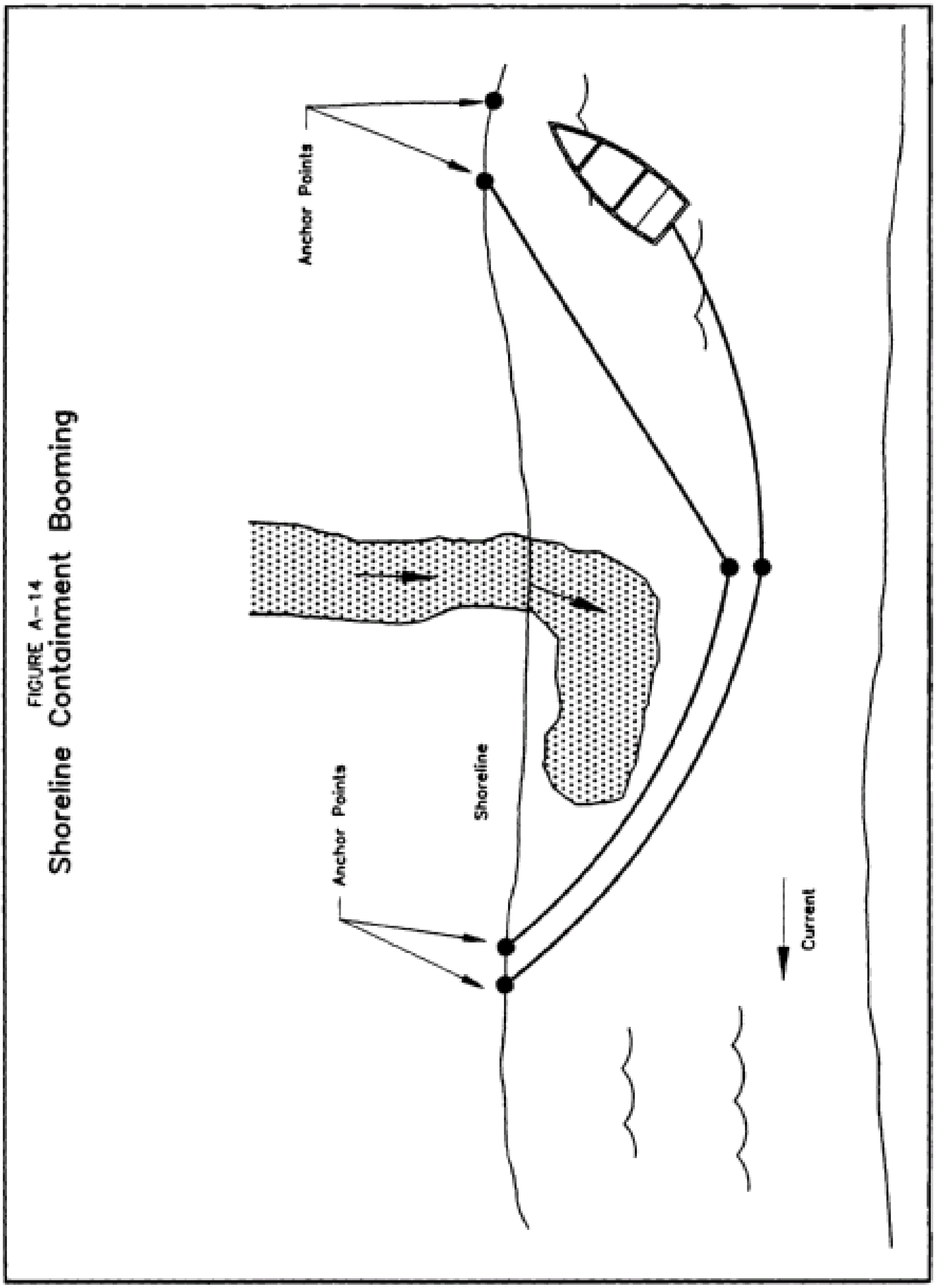


FIGURE A-14
Shoreline Containment Booming

A-34

G. OPEN WATER CONTAINMENT BOOMING

Common Applications

Used on open water or near a shoreline to surround all, or portions of, an approaching oil slick as a means of protecting shoreline areas and facilitating oil recovery. Generally used where the oil slick does not cover a large area.

General Instructions

Oil on water forms a slick and spreads into shapes dictated by surface currents, winds, and physical boundaries. In the absence of boundaries, currents, and winds, a circular stick will form. An elliptical or triangular shape is formed by moderate or strong surface currents and winds, respectively. The slick will widen (spread) as it moves away from its source. Wave action, generally caused by wind and currents, will rapidly distort these shapes, eventually forming streamers or windrows of oil. Therefore, it is important to try to contain an oil spill before it becomes too wide for effective containment and/or breaks into streamers.

The direction of wind and current must be considered in deploying booms. Booms should be deployed using two vessels and beginning in the downwind or down-current direction, around the leading edge of the floating slick, and then back into the wind or current. If the boom is stored on one vessel, that vessel should remain in place while the second vessel, using a 25- to 50-foot tow line, pulls the boom off the back and into the water in the direction of the wind or current. If the boom is already in the water, one vessel should pull it downwind or down-current alongside and around the leading edge of the slick (Figure A-15a). The second vessel takes up the trailing end of the boom and both vessels proceed to tow the boom up either side of the slick as shown in Figure A-15b. This method will minimize the amount of time the boom is pulled perpendicular to winds or currents.

The vessels moving in unison can "sweep" through or across the leading edge of a larger slick making several passes and containing much more oil than if maintained in a stationary configuration. This "sweeping" technique can also be used to collect small patches of oil or streamers.

Once the slick or a significant amount of oil is contained within the boom, the ends can be brought together and, if desired, attached to form a closed containment area as shown in Figure A-15c. Skimmers can then be placed inside the boomed area to recover the oil. The oil will tend to concentrate against the boom in the direction of the wind and current. The skimmer should be located in this area and continually repositioned to skim the thickest area. If a portable skimmer is used, it should be deployed from a vessel situated outside the containment boom to minimize potential fire hazards (Figure A-15d). When skimming becomes inefficient, sorbent pads or rolls can be used to recover the remaining oil. Sorbents may also be used to recover small spills when skimmer deployment is not warranted.

Logistics

The equipment and manpower requirements depend primarily on the size of the slick to be contained. Heavy-duty or exceptionally long booms may require additional personnel for handling but would usually be limited to two or three workers per vessel. The general logistical requirements for open water containment booming are:

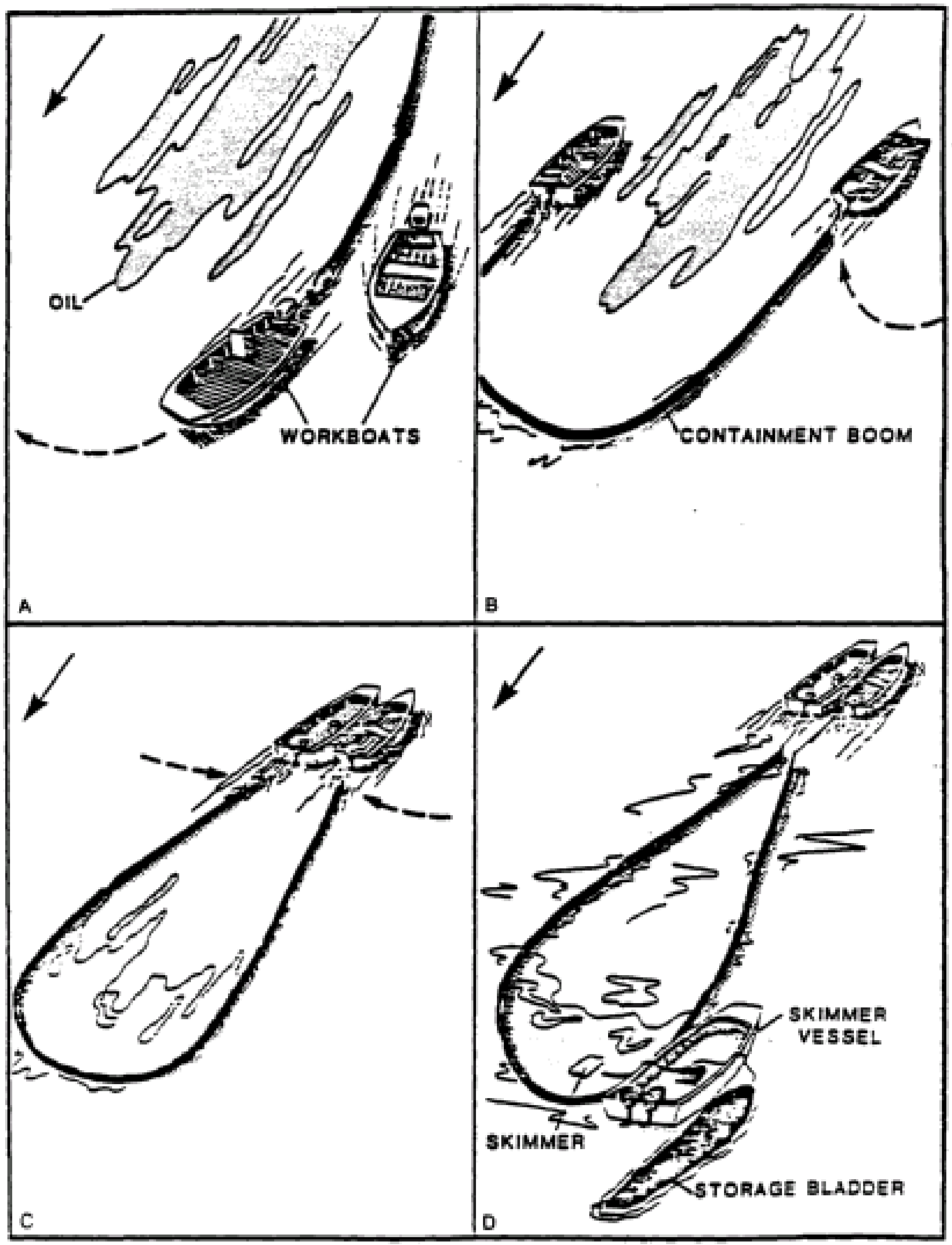
- Deployment - 2 work boats (25 to 50 feet), and 2 to 3 workers per boat.
- Equipment - 300 to 500 feet of containment boom, 2 50-foot tow lines, towing bridles, connectors, etc.
- Recovery - skimmer, sorbents, pump, or vacuum system.
- Miscellaneous (as required) - plastic bags, storage containers, personal protective equipment, hoses and fittings for recovery equipment, etc.

Limitations

The primary limitations to containment booming are:

- Wave heights (chop) >2 feet.
- Current and/or towing speeds >1 knot.
- Tensile strength of boom for lengths >300 feet.
- High winds.
- Towing capacity of vessels.

FIGURE A-15
Open Water Containment



H. NARROW CHANNEL CONTAINMENT BOOMING

Common Applications

Booms are deployed at an angle across a channel, slough, or other relatively narrow waterway to contain oil passing through the channel. Deploying the boom at an angle minimizes entrainment of oil beneath the boom and directs the oil to the downstream shoreline for recovery.

General Instructions

Anchor one boom end to the shoreline at the upcurrent side of the channel and, with a boat, pull the other end across the waterway and anchor it slightly downstream. A winch or vehicle situated on the opposite shore can also be used to pull the boom across the waterway. The optimum deployment angle depends on the current speed, boom length, and boom stability. Higher currents and longer boom lengths generally require a smaller angle to minimize entrainment of oil beneath the boom. Lower-stability boom types will also often require smaller angles. The boom may be anchored in several places to improve stability. Specially constructed booms with netting along the bottom of the skirt are particularly applicable to high current conditions. Multiple booms may also be necessary in high current areas.

Anchors placed in the waterway should be fitted with an anchor line approximately 5 times the water depth. A float should be fitted to the line 5 to 10 feet from the boom to prevent boom submergence in high currents and to enable crews to locate the anchor should the anchor line separate from the boom. Anchors should be set in place before attaching them to the boom to minimize the effects of currents and winds on boom placement.

Oil is recovered from the downstream end of the boom with skimmers, pumps, or vacuum trucks. A containment pit can be dug into the shoreline to facilitate oil recovery as shown in Figure A-16.
For wider waterways, deploy booms from each side with one slightly downstream of the other. Anchor the free ends to overlap somewhat past midstream. If sufficient boom is unavailable, deploy a single boom from the side of the river with the heaviest

concentration of oil or from the outside shore of a bend in the river where oil concentrates naturally. Both variations are shown in Figure A-17.

Logistics

The equipment and manpower requirements will primarily depend on the width of the waterway and the current speed. In general, the logistical requirements for narrow channel containment booming are:

- Deployment - small boat, winch, or vehicle to tow boom across waterway and 2-3 workers.
- Materials - boom (width of channel plus approximately 10 to 20 percent), anchors (1 per 25 to 75 feet), anchor line and floats, hand tools, and backhoe or shovels to excavate containment pit.
- Recovery - Skimmer, pump, vacuum truck, or sorbents.
- Miscellaneous (as required) - hose and fittings for recovery equipment, plastic bags, personal protective equipment, storage tanks, etc.

Limitations

- Potential for fire or explosion.
- Implementation time and accessibility.
- High currents (>2.5 knots).
- Equipment availability.

FIGURE A-16
Narrow Channel Containment Booming

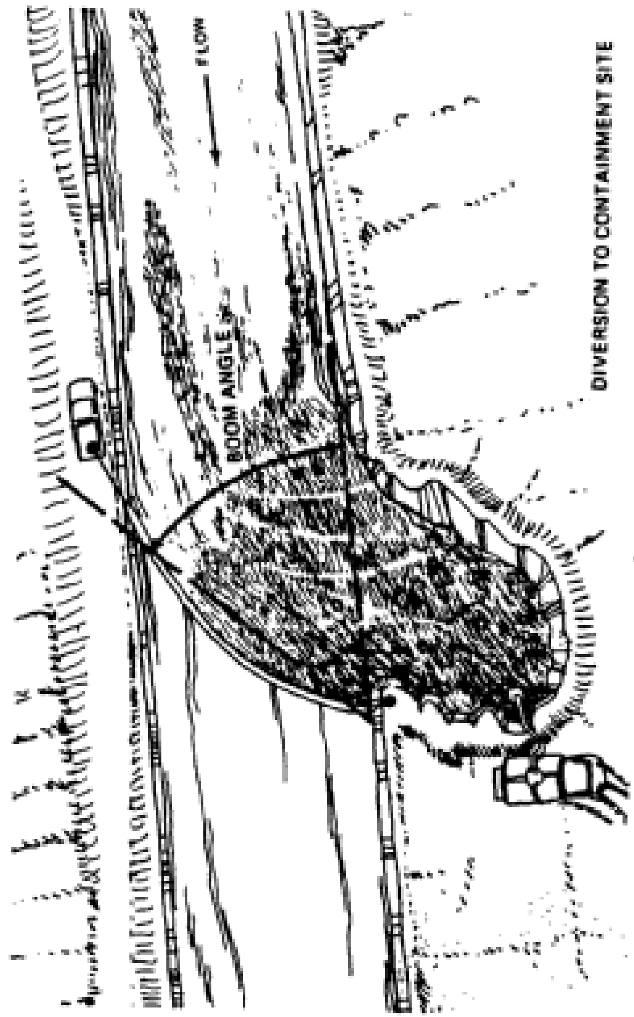
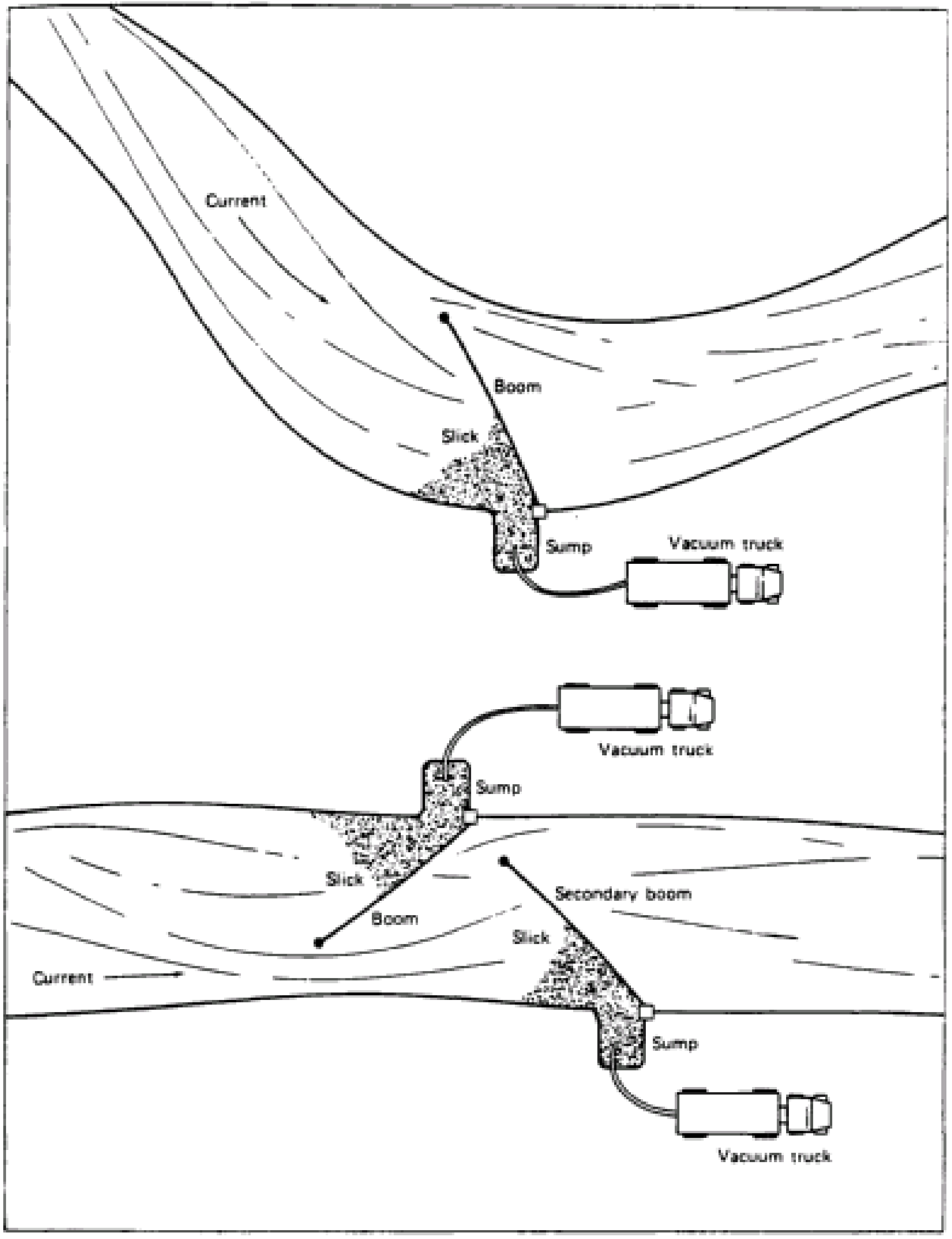


FIGURE A-17

WIDE CHANNEL CONTAINMENT BOOMING



A-41

I. SORBENT BARRIERS

Common Applications

Used primarily on narrow and shallow waterways with low current speeds to contain oil floating along the waterway or exclude oil from entering it.

General Instructions

Permeable barriers are constructed on-site and made of wire screen or mesh and sorbents. They offer the advantages of non-interference with flow, conformance with bottom configuration, and response to minor water level variations. Unless currents are strong enough to continually hold the sorbents against the screen, double sided barriers are recommended to prevent wind from dispersing sorbents. A diagram of a typical permeable barrier is shown in Figure A-18.

While a variety of screen and mesh fencing is available, heavier materials are recommended. When subjected to high currents and debris, lighter material, such as chicken wire, will often fail.

To construct the barrier, a double line of fence posts, iron pipes, or stakes is driven into the stream bottom with the screen fastened to the upcurrent side. Loose sorbents (straw or peat can also be used), sorbent pads, boom, sweeps, etc. are placed between the two screens to provide a barrier to the oil. The screen height must be sufficient to prevent sorbents from going over the top or under the bottom should water levels fluctuate. The screen mesh size must be compatible with the type and size of sorbent used. The sorbents should be turned periodically to maximize recovery and replaced once completely oiled or if they become water-logged.

Logistics

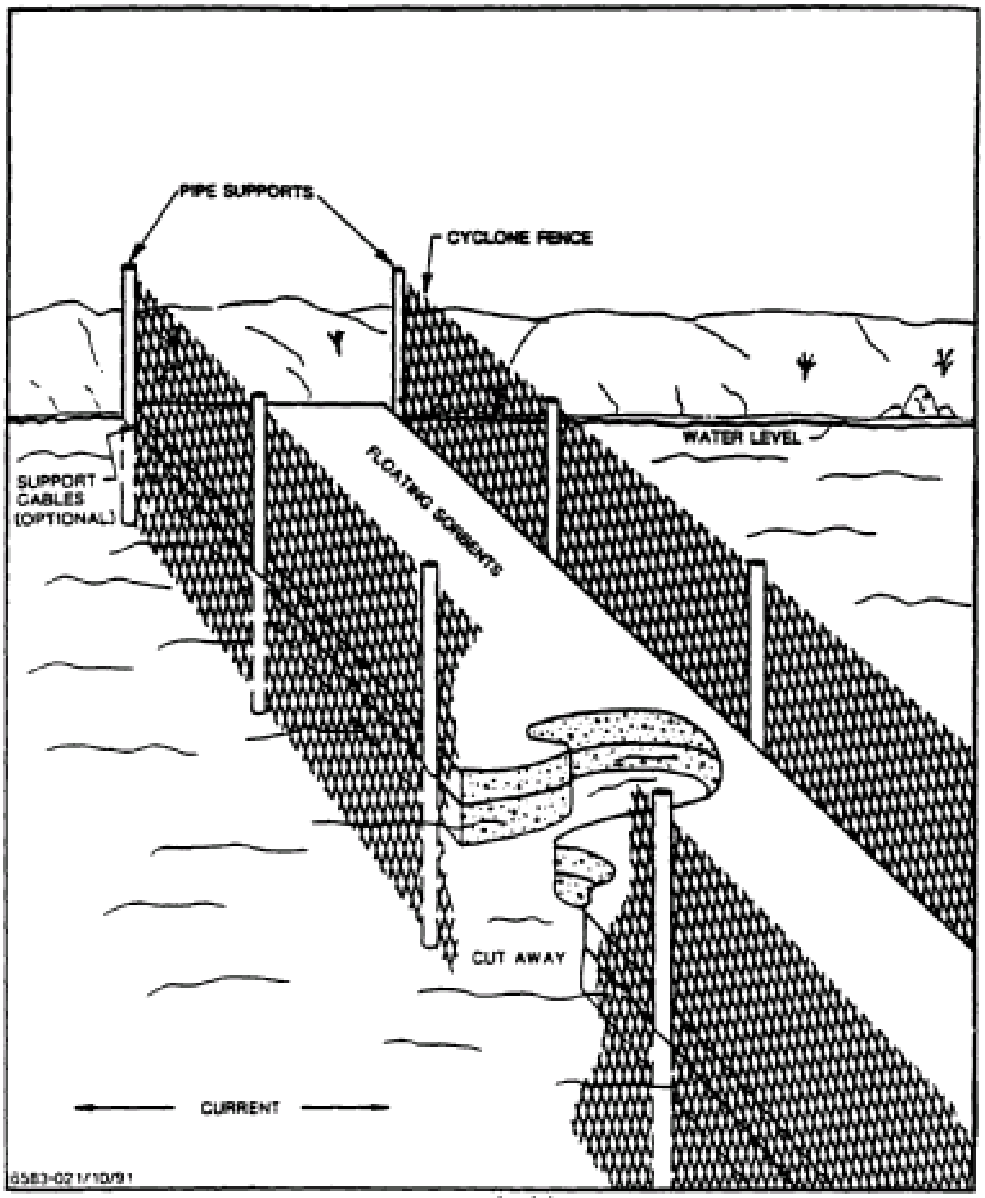
The requirements of the permeable sorbent barrier are also dependent on many variables and again are not easily quantifiable. The variables include stream or channel width and depth, water level variation, current, type of screen and sorbent used, type and quantity of oil, and amount of debris in the waterway. In general, the logistical requirements are:

- Construction - hand tools and 2-3 workers.
- Materials - stakes (preferably steel fence posts or 0.75-inch rebar placed every 10 to 20 feet), heavy-gauge wire mesh, bailing wire or cable ties, sorbent material (loose, pads, booms, sweeps, etc.), support wires or ropes, etc.
- Recovery - hand tools.
- Miscellaneous (as required) - plastic bags, storage, containers, personal protective equipment, etc.

Limitations

- Potential for fire or explosion.
- Implementation time and accessibility.
- Material availability.
- High currents.
- Large water level fluctuations.
- Significant quantities of floating debris.

FIGURE A-18
Sorbent Barrier



A-44

J. SKIMMERS

Common Applications

The most specialized mechanical devices for oil recovery are skimmers, which are used for the recovery of oil on water. The skimmers can be of either the advancing or stationary type. The advancing skimmers are typically used in open water to recover uncontained oil slicks in the form of windrows or streamers. They can also be used in conjunction with booms to increase the effective sweep width and, subsequently, the oil encounter rate. They may be vessel-mounted or self-propelled. The stationary skimmers are primarily used for recovering oil already contained within booms or in quiet water areas or large tide pools where oil has become trapped or contained by natural barriers.

The most commonly used skimmers fall into several general categories, including:

- Weir (saucer, self-leveling, vortex, boom, suction head).
- Sorbent belt.
- Paddle belt.
- Disc/drum.
- Rope mop.

Descriptions of each skimmer type and guidelines for skimmer selection are provided in Section A.3.

General Instructions

Advancing Skimmers

Advancing skimmers are typically used in two ways, either individually or in conjunction with containment booms and one or two vessels. When used individually, the skimmers generally work back and forth along the leading edge of the slick or along the length of a windrow to recover the oil as shown in Figure A-19.

When used with booms and vessels, a length of containment boom is attached between each side of the skimmer at the bow and a suitable workboat. The workboats then tow the skimmer and booms "up" current in a "V" or catenary configuration with the skimmer intake located at the apex. To maintain proper boom configuration, the two vessels must maintain the same speed and distance between them. The boom should be tied together with bridles near the skimming vessel to maintain the proper "V" configuration and help reduce oil entrainment beneath the booms. The bridles are of different lengths and are typically color-coded to aid in proper placement. Two small workboats may be used to push the boom together for easy attachment of the bridles.

The two larger workboats towing the leading ends of the boom would separate to a distance of about two-thirds the length of the boom as shown in Figure A-19. Boom length should be limited to 150 to 300 feet on each side, although lengths of up to 1,000 feet have been used. The shorter booms are often preferable due to the increased maneuverability. In the event that insufficient boom or workboats are available, only one boom and workboat can be used in a "J" configuration (one side of the "V" configuration discussed above) to increase the sweep width of the skimmer.

If the onboard storage capacity of the skimming vessel is exceeded, additional storage equipment would be used. This equipment could include floating Dracone type storage bags or an empty barge positioned behind the skimmer with an assisting tug (Figure A-19).

Portable Skimmers

Containment booms and workboats would be used to contain all or portions of a slick and the skimmer placed within the boom in the area of heaviest oil concentration (Figure A-20). The skimmer is then repositioned periodically until the majority of the oil is recovered. Sorbents would then be used to recover the remaining oil.

A barge or workboat could also be used to conduct recovery operations in waters with relatively low currents. Conventional containment boom would be deployed from an anchored barge or boat to divert the slick to a point next to the barge or vessel where a skimmer would be placed. This method is often conducted using a rope mop skimmer and a telescoping arm to hold the tail pulley in place and control the tension on the rope mop. Recovered product would be pumped directly into the barge or a storage tank.

Skimmers working from the shoreline can also be used to recover oil from quiet water areas such as marshes, small coves, or marinas in the same manner as for use within containment booms or from the side of a vessel. In addition, portable skimmers are typically used in conjunction with diversion, shoreline containment, or narrow channel booming where oil is diverted to the shoreline. As before, the skimmers are periodically repositioned into the area with the heaviest oil concentration to maximize recovery. Water streams provided by pumps and hoses or "squeegees" can also be used to direct oil to the skimmer intakes. Figure A-21 shows the use of a rope mop skimmer and water streams to recover oil.

Logistics

The logistical requirements for skimming operations will vary depending upon whether advancing or portable stationary skimmers are used and if booms are to be used with the advancing skimmers. A general list of the major types of equipment and supplies that could be used in a skimming operation is provided below.

Advancing Skimmers:

- Advancing skimmer.
- Containment boom and towing vessels (depending on method used).
- Boom ancillary equipment (tow lines, connectors, bridles, etc.).
- Transfer pumps and hoses (if necessary).
- Storage containers.
- Tools and miscellaneous spares.
- Sorbents and plastic bags.
- Fuel.
- Boom lights (if necessary).

Portable Skimmers:

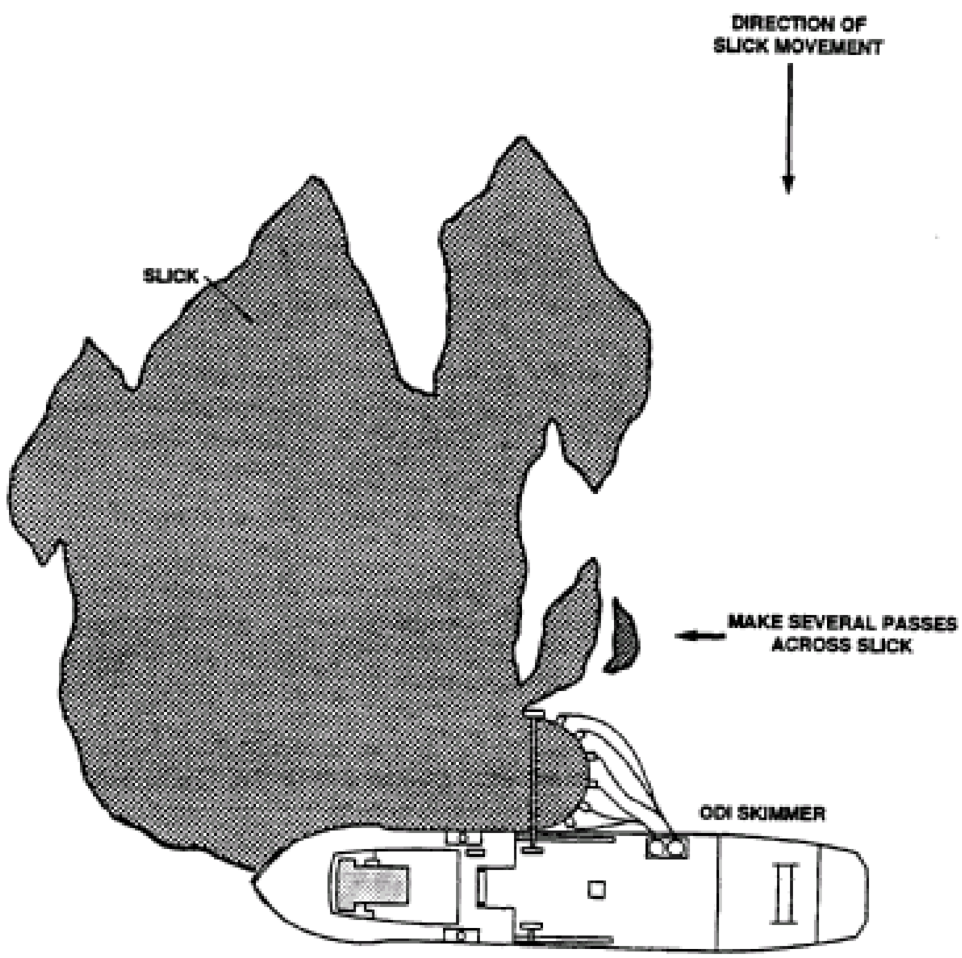
- Portable skimmer.
- Containment boom and deployment vessels (if necessary).
- Power supply, pumps and hoses.
- Transfer pumps and hoses (if necessary).
- Storage containers.
- Tools and miscellaneous spares.
- Sorbents and plastic bags.
- Fuel.
- Boom lights (if necessary).

Limitations

The efficiency of many skimmers decreases as oil weathers and becomes more viscous, although this should not be a problem with lighter products such as gasoline and diesel unless the latter becomes emulsified. Many skimmers including weir, disk, and rotating vane types
are susceptible to clogging from debris and viscous, weathered, or emulsified oils and should not be used if large amounts are present. Other limitations include:

- Potential for fire or explosion.
- High winds and waves.
- Storage capacity for recovered oil.

FIGURE A-19
OIL RECOVERY WITH ADVANCING SKIMMER



Source: Clean Seas Oil Spill Cleanup Manual, 1991. A-47

FIGURE A–20

CONTAINED OIL RECOVERY WITH PORTABLE SKIMMER

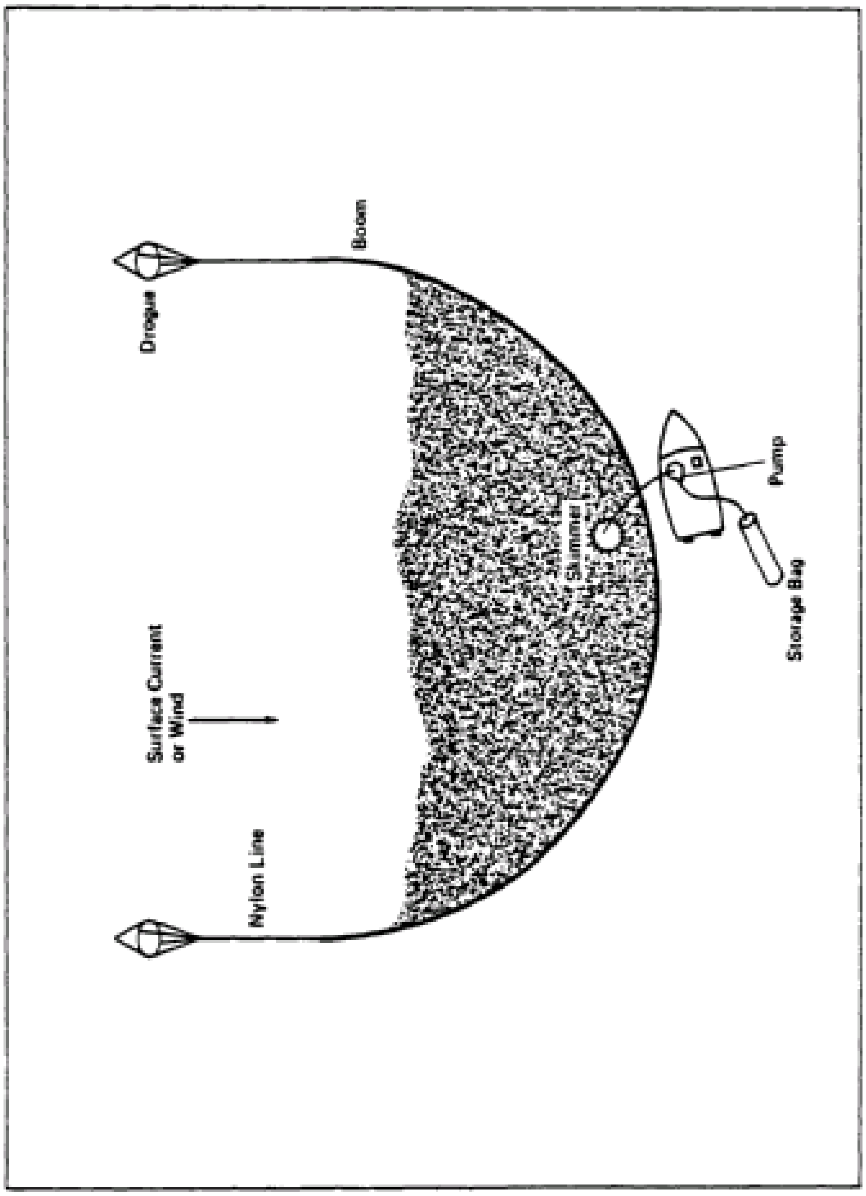
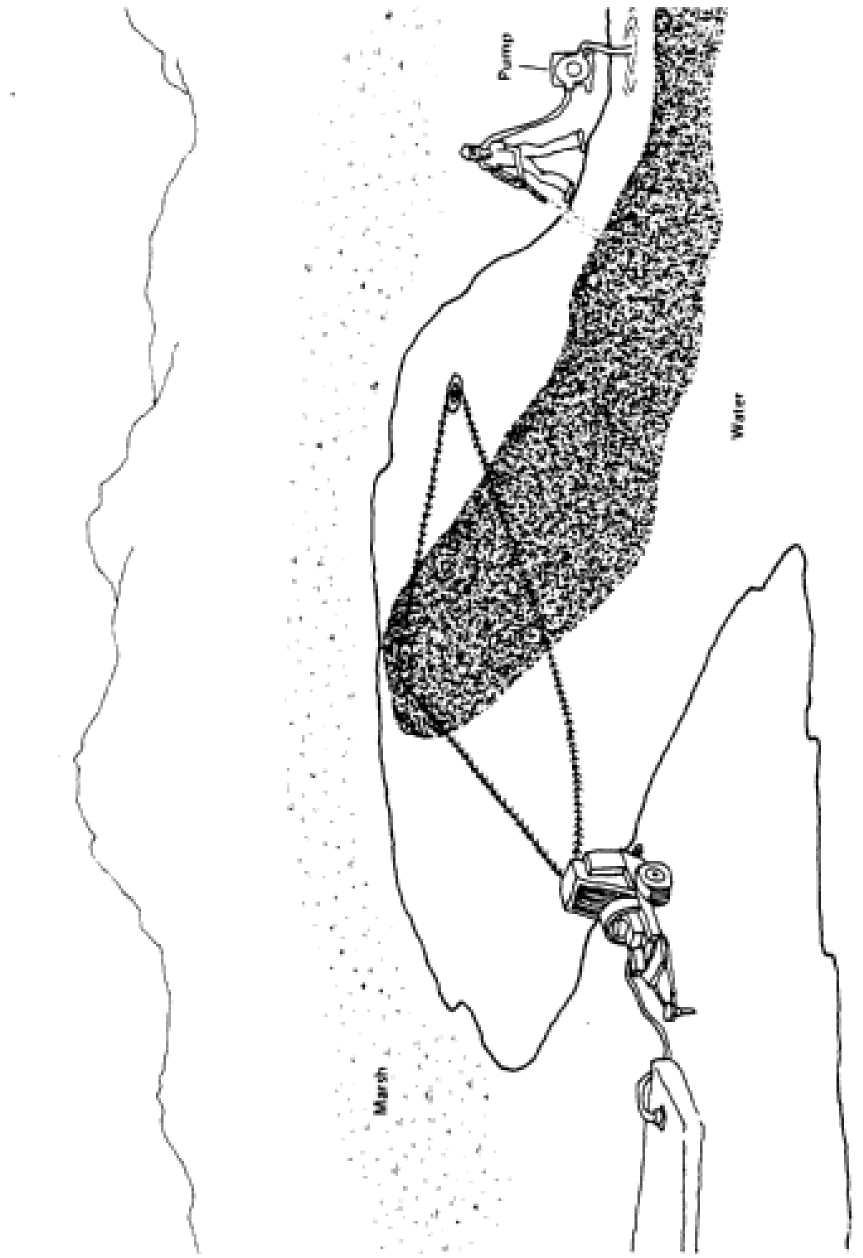


FIGURE A-21

OIL RECOVERY ROPE MOP AND WATER STREAM



K. SORBENTS

Common Applications

Sorbents are used to remove sheens and lighter accumulations of floating oil from the water's surface. They are typically used as a "polishing" tool in the final stages of recovery when skimmers or other mechanical methods are no longer effective. Sorbents can also be used in the absence of these systems to recover heavier accumulations of oil.

General Instructions

Most sorbents consist of synthetic, oleophillic fibers (although some organic types are available), which adsorb oil and generally repel water. They are available as pads, sheets, rolls, loose pieces, sweeps, and booms with the latter two designed for use in both stationary and advancing modes. Loose sorbents are generally not recommended for this type of use due to the difficulties inherent in their recovery. Typical sorbent uses are depicted in Figure A-22.

Sorbent pads or sheets are the most common type and are used by laying them directly on the floating oil and allowing the oil to be absorbed by the sorbent material. They should be turned frequently to maximize the sorbent's recovery capacity. Once they become relatively oiled, they should be replaced with clean sorbents. Although they are designed to repel water, most sorbents will become water logged after a period of time and should be replaced with new sorbents. Sorbent rolls, sweeps, and booms can also be used in this manner.

In the case of sheen recovery, the oil often has to be concentrated slightly for the sorbents to be effective. In this case, one end of the pad or sheet is raised slightly and dragged through the floating sheen thereby concentrating the oil at the pad/water interface and enhancing recovery. Sorbent "sweeps," which are long, rectangular sorbent pads with a rope sewn into

one edge, can be pulled through the water in a similar fashion using the ropes sticking out each end (Figure A-22C). This can be done either by hand or between two small boats.

Sorbent, or "sausage," booms are another very common form of sorbents used for oil recovery containment and protection purposes. For containment purposes, the sorbent booms are used in a manner similar to standard containment booms and are often deployed behind the containment booms to capture and recover any oil that escapes the primary boom. Sorbent booms are, however, very sensitive to currents and waves and should only be used in relatively calm waters.

Oil recovery is conducted by placing the boom in the floating oil and turning it frequently to maximize exposure to the oil and enhance recovery. Booms can also be towed in a "U" or catenary configuration behind a boat or between two boats to recover sheens or oil on the open water. Towing in a circular or zig-zag fashion is often more effective than in a straight line. Extended towing can also result in the booms absorbing 4 to 8 times their weight in water which decreases their ability to recover oil. Sorbent booms made of rolled pads are generally preferable to those consisting of loosely packed particles because of their lower tendency to absorb water, higher strength, and, in the case of breakage, substantially less effort required to recover the pieces.

Logistics

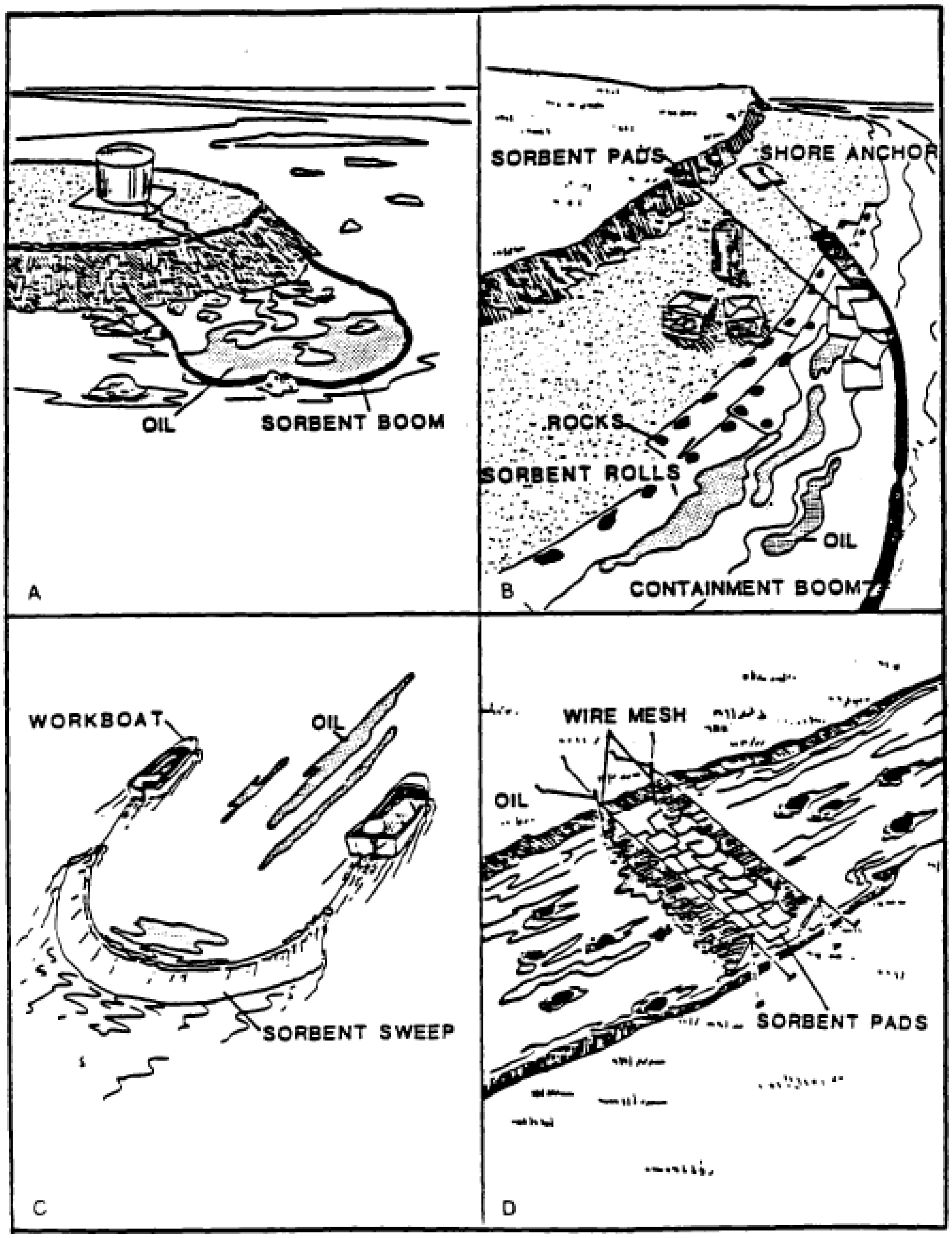
The logistical requirements for sorbent use depend on whether they are used in the stationary or advancing mode. Logistics for use in the advancing mode are similar to those described above under Technique G - Open Water Containment Booming, whereas the general logistics for use in the stationary mode are:

- Deployment - minimum of 1 worker.
- Equipment - none.
- Recovery - storage containers, plastic bags, hand tools (pitch fork or rake), etc.
- Miscellaneous (as required) - wringer device for removing water from the sorbents (if necessary), waders for cleanup workers, personal protective equipment, etc.

Limitations

- Potential fire and explosion hazard.
- Site access.
- Labor intensive and generates considerable quantities of solid waste.

FIGURE A-22
General Sorbent Use



A-54 Source: Alaska Clean Seas Contingency Planning Manual, 1984

L. EXCLUSION BOOMING

Common Applications

Containment and/or sorbent booms are placed across marshes, marina entrances, sloughs, and around water intakes and other sensitive areas, where currents are less than 1-2 knots and wave chop is less than 1.0 to 1.5 feet high, to exclude oil from the area.

General Instructions

Shorelines or Small Inlets

Exclusion booming of various sensitive areas involves deploying one or more containment booms along a shoreline or across an inlet to prevent or exclude oil from contacting the shore or entering the inlet (i.e., marina, slough, boat slip, etc.) Typically, one boom end is anchored onshore upstream of the sensitive area or inlet and the other end pulled downstream by boat and anchored to the shoreline beyond the sensitive area or inlet. The recommended boom length is 1.5 times the straight-line distance between the shoreline anchor points. One or more anchor systems are placed in the water offshore of the area to be protected. The boat then pulls the boom away from the shore and attaches it to the anchor system(s) as shown in Figure A-23. A second boom can be deployed in the same manner just beyond the first boom.

The anchor systems should consist of an anchor (Danforth or mushroom type preferred), an anchor line approximately 5 times the water depth, and a float attached to the anchor line 5-10 feet from the boom. The float will minimize the potential for boom submergence in high currents and enable crews to locate the anchor should the anchor line separate from the boom.

Marshes, Wetlands, or Stream Deltas

Exclusion booming of marshes, wetlands, or stream deltas where the entrance or mouth width is significant or where sand bars are present can pose problems in boom placement. Because shallow water can be expected near the entrances or mouths, boom placement should be attempted on the open water side of the entrance where water depths are generally greater (see Figure A-24a and A-24b).

River Channels or Marinas

In the case of river channels, current at the opening may exceed 1-2 knots which could require that booms be positioned inside the opening at a wider point in the channel where currents are typically lower. The booms should be positioned at an angle to the current to minimize entrainment of oil beneath the boom and to direct oil towards the shoreline for subsequent recovery. In many cases, the deployment of a secondary boom behind the primary boom is desirable to contain oil that may escape under the primary boom. The secondary boom can be either a containment type or a sorbent type. Sorbent, or "sausage," booms are the type most often used although snare type sorbent booms can be more effective for weathered oils. This variation of exclusion booming is similar to that described above under Technique H - Narrow Channel Containment Booming.

Exclusion booming of marinas can also be done by placing boom just inside the entrance rather than around the outside. This placement may be facilitated by the presence of existing anchor points (piers, bulkheads, rip-rap, etc.). Exclusion booming of marinas may require that a small work boat be stationed at the upstream end of the boom to open the boom for boat traffic entering or leaving the marina as shown in Figure A-24c.

Water Intakes

Although most intakes are typically situated well under the water surface, they can still be affected by dissolved hydrocarbons or by entrainment into the intake should the spill correspond to excessively low water levels. In most cases the intake will be shut down, but some industrial users may choose to continue withdrawing water and request that their intake be protected.

Some water intakes are situated at the back of sloughs, inlets or other relatively narrow channels and are easily protected by a series of booms deployed across the channel as shown in Figure A-25a. Most other intakes are situated along the shoreline and draw water directly from the river. In this case the booms should be deployed in a triangular configuration beginning at the shoreline upstream of the intake and extending out past the intake opening and back to the shoreline on the downstream side (see Figure A-25b). The boom should extend as far as practical beyond the intake to minimize the potential for entrainment of dissolved hydrocarbons. Deflection booming (see Technique M) is also well suited for protecting water intakes.

Sorbent Booms

Sorbent booms can be used in the same manner as described above for containment booms except they are usually used to protect much smaller areas. Once the booms are set up, they must be rotated frequently to be effective. Snare booms, consisting of polypropylene rope with snares, or pom poms, attached in an overlapping fashion, are also effective when used in this manner or in conjunction with sorbent booms. If used as a backup for standard booming operations, the sorbent or snare booms are deployed a few yards behind (downstream of) the primary booms to trap any oil splashing over or escaping under the containment boom.

Sorbent booms are also subject to frequent breakage from current, wind, or wave induced stress and should be reinforced by running a single line of polypropylene rope (poly rope will float whereas cotton rope often sinks) along the boom and attaching it to the boom with cable ties at several locations. A snare boom can be attached to the sorbent boom in the same manner to both increase the boom's strength and enhance its containment and recovery capacity.

Logistics

Specific manpower and equipment requirements will depend on the length of boom used, current speeds, and the nature of the area in which it is deployed. The general logistical requirements for exclusion booming are:

- Deployment - 1 boat (15 to 25 feet), 3 to 4 workers.

- Materials - boom (length is dependent on width of area to be protected) and 3 to 5 anchors plus anchor lines and floats per 100 feet of boom.

- Miscellaneous (as required) - boom lights, connectors, sorbent boom, sorbents, plastic bags, storage containers, poly rope, cable ties, hose and fittings, personal protective equipment, etc.

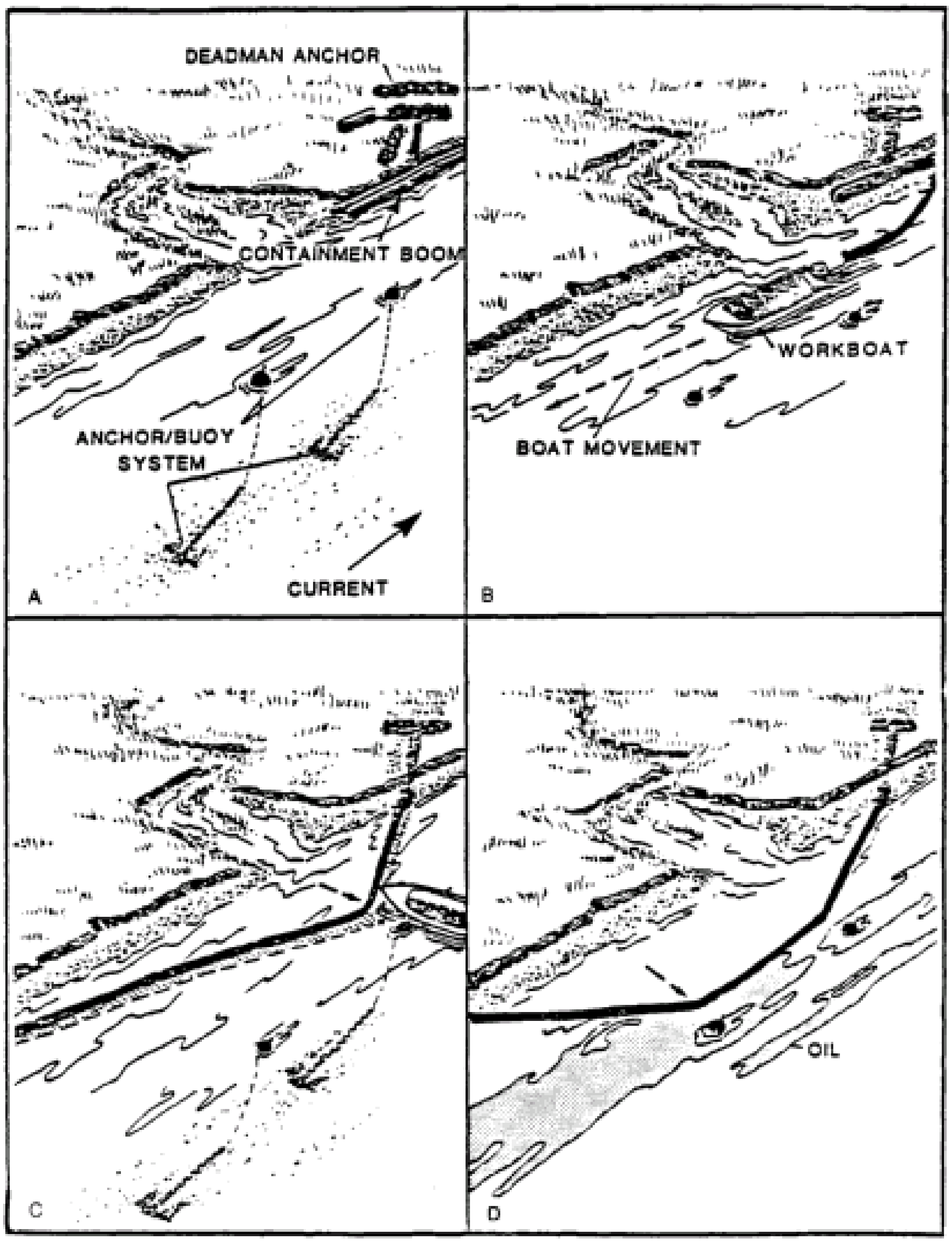
Limitations

- Potential fire and explosion hazard.
- Implementation time and accessibility.
- Currents >1.5-2.0 knots can cause boom failure.
- Low stability booms.

- Shallow water depths (less than the draft of the boom).

FIGURE A-23

SMALL INLET OR SHORELINE EXCLUSION BOOM



SOURCE: ALASKA CLEAN SEAS CONTINGENCY MANUAL, 1984

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FIGURE A-24
Exclusion Booming of Marshes, Stream Deltas and Marinas

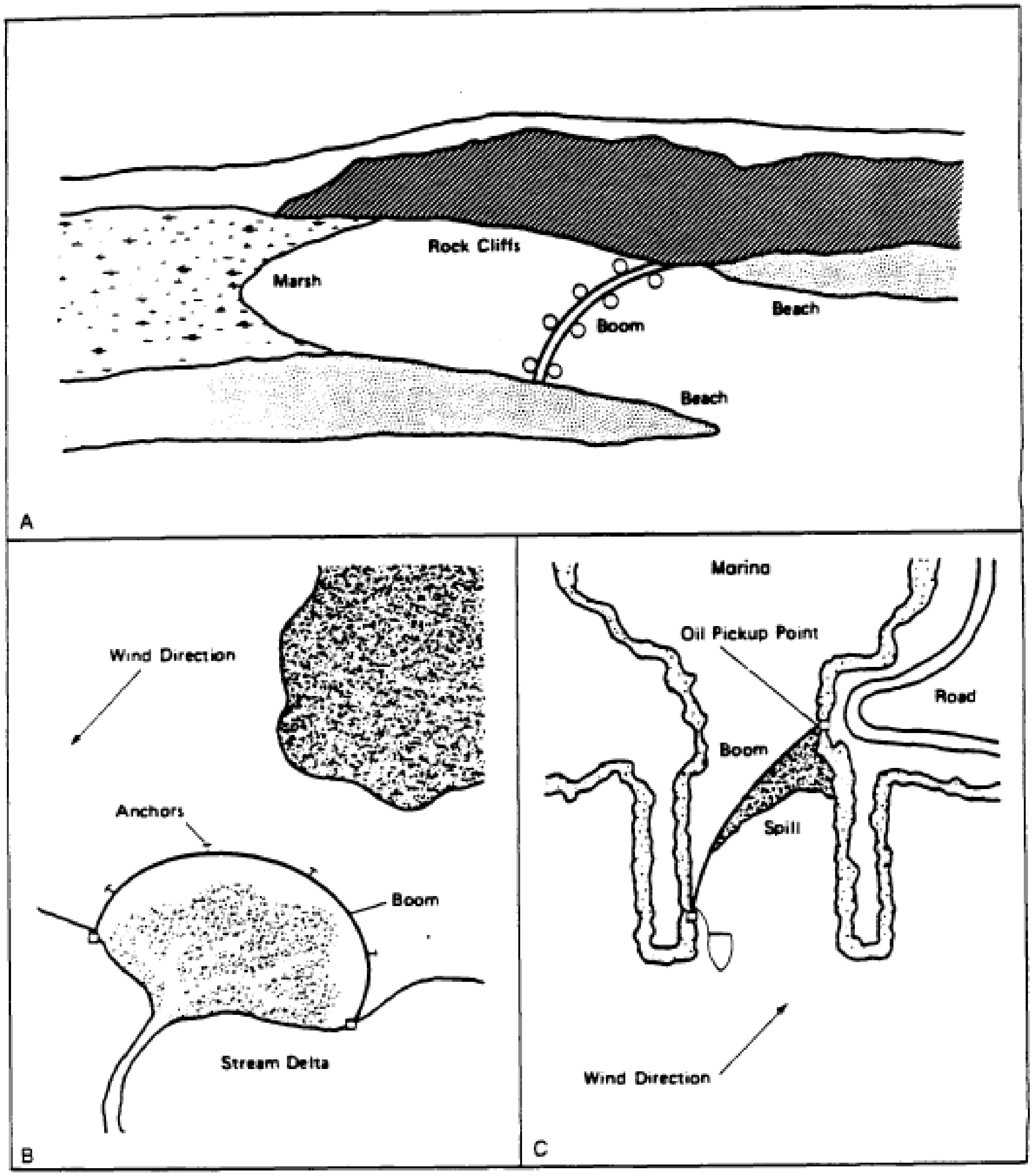
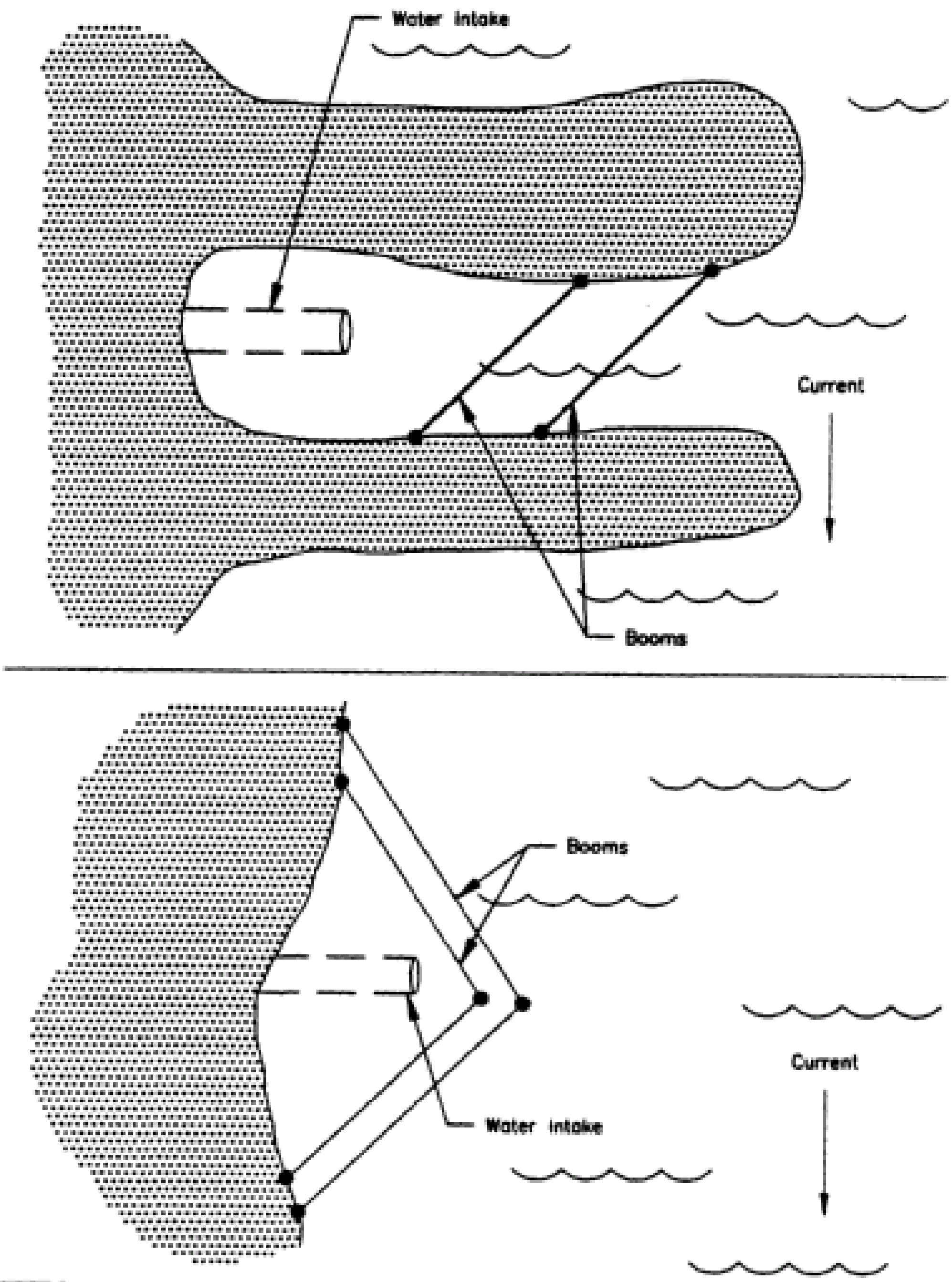


FIGURE A-25
Water Intake Booming



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M. DIVERSION BOOMING

Common Applications

Diversion booming involves the use of booms to divert oil to a shoreline upcurrent of a sensitive area. It is primarily used where the water current is greater than 1 knot or if the area to be protected is so large that the available boom and/or the required logistics make exclusion booming impractical. It is generally only applicable in situations where the shoreline to which the oil is being diverted is considerably less sensitive than the area being protected.

General Instructions

One end of the boom is anchored to the shoreline upcurrent of the sensitive area and the other is towed by vessel at an angle from the shoreline into the current and/or wind towards the leading edge of the approaching oil slick as shown in Figure A-26. The boom can either be anchored in place at the optimum angle or held in place by the vessel. The latter option allows the angle to be adjusted periodically in response to changing wind and current conditions or oil loadings. The approaching oil encounters the boom and is diverted to the shoreline where the concentrated oil can be easily recovered by skimming, pumping, or vacuuming.

By deploying the boom at an angle to the current, surface flow is reduced and diverted, permitting the oil and water to move downstream along the boom into the collection area and/or against the shore. If the boom were placed perpendicular to the oncoming oil in currents of 1.0 to 1.3 knots or greater, entrainment of oil in the water passing underneath the boom would likely occur, resulting in partial or total boom failure. The higher the current speed, the smaller the angle that will be required to prevent entrainment. Guidelines for boom deployment angles at various current speeds are provided in Figure A-27.

The optimum deployment angle is similarly dependent on boom length and stability. Longer and lower-stability booms generally require smaller deployment angles unless different booms are used and several anchors are placed along its length. In general, booms with a high ratio of buoyancy to weight and tension members located at the top and bottom edges, and booms with horizontally oriented flotation collars resist pivoting and have good stability under most conditions.

For wider waterways or oil slicks, a variation of diversion booming known as cascade booming can be used. This method involves two or more lengths of boom ranging from 100 to 500 feet placed in a cascading formation in the water (Figure A-28). The lead boom intercepts the oncoming oil slick and diverts it toward the shore. Subsequent booms placed downstream of the lead boom continue the diversion process until the slick is directed to the recovery area on the shoreline.

The deployment procedure used for this method is summarized as follows:

- The lead boom is placed in the water and towed by a small work boat to a position predetermined to intercept the outer edge of the slick. The up-current end is anchored in place.

- The deployment vessel is then maneuvered to the down-current end where the boom is pulled toward the shoreline until the optimum angle is achieved where it is anchored in place.

- The first two steps are repeated with each successive boom until the end of the last boom reaches the recovery area at the shoreline. The leading end of each boom is positioned approximately 25 to 30 feet behind the trailing end of the previous boom in a slightly overlapping configuration.

The booms are fixed in place by several anchor systems consisting of an anchor, an anchor line equal to approximately 5 times the water depth, and a float. The float is then fastened to the anchor line 5 to 10 feet from the boom. Because the current will naturally cause the booms to bow slightly, additional anchors may be required along the length of the boom to minimize this effect. Anchors should always be deployed first and then attached to the boom to minimize the effects of currents and wind on anchor/boom placement. Figure A-28 shows the placement configuration of three lengths of boom.

Logistics

The specific manpower and equipment requirements will depend primarily on the width of the approaching slick and the current speed. Larger deflection distances in stronger currents will necessitate the use of more boom and logistical support. The general logistical requirements for standard diversion booming (single boom) with a 100 foot deflection in a 2-knot current are:

- Deployment - 1 boat (15 to 20 feet), 3 to 4 workers, tow line and bridle (if necessary).
- Equipment - 150 feet of boom and 4 to 5 anchor systems (anchors, line, and floats).
- Recovery - skimmer, pump, or vacuum system.
- Miscellaneous (as required) - sorbents, storage tanks, plastic bags, hose and fittings, personal protective equipment, boom lights, etc.

<u>Limitations</u>

- Potential fire or explosion hazard.
- Implementation time and accessibility.
- Excessive currents or wind.
- Excessive floating debris.
- Excessive water depths can complicate boom anchoring.

FIGURE A-26
Diversion Booming Along Shoreline

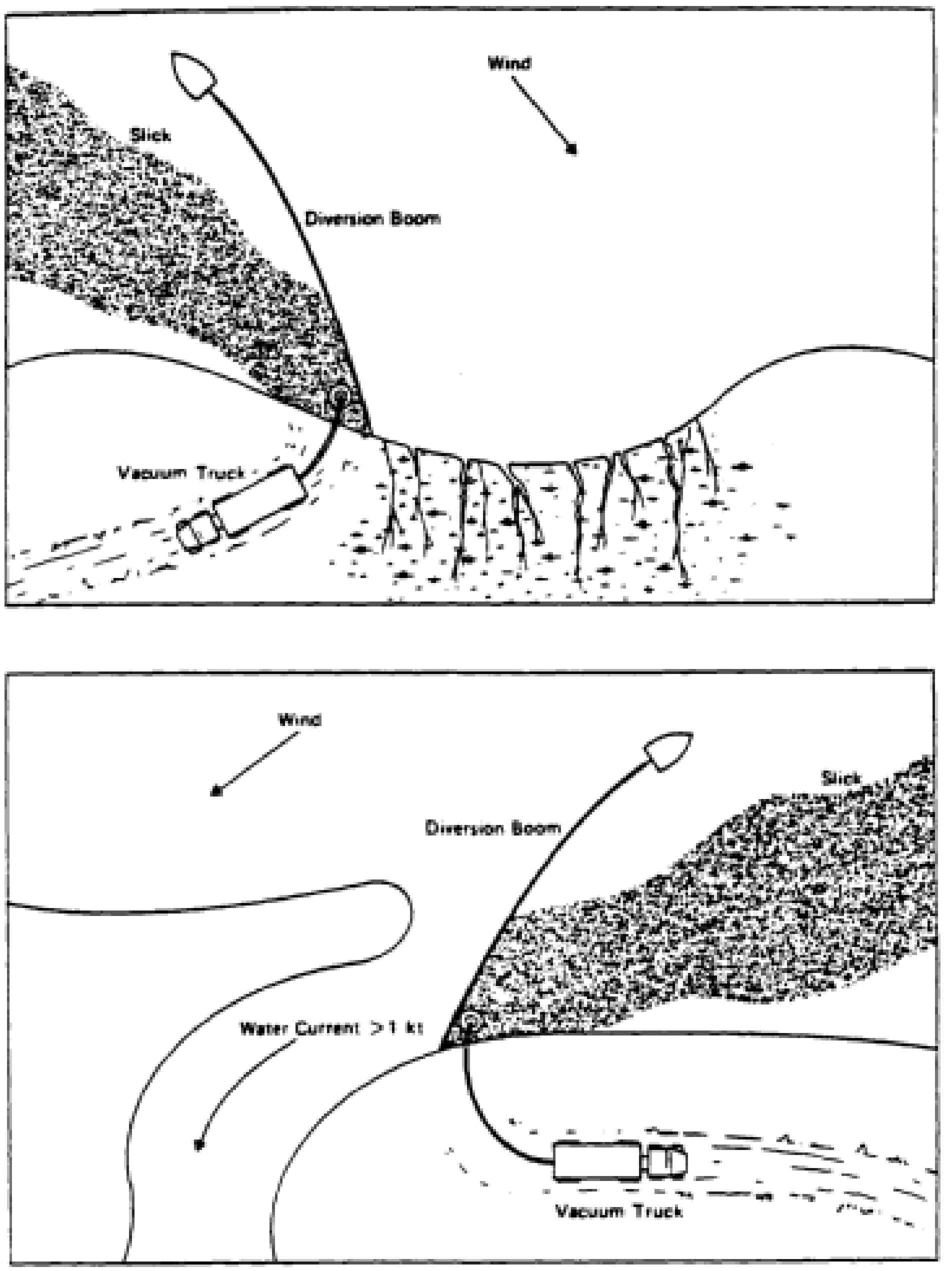

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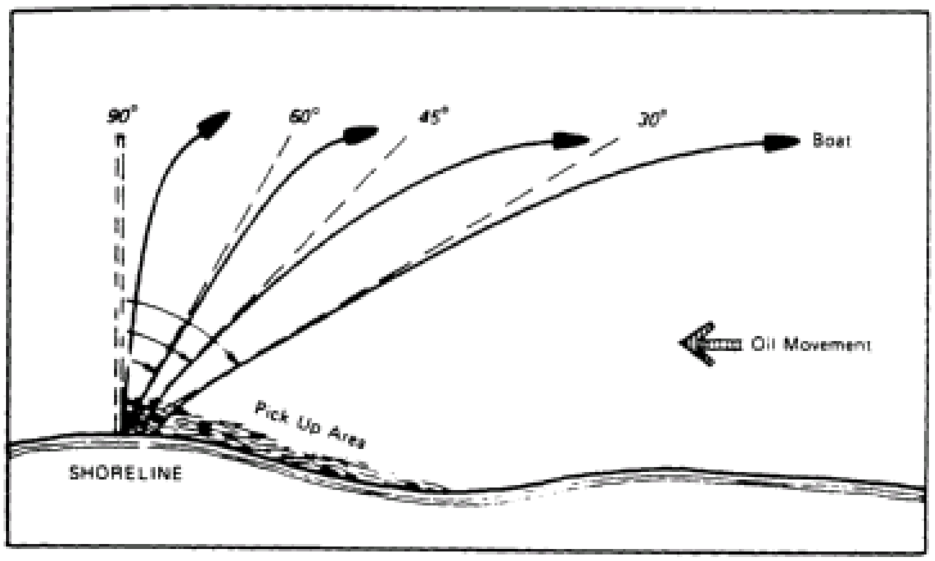
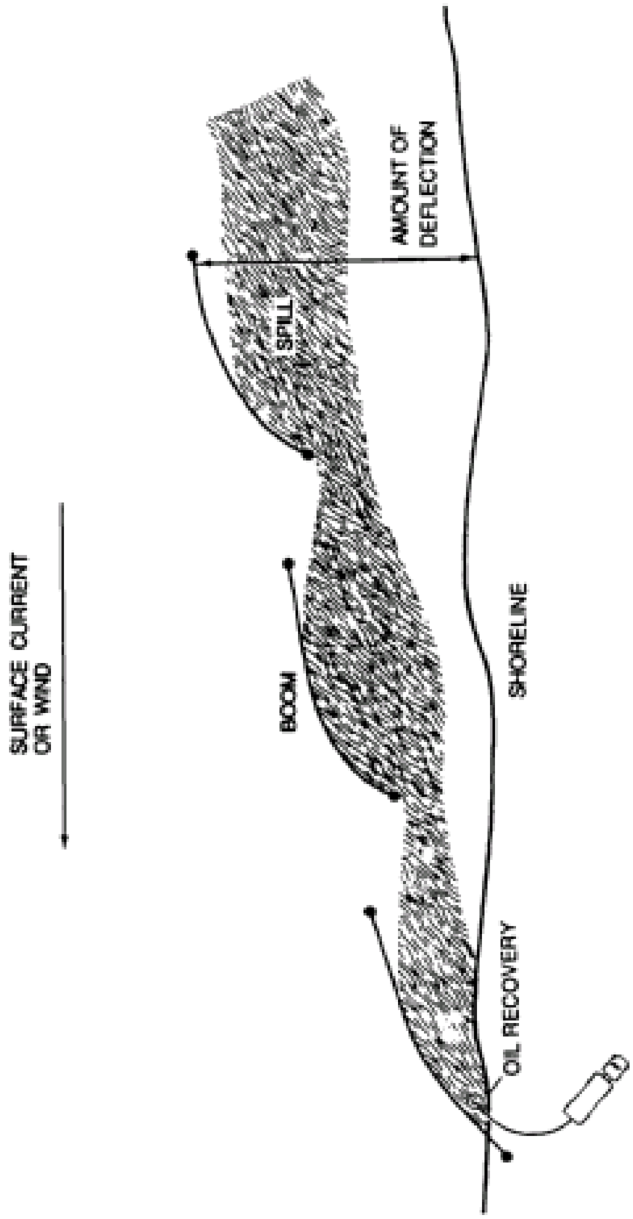
FIGURE A–27

Booming Deployment Angles



Current (kts)	Current (fps)	Boom (angle)
1 5	2 5	70
1 6	2 7	60
1 7	2 8	55
1 8	3 0	50
2 0	3 4	45
2 2	3 7	40
2 5	4 2	35
2 8	4 8	30

FIGURE A–28
CASCADE DIVERSION BOOMING



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N. DEFLECTION BOOMING

Common Applications

Deflection booming is used in situations similar to those described above for diversion booming and is typically used where currents, logistics, shoreline sensitivity, or other factors prevent the use of exclusion or diversion booming. In this case, however, the oil is deflected away from, instead of toward, the shoreline.

General Instructions

Deflection booming involves the use of boom deployed from a shoreline and angled away from an approaching slick to divert oil away from the shore and around a sensitive area. The leading end of the boom is anchored to the shoreline just up current from a sensitive area such as a marsh, marina, fish spawning area, water intake, etc. A vessel then angles the trailing end of the boom down current and away from the shoreline as shown in Figure A-29.

The trailing end can be anchored in place or maintained with the vessel, allowing periodic adjustments in response to changes in winds, current speeds, or oil loading. If the boom is to be anchored in place, multiple anchor systems should be considered to maintain boom shape and integrity, particularly in stronger currents. The anchor systems should be deployed first and then attached to the boom to minimize the effects of currents and wind on boom/anchor placement.

Anchor systems should consist of an anchor (preferably Danforth or mushroom types), an anchor line equal to approximately 5 times the water depth, and a float. The float is attached to the anchor line 5 to 10 feet from the boom to minimize potential boom submergence in strong currents and to enable location of the anchor should the anchor line separate from the boom.

The appropriate deployment angle is proportional to the current speed. The angle guidelines provided previously in Figure A-27 for diversion booming are also applicable to deflection-booming, except that the booms are angled away from the current instead of into it. In general, the objective is to achieve the greatest angle possible without entrainment of oil under the boom or failure of the boom itself.

As in diversion booming, deflection booming can also incorporate two or more booms deployed in a cascading formation to increase the deflection distance. The boom overlap and
angles are the same as those described for diversion booming except that the booms are angled away from the oncoming slick and current.

Logistics

The specific manpower and equipment requirements will depend primarily on the width of the approaching slick and the current speed. Booms deployed at small angles in high current areas require greater boom lengths to cover the same width as those deployed at greater angles. In general, the logistical requirements for obtaining a 100 foot deflection in a 2-knot current are:

- Deployment - 1 boat (15 to 20 feet), 3 to 4 workers, tow line and bridle (if necessary).
- Equipment - 150 feet of boom and 4 to 5 anchor systems (anchors, line, and floats).
- Recovery - skimmer, pump, or vacuum system, sorbents, etc.
- Miscellaneous (as required) - storage tanks, plastic bags, hose and fittings, boom lights, personal protective equipment, etc.

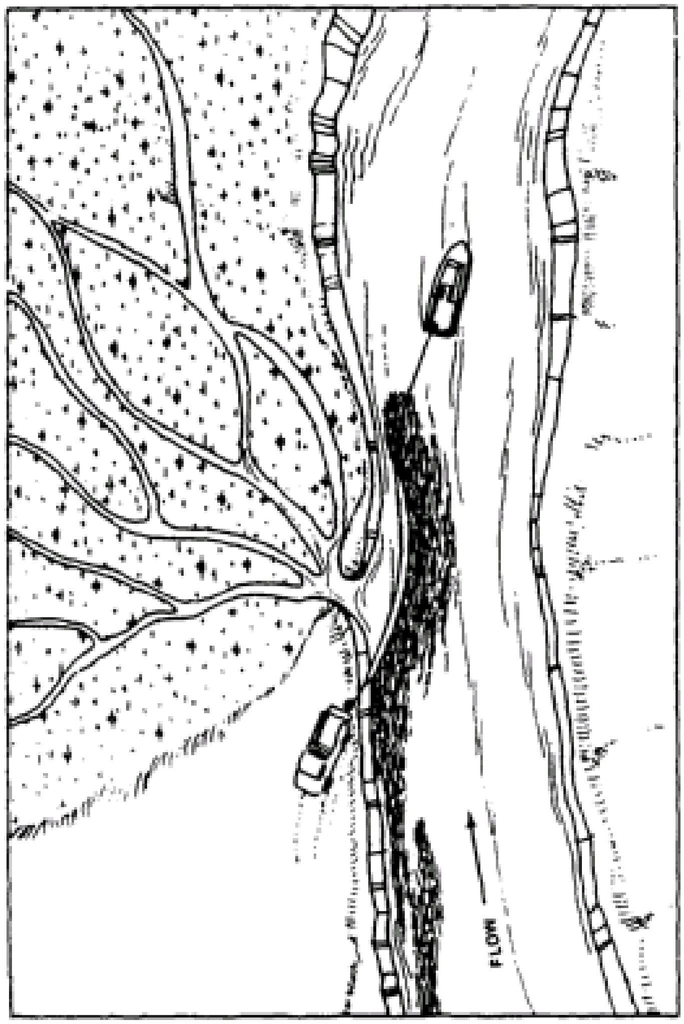
Limitations

The presence of a current or wind strong enough to move the oil at a reasonable rate is required for the technique to be effective. Winds blowing directly or semi-directly onshore can also render this technique ineffective as oil deflected by the boom will be pushed back to the shore by the wind within a relatively short distance. Other limitations are:

- Potential fire or explosion hazard.
- Implementation time and accessibility.
- Excessive currents (>2.5-3.0 knots) or wind (40-50 knots).
- Excessive floating debris.

- Excessive water depths can complicate boom anchoring.

FIGURE A–29
River Deflection Booming



O. INLET DAMS

Common Applications

This method can be used to protect sensitive sloughs, channels, inlets, and marshes as an alternative to conventional booming or where conventional booming is not feasible.

General Instructions

A dam is built across the inlet entrance using sediments from the foreshore, nearby earthen materials, or sandbags. The dam is extended into the banks on either side and is constructed to a height of 2 to 3 feet above the highest anticipated water level. Plastic sheeting can be placed over the dam to minimize erosion. The dam should be removed when the danger of oil entering the protected area is past. Figure A-30 depicts damming of a slough or marsh entrance.

If oil has already entered the inlet, a careful assessment should be made of the potential impact of closing the entrance and thus eliminating the natural flushing of the area through river flow. If the inlet also serves as a drainage for storm water runoff, it may be necessary to install an underflow pipe to prevent water from building up behind the dam and overflowing the top. In this case, an inclined pipe is installed within the dam with the elevated end on the river side and positioned above the river water level. This underflow technique is discussed in detail under Technique C - Blocking Dams. The dam will prevent oil from reaching the typically more sensitive and difficult-to-clean backwater areas.

Logistics

The equipment and manpower requirements for dam construction will vary with the size and type being built. Generally, a backhoe, front-end loader, bulldozer, or hand tools is all that is needed for construction. The general logistical requirements for inlet dams are:

- Construction - heavy equipment and 2 workers or hand tools and 4 workers.
- Materials - adjacent sediments or sand bags and plastic sheeting.
- Recovery - not generally applicable to this protection technique.

- Miscellaneous - personal protective equipment.

Limitations

- Potential fire or explosion hazard.
- Site accessibility and implementation time.
- Site must be accessible to heavy motorized equipment, or the opening sufficiently small to permit its closure by response crews alone.
- Closure of the entrance can upset the natural processes which depend upon natural flushing and/or the movement of biota to and from the adjacent waterway.
- Porous materials may allow oil to penetrate the barrier; plastic sheeting may be used to reduce penetration.

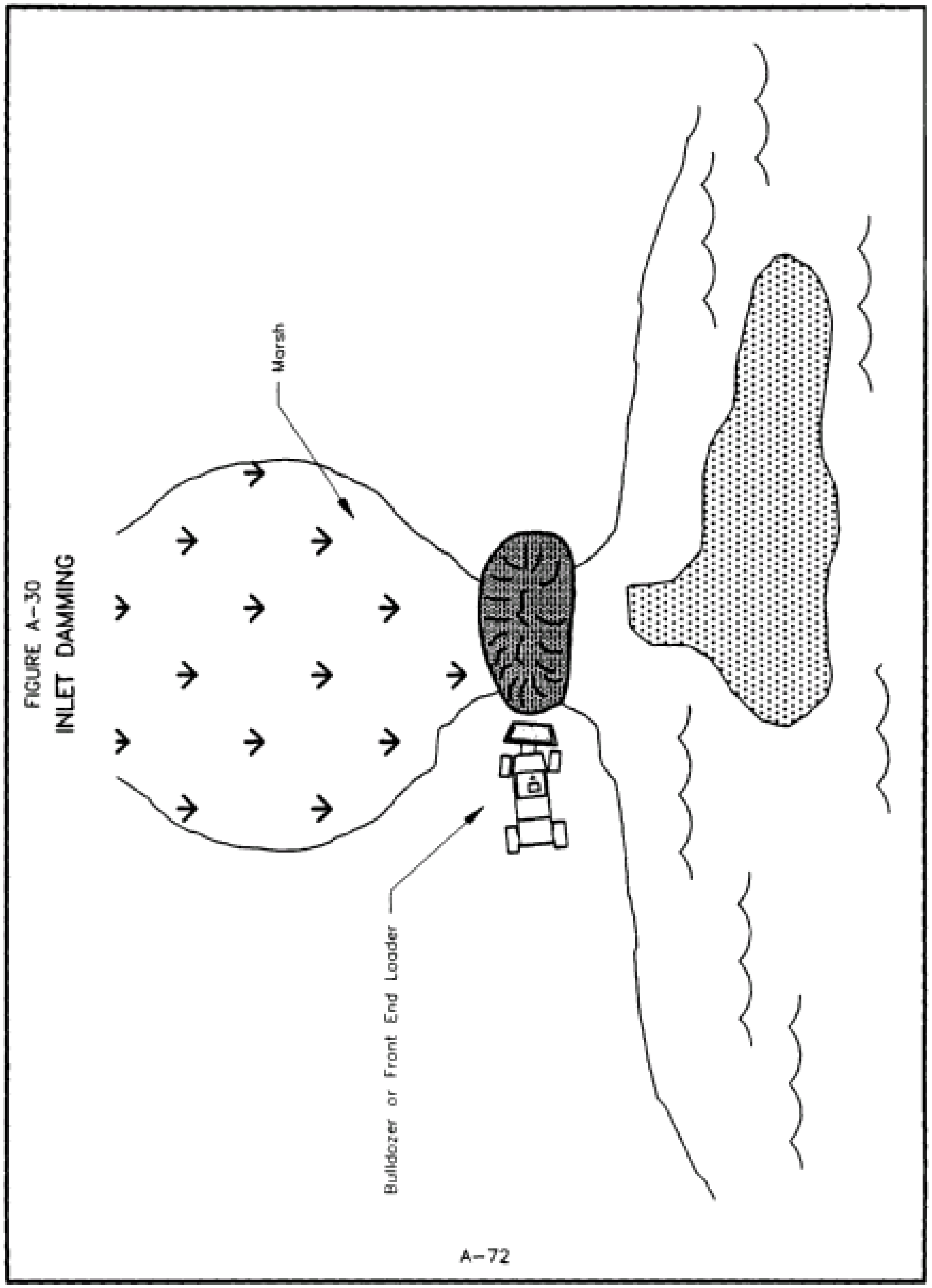


FIGURE A-30
INLET DAMMING

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P. DEBRIS/ICE EXCLUSION

Common Applications

Wire mesh barriers deployed across streams or rivers are used in waterways containing floating debris or ice to prevent interference with downstream cleanup operations.

General Instructions

Drive posts into stream bottom in a line angling upstream from one shore to the other. Fasten cyclone fencing or other heavy wire mesh screen to the upstream side. The screen should extend well below the water surface. A cable or strong rope should be secured along the top of the posts for extra support. The angle should be sharp enough to allow debris or ice chunks to slide to the downstream end where it can be removed manually or by using a crane or winch. Figure A-31 illustrates this technique.

Logistics

The requirements of this technique depend on many variables and are not easily quantifiable. The variables include stream or channel width and depth, water level variation, current, type of screen used, and type and quantity of debris in the waterway. In general, the logistical requirements are:

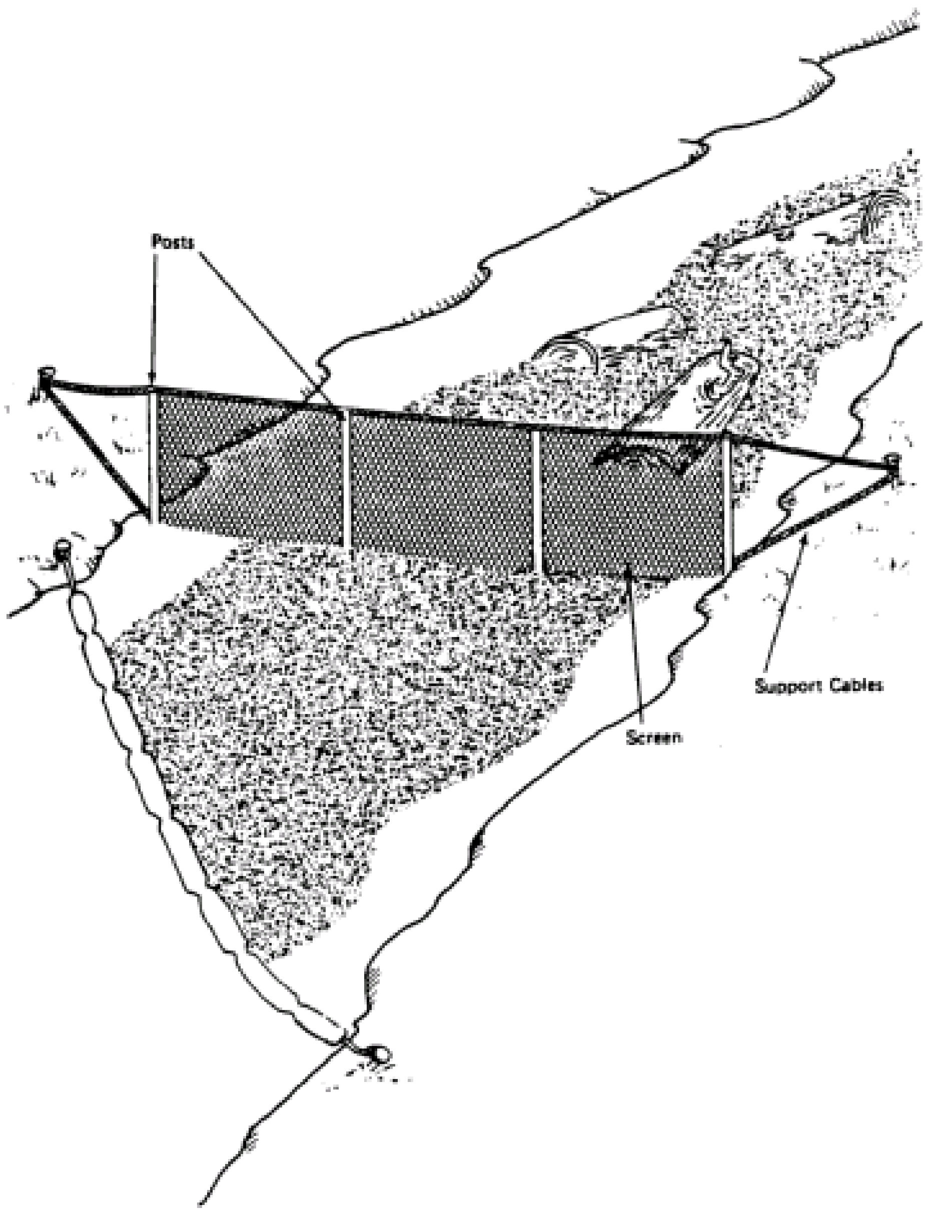
- Construction - hand tools and 2-3 workers.
- Materials - stakes (preferably steel fence posts or 0.75-inch rebar placed every 10 to 20 feet), cyclone fencing or heavy-gauge wire mesh, bailing wire or cable ties, support wires or ropes, etc.
- Recovery - hand tools.
- Miscellaneous (as required) - plastic bags, storage containers, personal protective equipment, etc.

Limitations

- Potential for fire or explosion.
- Implementation time and accessibility.
- Material availability.

- High currents.
- Large water level fluctuations.
- Substantial quantities of floating debris.

FIGURE A-31
DEBRIS/ICE EXCLUSION



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APPENDIX B

CLEANUP TECHNIQUES

General

In the event that oil does contact a shoreline or terrestrial area, the appropriate response actions should be implemented as soon as practicable to minimize environmental damage. In situations where oil continues to wash onshore, it may be preferable to wait until all or most of the oil has become stranded as repeated cleanup of a shoreline may create more harm than the oil itself. Conversely, if the oil has a high remobilization potential, it is often better to clean the shoreline as the oil comes in and recover trapped floating oil than to allow it to be remobilized by the changing winds or water levels and possibly impact another, previously clean area.

The appropriate cleanup technique to be used for a given area will depend primarily on the sediment type, slope, level of oil impact, and potential impacts from the candidate cleanup technique(s). Guidelines for selection of the appropriate cleanup technique are provided in Section 4.7. The cleanup techniques considered most applicable to the area surrounding ExxonMobil Pipeline operations and the downstream aquatic shorelines have been categorized below by type:

A few of the above techniques are normally restricted to use on tidally influenced shorelines where the oil can be deposited over a wide area instead of a relatively thin band as would be expected along an inland waterway. However, large terrestrial spills can result in oil distributions that are similar to those found on coastal shorelines with a significant tidal range. The cleanup techniques would be similar in both cases. Therefore, selected coastal shoreline cleanup techniques that are also applicable to terrestrial spills have been included in this section.

A summary of the cleanup techniques, their uses, logistics, and potential environmental effects are listed in Section 4.7.3. Detailed procedures for the implementation of each technique are discussed in this section and include information on use, limitations, logistics, and impact minimization measures. Although the techniques are discussed separately, spill circumstances may dictate the simultaneous use of multiple techniques.

Technique Descriptions

Detailed descriptions of each of the cleanup techniques that are generally applicable to the one or more areas along the pipeline routes are provided in the following sections. The numerical designations correspond to those given in the various response decision and technique selection guides in Section 4.7.3.

1. MANUAL REMOVAL

Common Applications

Manual removal can be used on most terrestrial areas and shoreline types with the possible exception of soft sediments or marshes where considerable foot traffic generally creates more of an impact than the oil itself. It is most applicable to lightly oiled or relatively inaccessible shorelines where the use of mechanical equipment is not warranted or feasible or where the equipment would cause significant environmental damage. Manual removal is very useful for removing oil-contaminated vegetation (marsh grasses, small plants, etc.) to avoid leaching and recontamination. It is also widely used in the final stages of cleanup where only minor amounts of oil remain on surface sediments or on the water's surface (i.e., sheens).

General Instructions

Manual removal entails the recovery of surface oil, oiled sediment, or oily debris by manual means (hands, rakes, shovels, pitchforks, buckets, etc.) and placing it into containers (plastic bags, super sacks, drums) for subsequent transport and disposal. Weathered oil on hard surfaces can be removed using scrapers or wire brushes. Generally, mechanical equipment is not used, with the possible exception of all-terrain vehicles, bobcats, wheel barrows, etc., to transport the contained material to a staging or interim storage area.

Small quantities of oil or oiled material can be placed in plastic bags and removed for disposal. Larger quantities can be placed in barrels, super sacks, totes, debris boxes, etc. for temporary storage and/or subsequent disposal. All material must be stored above the high water line to prevent loss or remobilization from potential water level increases. Containers may be removed manually, by vehicle, airlifted by helicopter, or loaded onto small boats or barges from the shoreline or makeshift docks.

Manual cutting of vegetation requires moderate to large crews equipped with shears, power brush cutters, scythes, or other devises. The crews should be split into cutters, debris handlers, and baggers for efficiency.

- Before cutting, the areas to be cleared should be boomed so that oil freed during the procedure can be contained. Likewise, cleared areas should be protected from recontamination until that threat is eliminated.

- Cutting should begin at the upstream end of the area and should work downstream, thus limiting the possibility of recontamination.

- In some cases, cutting can be done from small skiffs to minimize impacts from trampling.

- The debris handlers should follow the cutters, collecting the oiled vegetation in small piles to be placed in plastic or burlap bags and removed by the bagger group. Debris may be piled directly onto barges or small flat-bottom boats for disposal if cutting is adjacent to a waterway.

- Cut vegetation that is stockpiled on the site for a period of time should be stored above the high-water line on plastic sheets, tarps, sorbents, or burlap to minimize oil leaching from the cut material.

General considerations for conducting manual removal include:

- Do not rake healthy vegetation.

- Cut and/or collect contaminated material into small piles.

- Fill plastic bags or containers only to the point where they can easily be carried by one person (i.e., 40 - 50 lbs).

- Plastic bags should be of the heavy-duty type (4 to 8-mil thickness).

- Double bag heavily oiled materials to prevent leakage and bag failure.

Logistics

The logistical requirements for manually cleaning a shoreline will vary with the level of oil conditions, disposition of the oil, and length of shoreline. The general logistical requirements are provided in Table B-1. The logistical requirements for manual cutting will vary with the size of the contaminated area, substrate type (soft sediments, hard sediments, access, etc.), and the amount of vegetation.

TABLE B-1

Logistical Requirements for Manual Removal

Item	Number Required/0.5 miles of shoreline
Equipment	
Debris box	1
Helicopter/boat/truck	1
Collection tools (shovels, rakes, pitch forks, etc.)	4 - 6
Cutting tools (scythes, power cutters, shears, etc.)	3 - 4
Plastic bags	100 - 200
Rolls of ground cover (plastic, sorbent, burlap, etc.)	1 - 3
Personnel	**Number per Crew**
2 Crews	5 - 10 workers and 1 Supervisor
Access Requirements	
Foot, vehicular, shallow craft, helicopter.	N/A

Limitations

- Potential fire or explosion hazard (can be minimized by using non-sparking hand tools).

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- Labor-intensive and time-consuming.
- Heavy foot traffic can cause significant environmental damage.
- Removal of recovered wastes if often problematic in areas with limited access.
- Vegetation cutting and removal can cause severe damage to root systems, particularly in marsh areas with soft sediments.

In most cases, the impacts of leaving the oiled vegetation in place are considerably less than the trampling associated with cutting and removal.

Impact Minimization

- Restrict heavy foot traffic to firm substrate with limited vegetation.
- In marshes or soft sediments, place boards along foot paths or use snow shoes to reduce sediment disturbance.
- Do not cut healthy or very lightly oiled vegetation.
- Restrict access to unconsolidated slopes.

2. MECHANICAL REMOVAL

Common Applications

Mechanical removal is primarily used to remove oiled sediments on finer-grained sediment shorelines or terrestrial areas where the oil is on or near the surface and trafficability and slope permit the use of heavy equipment. Certain types of equipment may also be used to remove subsurface oil from similar areas. Mechanical removal should not be considered where shore or slope erosion may result unless only a small amount of sediments will require removal.

General Instructions

Various types of heavy equipment are used individually or in combination to remove oiled sediments for processing and/or disposal at an approved facility. Earthmoving equipment such as motor graders, bulldozers, front-end loaders, backhoes, and dump trucks are the types most commonly used in sediment removal.

For spills in river environments, the shoreline oil conditions are typically limited to a narrow band and, as such, the use of heavy equipment is generally restricted to front-end loaders, backhoes, and dump trucks. Uncontained terrestrial spills can, however, cover larger areas which may require the use of larger equipment, such as bulldozers, motor graders, and elevating scrapers.

Typically, motor graders or bulldozers are used to concentrate the oiled sediments into windrows or piles for removal by front-end loaders or backhoes. The sediments can be transported to an interim storage site by the loader or loaded onto dump trucks for transfer to the storage or disposal site. Front-end loaders and backhoes can also be used independently to remove oiled sediments but generally have less control of the excavation depth than do motor graders and bulldozers.

Specific Instructions

There are several methods that can be used to mechanically recover oiled sediments and surface oil depending on the circumstances and the type of available equipment. On heavily oiled, finer sediment (e.g., soil, sand, granule) substrates with good trafficability and minimal slope, motor graders and elevating scrapers or front-end loaders would be the preferred method, whereas bulldozers, backhoes, and front-end loaders may be more desirable on lightly oiled, coarser grained (pebble/cobble) shorelines and/or areas with low trafficability or greater slope.

Backhoes are best suited for recovering subsurface oil although bulldozers or front-end loaders may also be used. Backhoes or front-end loaders can also be used to recover oiled sediments from small, relatively inaccessible areas. Each one of these types of equipment and their recommended uses are explained below.

A. MOTOR GRADER AND ELEVATING SCRAPER

The most effective method of cleaning fine-grained shorelines or terrestrial areas with significant oil conditions is with motor graders and elevating scrapers working together. Motorized graders cut and cast to one side the surface layer of sediments to form large windows, which motorized scrapers pick up and haul to a staging or interim storage area (Figure B-1). These are used primarily where oil penetration is 0-4 inches and trafficability is good.

Grading of the first pass is begun on oil-contaminated material farthest inshore or upgradient, casting a windrow parallel to water line or slope. Grading is continued to the end of the oiled area or approximately 500 to 1000 feet in distance. The elevating scraper then straddles the windrow, formed after two or three passes by the motorized grader, lowers the cutting edge of the bowl to the depth of oil penetration, and begines to move forward, picking up the windrow as it goes. Once full, the scraper proceeds to the temporary storage or staging area and deposits the oiled sediments.

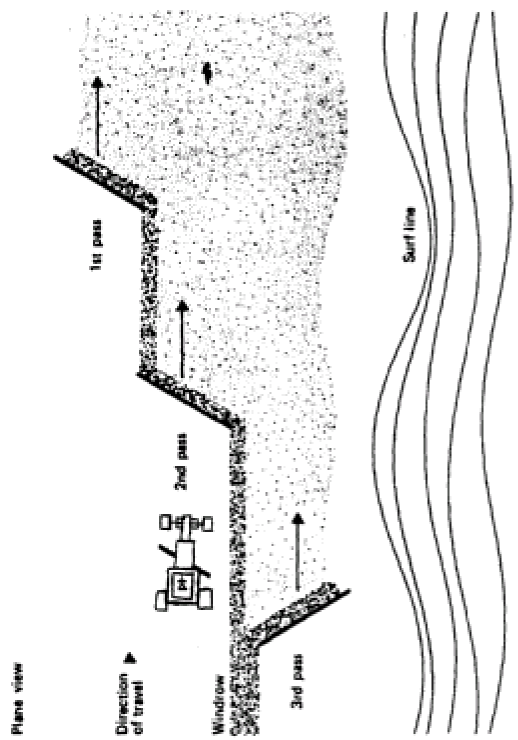
Since one motorized grader can produce windrows continuously, two or more motorized elevating scrapers should be used simultaneously to pick up the windrows.

B. MOTOR GRADER AND FRONT-END LOADER

A second method of cleaning large areas with fine grained substrates and heavy oil conditions is with motor graders and front-end loaders working together. This method also is used where oil penetration is less than 2 to 4 inches and trafficability is good.

Beginning on the upgradient side, motorized graders cut and displace to the side the surface layer of sediments and form large windrows (as explained above), which front-end loaders pick up and haul to a staging or interim storage area or place in dump trucks for transport to an

FIGURE B-1
Motor Grader/Elevating Scraper Sequence



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interim storage or disposal area (Figure B-2). Depending on the depth of the cut, it may be desirable to make several passes with the motor grader to form a large enough windrow to maximize use of the front-end loaders. Several front-end loaders may be required to keep up with one motor grader.

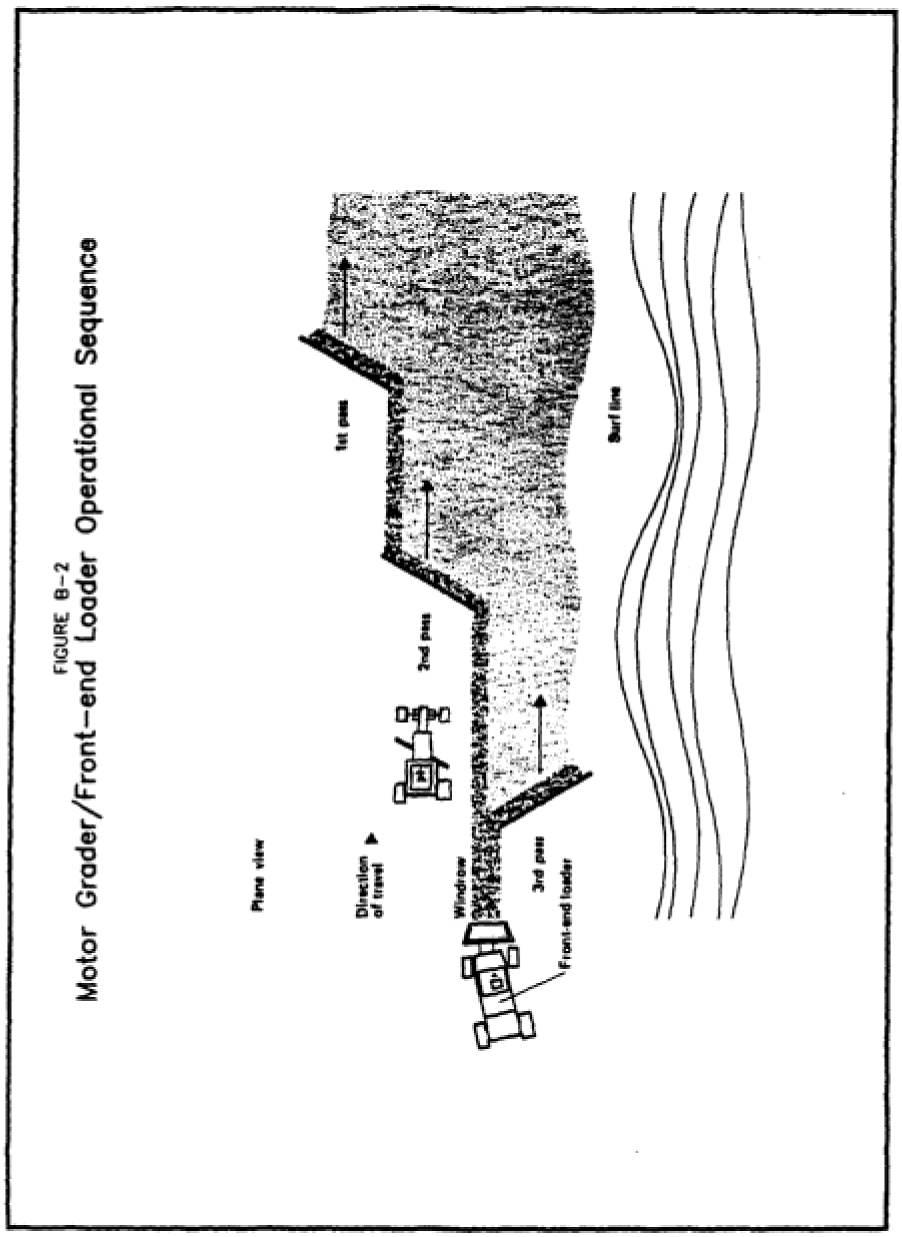

FIGURE B-2
Motor Grader/Front-end Loader Operational Sequence

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C. BULLDOZER/FRONT-END LOADER (RUBBER TIRED)

Bulldozers are used primarily on gravel or rocky soil areas and/or where oil penetration is deep, oil conditions are extensive, and trafficability poor. Beginning on the downgradient side of the oiled area, the oiled sediments are pushed up the shore perpendicular to the water line or slope and, if necessary, onto an area with suitable trafficability to operate a front-end loader (Figure B-3). For shorelines, the bulldozer should always begin at the up-current end of the oiled area.

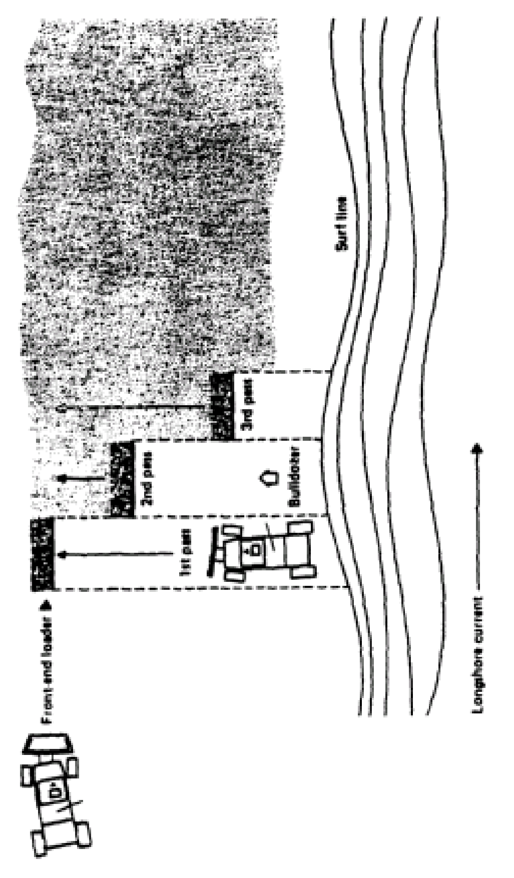


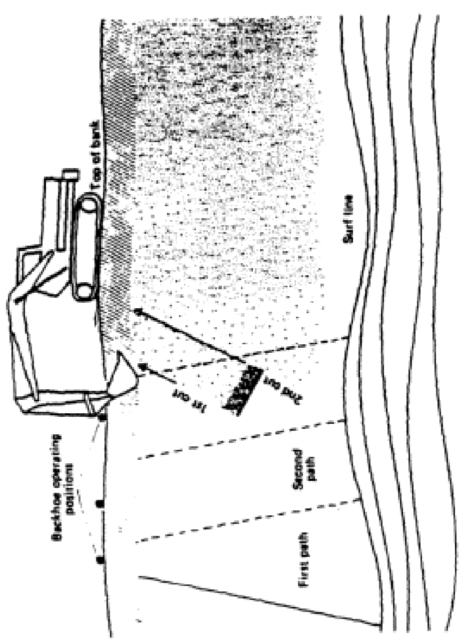
FIGURE B-3
Bulldozer/Front-end Loader Operational Sequence

Rubber-tired front-end loaders operate at the top of the contaminated area to pick up the stockpiled sediments and transfer them to dump trucks or a temporary storage area. The cut depth should not exceed the depth of oil penetration and the material should not be pushed beyond the affected area to avoid impacting unoiled areas.

D. BACKHOE

Backhoes are used primarily to remove oil-contaminated subsurface or surface sediments on steep banks where other types of equipment are unable to operate. They can also be used to remove surface sediments on flatter surfaces should other equipment be unavailable. Oiled surface sediments are removed by positioning the backhoe at the top edge of the bank or slope,

FIGURE B-4
Backhoe Operational Sequence



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extending the boom down, and scraping the surface layer into the bucket as the boom is retracted up the slope (Figure B-4). The backhoe can also be positioned at the base of the slope and operated in the much the same manner except that the material is pulled downhill.

For removal of oiled subsurface sediments or surface sediments on a flat beach, the backhoe is positioned at one end of the oiled area and worked towards the other end. Multiple passes may be required as backhoes typically have a lateral range of only 10 - 30 feet. For shoreline cleanup, removal should begin at the up-current end. The excavation depth should not extend beyond the depth of oil penetration.

The excavated material can be loaded directly into dump trucks or placed in piles for subsequent removal for disposal by front-end loaders and dump trucks. Any significant excavations should be at least partially back-filled with adjacent or nearby clean materials to avoid a safety hazard and minimize potential erosion.

Logistics

The required logistics for mechanical removal depend heavily on the loading capacity of the equipment and haul distance to the unloading area. The primary logistical requirements for each of these techniques to clean 0.5 mile of shoreline or a 4-acre area are summarized in Table B-2.

TABLE B-2

Logistical Requirements for Mechanical Removal

Technique and Equipment	Number of Equipment Required For:				No. of Truck Loads/Hour	Individual or Combined Cleaning Rate
	Load Capacity	No Haul Distance	100-ft. Haul Distance	500-ft. Haul Distance		
Motor Grader/Elevating Scraper						
Motor grader	N/A	1	1	1	N/A	0.5 hr/acre or ¼ mile
Elevating scraper	20 yd^3	N/A	1	1	N/A	2 hr/acre or ¼ mile
Elevating scraper	10 yd^3	N/A	1	2	N/A	3 hr/acre or ¼ mile
Motor Grader/Front-End Loader						
Motor grader	N/A	1	1	1	N/A	0.5 hr/acre or ¼ mile
Loader-rubber tired	3 yd^3	1	2	3	N/A	2 hr/acre or ¼ mile
Loader-tracked	3 yd^3	1	2	4	N/A	2 ¼ hr/acre or ¼ mile
Dump truck	10 yd^3	N/A	N/A	N/A	19	N/A
Bulldozer/Front-End Loader						
Bulldozer	N/A	1	1	1	N/A	3 hr/acre or ¼ mile
Loader-rubber tired	3 yd^3	1	2	3	N/A	6 hr/acre or ¼ mile
Dump Truck	10 yd^3	N/A	N/A	N/A	23	N/A
Front-End Loader						
Loader-rubber tired	3 yd^3	1	2	3	N/A	4 hr/acre or ¼ mile
Loader-tracked	3 yd^3	1	2	4	N/A	5 hr/acre or ¼ mile
Dump truck	10 yd^3	N/A	N/A	N/A	23	N/A
Backhoe						
Backhoe	16ft^3	2	N/A	N/A	N/A	10 hr/acre or ¼ mile
Backhoe	12ft^3	3	N/A	N/A	N/A	10 hr/acre or ¼ mile
Dump truck	10 yd^3	N/A	N/A	N/A	23	N/A
Personnel						

1 operator for each piece of equipment and 1 supervisor.
Access
Heavy equipment, barge, or landing craft.

Limitations

Large-scale sediment removal is one of the least desirable techniques due to the level of potential physical and environmental impacts. Use of this technique may be restricted by disturbance to adjacent habitats such as bird nesting or feeding locations or fish-spawning areas. Other potential limitations include:

- Potential for fire or explosion hazard (can be minimized by using non-sparking equipment.
- The equipment is generally heavy and large, and often support-intensive (i.e., maintenance, fuel, parts, etc.).
- Large scale sediment removal can result in shoreline or slope erosion if material is not replaced with clean sediments.
- Depletion of sediment-dwelling organisms is also associated with large-scale excavation although recruitment from nearby areas is typically rapid.
- Release of oil and fine-grained oily sediments to the water during removal activities is also common unless containment or sorbent booms are used.

Impact Minimization

- Restrict, where possible, material removal to moderate to heavily oiled sediments.
- Replace excavated sediments with clean materials if shore or slope stability is compromised.
- If removal operations are conducted along the waterline, boom off the work area to contain oil that may be released into the water.
- Minimize or avoid sediment removal in marshes or heavily vegetated areas.

3. SORBENT USE

Common Applications

Sorbents are typically used to remove oil coatings from hard surfaces (bedrock, boulders, manmade structures, etc.) or thin films or sheens from water surfaces. They may also be used to recover small pools of oil on land or water, or mobile oil from saturated sediments. They are most often used in the final stages of cleanup or as the primary means of response to very small spills. In addition, sorbents can be used to prevent oil contamination of facilities such as walkways, offices, changing or decontamination areas, etc.

General Instructions

When removing oil from hard surfaces, sorbents are used to wipe or blot the oil off. For saturated sediments, sorbent pads or blankets are laid on the surface and worked into the sediments by rubbing or applying pressure. If the sediments are very soft, boards may be placed over the sorbents and walked on to better distribute the weight and minimize substrate disturbance. When removing oil from pools or the surface of water, the sorbents (usually in the form of pads) are placed on the oil or oil/water and turned over frequently to maximize the recovery capacity of the sorbents. The sorbents can also be moved across the water's surface in a sweeping motion to enhance recovery. Sorbent "sweeps", which are long rectangular sorbent pads with ropes bound into each end, can also be pulled through the water between two boats with the front edge raised slightly by the ropes to quickly cover larger areas.

If used for preventing contamination of facilities, sorbent rolls or pads are laid on the surface(s) to be protected and secured in place with duct tape along all edges to minimize tripping hazards. Once they become relatively oiled, they can be turned over to increase utilization or, if depleted, replaced with clean sorbents.

Logistics

There are no logistical requirements for general sorbent use other than the following:

- Containers or plastic bags for storage of oiled sorbents.

- Boards if recovering oil from saturated soft sediments.
- Boats if using sweeps to recover floating sheens.
- Duct tape if using sorbents to protect walkways or other surfaces.

Limitations

- Potential fire and explosion hazard.
- Site access.
- Less effective on weathered oils.
- Very labor intensive and can result in significant shoreline or substrate disturbance.

Impact Minimization

- Restrict heavy foot traffic to firm substrate with limited vegetation.
- Recover all oiled sorbents.

4. VACUUM/PUMPS/SKIMMERS

Common Applications

Vacuum equipment such as pumps or vacuum trucks are typically used for recovering mobile oil which has accumulated in sufficient quantities within containment devices or in natural depressions, cracks, crevices, interstitial spaces, etc. Portable skimmers are primarily applicable to removing oil from the surface of water within containment booms or adjacent to the shoreline where wind, currents, and natural barriers may have trapped pockets of oil.

General Instructions

Vacuum sources such as pumps, vacuum trucks, or portable vacuum units are used to recover free oil from the shoreline surface where it has accumulated in pools or in cracks and crevices and interstitial spaces within coarse sediments. The equipment can range from small, portable pumps to vacuum units fitted to a 55-gallon drum, to large, truck-mounted supersuckers that can lift large cobbles.

The vacuum unit or pump can be positioned adjacent to the area to be worked or, for shorelines with limited access, on a shallow draft vessel such as a skiff or landing craft. Reinforced suction hoses are attached to the vacuum source and fitted with a coarse screen or wire mesh over the end of the hose to minimize the intake of rocks and debris. Hose diameters of 2 to 4 inches for lighter oils are often required to prevent clogging. The vacuum source is activated and the hose end placed directly in the oil. Recovery is maximized by continually repositioning the intake to the point of greatest accumulation.

This technique can also be used to skim oil off the surface of the water if relatively thick accumulations of oil are present or shallow water depths preclude the use of skimmers. In this case, the hose opening should be positioned just above the water surface or at an angle to the water with the lower edge situated just below the oil-water interface. This will minimize the typically large quantities of water recovered along with the oil.

Where water depths permit, such as in nearshore areas, sloughs, marshes, etc., skimmers are used to recover oil from the water's surface. They are typically used in conjunction with flushing, flooding, or spot washing techniques where oil is remobilized back into the water and contained by booms for subsequent recovery with a skimmer.

Portable skimmers are typically deployed from vessels to recover oil within containment booms. They should be positioned in the area of heaviest oil concentration and periodically repositioned to maximize recovery. Shallow draft skimmers such as rope mops, disc, and some weir types usually work well with most light petroleum products. If rope mops are used, anchors or outriggers fitted to the vessel will be required to hold the tail pulleys in place. Squeegees or water streams from hoses can be used to direct oil to the rope mops or skimmer intakes if they cannot be relocated easily.

Storage tanks are typically required when using this technique particularly when recovering oil from the water. If operating from the shoreline, the tanks should be placed in an easily accessible area for periodic transfer of the tank or its contents to a storage/disposal site. For vessel operations, the tanks can be placed directly on the vessel or on a separate vessel nearby and connected by a hose.

For very shallow nearshore areas with relatively weak currents, a sump can be dug in the shoreline with a boom attached to the back of the sump on the down-current side and extending out into the waterway (Figure B-5). The current moves the oil down the river or along the shore where it is intercepted by the boom and channeled into the sump. If possible, the sump should be located along the outside shore of a bend in the waterway where oil will naturally tend to concentrate.

A vacuum truck, pump, or skimmer is used to remove the oil from the sump. Boards or squeegees can be used to further direct oil to the sump and concentrate it for pickup.

Logistics

The logistical requirements for using the vacuum/pump/skimmer technique will vary considerably with the amount of oil to be collected as well as the percentage of water recovered along with the oil. If skimmers are used, the percentage of water recovered will likely be low, thus requiring fewer containers or trucks. Conversely, pumps and vacuum systems typically recover large amounts of water with the oil, necessitating several storage containers or tank vehicles. Therefore, the primary logistical concern is temporary storage and disposal of the oil and water. The more oil collected, the greater the number of storage tanks and/or vacuum or tank trucks that will be needed to transport the liquids for recovery or disposal.

FIGURE B-5
Recovery of Oil With Sump and Pump/Vacuum

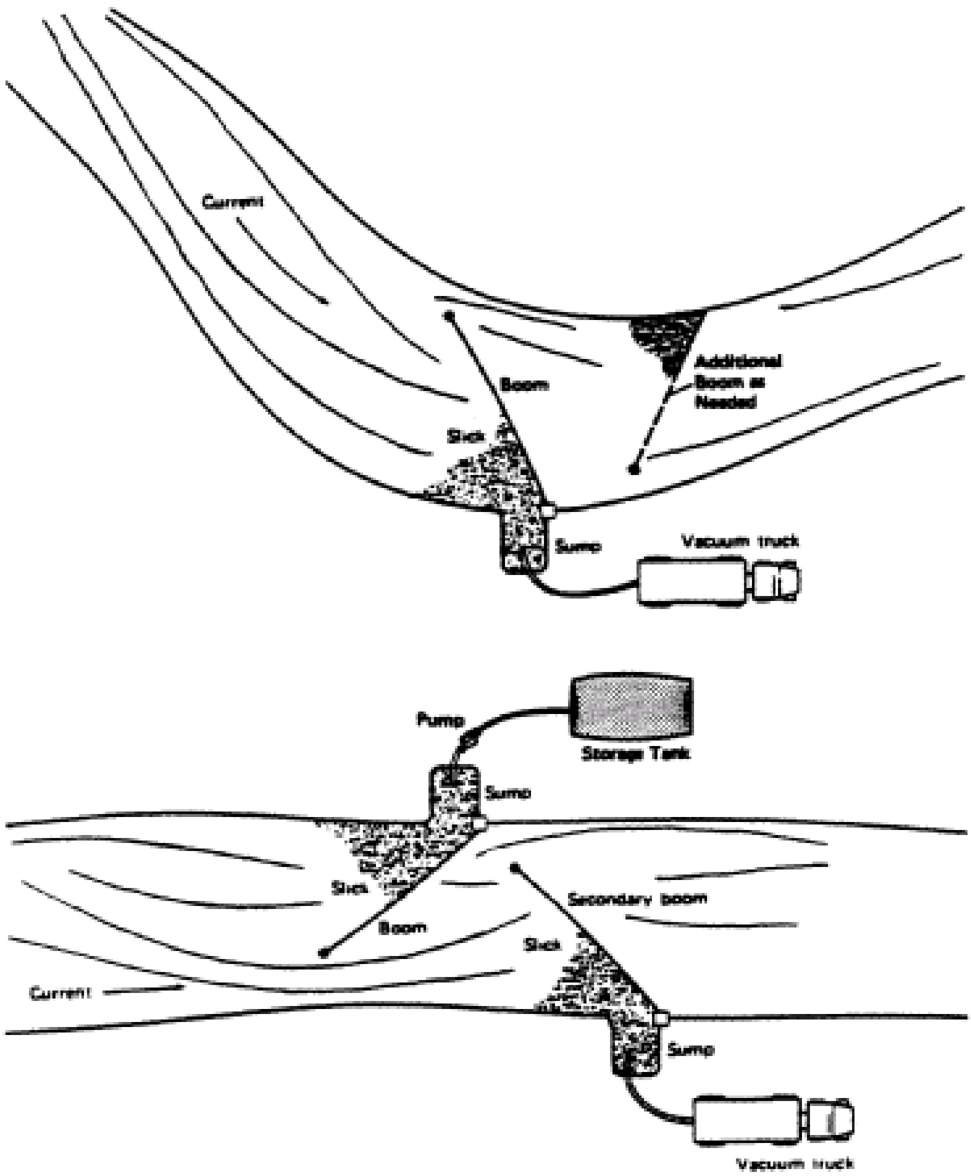

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Table B-3 gives logistical requirements for the various types of vacuum systems, pumps, and skimmers.

Limitations

- Potential fire and explosion hazards.
- Effectiveness is reduced for very thin oil accumulations.
- Access may restrict the use of vacuum trucks and larger storage tanks.
- The use of vacuum systems to recover floating oil may require substantial storage capacity.

Impact Minimization

- Proper control of the suction hose will minimize the recovery of sediments, debris, and water along with the oil.
- Operate from skiffs, if possible, along shorelines sensitive to substrate disturbance.
- The sump method should not be used on sensitive shorelines.

TABLE B-3

Logistical Requirements for Vacuum Trucks, Portable Skimmers, and Pumps

Logistics	Estimated Recovery Rate for Thick Oil Layer (0.1 inch)	Estimated Recovery Rate for Thin Oil Layer (0.005 inch)
Equipment		
Vacuum Truck	100 gpm (10% oil)	50 gpm (5% oil)
High capacity trash pump with 3" suction hose	50 gpm (20% oil)	20 gpm (5% oil)
Portable weir skimmer	30 gpm (35% oil)	30 gpm (20% oil)
Portable rope mop skimmer	4 gpm (70% oil)	2 gpm (70% oil)
Portable disc skimmer	20 gpm (80% oil)	5 gpm (80% oil)
Number of pumps or skimmers	Dependent upon quantity of oil and rate of introduction to skimmer or pump.	
Personnel		**Number per Crew**
Suction hose operator		1 each
Skimmer/oil concentration operations		1 - 2
Supervisor		1
Support		**Range of Capacities**
Vacuum Truck		6 - 140 barrels
Tank Truck		20 - 160 barrels
3" Suction Hose		300 - 400 gpm maximum
Pillow Tanks		2 - 2,500 barrels

5. FLOODING ("DELUGE")

Common Applications

Flooding is used to float oil off and out of shoreline sediments and transport it back into the water using large volumes of water at low pressure. The remobilized oil is subsequently recovered using skimmers or sorbents. Flooding is primarily applicable to coarser-grained substrates such as sand and gravel where the oil is fluid and present in relatively large quantities. It may also be used on rocky terrestrial areas where oil has pooled or collected in depressions or crevices.

This method is frequently used in conjunction with flushing and occasionally spot washing techniques to enhance effectiveness and minimize additional oil penetration into the sediments.

General Instructions

A large diameter (2- to 6-inch) header hose or pipe perforated with 1/4- to 1/2-inch holes along the downslope side is placed parallel to the shoreline above the oiled area. A hose is preferred as it will better conform to the actual shoreline profile. Similar, non-perforated hoses are used to supply water to the header. One or more centrifugal pumps (2 to 4 inches) are located on the shoreline or on nearby shallow draft vessels. Reinforced suction hoses fitted with screens to exclude debris are suspended in the water to supply the pumps. A manifold can be fitted to the pump discharge to permit the connection of smaller hoses used to "herd" floating oil to the recovery equipment.

Water at ambient temperature is pumped through the header hose at high volumes (50 to 200 gpm) and low pressure (<50 psi). The water flows out of the perforations and across the shore toward the water's edge carrying much of the free oil with it. On porous substrates, water also flows through the substrate driving the mobile oil ahead or floating the oil to the surface, then transporting it into the water.

Containment and/or sorbent booms should be anchored in the water around the work area to contain the oil as it is flushed back into the water. It is usually more effective if two lines of boom are used, with the primary (shoreward) boom being the standard containment type and the secondary boom being the sorbent type to recover any sheens that may escape the primary boom. Prior to setting up the entire system, a small area should be test flooded to evaluate technique effectiveness. An example of the flooding technique is shown in Figure B-6.

Begin flooding at the upcurrent end of the oiled area. Flooding is maintained as long as necessary to remove the majority of the free oil. Oil flowing back into the water is trapped by booms and picked up with a skimmer or other suitable equipment.

Logistics

The logistics required for conducting a flooding operation are dependent on several factors including:

- Length of shoreline to be cleaned.
- Width of oiled area.
- Porosity (size and sorting) of the beach sediments.
- Depth to groundwater.

In general, these factors are directly proportional to the flow rate required to produce the desired flooding effect. Insufficient flow rates will typically result in the water percolating downward into the beach without producing the lateral flow component required to remove the oil and transport it to the water's edge.

The general logistical requirements for flooding a 50- to 100-foot long section of shoreline are summarized in Table B-4.

Limitations

Accessibility to the shoreline and environmental sensitivity of the area to disturbance by equipment and personnel are the primary limitations. Other limitations include:

- Potential fire or explosion hazard.
- Decreased effectiveness on weathered oil and/or thin films or coatings.
- Sediments may be transported into the waterway and disrupt water quality.

- Generally not applicable to mud and other fine-grained sediments.

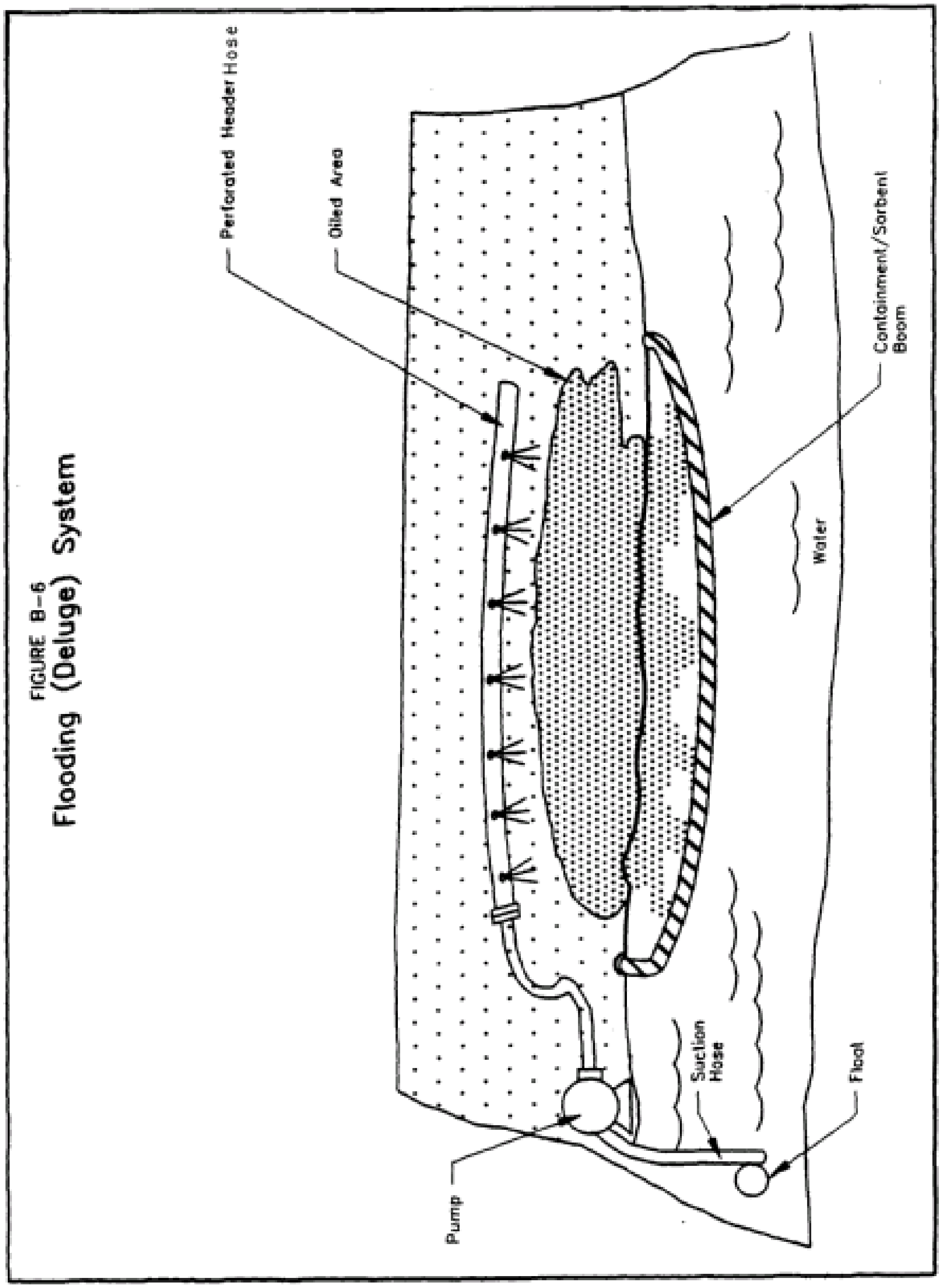

FIGURE B-6
Flooding (Deluge) System

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TABLE B-4

Logistical Requirements for Flushing

Item	Type	Number Required
Equipment		
Pumps (4" - 6")	75 - 150 gpm @ <50 psi	1-2
Suction hose	2 - 4" x 25 ft.	1-2
Discharge hose	2 - 4" x 50 ft.	1
Perforated header hose	4" x 50 ft.	1
Containment boom	12 - 24" x 1150 ft. (min.)	1-2
Oil recovery	Skimmer/pump/vacuum unit	1
Oil storage tank	10 - 100 bbl	1
Personnel		**Number per Crew**
Pumping system		2 - 3
Recovery operation		2 - 3
Supervisor		1
Access Requirements		
Heavy equipment, vessel, light vehicular or helicopter.		

Impact Minimization

- Adjust water volume and pressure to achieve the desired results while minimizing sediment disturbance.
- Ensure work area is adequately boomed to contain remobilized oil.
- Use with caution on shorelines with erosion potential.
- Orient header hose perforations such that water sprays into the air rather than onto the ground to minimize erosion.

6. FLUSHING

Common Applications

Flushing is used to remove oil lightly adhered to surface materials or buried in shallow layers of sand/gravel-sized sediments through agitation and direct contact with the water stream, and to flush the removed oil back into the water for recovery. It can also be used on rocky shorelines or rip-rap to flush floating or loose oil out of depressions, crevices, or from behind rip-rap, boulders, or other obstructions. It is commonly used in conjunction with the flooding technique to minimize oil penetration into the substrate and assist in the transport of the oil back into the water. The water can be applied at ambient temperature or heated (up to 140°F) depending on the oil type and/or degree of weathering. Elevated temperatures are not usually required for lighter petroleum products unless they are emulsified or highly weathered.

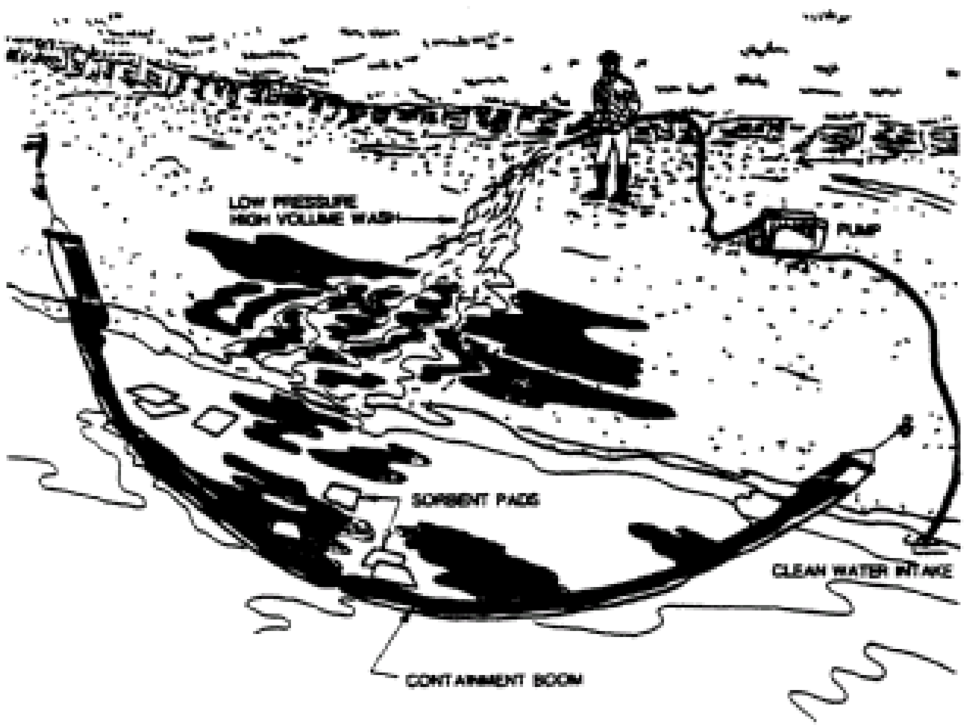
General Instructions

Containment and/or sorbent booms should be anchored in the water around the work area to contain the remobilized oil. Flushing equipment is typically placed on a shallow draft vessel and anchored to the shore. One or more centrifugal pumps (2 to 4 inches) are used to supply the flush water. The intake hoses can be lowered over the side of the vessel and directly into the water. Hot water, if required, can be provided by hot oil trucks or direct-fired industrial heaters using electricity, diesel, or propane as the energy source. A manifold is fitted to the discharge of each pump. Several fire hoses are then attached to the manifold and fitted with adjustable fog nozzles to produce narrow streams for sediment agitation and oil removal and coarse sprays for flushing the oil downslope. If the oiled area is small, a portable pump and single hose and nozzle can be used to flush the area as shown in Figure B-7.

Prior to setting up the complete system, a test flushing should be conducted in a small area to determine the effectiveness of the technique.

Flushing should begin at the top of the oiled area and proceed downslope. Oil re-entering the water is recovered by skimming, pumping or sorbents. The water streams can also be used to direct the floating oil towards the recovery equipment. If authorized by the state and/or federal On-Scene Coordinator (OSC), dispersants or other surfactants (low-toxicity beach cleaning agents) may be mixed, at low concentrations, with the flushing water to aid oil removal and prevent re-oiling by, and re-coalescing of, the removed oil. This is generally not necessary when lighter petroleum products are involved.

FIGURE B-7
Small Flushing Operation



Low-pressure water streams can also be used to flush out oil stranded in backwater areas or under docks and herd it into containment or recovery devices. Very low pressure water streams can also be used to remove oil from vegetation. When operating from a small skiff and using smaller pumps, low-pressure water streams have been used effectively to flush oil that has become stranded within marsh vegetation out into open water where it can be recovered. Additionally, low-pressure water streams can be used to remove oil from the surface of fine-grained sediments (i.e., mud) by "bathing" the surface with the water and floating it back into the water for recovery.

Logistics

The logistical requirements for using flushing will vary with the degree and type of oil contamination, sediment type, and size of oiled area. In general, the number of pumps, hoses, and ancillary equipment is directly related to the size of the area and degree of oil conditions. The size of the sediments and degree of weathering is also directly proportional to the pressure used. Temperature is similarly dependent on the weathering of the oil. The general logistical requirements for flushing a 100-foot area are listed in Table B-5.

Limitations

Mobilized oil may percolate or be driven down to greater depths in permeable substrates by the water streams unless an effective flooding system is also used. Other potential adverse effects or limitations are:

- Potential fire or explosion hazard.
- Removal or mortality of surface organisms.
- Surface and near-surface habitat disruption.
- Transport of sediments into water and resulting effects on water quality.

This technique, particularly when elevated temperatures are employed, is generally not appropriate for use in biologically sensitive areas, including fish spawning stream channels and mouths.

TABLE B-5

Logistical Requirements for Flushing

Item	Type	Number Required
Equipment		
Pumps (2" - 4")	50 - 100 gpm @ 50 - 80 psi	2
Suction hose	2 - 4" x 25 ft.	2
Discharge hose	2 - 4" x 50 ft.	1
Manifold	2 - 4" (1 into 4)	1
Fire hose with nozzle	1½ - 2" x 50 ft.	4
Heaters	100 gpm @ 50 - 80 psi and 140°F	1 - 2
Containment boom	12 - 24" x 150 ft. (min.)	1 - 2
Oil recovery	Skimmer/pump/vacuum unit/sorbent supply	1
Oil storage	10 - 100 bbl	1
Personnel		**Number per Crew**
Pumping system		2 - 3
Flushing (fire) hoses		1 each
Recovery operation		2 - 3
Supervisor		1
Access Requirements		
Heavy equipment, vessel, light vehicular or helicopter.		

Impact Minimization

- Adjust spray pattern to achieve desired results while minimizing sediment disturbance.
- Ensure work area is adequately boomed to contain remobilized oil.
- Use with caution on shorelines with erosion potential.

- For marshes or mudflats, reduce pressure to minimum and bathe instead of agitating substrate or vegetation.

7. SPOT (HIGH-PRESSURE) WASHING

Common Applications

Spot washing is used to remove oil coatings from hard surfaces such as boulders, rock, piers, boat hulls, logs, and manmade structures in small areas where oil is weathered and/or cannot be removed by flushing.

General Instructions

Spot washing uses a high-pressure water jet that removes oil from almost any surface. The water can be heated for increased effectiveness. The water jet should be used only by trained personnel. A properly controlled jet can remove oil from painted surfaces without harming the paint, but too strong a jet at close range will remove all of the paint and could damage the surface.

Most pressure washing units are relatively small, portable, and self-contained with a pump, electric generator, hoses, and spray wands, and may be equipped with a water heater. The units can usually deliver pressures up to 2,000 psi and temperatures of up to 150°F. Spray wands similar to those found in self-service car washes are used to apply the water to the oiled surfaces. The units are typically placed on the shore with a suction line and screen attached to a float in the water.

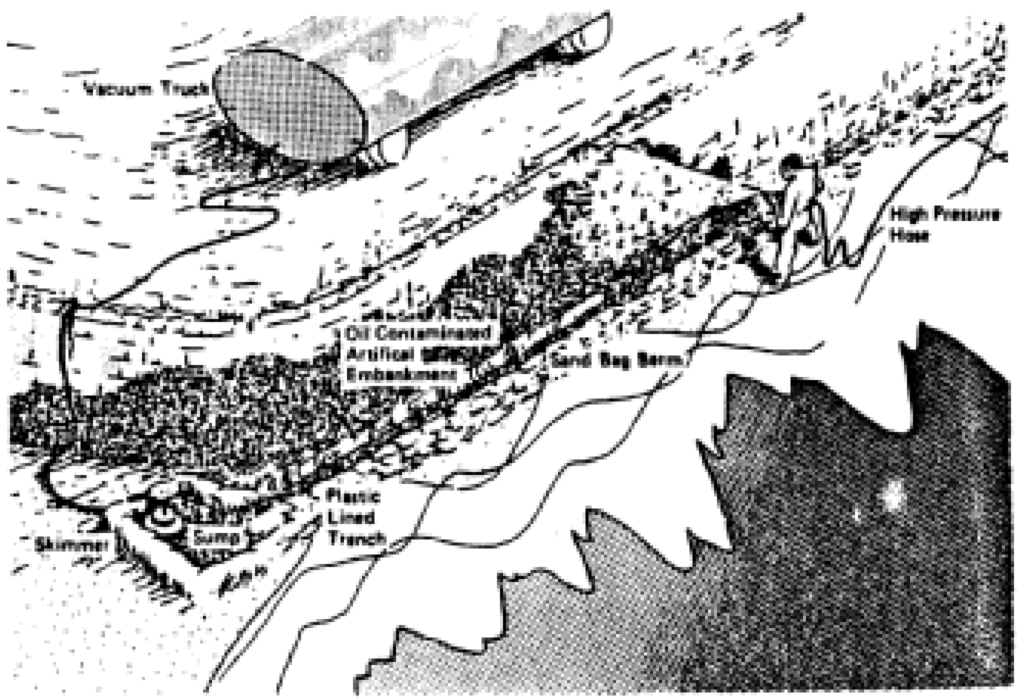
When spot washing small areas, the surrounding surfaces should be covered with plastic sheeting or sorbents as the removed oil and water tend to spread over a large area. Collection of the oil and water can be accomplished by allowing it to pool in natural depressions on the shore, channeling it to a collection sump, or letting it drain back into the water. An example of spot washing is shown in Figure B-8. Specific operating procedures for spot washing are:

- If the oil is allowed to drain back into the water or if there is a possibility of it re-entering the water, containment booms should be anchored close to the shore.

- Flushing should begin at the upcurrent end and work downcurrent. If a relatively large area is to be cleaned, it should be done in small sections.

- Berms or ditches can be constructed or booms used to further channel the oil and water into collecting pools, or back into the waterway.

FIGURE B-8
Spot (High Pressure) Washing



- Pumps, vacuum trucks, sorbents, or skimmers can be used to recover the remobilized oil.

Logistics

The logistics required to clean a shoreline using spot washing are dependent on the size of the area and the desired rate of cleaning. The cleaning rate is, in turn, influenced primarily by the type and condition of oil, the type of substrate, and the water pressure and/or temperature used. In general, the cleaning rate is adversely affected by weathered oil and convoluted surfaces (e.g., rip-rap vs. a boat hull) and enhanced by elevated pressures and temperatures. The general logistical requirements for cleaning a 100-foot area are shown in Table B-6.

TABLE B-6

Logistical Requirements for Spot (High-Pressure) Washing

Item	Type	Number Required
Equipment		
Pressure washer (Self-contained)	4 - 12 gpm @ 200 - 2,000 psi (hot water optional)	1 - 2
Containment boom	12 - 24" x 150 ft. (min.)	1 - 2
Oil recovery	Skimmer/pump/vacuum unit/sorbent supply	1
Oil storage	10 - 100 bbl	1
Personnel		**Number per Crew**
Washing operation		1 each
Recovery operation		2 - 3
Supervisor		1
Access Requirements		
Light vehicular, vessel, helicopter.		

Limitations

- Potential fire or explosion hazard.
- Oil recovery is difficult due to the size of the area which typically receives the deflected water and oil spray.
- High pressures can cause damage to even very hard or manmade surfaces.
- Not applicable to fine grained substrates or vegetated shorelines.

Impact Minimization

- Implement appropriate measures to contain and recover all removed oil.
- Do not use hot water unless required.
- Do not apply spray at close range or in one place for more than a few seconds to avoid damaging the surface.

8. PASSIVE COLLECTION

Common Applications

Sorbent materials (e.g., snare or sorbent booms or sorbent sweeps) are anchored or otherwise installed in the water adjacent to the shoreline and downslope of the oiled area. As the oil is remobilized or released from the sediments through precipitation or gravity drainage, it contacts the sorbent materials and becomes immobilized. Oil migrating towards the shoreline from upstream areas is also recovered by the sorbent materials and prevented from contacting the shore.

Passive collection is primarily used on shorelines where oil conditions are light and the oil is leaching from the shoreline at a relatively low rate. This method can also be used where oil is mobile and the transport of large quantities of oil is expected on or off the site. It can also be applicable to light to moderately oiled shorelines that are very sensitive to foot traffic and mechanical equipment.

General Instructions

Recovery effectiveness is dependent upon the capacity of the particular sorbent material. Snare booms are generally the most effective sorbent material for this technique when weathered or emulsified crudes and medium fuel oils are involved. Sorbent booms are typically more effective on gasoline or fresh petroleum products.

The snare or sorbent booms are installed along the shoreline using anchors or rebar stakes and rope. In many cases, the booms can be tied to large boulders or bedrock protrusions thereby eliminating the need for anchors. Danforth or mushroom are the preferred anchor types for this purpose. If anchors are not available, rebar stakes measuring 3 to 4 feet in length and 0.5 to 0.75 inch in diameter can be pounded into the sediments to serve as anchor points. The number and size of the anchors or rebar should increase with the nearshore current velocity.

If the water level is expected to rise or fall, booms should be attached to the anchor points with sections of poly or nylon rope and floats or buoys. Each rope section should be long enough to prevent the float and/or boom from submerging at high water levels but not so long that it allows the boom to become "beached" by onshore winds. Floats should be attached to the anchor line a few feet from the boom to eliminate or minimize the current-related downward tension and subsequent submergence of the boom. If stakes are used and the water is shallow, the booms may be tied directly to the stakes with a short length of rope.

Sorbent booms are often susceptible to breakage at their connection points even in light current conditions and should be strengthened by running poly rope along the entire length of the sorbent booms and attaching it to the booms with cable ties or baling wire. This is not necessary for snare booms as the snares are already attached to a length of poly rope.

Booms should also be checked periodically for oil saturation and replaced as needed. Sorbent booms must also be rotated periodically to maximize oil sorption capacity if wave action does not rotate them naturally.

Logistics

The logistical requirements for passive sorbent use will vary with the type of oil and the size of the oiled area. Specific manpower and equipment requirements will depend on the length of boom used and the nature of the area in which it is deployed. In general, anchors should be located every 50 to 100 feet in low currents, whereas a spacing of 25 feet may be required in higher currents. A crew of 2 to 3 workers operating from a small skiff or on foot is usually sufficient for deployment of sorbent booms. Depending on water depth and anchoring requirements, an installation rate of 100 to 300 feet of boom per hour should be possible.

Limitations

- Potential fire or explosion hazard.
- Removal can be slow, thus allowing oil to remain in critical habitats during sensitive periods of time.
- Significant amounts of oil may remain on the shoreline after natural leaching is no longer effective in removing stranded oil.

Impact Minimization

- Deploy anchors and boom from a skiff in marshes or along sensitive shorelines to avoid substrate disturbance.

- Check boom periodically for failure or leakage.

9. SEDIMENT TILLING

Common Applications

Sediment tilling involves the use of mechanical equipment or hand tools to turn over or till surface and near-surface oiled sediments as a means of maximizing their exposure to physical, microbial, and photochemical degradation processes. It is primarily applicable to finer grained or mixed sediment shorelines but may also be used on terrestrial areas where the oil has not penetrated too deeply. Tilling is often restricted to use on non-recreational shorelines with light oil conditions due to the potential for the oil to persist for extended periods of time. Tilling of shorelines or terrestrial areas is likely to require regulatory approval.

General Instructions

The surface sediments are mechanically, or in some cases manually, tilled or mixed. For small areas a rototiller or hand tools (shovels, rakes, picks, etc.) are usually sufficient. For large terrestrial areas, a tractor equipped with cultivating tines or a disking apparatus may be more effective. Conventional or chisel ploughs should be used if penetration exceeds 8 inches. This process is often repeated over time to further speed the rate of degradation. Specifically, the tilling procedures are:

- Tilling should begin along the top edge or at the upcurrent end of the oiled area and continue parallel to the water or slope to the end of the oiled area or for approximately 500 to 1000 feet.

- For wide terrestrial areas, the tractor is turned around and a new path is started adjacent to, and slightly overlapping, the previous one. The process is repeated until the entire oiled area has been tilled.

- For shoreline tilling, containment or sorbent booms should be positioned adjacent to the shore to contain and recover oil that may be released.

Logistics

The logistical requirements for sediment tilling are primarily dependent upon the size of the oiled area. Under normal circumstances, unless the area is very large, one tractor and tilling device can usually maintain a sufficient cleaning rate. Table B-7 gives the logistical requirements for a 500-foot by 20-foot area.

TABLE B-7

Logistical Requirements for Sediment Tilling

Item	Type	Number Required
Equipment		
Tractor with tilling device	Rubber tired or tracked	1
	or	
Rototiller	Self-powered	2 - 3
Personnel		**Number per Crew**
Equipment operators		1 each
Supervisor		1

Limitations

- Potential fire and explosion hazard.
- Should not be used near fish-spawning areas because of the potential for long-term chronic releases of oil.
- Oil can be mixed deeper into the sediments and prolong its persistence.
- May require regulatory approval, particularly if used on terrestrial spills as shoreline oil conditions are typically limited to a narrow band that degrades relatively quickly.

Impact Minimization

- Limit tilling to depth of oil penetration.
- Do not use on areas with healthy vegetation.
- Use with caution on slopes or shoreline with erosion potential.
- Boom off work area if adjacent to water to contain oil that may be released by tilling.

10. IN SITU BIOREMEDIATION

Common Applications

Natural oil degradation processes are enhanced by stimulating the growth of existing microbial communities. Bioremediation is primarily applicable to shorelines or terrestrial areas with light to moderate oiling of surface or near-surface sediments and where the physical and/or ecological impacts from other candidate techniques are considered unacceptable. It is also commonly used as a polishing technique to treat minor amounts of oil remaining after the initial cleanup is completed.

General Instructions

Species of oil-metabolizing microbes are present to varying degrees on most shorelines and will began to reproduce rapidly in the presence of a food source such as an oil spill. As the microbes metabolize the oil they also utilize various nutrients including nitrogen and phosphorus. Once the supply of nutrients is depleted, the microbes rapidly die off and the natural degradation rate of the oil similarly decreases. Therefore, applications of a nitrogen and phosphorus fertilizer are usually required to maintain a high rate of hydrocarbon metabolization or degradation. In some cases, the area can be inoculated with indigenous or genetically engineered hydrocarbon-degrading micro-organisms to rapidly increase microbial populations. This latter approach will not be considered here as native populations are generally sufficient to achieve the desired results.

The most commonly used fertilizers are the granular types which are similar in appearance and makeup to lawn fertilizers. Certain brands, such as Customblen, have time release capabilities and are preferable to the standard fertilizers. They are generally effective on both surface and near-surface oil conditions. Liquid fertilizers can also be effective but are usually applied to heavier oils on solid surfaces. INIPOL, which was used extensively during the Exxon Valdez cleanup, is a viscous, oily liquid which adheres strongly to various surfaces and is not easily washed off by precipitation.

Granular, or dry, fertilizers are applied using hand-cranked broadcast spreaders similar to those used to fertilize home lawns. A constant cranking speed should be maintained to provide an

even distribution. The application rate for Customblen or most other granular fertilizers is 0.6 lb/300 sq. ft. The fertilizer should be reapplied every two to four weeks as the nutrients may be dissolved or flushed into the water by precipitation and storm water runoff.
Liquid fertilizers are often applied using airless paint spraying equipment and, in the case of INIPOL or similar fertilizers, a heated (90 degrees F) storage tank. Typically, the INIPOL is preheated and placed in an insulated storage tank on a small landing craft along with the airless sprayers with long hoses for maximum range. The landing craft moves onto the shoreline, lowers the front gate and the workers take the hoses onto the shore. They spray the oiled areas and then return to the landing craft for transport to the next area. The recommended application rate of INIPOL is approximately 0.75 gallon/300 sq. ft.

Logistics

The logistical requirements for in situ bioremediation will vary with the type of fertilizer used and the size of the area to be treated. Because liquid fertilizers are not normally applicable for spills of petroleum products, they are not considered here. In general, one person with a hand fertilizer spreader is sufficient, although the larger the area, the greater the number of application units and personnel that will be required.

Limitations

Potential health problems from inhalation and skin contact are of concern during the application of some fertilizers. Goggles, a respirator, rubber gloves, and protective coveralls should be worn when applying the fertilizers. Other limitations are:

- Potential fire or explosion hazard.
- Generally not used on shorelines with heavy oil accumulations.
- Increased nutrient levels can cause algal blooms and short-term water quality problems in protected areas.
- Should be avoided near fish streams or other ecologically sensitive areas.

- May require special regulatory approval.

Impact Minimization

- Do not apply more than the recommended amount.
- Avoid application to water and unoiled areas.
- Balloons or other bird deterrents should be used to prevent birds from contacting or ingesting the fertilizer.

11. LOG/DEBRIS BURNING

Common Applications

Oiled logs, vegetation, and debris can be burned, where local air quality regulations permit, to minimize material handling and disposal requirements. Burning is primarily applicable to situations where the material is heavily oiled and presents either a potential source of released oil, an aesthetic problem, or the possibility of ingestion by animals feeding along the shoreline. It is also used where removal of the logs or large quantities of debris is not desirable or feasible. On a smaller scale, hand-held weed burners can be used to burn oil off of moderately to heavily oiled logs, bedrock, or other solid surfaces. In addition, burning can be used in marshes where large areas of grasses or other vegetation have been oiled and cutting would create too great an impact.

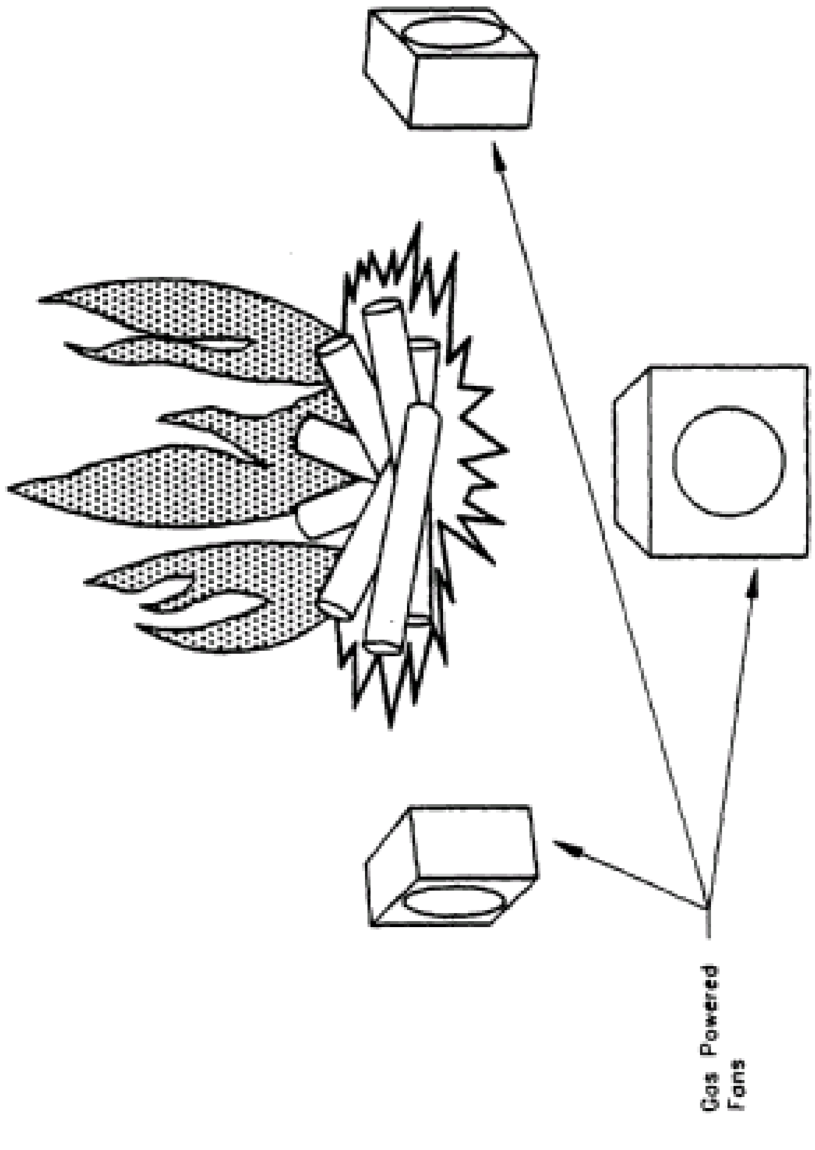
General Instructions

A plan that provides for safe, controlled burning should be prepared prior to burning. Moderately to heavily oiled logs and other oiled organic debris including driftwood, cut vegetation, leaves, etc., are placed in a pile on the shoreline at least 50 feet from any combustible materials (clean logs and debris, local vegetation, trees, etc.). Larger logs and debris should be cut into smaller pieces with chain saws to facilitate handling and minimize the size of the burn pile. The pile itself should not be greater than 15 to 20 feet in diameter to ensure it can be easily controlled. Fire extinguishers or water hoses should be on hand in the unlikely event that the fire does begin to get out of control. If required, kerosene or diesel fuel can be used to aid in starting the fire, particularly if the material is wet or it is raining. Once the fire is sustaining ignition, blowers (gasoline powered fans) can be placed around the perimeter of the fire and directed towards the base to speed combustion and increase temperatures which, in turn, reduces smoke and potentially harmful emissions (See Figure B-9).

If vegetation is to be burned in place, the fire should be started at the upwind end and allowed to burn downwind. It may be necessary to section off the burn area with fire breaks to ensure controlled burning. Fire control equipment must be stationed on-site should the fire extend beyond the desired area. Blowers will generally have little effect on fires covering large areas and therefore are not recommended.

Once all of the oiled material has been burned, water should be applied to any smoldering areas to ensure that the fire is completely out and that re-ignition is not possible.

FIGURE B-9
Debris Burning



Logistics

The logistical requirements for burning differ somewhat from burning logs and debris to burning vegetation in situ, but are concerned primarily with maintaining combustion and controlling the fire. Combustion promoters such as kerosene or diesel fuel can be used, if necessary, to initiate and maintain combustion. The amount of fire control equipment required will depend on the size of the pile or area to be burned and proximity to other sources of combustion. Table B-8 provides the logistical requirements for both burning piles of logs and debris and burning vegetation in place.

TABLE B-8

Logistical Requirements for Burning

Item	Type	Number Required
Equipment		
Weed Burner	Propane, kerosene, gasoline	2 - 4
Fans	Gasoline powered	2 - 4
Fire extinguisher	Portable	2 - 4
Fire fighting equipment	Small truck or portable pump	1
Fire promoters	Chemicals, diesel fuel, kerosene, or flammable materials (rags soaked in diesel fuel, wood chips, dried brush, etc.)	1
Personnel		**Number per Crew**
Fire control		2 - 3
Supervisor		1
Access Requirements		
Foot, boat, helicopter.		

Limitations

Non-organic or wet debris, such as oiled plastics, sorbents, and wet vegetation are NOT to be burned on-site due to the pollution potential. Open burning of materials in a manner which produces large amounts of black smoke should also be avoided. Other limitations include:

- Potential explosion hazard.
- Burning permits from the local air quality agency and/or landowner are usually required.
- Heat generated by burning will impact any near-surface organisms in the burn area.
- Blowers may be required to reduce emissions of smoke or toxic substances.
- Burning should not be conducted during high wind conditions or when the wind is blowing towards populated areas.

Impact Minimization

- Do not burn near wooded or vegetated areas.
- Ensure wind is blowing away from populated areas or known sensitive wildlife habitats.
- Do not burn healthy vegetation.

12. NATURAL RECOVERY

Common Applications

Natural recovery involves allowing nature to degrade and remove oil from the shoreline with no external assistance. This is often referred to as the "no action" alternative.

It is primarily used on remote shorelines with light to moderate oil conditions and low environmental sensitivity where natural processes will remove most of the oil in a relatively short period of time. It is also frequently used on shorelines with little or no access or where cleanup operations would cause significant ecological or safety impacts.

General Instructions

No cleanup activities are conducted on the shoreline. Removal of the oil is left to natural processes such as evaporation, erosion, biodegradation, photo-oxidation, dissolution, and dispersion. The area should be monitored periodically to determine if natural cleaning is sufficient and to ensure the oil is not remobilizing and impacting other areas.

Logistics

The natural cleaning rate varies with the level of exposure to natural degradation processes, the degree of oiling, and the substrate type. Logistical requirements are not applicable to natural recovery.

Limitations

- Typically not suitable for sensitive areas or heavy oil conditions where the oil would be expected to persist for substantial periods of time.

- Not recommended for situations where the oil is very mobile and could impact down-current or nearby sensitive areas.

- May require regulatory and/or land owner approval.

Impact Minimization

- None.

APPENDIX C

LOCATING UNDERWATER LEAKS

1. LEAK VERIFICATION AND PIPELINE OWNERSHIP

In many cases leak verification and determination of the pipeline owner will be no problem. Obvious pressure drop on a line, the presence of oil on the water surface downstream of a crossing or in the immediate vicinity of the line, and given the fact that the Company is the only one having a pipeline in the area is justification to initiate emergency response.

The presence of oil on water in a vicinity where a number of different companies have pipelines could pose a problem in determining whose pipeline is leaking. An obvious pressure drop on one of the pipelines in question would fairly well indicate the affected party and they would initiate the emergency response.

However, a small leak might not be conclusively identifiable from a pressure drop in the line. In this case, all of the parties having pipelines in the affected area would need to systematically investigate their pipelines in a coordinated effort to determine which pipeline is leaking. In this situation, the U.S. Coast Guard or the EPA would probably mount a response to the spill under the National Contingency Plan. Whenever an affected pipeline is identified as belonging to the Company, it will initiate an emergency response to the spill coordinated under the provisions of the National Contingency Plan.

In cases where the Company has multiple pipelines crossing a river or other water bodies, the determination of which pipeline might be leaking in an outage situation requires systematic investigation if the leak is small and none of the pipelines show recognizable pressure drop. In such a case, where Company ownership is unknown, an immediate response will be mounted to handle the spilled oil concurrent with efforts to locate precisely which line is affected.

Aircraft observation and/or boat observation are usually utilized as part of the procedure in verifying small leaks. In some cases, they might also be of assistance in determining whose pipeline, or which pipeline is leaking.

2. LEAK INVESTIGATION

Once a leak is verified and determined to be on a Company pipeline, appropriate response action described in this Plan and the Area Plans are taken to contain and clean up the spill. Concurrent with the response actions, the leak needs to be investigated to determine the cause and the extent of damage so that repair efforts can be initiated. In many cases, the leak investigation efforts can complement or aid repair efforts.

a. Offshore Pipelines

The investigation of an underwater leak on an offshore pipeline will require a substantial workboat. The vessel selected must be capable of transporting and supporting a diving crew and associated equipment in water depths which will be encountered. The vessel should have at least a two anchor system and have a communication link with shore based stations.

Each area should maintain a list of possible sources of vessels available for lease which will meet their respective needs. If difficulty is encountered in leasing a satisfactory boat for leak investigation, assistance should be requested through Co-Ops such as MSRC or industry partners. Arrangements should be initiated to obtain a satisfactory repair vessel unless the leak investigation vessel is suitable for the anticipated repair effort.

The services required of a diving crew can best be obtained through a diving contractor. Many diving contractors provide the tools and equipment necessary for an underwater leak investigation and one should be selected that will provide all the basic items. The following list of basic items should be collected at a mobilization site where all resources are readied for loading on the investigation vessel. Some of the equipment included can be used to effect preliminary repairs in case the repair vessel is not on site at the conclusion of the leak investigation.

- Air Compressors
- Umbilical Cable for Appropriate Water Depths to be encountered
- Decompression Chamber if water depths exceed 70 feet
- Jetting Equipment and Air Lifts
- Handlights

- Hydraulic Power Supply
- Hydraulic Chipping Hammers and Extra Chipping Tools
- Hydraulic Disc-Grinder
- Underwater Impact Tools including:
  - 4 Sockets of Proper Bolt Size; 2-Deep, 2-Shallow
  - Universal Joints
- Assorted Hand Wrenches
- Wire Cutters
- Draw Knives
- Probing Bar• Measurement
- Calipers
- Pipeline Location Equipment
- Come-Alongs
- Underwater Torch - Cutting Equipment

(1) Travel to Suspected Site of Leak

A means of locating the leak site is necessary for minimum travel time. The general location of the leak may be known from reports of the leak from surface vessels and aircraft.

If precise enough direction is not available for finding the site, air surveillance and assistance from a helicopter or other aircraft may be necessary. Areas should maintain a list of companies with aircraft for charter.

(2) Locate Pipeline

Once the general vicinity of the leak is established, pipeline location equipment will increase the chances of finding the pipeline in the least amount of time.

There are three basic systems for detecting underwater pipelines: Ferrous metal detectors, magnetometers, and subsurface profiling systems. The ferrous metal detector is the cost reliable method of detecting an underwater line. Other pipeline detectors such as magnetometers and subsurface profiling systems are usually available from diving companies. Area should maintain a list of suitable available equipment.

Using any of the three systems mentioned above, the method of detection is essentially the same. The line is found by transversing the suspected site with the pipeline detector. When pipeline is crossed, the detector will so indicate and the vessel can then position itself over the line.

If gas or oil is escaping from the line, the line and leak may be detected visually. Otherwise, the final location of the line will be by diver probe. Once the diver locates the line, a buoy should be tied off to the line before the diver surfaces.

(3) Find Leak

Once the line is found, the leak can be found by having the diver walk the line. Detection of the leak will be either visually or by feel. If the leak is significant, a large hole may be scoured out in the vicinity of the leak, thus making location of the leak easier. However, a small leak may not leave visible other otherwise obvious indications, thus the line may have to be pressured up to force gas or oil out of the leak to aid the diver in locating the leak.

Once the damaged area of the line is discovered, a buoy should be tied to the line at that point.

(4) Determine Extent of Damage

In determining the extent of damage, three basic conditions of the line must be determined; (1) degree of damage to the line, (2) length of damaged line, and (3) misalignment angle of the pipeline.

The area in the vicinity of the leak should be jetted out to aid determining the full extent of the damage.

- Degree of Damage

If the visibility is good, damage can be defined visually by diver or by diver operated TV cameras.

If the visibility is poor, the possibility of using clear plastic bags filled with water should be considered for improvement of visibility. These bags are filled with clear water at the surface and taken to the bottom by divers. To improve visibility, these bags are then placed against the area of interest.

The diver may also be able to define damage by feeling the damaged section or by using calipers to measure variations in the O.D. of the pipe.

A hinged pipe gage can be used to measure out-of-roundness in the pipe. The gage is made to close over a circular section of the pipe. If the gage will not close, the pipe is out-of-round. This is an important measure since the repair method requires round pipe.

Once the degree of damage is determined, the extremities of the damaged section should be marked with buoys.

- Approximate Length of Damaged Line

The length of damaged section can be determined by tying a rope between the extremities of damage, cutting the rope at these extremities and bringing the rope to the surface for measurement. It should be noted that only a rough measure of length is required at this point.

If the length measured here is greater than can be handled by the repair vessel, arrangements should be made to have the spool fabricated onshore and towed to the site.

In any case, be sure all possible damaged pipe is removed. Replacement pipe is cheap compared to other repair expenses.

- Misalignment Angle of Pipeline

A rough measure of misalignment of the damaged line should be obtained at this time. This can be obtained by diver estimate or by aligning two rods along the top of the line and measuring the misalignment angle (Figure C-1).

(5) Report to Shore Based Mobilization Site

Once the extent of damage has been determined the following information should be passed on the shore station:

- Location of Leak
- Owner of the Line (if not Company owned)
- Size of the Line
- Misalignment Angle
- Water Depth
- Bottom Conditions (Mud, Clay, Rock, etc.)

(6) Begin Repair Preliminaries

Perform whatever repair preliminaries are possible until the vessel is on site or no more work can be accomplished by the investigation vessel.

b. Onshore Water Body Crossings

Leak investigation activities described above under a.-Offshore Pipelines are applicable for pipelines crossing large rivers, the Intercoastal Canal, or large water bodies such as those found in south Louisiana. Some modifications of the equipment may be necessary to fit local situations on smaller river and creek crossings.

Large vessels may not be available or capable or navigating some of the smaller streams. In such cases, a suitable work boat can be constructed from devices such as Flexi-floats.

Local conditions may warrant abandoning the water crossing inplace the constructing a new crossing.

SITE SAFETY AND HEALTH PLAN (ICS FORM 208)

Purpose: The Site Safety and Health Plan (SSHP) is a site-specific document required by state and federal OSHA regulations and specified in the Area Contingency Plan. The SSHP, at minimum addresses, includes, or contains the following elements: health and safety hazard analysis for each site task or operation, comprehensive operations work plan, personnel training requirements, PPE selection criteria, site-specific medical monitoring requirements, air monitoring plan, site control measures, confined space entry procedures (if needed), pre-entry briefings (tailgate meetings), pre-operations commencement health and safety briefings for all incident participants, and quality assurance of SSHP effectiveness,

Preparation: The Safety Officer prepares the SSHP with input from the Industrial Hygienist and Medical Unit Leader.

Distribution: The SSHP is distributed to the Operations Section Chief for implementation and promulgation to all operational groups and responding agencies. A copy is provided to the Incident Commander, the Command Staff, and the General Staff.

ICS 208 – Site Safety Plan

Incident:	Prepared by: at:
Period:	Version Name:
Revision:	
Applies To Site:	
Products:	(Attach MSDS)

SITE CHARACTERIZATION

Water:
Wave Height: ______ Wave Direction: ______
Current Speed: ______ Current Direction: ______
Land: ______ Use: ______
Weather: ______ Temp: ______
Wind Speed: ______ Wind Direction: ______

Pathways for Dispersion:

Site Hazards

- ☐ Boat Safety
- ☐ Chemical hazards
- ☐ Cold Stress
- ☐ Confined Spaces
- ☐ Drum handling
- ☐ Equipment operations
- ☐ Electrical operations
- ☐ Fatigue
- ☐ Other
- ☐ Fire, explosion, in-situ burning
- ☐ Heat stress
- ☐ Helicopter operations
- ☐ Lifting
- ☐ Motor vehicles
- ☐ Noise
- ☐ Overhead/buried utilities
- ☐ Plants/wildlife
- ☐ Other
- ☐ Pump hose
- ☐ Slips, trips, and falls
- ☐ Steam and hot water
- ☐ Trenching/Excavation
- ☐ UV Radiation
- ☐ Visibility
- ☐ Weather
- ☐ Work near water
- ☐ Other

Air Monitoring

%02: ______ %LEL: ______ ppm Benzene: ______
ppm H2S: ______ ☐ Other (Specify):

CONTROL MEASURES

Engineering Controls

- ☐ Source of release secured
- ☐ Site secured
- ☐ Valve(s) closed
- ☐ Facility shut down
- ☐ Energy source locked/tagged out
- ☐ Other ______

Personal Protective Equipment

- ☐ Impervious suit
- ☐ Inner gloves
- ☐ Outer gloves
- ☐ Flame resistance clothing
- ☐ Hard hats
- ☐ Respirators
- ☐ Eye protection
- ☐ Personal floatation
- ☐ Boots
- ☐ Other ______

Additional Control Measures

- ☐ Decontamination
- ☐ Sanitation
- ☐ Illumination
- ☐ Medical Surveillance
- ☐ Stations established
- ☐ Facilities provided – OSHA 29 CFR 1910.120n
- ☐ Facilities provided – OSHA 29 CFR 1910.120m
- ☐ Provided – OSHA 29 CFR 1910.120fq

ICS 208 Site Safety Plan			© 1997-2009 TRG/dbSoft, Inc.

ICS 208 – Site Safety Plan

Incident:	Prepared By: at:
Period:	Version Name:

WORK PLAN

- ☐ Booming ☐ Skimming ☐ Vac trucks ☐ Pumping ☐ Excavation
- ☐ Heavy equipment ☐ Sorbent pads ☐ Patching ☐ Hot work ☐ Appropriate permits used
- ☐ Other

TRAINING

- ☐ Verified site workers trained per OSHA 29 CFR 1920.120

ORGANIZATION

Title	Name	Telephone/Radio
Incident Commander:		
Deputy Incident Commander:		
Safety Officer:		
Public Affairs Officer:		
Other:		

EMERGENCY PLAN

- ☐ Alarm system:
- ☐ Evacuation plan:
- ☐ First aid location

Notified

☐ Hospital		Phone:
☐ Ambulance		Phone:
☐ Air ambulance		Phone:
☐ Fire		Phone:
☐ Law enforcement		Phone:
☐ Emergency response/rescue		Phone:

PRE-ENTRY BRIEFING

- ☐ Initial briefing prepared for each site

INCLUDING ATTACHMENTS/APPENDICES

Attachments	Appendices
☐ Site Map	☐ Site Safety Program Evaluation Checklist
☐ Hazardous Substance Information Sheets	☐ Confined Space Entry Checklist
☐ Site Hazards	☐ Heat Stress Consideration
☐ Monitoring Program	☐ Cold Stress and Hypothermia Consideration
☐ Training Program	☐ First Aid for Bites, Stings, and Poisonous Plant Contact
☐ Confined Space Entry Procedure	☐ Safe Work Practice for Oily Bird Rehabilitation
☐ Safe Work Practices for Boats	☐ SIPI Site Pre-Entry Briefing
☐ PPE Description	☐ Personnel Tracking System
☐ Decontamination	
☐ Communication and Organization	
☐ Site Emergency Response Plan	

ICS 208 – Site Safety Plan

Appendix D

Form510

SITE SAFETY AND HEALTH PLAN (SSHP)

CONTENTS

Note that attachment and reference documents are separate electronic files

Attachments (need to be completed as extension of SS&H Plan):

1. On Site Organization and Phone / Radio Information
2. Site Maps and Entry / Exit Logs
3. Site Exposure Monitoring Plan and Monitoring Form
4. Personal Protective Equipment (PPE) Plan
5. Decontamination Plan
6. Emergency Plan
7. Medical Surveillance
8. Pre-Entry Briefing Attendance Log
9. SS&H Plan Implementation Checklist

References (health and safety information for reference as needed):

A. Site Control Plan (Exclusion Zones)

Appendix D

- **B.** Fire, Explosion, and In-situ burning Issues
- **C.** Miscellaneous Site Hazards
- **D.** Equipment Operations for Cleanup / Containment
- **E.** Aviation (Airplane / Helicopter) Safety
- **F.** Marine (Boat) Safety
- **G.** Confined Space Program
- **H.** Illumination
- **I.** Sanitation
- **J.** Noise
- **K.** Heat Stress
- **L.** Cold Stress and Hypothermia Plan
- **M.** Biological Hazards (Bites, Stings, and Poisonous Plants)

Appendix D

SITE SAFETY AND HEALTH PLAN

INTRODUCTION

This document describes the health and safety guidelines developed for the Response Operations to protect personnel, visitors, and the public from physical harm and exposure to hazardous materials or wastes. The procedures and guidelines contained herein are based upon the best available information at the time of the plan's preparation. Specific requirements will be reviewed and revised when new information is received and/or conditions change.

The SS&H Plan is designed to comply with OSHA regulations for Response Operations covered in 29 CFR 1910.120. Specifically, this program provides procedures and information for program administration, safety and health considerations, personal protective equipment, medical surveillance, training, site control, industrial hygiene monitoring programs, personal hygiene, sanitation, housekeeping, and the decontamination of both personal protective equipment and equipment utilized during the response.

SCOPE

All spill response and remedial activities will be conducted in accordance with this Site Safety and Health Plan. This plan will cover all personnel, including ExxonMobil employees, contractors, subcontractors, government employees, and visitors. The SS&H Plan will be modified as necessary and where applicable will address multiple work environments. A copy of this program will be posted at all command, operations, and field centers for the duration of the clean-up activity. It is the responsibility of each manger, supervisor, and crew foremen to be familiar with this plan and to assist in its implementation.

PROGRAM ADMINISTRATION

The Safety and Health Officer will administer the SS&H Plan. The Safety and Health Officer will be available to answer questions regarding effective implementation of the Program Plan. The Safety and Health Officer is supported by other staff personnel advisors in Safety, Industrial Hygiene, Occupational Medicine, Environmental, Operations and Legal.

It is the responsibility of the Safety and Health Officer to monitor the effectiveness of the SS&H Plan and to contact the appropriate support staff for guidance if changes to the plan are necessary.
All employees who may be directly involved in any clean-up activities are required to have completed HAZWOPER Training and to have been briefed on the contents of this SS&H Plan. All employers and employees will be responsible for adhering to all

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Federal, State and Local regulations that may not be specifically outlined in this program.

The Safety and Health Officer will enforce compliance with the SS&H Plan and all other requirements. Any deviations from the stipulated requirements, which are noted by the Safety and Health Officer or any other ExxonMobil personnel, will be communicated to the responsible contractor. The contractor will take immediate actions to correct the deviations and prepare a written corrective action report to be submitted to the Safety and Health Officer.

DAILY SAFETY BRIEFINGS

Site safety meetings/briefings are the first step in maintaining site safety. Daily meetings will be held at the start of each shift to ensure that all personnel understand site conditions and operating procedures, to ensure that personal protective equipment is being used correctly, to address worker health and safety concerns and to communicate any changes or revisions to the Site Safety and Health Plan.

Briefing Attendance Forms shall be used to document that individuals working the Response Operation recognize the hazards present and the policies and procedures required to minimize exposure or adverse effects of these hazards. A Pre-Entry Briefing Attendance Log is located in ***Attachment 8***.

VISITOR POLICY

All visitors must provide all required training documentation prior to arrival on-site, if possible. The on-scene Incident Commander (OIC) and Public Affairs Advisor, or their designee, must approve the site visit and shall coordinate visitor tours with the Spill Containment/Clean-up Organization. The Safety Advisor shall establish a safe route through the site and away from the on-going operations, and provide for visitor escorts. The Team Leader/Foreman at the task site must be notified when the visitor approaches. The Team Leader-Foreman shall acknowledge visitor arrival onsite and communicate approval of the visit and acceptable duration for the visitor onsite.

Visitors are expected to dress appropriately for a field visit and when required, shall wear personal protective equipment (PPE) consistent with that used by workers at the Response Site.

1. **All visitors shall be approved prior to arrival at the Incident Site**
2. **All visitors to be escorted.**

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SITE SAFETY AND HEALTH PLAN

Date/Time of Leak: **Todays Date:** **Revision No.**
Site and Incident Description:

Leak Source Tank / Ship / Equipment Number: **Location:**

Products Involved: **(attach MSDS)**

SITE and RELEASE CHARACTERIZATION

Spill to Water: ☐ Bay ☐ Canal ☐ Creek ☐ River ☐ Ocean ☐ Shoreline ☐ Wetlands
☐ N/A ☐ Muddy ☐ Sandy ☐ Rocky ☐ Other _____ ☐ Other _______________
Waves: ☐ Height _________ft/m ☐ Direction __________________
Current: ☐ Speed _______mph/kts ☐ Direction __________

Spill to Land: ☐ Brushland ☐ Forest ☐ Grassland ☐ Hills ☐ Mountains
☐ N/A ☐ Other ______
Land Use ☐ Commercial ☐ Farmland ☐ Government ☐ Industrial ☐ Public
☐ Recreational ☐ Residential ☐ Other _______

Release to air: ☐ Toxic Vapor Release ☐ Explosive Vapor Release**:**
☐ N/A

Potential Pathways for Dispersion: ☐ Air ☐ Land Surface
☐ Biological (Food Chains) ☐ Surface / Ground Water

Potential Community Impact Sites: ☐ School (s) __________________ ☐ Hospital (s) _____________
☐ N/A ☐ Nursing Home(s) _________ ☐ Residential _________
☐ Business _________________________

Weather: ☐ Ice ☐ Rain ☐ Snow ☐ Other __________________
Temp _____________ °F/°C Wind Direction _____ Wind Speed __________mph
Cloud cover**:** ☐ Clear ☐ Partly cloudy ☐ Cloudy

SITE HAZARDS (when box checked, see attachment or reference documents for detailed information)

☐ Boat Safety
☐ Chemical Hazards:
- ☐ Asbestos
- ☐ Benzene
- ☐ Hydrogen Sulfide

☐ Noise
☐ Confined Spaces
☐ Equipment Operations
☐ Pressurized containers
☐ Other _____

☐ Fire, explosion, in-situ burning
☐ Heat Stress
☐ Cold Stress
☐ Helicopter operations
☐ Plants & Wildlife (biological)
☐ Radiation
☐ Misc Site Hazards:
- ☐ Drum Handling
- ☐ Electrical Hazards
- ☐ Fatigue

Misc. Site Hazards Cont.
☐ Lifting
☐ Motor Vehicles
☐ Overhead/Buried Utilities
☐ Visibility/Lighting
☐ Pumps & Hoses
☐ Steam & Hot Water
☐ Slips,Trips,Falls,Water
☐ Weather
☐ Weather

AIR MONITORING (see air monitoring attachment for additional detail)

$\%O_2$ _____	%LEL _____	ppm Bz _____	ppm THC _____
☐Continuous	☐Continuous	☐Continuous	☐Continuous
☐Daily	☐Daily	☐Daily	☐Daily
☐Hourly	☐Hourly	☐Hourly	☐Hourly
Other _____	Other _____	Other _____	Other _____

ppm CO _____	ppm H_2S _____	Other _____	Other _____
☐Continuous	☐Continuous	☐Continuous	☐Continuous
☐Daily	☐Daily	☐Daily	☐Daily
☐Hourly	☐Hourly	☐Hourly	☐Hourly

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Other ______ Other ______ Other ______ Other ______

CONTROL MEASURES:
Engineering Controls
☐ Source of release secured ☐ Valve(s) closed ☐ Facility shut down
☐ Site secured ☐ Energy LOTO ☐ Other __________

CONTROL MEASURES (continued):
Work Plan and Personal Protective Equipment (see PPE attachment for detail) _______

Work Plan (circle appropriate)	Required PPE	Additional PPE
Mobilization/Site Set-up	A B C D	
Equipment placement/Zone Establishment	A B C D	
Containment / booming / patching	A B C D	
Recovery / skimming	A B C D	
Shoreline Clean-up	A B C D	
Hydroblasting	A B C D	
Transportation / Vac Truck / Waste Disposal	A B C D	
Excavation	A B C D	
Decontamination	A B C D	
Demobilization	A B C D	
Other	A B C D	
Other	A B C D	

⇒ Note: Buddy system must be used for all work in Hot (Contaminated) Zone

Other controls:
☐ **Decontamination** (See attached procedures/map)
☐ **Sanitary Facilities / Drinking Water** (See attached map)
☐ **Illumination** (See attached procedures)
☐ **Medical Surveillance** (See attachment for detail)

Check if complete:
☐ **Work Zones Established:**
Hot (Contaminated) Zone
Warm (Decontamination) Zone
Cold (Support) Zone

EMERGENCY PLAN (see attachment):

TRAINING: (See attachment for site training detail)
☐ Verified site workers trained per OSHA 29CFR1910.120 ☐ Initial Site Briefing required for visitors

ORGANIZATION: (See attachment for complete IC organizational detail)

Title	Name	Telephone/Radio
Incident Commander		
Deputy Incident Commander		
Safety Officer		
Public Affairs Officer		

Other Phone numbers:

Hospital ______	Fire ______	LEPC ______	Caterer ______
Ambulance ______	Police ______	Vac truck ______	Safety supply ______
Air Ambulance ________	USCG ______	Cleanup crew ______	Other ______

NOTIFICATIONS (ExxonMobil, agency, local community)**:**
ExxonMobil Severity / Tier Level: ☐ 0 ☐ 1 ☐ 2 ☐ 3

ExxonMobil Notification (check if complete):
☐ Site SHE ☐ Regional SHE ☐ Business unit SHE ☐ Corp. SHE ☐ ELIRT
☐ Site Mgmt ☐ Regional Mgmt ☐ Business unit Mgmt ☐ Corp. Mgmt ☐ RRT

Agency Notification (check if complete):
☐ USCG ☐ Local Fire ☐ Oil spill response center ☐ EPA ☐ DOT
☐ LEPC ☐ Local Police ☐ OSHA ☐ Other ______ ☐ Other ______
☐ Press Release Today? ___________

ACCIDENT / INJURIES / ILLNESSES (see attached documentation):
☐ Injury ______
☐ Illness ______

DATE PLAN COMPLETED: ____________________ **BY:** __________

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Attachment 1
On-Site Organization and Phone / Radio Information

CONTACT		PHONE					RADIO					
Position	Name	Work	Fax	Cellular	Pager	Home	Freq	Chan	UHF	VHF	CB	Other
Incident Commander												
Deputy Incident Commander												
Environmental Officer												
Industrial Hygienist												
Insurance Claims												
Legal												
Logistics												
Medical Officer												
Operations												
Planning Officer												
Public Affairs Officer												
Responsible Party's Incident Commander												
Safety Officer												
Contractor												
Other												
Other												
Other												
Other												
Other												

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Attachment 2
SITE MAPS AND ENTRY / EXIT LOGS

Attach Sites Maps, as needed:

- ❑ Site Name and Location
- ❑ Work Zones
- ❑ First Aid Locations
- ❑ Surrounding Land Uses
- ❑ Primary and Secondary Evacuation Routes
- ❑ Assembly Points
- ❑ Staging Area and Command Post Locations

Entry and Exit Log is on next page

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Attachment 2 (continued)
ENTRY AND EXIT LOG

Anyone entering or departing a work area, shall report to the site supervisor or designated representative. Please complete upon entering or departing the site:

NAME	LOCATION	TIME IN	TIME OUT

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Attachment 3
SITE EXPOSURE MONITORING PLAN AND MONITORING FORM

SITE: ______________________________

DATE: ______________________________

A. MONITORING PLAN:

1. Air monitoring at the spill site and surrounding areas will be done to ensure site worker and community safety.
2. Air monitoring will be done during work shift site characterization, and on each work shift during cleanup activities until results indicate no further monitoring is required.
3. All monitoring done at the cleanup site will be documented and the data maintained by qualified personnel on site.
4. Monitoring will be done in accordance with OSHA 29 CFR 1910.120. Monitoring to be done:
   - during initial site entry and characterization;
   - if a new potential inhalation hazard is introduced into the work area;
   - during cleanup activities, on each work shift;
   - if a new task is begun which may involve potential inhalation exposure.
5. Noise monitoring, radiation monitoring, etc. will be conducted as needed.

B. INITIAL SITE MONITORING

1. Monitoring will be done during initial site entry. The monitoring will include checking for:
   - oxygen (O2) deficiency using a direct reading oxygen meter;
   - flammable atmospheres (%LEL) using a combustible gas indicator;
   - benzene, hydrogen sulfide, hydrocarbons, and combustion by-products (SO_2, CO), as needed, using direct-reading instruments, colorimetric indicator tubes, and/or other valid methods.
2. Instruments will be calibrated prior to and following use.
3. All monitoring will be documented. (See attached form for example.)

C. POST-EMERGENCY MONITORING (ON-GOING)

1. Monitoring for benzene, hydrogen sulfide, hydrocarbons and combustion by-products will be done during each work shift on an on-going basis, as needed. Repeat initial site monitoring if any significant changes occur (i.e., temperature increases, more material released, wind direction changes, etc.)
2. Checks for oxygen deficiency and flammable atmospheres will be made if confined spaces are encountered, or as required.
3. Exposure monitoring shall be done as necessary. Personnel samples will be collected under the direction of the industrial hygiene personnel. Samples will be analyzed by a laboratory accredited by the American Industrial Hygiene Association.
4. Results of site monitoring will be made available to site workers' supervision for informing all affected employees. Results will be available to the Command Center for review by regulatory agencies.

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Attachment 3 (continued)
Industrial Hygiene HAZMAT Information
-- Field Data Form --

Date: ______ **Time** ________ **Wind Dir.** ______ **Wind Speed** ________ **Temp.** _______

Event Description: ____

Location Description	Time	PID / FID	H_2S	SO_2	CO	LEL	O_2	Benzene	Other	Comments
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										
12.										

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13.										
14.										

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Attachment 4
Personal Protective Equipment (PPE) PLAN

All work shall be conducted in accordance with procedures established during pre-entry briefings and the attached Work Plan. Personal Protective Equipment shall be selected and used to protect personnel from hazards that are likely to be encountered as identified during the initial site characterization and subsequent monitoring.

The Safety and Health Officer will determine the PPE requirements for each task associated with the incident based on the work to be conducted, associated hazards, and the following criteria:

1. PPE Use and Limitations
   Several factors must be considered when selecting and using PPE:
   - The protective clothing, gloves and boots must be resistant to permeation or penetration by oil and other chemicals that may be encountered on the site.
   - Protective clothing and gloves should be durable for heavy work.
   - Protective clothing and glove materials must maintain protection and flexibility in hot or cold weather conditions.
   - Protective clothing must be large enough to fit over other clothing without ripping and tearing.
   - For respirator use, procedures must be in place for the proper selection, use, care, and fit testing of the respirators. Additionally, wearer must be advised as to respirator cartridge expected life and of monitoring for contaminant breakthrough, etc.
   - Protective footwear must have non-slip soles. Additionally, conditions may require the use of steel toe and/or steel shank footwear.

2. Work Duration
   The work duration is expected to last for the full shift and will involve moderate to heavy physical exertion during cleanup activities.

3. PPE Maintenance and Storage
   PPE will be maintained and stored by an assigned work crew. Protective clothing and gloves will be evaluated during and at the end of each shift and will be replaced as necessary. Boots and other PPE may be decontaminated for re-use.

4. PPE Decontamination and Disposal
   PPE may be decontaminated in designated areas by assigned crews using soap or other suitable cleanser and rinse water. The cleaning solution used will be disposed of in properly labeled containers according to applicable regulations. Contaminated protective gloves and any other PPE to be disposed of will be placed in properly labeled bags and disposed of according to applicable regulations.

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5. PPE Training and Proper Fitting
All site cleanup workers, supervisors and others entering the contaminated zone will be given training in proper use of PPE. The training will include:
- How to use PPE
- When and where to use the PPE
- How to inspect PPE to determine if it is working properly

Care will be taken to ensure employees are provided properly fitted PPE.

6. PPE Donning and Doffing Procedures
Prior to starting work, all site cleanup workers and others required to wear PPE will be instructed on proper procedures for donning and doffing PPE. Doffing of contaminated clothing, gloves and boots must be done in a manner to prevent skin exposure to the oil or chemicals.

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Attachment 4 (continued)
PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

LEVEL A	LEVEL B	LEVEL C	LEVEL D
LEVEL OF PROTECTION (A) **Equipment Recommended**: • Positive pressure, full-facepiece SCBA or positive pressure supplied air respirator with escape SCBA. • Full-encapsulating, chemical-resistant suit. • Inner chemical-resistant gloves. • Chemical-resistant safety boot/shoes. • Two-way radio communications.	**LEVEL OF PROTECTION (B)** **Equipment Recommended** • Positive pressure, full-facepiece SCBA or positive pressure supplied-air respirator with escape SCBA. • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit). • Inner and outer chemical-resistant gloves. • Chemical-resistant safety boots/shoes. • Hard hat • Two-way radio communications. • Noise protection.	**LEVEL OF PROTECTION (C)** **Equipment Recommended** • Full-face piece, air-purifying, cartridge equipped respirator. • Chemical-resistant clothing (coveralls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit). • Inner and outer chemical-resistant gloves. • Chemical-resistant safety boots/shoes. • Hard hat. • Two-way radio communications.	LEVEL OF PROTECTION (D) Equipment Recommended: • Coveralls • Sturdy work boots/shoes • Safety glasses or chemical splash goggles • Hard hat
Optional: • Cooling unit • Coveralls • Long cotton underwear • Hard hat • Disposal gloves and boot covers • Noise protection as required	**Optional**: • Coveralls • Disposable boot covers • Face shield • Long cotton underwear	**Optional**: • Coveralls • Disposable boot covers • Face shield • Escape mask • Long cotton underwear • Noise protection	**Optional** • Gloves • Escape mask • Face shield • Noise protection
Protection Provided: The highest available level of respiratory, skin, and eye protection.	**Protection Provided**: The same level of respiratory protection but less skin protection than Level A. t is minimum level recommended for initial site entries until the hazards have been further identified.	**Protection Provided**: The same level of skin protection as Level B, but a lower level of respiratory protection.	**Protection Provided**: No respiratory protection. Minimal skin protection.
Should Be Used When: • The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either: - measured (or potential for) high concentration of atmospheric vapors, gases, or particulates. **or** - site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin. - Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible. - Operations must be conducted in confined, poorly ventilated areas until the absence of conditions requiring Level A protection is determined.	**Should Be Used When** • The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection. This involves atmospheres: - with IDLH concentrations of specific substances that do not represent a severe skin hazard; **or** - that do not meet the criteria for use of air-purifying respirators - atmosphere contains less than 19.5 % oxygen. • Presence of incompletely identified vapors or gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.	**Should Be Used When** • The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin. • The types of air contaminants have been identified, concentrations measured, and a canister is available that can remove the contaminant. • All criteria for the use of air-purifying respirators are met.	**Should Be Used When**: • The atmosphere contains no known hazard. • Work functions preclude splashes immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

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Limiting Criteria:	**Limiting Criteria**:	**Limiting Criteria**:	**Limiting Criteria**
• Fully-encapsulating suit material must be compatible with the substances involved.	• Use only when the vapor or gases present are not suspected of containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin.. • Use only when it is highly unlikely that the work being done will generate either high concentrations of vapors, gases, or particulates or splashes of material that will affect exposed skin.	• Atmospheric concentration of chemicals must not exceed IDLH levels. • The atmosphere must contain at least 19.5% oxygen.	• This level should not be worn in the Exclusion Zone. (Unless deemed acceptable by SSO.)

Attachment 4 (continued)

SITE HEALTH AND SAFETY PLAN **PERSONAL PROTECTIVE EQUIPMENT (PPE) FORM**
PROTECTIVE EQUIPMENT: Specify by task. Indicate type and/or material, as necessary.

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TASKS: ___________
LEVEL: A B C D
( ) Primary ( ) Contingency

Respiratory: ( ) Not Needed

( ) SCBA, Airline: __________

( ) APR: _________________

( ) Cartridge: ____________

( ) Escape Mask: __________________

( ) Other: _______________

Protective Clothing: ( ) Not Needed

( ) Encapsulating Suit: ___________

( ) Splash Suit: ________________

( ) Apron: ___________________

( ) Tyvek Coverall: ______________

( ) Saranex Coverall: ____________

( ) Coverall: _______________

Head and Eye: ( ) Not Needed

( ) Safety Glasses: _______

( ) Face Shield: __________

( ) Goggles: ____________

( ) Hard Hat: __________

( ) Other: _____________

Gloves: ( ) Not Needed

( ) Undergloves: ____________

( ) Gloves: ______________

( ) Overgloves: _______________

Boots: ( ) Not Needed

( ) Boots: ___________

( ) Overboots: _____________

( ) Other: _______________

Seam sealing:( ) Not Needed

( ) Duct tape around wrist and ankles

TASKS: ___________
LEVEL: A B C D
( ) Primary ( ) Contingency

Respiratory: ( ) Not Needed

( ) SCBA, Airline: __________

( ) APR: _________________

( ) Cartridge: ____________

( ) Escape Mask: __________________

( ) Other: _______________

Protective Clothing: ( ) Not Needed

( ) Encapsulating Suit: ___________

( ) Splash Suit: ________________

( ) Apron: ___________________

( ) Tyvek Coverall: ______________

( ) Saranex Coverall: ____________

( ) Coverall: _______________

Head and Eye: ( ) Not Needed

( ) Safety Glasses: _______

( ) Face Shield: __________

( ) Goggles: ____________

( ) Hard Hat: __________

( ) Other: _____________

Gloves: ( ) Not Needed

( ) Undergloves: ____________

( ) Gloves: ______________

( ) Overgloves: _______________

Boots: ( ) Not Needed

( ) Boots: ___________

( ) Overboots: _____________

( ) Other: _______________

Seam sealing:( ) Not Needed

( ) Duct tape around wrist and ankles

* FRC = Flame Retardant Coverall , PFD = Personal Flotation Device.

Note: Upgraded/Alterations to PPE choices to be made by Site Safety Officer based on environmental conditions, job activity, and monitoring data.

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Attachment 5
DECONTAMINATION PLAN

All personnel, tools, and equipment which have entered the Exclusion Zone job site(s) involving hazardous materials require decontamination upon leaving the Exclusion Zone as required in OSHA 29 CFR 1910.120. This decontamination can be achieved by removing or neutralizing the contaminants that have accumulated on clothing and equipment.

Due to the fact that each situation is unique, during the course of the incident, the decontamination plan will have to be revised to address changing conditions. Decontamination procedures will begin upon arrival at the scene, will provide for an adequate number of decontamination personnel, and will continue until the decontamination procedures are no longer required.

1. DECON STATIONS:

   Decon is carried out at a series of stations within the Contamination Reduction Zone. The ground at each station is covered with heavy diked PVC sheets to prevent contamination of the soil. These stations and the procedures at each are as follows:

   STATION 1 Deposit contaminated equipment (tools, containers, etc.). Use this station for cool down if needed.

   STATION 2 While workers stand in shallow plastic tubs, remove tape, if worn, from glove and boots. Scrub boots, outer gloves and protective clothing with decon solution (detergent in water). Rinse with water from hand-held sprayers as workers step from tubs.

   STATION 3 Remove boots and outer gloves. Deposit in designated containers.

   STATION 4 Remove protective clothing and deposit in designated containers. Remove inner gloves and deposit in designated containers.

   STATION 5 Wash hands and face with mild soap. Shower as soon as practical.

2. EQUIPMENT NEEDED FOR DECON:
   - Shallow plastic tubs
   - Mild detergent
   - Long-handled, soft-bristle scrub brushes
   - Benches or stools and tables
   - Towels
   - Wash basins and Various size containers
   - Plastic drop cloths
   - Decon solution (detergent in water)
   - Hand-held pressure sprayer
   - Rinse water
   - Tool/equipment drop containers, trash cans, trash bags

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Attachment 6
Emergency Plan

General

Because of the nature of Incident Response Operation activity, it is impossible to foresee and establish set procedures for all types of emergency situations. Therefore, this plan will be primarily based on general information.

All emergencies will be reported to the Incident Command Center
Phone Number Radio

The following general guidelines should be followed by site personnel involved in an emergency situation.

Alarms, Evacuation Routes and Procedures

- Team Leaders shall identify safe evacuation routes, safe distances, and places of refuge (assembly areas) for each work site.
- Supervisors will ensure that all personnel are accounted for and evacuated.
- **EMERGENCY ALARMS**
  1. Onshore Emergency Alarm Signals/Method:

  2. Offshore Emergency Alarm Signal/Method:

Personnel Injury Procedures

- All injuries shall be reported to the Incident Command Post.
- The Safety and Health Officer will assess the seriousness of all injuries to determine the appropriate action.
- If emergency medical assistance is required, contact the on-site health care practitioner, i.e. EMT, Doctor, etc.

Accident Involving Chemical Exposure

- If personnel have skin contact with the hazardous materials, the affected body part/area shall be flushed with water and wet or soiled clothing removed.
- If there is any skin, eye, or respiratory irritation, personnel shall be referred to the on-site health care practitioner, i.e. EMT, Doctor, etc.
- All episodes of obvious chemical contamination shall be reported to Safety and Health Officer to determine appropriate action.
- Hazardous material information (MSDS[s]) and decontamination procedures for injured personnel will be provided to the hospital.

Fire/Explosion

- All fires and explosions will be reported to the Incident Command Post immediately.
- Since site personnel will not fight major chemical fires, but will evacuate to designated assembly areas.
- The Safety and Health Officer will coordinate with the emergency response personnel on management of a fire.

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Attachment 6 (continued)
EMERGENCY CONTACTS

LOCAL CONTACTS

Organization	Contact	Phone Number
Primary Fire Department		
Secondary Fire Department		
Primary Hospital		
Secondary Hospital		
Primary Ambulance Service		
Secondary Ambulance Service		
Air Ambulance Service		
Emergency Response Contractor		
City/County Emergency Mgmt. Coordinator		
Sheriff's Department		
Local Police Department		
Disposal Company		

STATE CONTACTS

Organization	Contact	Phone Number
State Police Headquarters		
Emergency Response (Department of Emergency Management)		
General Land Office (Coastal Oil Spill)		800-832-8224 (24-Hour)

FEDERAL CONTACTS

Organization	Contact	Phone Number
Regional EPA Office	Federal On-Scene Coordinator	214-655-2222 (24-Hour)
USCG National Response Center	Pollution Response Section	800-424-8802
USCG Marine Safety Office -	Pollution Response Section	
CHEMTREC	Emergency Response	800-424-9300
Poison Center		800-441-0040

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Attachment 7
Medical Surveillance

Workers participating in a Response Operation may be exposed to toxic chemicals and other health hazards including heat and cold stress, noise and hand-arm vibration. Employers are responsible for ensuring that their respective employees are enrolled in a medical surveillance program as required. Criteria that trigger a Medical Surveillance Program include:

- All workers exposed or potentially exposed to hazardous substances or health hazards above the Permissible Exposure Limits for more than 30 days per year;

- Workers exposed above the published exposure levels (if there is no permissible exposure limit for these substances) for 30 or more days a year;

- Workers who are required to wear approved respirators for 30 or more days per year;

- Members of Hazardous Material Team (HAZMAT Team);

- Workers who show signs, symptoms or illness that may have resulted from exposure to hazardous substances.

OSHA regulations mandate that, unless a specific occupational safety and health standard provides a different period, the employer must maintain and preserve medical records on exposed workers for the duration of employment plus 30 years (29 CFR 1910.20).

In addition, the results of medical testing and full medical records must be made available to workers, their authorized representatives, and authorized OSHA representatives in accordance with regulations.

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Attachment 8
PRE-ENTRY BRIEFING ATTENDANCE LOG

Spill Incident:

Site:

Date: Time: Shift:

Meeting Conducted By:

Topics Discussed:

- ☐ Weather Conditions
- ☐ Injuries and Illnesses
- ☐ Corrective Actions/Precautions
- ☐ Site Emergency Plan
- ☐ Review of Site Health and Safety Hazards
- ☐ Oil/Chemical Hazards
- ☐ PPE to be Worn
- ☐ Decontamination Procedures
- ☐ Other Topics (list)

Attendees:

NAME (printed)	WORKER ID#	SIGNATURE

Attach training program
Refer to Reference P for Fed-OSHA Training Requirements

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Attachment 9
SITE SAFETY & HEALTH PLAN EVALUATION CHECKLIST

Name of Program Reviewed:
Program Drafted By (Name/Organization):
Program Reviewed By:
Date of Review:

Review Includes (check those appropriate):
- ☐ Comprehensive Work plan (post-emergency)
- ☐ Safety & Health Program (for planning not site-specific)
- ☐ Site-Specific Site Safety & Health Plan (post-emergency)
- ☐ Emergency Response Plans (emergency phase & routine sites)

1. Comprehensive Workplan [1910.120(b)(3)].
   - ☐ Work tasks, and objectives defined
   - ☐ Methods of accomplishing tasks & objectives defined
   - ☐ Personnel requirements for work plan accomplishments
   - ☐ Training requirements identified (see 1910.120(e))
   - ☐ Informational programs implemented (see 1910.120(i))
   - ☐ Medical surveillance program (see 1910.120(f))

2. Safety and Health Program [1910.120(b)]. Note: This is not the same as the site-specific plan addressed in 3. below.

   General:
   - ☐ A written safety and health program [1910.120(b)(1)]. Note: This may be incorporated in other documents
   - ☐ Organizational structure [1910.120(b)(1)(ii)(A)]
   - ☐ Safety and health training program
   - ☐ Medical surveillance program
   - ☐ Employer SOP on safety and health

   Organization Structure [1910.120(b)(2)]:
   - ☐ Chain of command identified
   - ☐ Responsibilities of supervisors and employees
   - ☐ Identifies supervisor
   - ☐ Identifies site safety and health officer(s)
   - ☐ Other personnel functions and responsibilities
   - ☐ Lines of authority/responsibility/communications

3. Site-Specific Safety & Health Plan [1910.120(b)(4)].

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For spill response operations (as opposed to those that start from a remedial action) these plans will vary in detail as the response progresses. During the initial emergency phase, responders rely on generic emergency response plans - contingency plans - while a site-specific plan is being developed. As the response progresses into post-emergency phase recovery operations, a basic site-specific plan is used and may become quite detailed for prolonged or large cleanups. Finally, a spill response may become a fully controlled site cleanup (e.g., remedial cleanups) where a fully developed site-specific plan is developed, including detailed emergency response plans for on-site emergencies.

General - Identify and/or specify:

- ☐ Risks for each task in work plan
- ☐ Employee training assignments
- ☐ Protective equipment for each task/objective
- ☐ Medical surveillance requirements
- ☐ Frequency and types of air monitoring
- ☐ Frequency and types of personnel monitoring
- ☐ Sampling techniques
- ☐ Air monitoring instruments to be used
- ☐ Maintenance and calibration for instrumentation
- ☐ Site control measures
- ☐ Site map
- ☐ Work zones
- ☐ Use of “buddy system”
- ☐ Alerting means for emergencies
- ☐ Safe working practices
- ☐ Nearest medical assistance
- ☐ Decontamination procedures
- ☐ Emergency response plan
- ☐ Confined space entry procedures
- ☐ Spill containment program
- ☐ Pre-entry briefings [1910.120(b)(4)(iii)]
- ☐ Provisions for continual evaluation of plan

Site Characterization and Analysis:

- ☐ Spill sites shall be evaluated to identify specific site hazards and determine appropriate safety and health controls

Preliminary Evaluation - Performed by a qualified person, prior to site entry, to identify and/or specify:

- ☐ Protection methods and site controls
- ☐ All inhalation/skin hazards
- ☐ Location and approximate size of site
- ☐ Description of response activity
- ☐ Duration of response activity
- ☐ Site topography and accessibility (include air and ground accessibility)
- ☐ Safety and health hazards anticipated
- ☐ Pathways for hazardous substance dispersion
- ☐ Status of emergency response units (rescue, fire, hazmat)

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- ☐ Hazardous substances and associated hazards
- ☐ Need for SCBA
- ☐ If SCBA is not used and potential for inhalation hazard might exist: an approved escape SCBA shall be provided with a minimum of 5 minutes of air supply.

Risk Identification [1910.120(c)(7)]:

- ☐ Employees on site are informed of identified risks
- ☐ All information concerning the chemical, physical and toxicological properties of each substance available to the employer are made available to the responders

Detailed Evaluation [1910.120(c)(2)]:

- ☐ Immediately after preliminary evaluation, a detailed evaluation is conducted to determine safety controls and protection needed

Monitoring [1910.120(h)]:

- ☐ Monitoring performed during initial entry
- ☐ Monitoring performed periodically
- ☐ Personnel monitoring performed

Illumination Requirements [1910.120(m)]:

- ☐ Areas accessible to employees are lighted to levels not less than the intensities outlined in Table H-120.1

Sanitation Requirements [1910.120(n)]:

- ☐ Potable water (n)(1)
- ☐ Non-potable water (n)(2)
- ☐ Toilet facilities (n)(3)
- ☐ Washing facilities (n)(6)
- ☐ Shower and change rooms (n)(7)

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4. Emergency Response Plans [1910.120(l) and (q)] for emergency response operations (e.g., contingency plans used prior to site safety plan development), routine sites (e.g., emergency plans for remedial sites).

Purpose is to prepare for anticipated emergencies:

☐ Plan is written and available for inspection

Elements [1910.120(l)(2)(i-ix) to be specified:

☐ Pre-emergency planning
☐ Personnel roles, lines of communication
☐ PPE and emergency equipment
☐ Emergency recognition and prevention
☐ Safe distances and places of refuge
☐ Site security and control
☐ Evacuation routes and procedures
☐ Emergency medical treatment and first aid
☐ Emergency decon procedures
☐ Emergency alerting and response procedures
☐ Critique of response and follow-up

Additional Elements [1910.120(l)(3)(i)(A-B)]:

☐ Site topography, layout and prevailing weather conditions
☐ Procedures for reporting incidents to: local, state, and federal government agencies
☐ Employee alarm system is installed to notify persons of an emergency situation

Additional Requirements [1910.120(l)(3)(ii-viii)] Emergency Response Plan shall be:

☐ A separate section of Site Safety and Health Plan
☐ Compatible with federal, state and local plans
☐ Rehearsed as part of on-site training
☐ Current

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Reference A
SITE CONTROL PLAN (EXCLUSION ZONES)

<u>Work Zones</u>

The method of reducing the potential for transfer of contamination is to delineate zones or work areas within the vicinity of the incident based on expected or known levels of contamination. Within these zones, prescribed operations occur and appropriate personal protective equipment used. Movement between three zones is controlled at checkpoints. The three zones are:

- Exclusion Zone (Hot or contaminated zone)
- Contamination-Reduction Zone (Warm zone)
- Support Zone (Cold zone)

1. Exclusion Zone (Hot or contaminated zone)
   The exclusion zone is considered contaminated, and within it, prescribed levels of protection must be worn by all entering personnel. An entry checkpoint for personnel and equipment are established to ensure that established procedures for entering and exiting the zones are followed. The boundary should be physically secured, fenced, posted, or well defined by geographical boundaries. Basic air monitoring and site sampling analyses are the governing factors for determining the range of specific boundary perimeters.

2. Contamination-Reduction Zone (Warm zone)
   The contamination-reduction zone provides an area to prevent or reduce the transfer of contaminants that may have been picked up by personnel or equipment returning from the exclusion zone. All decontamination activities occur in this zone.

   The boundary between the support zone and contamination-reduction zone is the "contamination control line." This boundary separates the possibly contaminated area from the clean zone. Entry into the contamination-reduction zone from the support zone is through an access control point.

   At the boundary between the contamination-reduction zone and the exclusion zone is the "hot line" and access control station. At a point close to the "hot line", a personnel and/or equipment decontamination station is established for those exiting the exclusion zone. In some cases, another decontamination station is needed closer to the contamination control line for those working only in the contamination-reduction zone.

3. Support Zone (Cold zone)
   The support zone is the outermost area of the site and is considered a "clean" zone. It is designated as a controlled traffic area for authorized support personnel and the location for support equipment. Since normal work clothes are the appropriate apparel within this zone, potentially contaminated personnel, clothing, equipment, etc., are not permitted.

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General Requirements:

- Anyone entering or departing a WORK AREA, shall report to the site supervisor or designated representative.
- Trained site personnel will accompany visitors at all times and ensure they are provided with appropriate protective equipment.
- No person shall enter a site without subscribing to this Site Safety & Health Plan.
- The use of the buddy system is mandatory for everyone on site.
- All personnel arriving or departing the site must check-in and -out with the team. All activities on site must be cleared through the Leaders.
- The site safety map usually includes the location of:

- toilet/hygiene facilities	- command posts	- animal/rehab stations
- first aid equipment	- equipment staging and storage	- identified hazards
- fire extinguishers	- eating/rest areas	

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Reference B
FIRE, EXPLOSION AND IN-SITU BURNING

General Fire Safety:

Flammable and combustible materials may be encountered at the spill site. These may be fuels for vehicles and equipment or the spilled material itself. However, some cleanup chemicals such as solvents may also be used. Refer to the container label or proper MSDS for more information on these materials.

Precautions should be taken when working with either flammables or combustibles:

- No smoking
- Store in approved, labeled containers
- Ensure containers used to transfer materials are properly grounded
- Provide fire extinguishers in areas where these materials are used

Each restriction zone and associated contamination-reduction zone shall have at least one each of the following:

- a fully charged Class A fire extinguisher for ordinary fires,
- a fully charged Class B fire extinguisher for liquid fires, and
- a hand held fog horn to alert personnel.

The above items shall be maintained in a readily accessible location, clearly labeled in red, and with the location noted on the project map.

In-situ Burning:

In-situ burning presents health and safety hazards not only to the workers engaged in the burning activities, but also to individuals downwind of the burn site. Health and safety hazards include:

- Physical hazards: explosions, heat, loss of control of burning oil (e.g., flashback to the spill source, loss of containment).
- Inhalation of airborne burn products: These may include toxic and irritating substances such as: smoke particles, carbon monoxide, carbon dioxide, sulfur oxides, nitrogen dioxide, polycyclic aromatic hydrocarbons, acid aerosols, aldehydes, acrolein, polynuclear aromatic hydrocarbons, volatile organic hydrocarbons.

Safety factors to be considered include status of the spill (e.g., burning, being lightened, personnel being evacuated, etc.); weather and sea conditions; distance of intended burn location to the spill source; type and condition of the oil; proximity of ignitable vegetation, docks, and other facilities; and control measures.

A detailed Burn Plan should be prepared. This should include a summary of safety and control measures. Care must be taken to protect all personnel from any harmful exposure to heat and or combustion products.

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Reference C
MISCELLANEOUS SITE HAZARDS

☐ DRUM HANDLING AND SPILL CONTAINMENT.

Drum handling at a spill site will primarily involve drums of waste and contaminated clothing. Several types of drums may be used, ranging from 5 to 55 gallons in size. All drums and containers must be properly labeled in accordance with OSHA and DOT regulations. Manual lifting and moving of drums should be kept to a minimum. Mechanical devices and dollies should be used for moving heavy drums.

☐ ELECTRICAL HAZARDS.

Electrical hazards shall be identified and marked with suitable placards, barricades, or warning tape as necessary.

☐ FATIGUE.

Working long hours without rest may be required, especially during the early phase of response. This, coupled with the stress of the situation and wearing required PPE, can contribute to fatigue. Symptoms include loss of concentration, errors in judgment, irritability, sleepiness, soreness and stiffness in joints and muscles. Rest and sleep are the primary treatments for fatigue. Stress can be addressed by relaxation techniques, such as deep breathing, stretching, taking breaks, and other methods.

☐ LIFTING

Use available machinery and lift-aiding equipment before lifting heavy loads. Use team work for heavy and numerous small loads. Do not rush work. Use of chemical protective clothing will restrict movement and visibility. Use extra care while lifting in protective gear.

Safe lifting techniques:

1. Position feet properly. Feet should not be close together, but should be close to the load to help keep the body close to the center of gravity. One foot should be positioned in the direction the load will be moved to avoid twisting or turning of the back during the lift. Turn using your feet and not by twisting the back.
2. Before and during the lift keep the load close to you to keep the center of gravity over your feet.
3. Check your grip and test the weight of the load before lifting.
4. The back should be straight when starting the lift and the knees should be bent. This will help to ensure that much of the lifting is done with the legs. To help keep the back straight, the chin should be tucked in and head kept up.
5. Keep the stomach muscles tight while lifting. Keep your back straight during the lift and avoid twisting motions in particular.
6. Move slowly and deliberately.

☐ MOTOR VEHICLES

All motor vehicles must be operated in accordance with all state and local motor vehicle regulations. Posted speed limits must be observed and seat belts worn by all occupants. Check the outside of the vehicle and familiarize yourself with the interior and make all adjustments before driving. Drive defensively. Employees involved in any

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accident must inform their supervisor as soon as possible. The driver is responsible for getting as much accident information as possible. 29 CFR 1910.178

Safe use of motor vehicles is essential at the spill site and in traveling to and from the site. Vehicles should be checked:

Tires inflated	Fuel	Spare tire	Lights	Windshield wipers
Brakes	Turn signals	Seat belts	Horn	

☐ OVERHEAD AND BURIED UTILITIES

If work has to be performed near overhead lines, the lines must be de-energized and grounded, or other protective measures must be provided before work is started. Arrangements must be made with the person or organization that operates or controls the electric circuits to de-energize and ground them. If protective measures such as guarding, isolating, or insulating are provided, these precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment. Clearance from overhead power lines to persons or equipment must be at least 10 feet unless the voltage exceeds 50 kV. If a vehicle is in transit with its structure lowered, the clearance may be reduced to 4 feet. If voltage exceeds 50 kV, the clearance must be increased by 4 inches for each 10 kV. There are specific approach distances and insulation requirements given in the referenced OSHA standard. (29 CFR 1910.333)

The estimated location of buried utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground services should be determined before work begins. Utility companies or owners must be contacted, advised of the proposed work and informed of the urgency of the situation. OSHA states the aforementioned companies or owners have 24 hours to respond unless state or local laws allow more time. Excavation may proceed if the exact location of the installation cannot be determined or the utility company or owner does not respond in the time period required by law. When the excavation approaches the estimated location of the underground installations, the exact location must be determined by safe and acceptable means. While the excavation is open the installation must be protected, supported or removed as necessary to safeguard employees. (29 CFR 1926.651)

☐ PUMPS AND HOSES

Pumps and hoses may be used at the spill site to apply water, steam or chemicals for cleanup and/or decontamination. They may also be used for liquid waste collection. Caution should be used when working in areas where hoses are in use as they present a tripping hazard. Additionally, when using pumps and hoses, determine their last contents to avoid contamination or chemical reaction. Use the proper pump and hose for the job.

☐ STEAM AND HOT WATER

Steam and hot water may be used during the spill cleanup. Use caution when working with these materials since they can cause severe burns. Wear gloves and eye/face protection when handling and be careful not to spray in the direction of other personnel.

☐ UV RADIATION

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Ultraviolet radiation from sunlight can be a significant hazard at a spill site. Cleanup will primarily be done outdoors; therefore, sunscreens with the appropriate protection factor and UV-tinted safety glasses may be needed. Other types of radiation, such as from welding and cutting, may also be a hazard. Avoid direct visual contact and use proper eye protection as needed.

☐ SLIPS, TRIPS AND FALLS

Slips, trips and falls on oily surfaces are the major cause of injuries at an oil spill site. Many of these injuries occur in the first few minutes of work before workers realize the conditions and begin to take precautionary measures. When entering a spill site, walk slowly and carefully in oil-coated areas. Be especially careful when walking on oil-covered rocks. Oil-resistant safety-toe boots with non-slip soles should be worn at all times in areas containing oil-covered rocks. This type of footwear can help to minimize the falling hazard, but will not prevent it. Open manholes, mud, pits, trenches, or similar hazards shall be identified and marked with suitable placards, barricades, or warning tape as necessary.

☐ TRENCHING AND EXCAVATION

All surface encumbrances that may create a hazard to employees shall be removed or supported to safeguard employees. Consideration must be given to underground installations. Appropriate precautions must be taken with regard to soil type and conditions to avoid cave-in. Employees must be provided with an approved means of access and egress. Adequate precautions shall be taken to prevent employee exposure to hazardous atmospheres. Where hazardous atmospheres exist, emergency rescue equipment shall be readily available. Employees must be protected from cave-ins, falling loads, mobile equipment, water accumulation, loose rock and soil. A competent person must inspect the excavation, adjacent area, and protective systems prior to the start of work, as needed throughout the shift and after every rainstorm or hazard increasing occurrence. (29 CFR 1926.65 Subpart P)

☐ WEATHER

Spill cleanup operations may be conducted in a wide variety of weather conditions. Weather conditions change frequently and may require halting or modifying cleanup operations. Some typical weather conditions that could impact cleanup operations include: High tides, lightning, rain, hail, snow, sleet and high winds. A management and communication system for responding to changing weather conditions is an essential element of the Site Safety and Health Plan.

☐ WORK NEAR WATER

All personnel working in boats, on docks, or generally within 10 feet of water deeper than 3 feet, shall wear US Coast Guard approved Type I or Type II personal floatation devices unless protected by guardrails.

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Reference D
EQUIPMENT OPERATIONS FOR CLEANUP / CONTAINMENT

☐ Heavy Equipment:
Operation of heavy equipment, such as front end loaders, bulldozers and cranes must be done in accordance with applicable OSHA regulations. The operators must be trained and qualified to operate powered industrial vehicles. The operator and helper must be familiar with proper signaling techniques. Buckets must not be used as a lift; hard-hats must be worn; and a fire extinguisher must be present on board equipment.

Cranes must be operated in accordance with the manufacturers' instructions and established construction practices. Outriggers must be fully extended to assure maximum stabilization of the equipment. Cranes must be operated only where the ground provides adequate support. Rigging components must be inspected daily. Only certified wire rope slings with manufactured sledges or manufactured web slings will be used. Certification documents must be received and filed for all slings. Each sling must be marked or tagged with its rated capacity and slings must not be used with loads in excess of their rated
capacity. (29 CFR 1910.184) Personnel shall not be allowed under the boom or load except for the minimum time necessary to hook up or unhook the load. (29 CFR 1910.180)

☐ Forklifts:
Only trained and authorized operators shall be allowed to operate forklifts. Horseplay is not permitted. Only stable or safely arranged loads that do not exceed the capacity of the truck shall be handled. Fuel tanks must not be filled while the engine is running. Operators shall perform daily or pre-use inspections of the forklift to be operated. A separate inspection will be made each shift during multi-shift operations. Records of inspections must be maintained. All inspection discrepancies must be corrected prior to operation of the forklift. If the discrepancy cannot be corrected immediately, the forklift must be tagged out of service. 29 CFR 1910.178

☐ Hand/Power Tools:
Hand tools are non-powered. The greatest hazards posed by hand tools result from misuse and improper maintenance. Saw blades, knives or other tools should be directed away from other employees. Dull tools can be more hazardous than sharp tools. Personal protective equipment, such as wire mesh gloves, wrist guards, arm guards, aprons and belly guards may be appropriated. Spark resistant tools (brass, plastic, aluminum and wood) should be used around flammable substances.

Power tools are based on the power source used: electric, pneumatic, liquid fuel, hydraulic, and powder-actuated. The following general precautions should be observed: never carry power tools by the cord; never yank the cord to unplug the tool; keep cords and hoses away form heat, oil and sharp edges; disconnect tools when not in use and before servicing; keep observers a safe distance away; secure work with clamps or a vise freeing both hands to operate the tool; avoid accidental starting; maintain tools with care; keep them sharp and clean; safeguard hazardous moving

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parts of the tool; and, protect the operator from: point of operation, in-running nip points, rotating parts, and flying chips and sparks. Many tools including drills, tappers, fastener drivers, disc sanders, belt sanders and others must be equipped with momentary contact “on-off” control switch.

Employees using hand and power tools and exposed to the hazards of falling, flying, abrasive and splashing objects, or exposed to harmful dusts, fumes, mists, vapors or gases must be provided with the particular personal equipment necessary to protect them from the hazard. All hazards involved in the use of [hand] and power tools can be prevented by following five basic safety rules: Keep all tools in good condition with regular maintenance; use the right tool for the job; examine each tool for damage before use; operate according to the manufacturer’s instructions; and provide and use the right protective equipment.

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Reference E
AVIATION (AIRPLANE / HELICOPTER) SAFETY

All aircraft/aviation equipment shall meet FAA regulations. Specific regulations regarding the use of helicopters can be found in 29 CFR 1910.183.

BASIC SAFE WORK PRACTICES FOR ALL PASSENGERS/GROUND CREWS:

Helicopters may be in use at the spill site for overflight surveillance; site characterization; personnel/equipment transport; and rescue/medical transport. Safe work practices for passengers and other personnel include:

1. Passengers must receive a safety briefing from the pilot before liftoff. The briefing should include safety features and equipment and their location on the individual aircraft; helicopter underwater escape procedures when appropriate; and, emergency information.
2. Passengers and ground crew members approaching helicopters shall stay in a crouched position, and must be in clear view of the pilot while approaching or departing a helicopter.
3. Passengers and ground crew should approach/depart from the **FRONT** of the helicopter only when signaled by the pilot; and shall never walk under or around the tail, rotor or exhaust.
4. Loose fitting clothing, hats, hard hats, or other gear, which might be caught in rotor downwash, must be secured or removed within 100 feet of operating helicopters.
5. Passengers shall maintain a distance of 50 feet from helicopters while rotors are turning. Ground crew should also maintain this distance, unless specific work practices are developed for closer work.
6. Passengers shall wear seat belts at all times and personal floatation devices when flying over bodies of water.
7. Passengers and ground crew shall wear hearing protection (which may include communication headsets or helmets) at all times around operating helicopters.
8. Passengers shall assist the pilot in watching for other traffic or ground obstacles, as directed by the pilot.
9. During emergency landing in water:
    - Do not exit until instructed to do so by the pilot after rotor blades stop turning or pilot signals all clear.
    - Do not inflate personal floatation devices until outside of the helicopter.

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Reference F
MARINE (BOAT) SAFETY

All marine vessels and equipment shall meet USCG regulations.

Ensure that all boats and operators comply with the appropriate state and federal regulations. In addition to the items discussed below, certain types of vessels will require such items as USCG approved fire extinguishers, backfire flame control, powered ventilation, sound signaling devices (different from emergency signals), navigation lights/signals, pollution placards, and marine sanitation devices.

1. Boat operators must familiarize themselves and passengers with safety features and equipment on their boats.
2. Boats must be operated by qualified individuals.
3. Life jackets, work vests, cold water immersion suits, or other appropriate USCG approved Personal Floatation Devices (PFDs) must be worn by personnel in boats.

a. Use of cold water immersion suits is particularly critical under conditions of cold stress.

b. Types of PFDs:

Type I

Off-shore life jacket provides the most buoyancy. It is effective for all waters and intended specifically for open, rough, or remote waters where rescue may be delayed.

Type II

Near-shore buoyancy vests are intended for calm, inland water, or where there is a good chance of quick rescue.

Type III

Floatation aids are good for calm, inland water, or where there is a good chance of quick rescue. Examples: float coats, fishing vests, and ski vests.

Type IV

These are throwable devices, not intended to be worn or to replace those that are worn.

Type V Special Use.

These are intended for specific activities (according to the conditions on the labels). Some examples: deck suits, cold water immersion suits, work vests, and hybrid PFDs below.

Type VI Hybrid Inflatables.

These PFDs contain a small amount of inherent buoyancy and an inflatable chamber. Performance equals that of a Type I, II, or III PFD (as noted on the label) when inflated.

4. Boats should generally not be operated for oil recovery after sunset. If this is required or poses minimal risk, areas of operation should be carefully prescribed, and individual boat operators should maintain a communication schedule with a shore base. Each boat should be fully equipped with appropriate running lights and emergency signaling devices, and personnel onboard should be wearing emergency night signaling devices.

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5. Distress signals (three or more for day and three or more for night) should be carried on board all vessels. These devices may be required by regulation. They may be stored on board or issued to individuals. If stored on board, they should be in a sealed, watertight, orange container marked "DISTRESS SIGNALS".
   a. USCG-approved pyrotechnic visual distress signals include red flares (hand-held or aerial), range smoke (hand-held or floating), and launchers (for aerial red meteors or parachute flares). Pyrotechnic devices should not be used near flammable product spills.
   b. Non-pyrotechnic distress signals are not approved individually, but must meet certain requirements. They should be in serviceable condition, readily accessible, and certified by the manufacturer as complying with USCG requirements. These devices include orange distress flags, and electric distress lights.
   c. Distress flags are day signals only. They must be at least 3x3 feet with a black square and ball on an orange background.
      i. Electric distress lights are for night use only. These devices automatically flash the international SOS code (...- - -...) so a flashlight IS NOT considered a distress signal. Under inland navigation rules, a high intensity strobe light is considered a distress signal.
      ii. It is illegal to display visual distress signals on the water, except when assistance is required.
6. Boat operators must keep their supervisors informed of their area of operations, especially when they change their work area (if plans call for a boat to move to another location during a shift, the operator should advise the supervisor of his actual time of departure).
7. Boat operators should never anchor their boats by the stern. This is typically the lowest point on the boat due to design and/or loading, and is often squared off, making it vulnerable to swamping.
8. Portable fuel tanks should be filled outside of the boat. All sources of ignition in the area of fueling (e.g., engines, stoves, or heat-producing equipment, and electrical equipment) must be removed while fueling.
9. Strict adherence to the buddy system must be observed in boats; and all boats should be in direct visual or radio contact with the shore base at all times.
10. To avoid slipping on wet decks or falling in boats, personnel should remain seated while boat is underway. Horseplay and speeding are strictly prohibited. Personnel should keep their center of gravity as low as possible while working in boats.
11. Boat operators must also ensure that boats are not overloaded. The capacity should be marked on a label on the boat; if not, a general rule of thumb is: Length x Width / 15 = People (150 lbs). Since equipment adds to the weight, it should be considered as well. Weight should be distributed evenly.
12. Personnel working in or operating boats should wear appropriate shoes/boots designed to help maintain traction on wet surfaces.
13. Safety sunglasses or hearing protection should be worn by personnel working in, or operating,boats where appropriate.
14. Fixed ladders or other substantial access/egress should be provided at boat transfer locations from low water line to platform.

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15. Depending on the specific nature of the operations (e.g., work in remote areas), other emergency equipment that should be considered includes: anchors, radios, bailers, first aid kits, and additional means of propulsion (e.g., paddles).
16. Workers should be cautioned about using their legs or arms to fend off during docking, or getting their hands, arms, or legs between vessels or between vessels and docks or fixed structures.

Appendix D

Reference G
CONFINED SPACE PROGRAM

Provide a copy of Responder’s Confined Space Entry Program in place of this form (if needed).

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Reference G (continued)

CONFINED SPACE ENTRY CHECKLIST

These are strictly guidelines for use by field personnel based on NIOSH Publication 87-113, "A Guide to Safety in Confined Spaces"; and NFPA-306 "Control of Gas Hazards on Vessels," and OSHA 29 CFR 1910.146

SAT/UNSAT (if not applicable mark "NA" in SAT column)

☐ ☐ Is entry necessary?

TESTING

☐ ☐ Instruments calibrated?

☐ ☐ Oxygen must be equal or greater than 19.5% and equal or less than 23.5%. There should be no unexplained deflection from the calibrated setting for ambient air - typically 20.9%- outside of normal instrument variability. Atmospheres less than 19.5% should be treated as IDLH (Immediately Dangerous to Life or Health) atmospheres for purposes of respiratory protection selection. Atmospheres greater than 22% should be treated as a flammable atmosphere hazard.

Result:

☐ ☐ Combustible atmospheres - where flammable/combustible gases and vapors may be present - must be less than 10% of the LEL (Lower Explosive Limit). There should be no unexplained deflection from the calibrated zero setting without assessment of potential toxic hazards associated with the atmosphere.

Result:

☐ ☐ Toxic hazards (per NFPA 306 concentrations should not exceed the OSHA PEL, or ACGIH TLV, or appropriate recognized standards.) If exposure limits are exceeded, consider additional engineering controls such as ventilation or cleaning. If other controls are not effective/feasible, appropriate respiratory protection should be used above exposure limits. Toxic hazards evaluated:

Hazard:
Result:
Hazard:
Result:
Hazard:
Result:
Hazard:
Result:

Appendix D

Reference G (continued)

SAT/UNSAT (if not applicable mark "NA" in SAT column)

☐ ☐ Gas sources in, or adjacent to, the confined space have been inspected and adequately isolated (gas sources all present a potential for sudden changes in atmospheric conditions such as oxygen displacement, fires/explosions, or acute toxic atmospheres-continuous monitoring of oxygen deficiency and explosive atmospheres should be considered along with emergency escape respiratory protection.) The following were present:

- ☐ compressed gases
- ☐ liquefied gases
- ☐ welding gases
- ☐ inerting systems - including dry ice
- ☐ Other:

MONITORING

When considering monitoring requirements, personnel should consider such things as the potential for sudden changes in atmospheric conditions (e.g., gas sources in or adjacent to the confined space); environmental or work activities which may change conditions over time (e.g., hot sunny weather increases vapor generations; welding/cutting/painting/curing consume oxygen; and internal combustion engines consume oxygen and produce oxygen-displacing gases).

SAT/UNSAT (if not applicable mark "NA" in SAT column)

☐ ☐ Appropriate monitoring is established as follows

- ☐ LEL
  - ☐ continuous
  - ☐ as directed by safety supervisor
  - ☐ daily or when safety supervisor changes watch
  - ☐ every hour(s)
- ☐ Oxygen
  - ☐ continuous
  - ☐ as directed by safety supervisor
  - ☐ daily or when safety supervisor changes watch
  - ☐ every hour(s)
- ☐ Other
  - Hazard
  - Monitoring Equipment
  - ☐ continuous
  - ☐ as directed by safety supervisor
  - ☐ daily or when safety supervisor changes watch
  - ☐ every hour(s)

ISOLATION

☐ ☐ Connections to confined space have been blinded, double blocked and bled, or offset

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Reference G (continued)

SAT/UNSAT (if not applicable mark "NA" in SAT column)

CLEANING

☐ ☐ Space has been cleaned prior to entry
☐ ☐ If steam or hot water cleaning systems were used, adequate cooling time has been provided

VENTILATION

☐ ☐ air changes prior to entry (minutes:)
continuous ventilation during entry
location /type/ducts (diagram & description):
☐ ☐ Source of air being blown to space is free of hazards
☐ ☐ Contaminated air is exhausted into a safe location

OTHER PROTECTIVE CLOTHING/EQUIPMENT

☐ ☐ Equipment for entry team
- ☐ PPE ensemble
- ☐ rescue/retrieval
- ☐ harness
- ☐ other:
- ☐ communication/signaling
- ☐ spark proof tools

☐ ☐ Equipment for rescue team
- ☐ PPE ensemble
- ☐ rescue/retrieval
  - ☐ retrieval tripod
  - ☐ other:
- ☐ communication/signaling
- ☐ PPE/respiratory
- ☐ other:

TRAINING/QUALIFICATIONS

☐ ☐ Confined space hazards and safe work practices
☐ ☐ Use of respirators and other PPE
☐ ☐ CPR, first aid, emergency entry/rescue
☐ ☐ Confined space plan briefing
☐ ☐ Work plan

Appendix D

Reference G (continued)

SAT/UNSAT (if not applicable mark "NA" in SAT column)

STANDBY and RESCUE PERSONNEL

☐ ☐ Personnel in addition to entry and rescue teams
Supervisor:
Safety Supervisor:
☐ ☐ Standby to maintain contact by
- ☐ visual
- ☐ radio
- ☐ line/rope
- ☐ other:

☐ ☐ Rescue procedures
- ☐ notify safety supervisor of problem
- ☐ test for combustible gas and oxygen prior to rescue
- ☐ enter using SCBA
- ☐ enter using harness and retrieval line

CONFINED SPACE ENTRY PERMIT/ CERTIFICATE

☐ ☐ Issued confined space entry permit. (29 CFR 1910.146)
☐ ☐ Marine chemist or Coast Guard authorized person issued certificate for hot work operations. (29 CFR 1915.14)
☐ ☐ Emergency phone numbers

Checklist completed by:
Date:
Time: Signature:

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INITIAL TESTING AND PERMIT

Confined / Hazardous Space Entry Authorized: Yes
Hotwork Authorized: Yes
Location and Description of Space:

Date: Time: Permit Expires:

Entry Team Supervisor

Special Requirements Met

- Lock-Out Yes
- De-Energize Yes
- Lines Broken, Capped / Blanked Yes
- Purge, Flush & Ventilation Yes
- Ventilation Yes
- Secure Area Yes
- Respiratory Protection Adequate Yes
- Personal Protective Equipment Adequate Yes
- Escape / Rescue Adequate Yes
- Fire Suppression Equipment Yes
- Lighting Yes

Pre -Entry Test and Monitoring Follow-Up Testing

Test	Limit	Initial Results	Follow-Up Tests Date / Time	Date / Time	Date / Time	Date / Time
$\%O_2$	>19.5% <22%					
%LEL	<10%					
CO	35 ppm TWA					
CO_2	5000 ppm					
THC	1 ppm TWA 5 ppm STEL					
H_2S	10 ppm TWA 15 ppm STEL					
Benzene	1 ppm TWA 5ppm STEL					

O_2 = oxygen, LEL = lower explosive limit, CO = carbon monoxide, CO_2 = carbon dioxide,
THC = total aromatic hydrocarbons; H_2S = hydrogen sulfide

Permit Completed by: ____

Date: Time: Signature:

Reference H

Appendix D

ILLUMINATION

The OSHA HAZWOPER Standard (29 CFR 1910.120 (m)) requires areas of a spill site accessible to worker to be lighted as follows:

Minimum Lighting Levels	**Accessible Area**
5 Foot Candles	General Site Areas
3 Foot Candles	Excavation and waste areas, accessways, active storage areas, loading platforms, refueling, and field maintenance areas
5 Foot Candles	Indoors - Warehouses, corridors, hallways, and exits.
5 Foot Candles	Tunnels, shafts, and general underground work areas (Exception: Minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Mine Safety & Health Admn. approved cap lights shall be acceptable for use in the tunnel heading.)
10 Foot Candles	General shops (e.g., mechanical and electrical equipment rooms, active storerooms, barracks or living quarters, locker or dressing rooms, dining areas, and indoor toilets and workrooms.)
30 Foot Candles	First aid stations, infirmaries and offices.

Fixed or portable lighting shall be maintained for dark areas or work after sunset to ensure that sufficient illumination is provided.

Appendix D

Reference I
Sanitation Plan

Potable Water:
- Where necessary, potable water shall be provided for drinking, cooking, food washing, washing of cooking and eating utensils and cleaning of food preparation areas.
- Potable drinking water dispensers shall be designed and constructed so that sanitary conditions are maintained, shall be capable of being closed and be equipped with a tap.
- Open containers from which water must be dipped is PROHIBITED!

Nonpotable Water:
- Shall only be used for such things as: firefighting and cleaning of work premises other than food preparation/serving areas.
- Use of nonpotable water, other than that mentioned above, shall require approval from the Site Safety and Health Officer.

Food:
- Food service facilities and operations shall be carried out in accordance with sound hygienic principles.
- No food consumption shall be permitted in areas exposed to hazardous materials.

Personal Hygine Facilities:
- Shall be provided as required by the need and the given situation.

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Reference J
NOISE

Noise may be a potential health hazard at a spill cleanup site. Noise may be generated by pumps, generators, compressors, trucks, and, heavy equipment. At a spill site, high noise areas and equipment will be identified.

- Areas > 82 dBA will require <u>single</u> hearing protection devices (HPD) (ear plug or ear muff).
- Areas > 95 dBA will require <u>double</u> HPDs.

Areas requiring the use of hearing protection will be posted. Hearing protection will be made available, as required. As a general rule, hearing protection should be worn in areas where noise prevents hearing ordinary conversation. Since hearing loss caused by high noise exposure may not be noticed at first, it is important to wear the hearing protection in high noise areas.

Appendix D

Reference K
Heat Stress Plan

OVERVIEW

Heat stress can result as responders perform heavy labor in protective and/or impermeable clothing that does not breathe or allow for the dissipation of normal body heat. Heat buildup can lead to a number of adverse health effects including: heat rash, heat cramps, dehydration, heat exhaustion or heat stroke. The incidence of heat stress is dependent upon a number of factors such as temperature, humidity, a person's physical fitness, age, acclimatization, weight, drug or medication use, and clothing worn, including protective clothing.

Supervisors must continually monitor their employees when workloads are heavy and temperatures and/or humidity are high. The site safety and health officer will generally be guided by the ACGIH guidelines in determining work/rest periods. Fluids shall be available at all times and personnel will be encouraged to drink fluids during rest periods. Shaded rest areas will be made available where feasible.

Appendix D

Reference K (continued)

HEAT STRESS CONSIDERATIONS

The following heat stress information has been taken primarily from NIOSH Publication 86-112 "Working in Hot Environments".

A. Health Concerns:

Excessive exposure to a hot work environment can bring about a variety of heat-induced disorders.

1. Heat Stroke

a. Signs and Symptoms. Heat stroke is the most serious of health problems associated with working in hot environments. It occurs when the body's temperature regulatory system fails and sweating becomes inadequate to reduce body temperature. The body's only effective means of removing excess heat is compromised with little warning to the victim that a crisis stage has been reached.

- i. a heat stroke victim's skin is hot, usually dry, red, or spotted
- ii. body temperature is usually 105 degrees F or higher
- iii. the victim is mentally confused, delirious, perhaps in convulsions or unconscious

b. Medical Attention. Unless the heat stroke victim receives quick and appropriate treatment, death can occur. Any person with signs or symptoms of heat stroke requires immediate hospitalization. Send someone to get medical assistance/EMT immediately. While waiting for medical assistance, first aid should be immediately administered. This includes:

- i. removing the victim to a cool shaded area
- ii. removing outer clothing, wetting skin with tepid water to increase conductive loss
- iii. vigorously fanning the body to increase cooling
- iv. avoiding shivering, which will only increase heat production

2. Heat Exhaustion.

Heat exhaustion includes several clinical disorders having symptoms that may resemble the early symptoms of heat stroke. Heat exhaustion is caused by the loss of large amounts of fluid by sweating, sometimes with excessive loss of salt.

a. Signs and Symptoms. A worker suffering from heat exhaustion:

- i. still sweats
- ii. experiences extreme weakness or fatigue, giddiness, nausea or headache in more serious cases
- iii. victim may vomit or lose consciousness
- iv. skin is clammy and moist
- v. complexion is pale or flushed
- vi. body temperature is normal or only slightly elevated

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b. Medical Attention. General treatment:

i. notify the site EMT
ii. have the victim rest in a cool place
iii. have the victim drink plenty of liquids

Victims with mild cases of heat exhaustion usually recover spontaneously with the treatment. Those with severe cases may require extended care for several days. There are no known permanent effects.

3. Heat Cramps

a. Signs and Symptoms. Heat cramps are painful spasms of the muscles that occur among those who sweat profusely in heat, drink large quantities of water, but do not adequately replace the body's salt loss.

b. Medical Attention. Cramps may occur during or after work and may be relieved by drinking liquids.

4. Fainting.

A worker who is not accustomed to hot environments and/or who stands erect and immobile in the heat may faint.

a. Cause. Enlarged blood vessels in the skin and in the lower part of the body due to the body's attempts to control internal temperature, blood may pool in the lower extremities rather than returning to the heart to be pumped to the brain.

b. Medical Attention. Upon falling down (or fainting), the worker should soon recover. Examine for signs of injury. If no apparent injury, place on side until awake, then offer fluids. Anyone who faints should see medical/EMT.

5. Heat Rash.

Heat rash, also known as prickly heat, is likely to occur in hot, humid environments where heat is not easily removed from the surface of the skin by evaporation and the skin remains wet most of the time.

a. Signs and Symptoms. The sweat ducts become plugged, and a skin rash soon appears. When the rash is extensive or when it is complicated by infection prickly heat can be very uncomfortable and may reduce a worker's performance.

b. Medical Attention. Rest in a cool place part of each day. Regularly bathe and dry the skin. Avoid tight fitting undergarments.

6. Transient Heat Fatigue.

Transient heat fatigue refers to the temporary state of discomfort and mental or psychological strain arising from prolonged heat exposure. Workers unaccustomed to the heat are particularly susceptible and can suffer, to varying degrees, a decline in task performance, coordination, alertness and vigilance.

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B. Preparing for Work in Heat.

One of the best ways to reduce the heat stress of workers is to minimize heat in the workplace. However, at oil spills, heat is difficult to control while working outdoors and exposed to various weather conditions. Humans are, to a large extent capable of adjusting to the heat. This adjustment to heat, under normal circumstances, usually takes about 5 to 7 days, during which time the body will undergo a series of changes that will make continued exposure to heat more endurable. Early on in an exercise, shorter shifts with frequent rotations will help with acclimatization

A worker who returns to work after vacation or extended illness may be affected by the heat in the work environment. Whenever such circumstances occur, the worker should be gradually reacclimated to the hot environment.

C. Mechanization.

Heat stress depends, in part, on the amount of heat the worker's body produces while a job is being performed. The amount of heat produced during hard, steady work is much higher than that produced during intermittent or light work. Therefore, one way of reducing the potential for heat stress is to make the job easier or lessen its duration by providing adequate rest time. Mechanization of work procedures can often make it possible to isolate workers from the heat source and increase overall productivity by decreasing the time needed for rest.

D. Work/Rest Cycles.

Rather than be exposed to heat for extended periods of time during the course of a job, workers should, wherever possible, be permitted to distribute the work load evenly over the day with work-rest cycles and regular (and enforced) breaks should be scheduled. Work-rest cycles give the body an opportunity to get rid of excess heat, slow down the production of internal body heat, and provide greater blood flow to the skin. Providing cool rest areas in hot work environments considerably reduces the stress of working in those environments. Rest areas should be as close to the work area as possible, and provide shade. Shorter, but more frequent work-rest cycles provide the greatest benefit to the worker. Reference "*ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*" for additional information on work-rest regimen.

E. Drinking Fluids.

In the course of a day's work in the heat, a worker may produce as much as 2 to 3 gallons of sweat. Because so many heat disorders involve excessive dehydration of the body, it is essential that water intake during the workday be about equal to the amount of sweat produced. Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst drive. A worker, therefore, should not depend on thirst to signal when and how much to drink. Five to seven ounces of fluids should be consumed every 15 to 20 minutes to replenish the necessary fluids in the body. As a general rule, workers who do not urinate in normal amounts are not drinking enough fluids.

There is no optimum temperature of drinking water, but most people tend not to drink warm or very cold fluids as readily as they will cool ones.

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Heat acclimatized workers lose much less salt in their sweat than do workers who are not adjusted to the heat. The average American diet contains sufficient salt for acclimatized workers even when sweat reduction is high. If for some reason, salt replacement is required, the best way to compensate for the loss is to add a little extra salt to the food. Salt tablets should not be used.

Athletic drinks should be diluted at least 50% if used.

F. Protective Clothing and Heat Stress.
Clothing inhibits the transport of heat between the body and the surrounding environment. Supervisors must pay particular attention to the condition of their employees, the work environment and the effects of chemical protective clothing as a contributor to heat stress.

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Reference L
Cold Stress and Hypothermia Plan

OVERVIEW

Cold stress can occur among responders as a result of prolonged exposure to low environmental air temperatures or from immersion in low temperature water. Cold stress can lead to a number of adverse effects including: frostbite, chilblain, frostnip, acrocyanosis, trench foot, Raynaud's Disease, and hypothermia. The single most important aspect of life-threatening hypothermia is the fall in the deep core temperature of the body. In addition to provision for total body protection, consideration shall also be given to the protection of other body parts, with emphasis on the hands, feet and head.

The incidence of cold stress is dependent upon a number of factors such as air and water temperature, wind speed, a person's physical fitness, age, and clothing worn, including protective clothing. Supervisors must monitor their employees for signs of cold stress when weather conditions necessitate. The site safety and health officer will generally be guided by the ACGIH guidelines in determining exposure control methods such as work/rest periods, clothing required, etc. Workers shall be provided with adequate warm clothing, and rest opportunities. Warm and/or sweet fluids shall also be available during rest periods. Protection from the elements, such as with warm rest shelters, shall be made available, where feasible.

Appendix D

Reference L (continued)
COLD STRESS AND HYPOTHERMIA CONSIDERATIONS

Frostbite and hypothermia are the two major hazards of working in cold temperatures. A cold environment can reduce the temperature of the body and cause shivering, reduced mental alertness, and sometimes loss of consciousness. However, a healthy worker who is properly protected and takes reasonable precautions can function efficiently and safely in cold environments.

A. Factors Affecting Cold Exposure Severity

1. Important factors contributing to cold injury
   - exposure to humidity and high winds
   - contact with moisture or metal
   - inadequate clothing

   General health conditions that affect cold stress severity:
   - age
   - overall health
   - fatigue
   - allergies
   - vascular disease
   - smoking
   - drinking
   - certain drugs or medications
2. If someone becomes fatigued during physical activity, they will be more susceptible to heat loss. As exhaustion approaches, the body's ability to contract the blood vessels diminishes; blood circulation occurs closer to the skin; and rapid loss of heat begins. Sedative drugs and alcohol increase the risk of hypothermia by dilating the blood vessels near the skin, which increases heat loss and lowers body temperature.
3. The actual effects of a cold environment on the body also depend upon how well the skin is protected. An insulating barrier affects the rate of heat loss from radiation, convection, conduction and evaporation.
4. Environmental factors include wind and humidity, as well as temperature. The faster the air movement, the greater the effects of cold exposure.

B. Hypothermia

Cold injury can be localized or generalized. Frostbite, frostnip, or chilblain are examples of localized injuries. Hypothermia is a generalized (threatening the whole body) cold injury that can be life threatening.

1. Hypothermia is an abnormally low body temperature caused by exposure to cold in air or in water. Hypothermia results as the body loses heat faster than it can produce it. Air temperature alone is not enough to judge the cold hazard of a particular environment. Hypothermia cases often develop in air temperatures between 30-50 degrees Fahrenheit. When you figure in such factors as windchill, the effective temperature can be significantly lower.
2. Pain in the extremities may be the first warning of dangerous exposure to cold. Severe shivering is a sign of danger requiring removal from the cold exposure.

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3. Early warnings of hypothermia are uncontrollable shivering and the sensation of cold; the heartbeat slows and sometimes becomes irregular; the pulse weakens; and the blood pressure changes. Fits of shivering, vague or slurred speech, memory lapses, incoherence, or drowsiness may occur. Other symptoms, which may be seen before unconsciousness, are cool skin, slow, irregular breathing, low blood pressure, apparent exhaustion, and inability to get up after a rest.
4. Handling cold stress and hypothermia victims

   a. A worker should go immediately to a warm shelter if any of the following symptoms occur:
   - pain, numbness, white color in the extremities, ears, nose, cheeks (or frostnip)
   - onset of heavy shivering
   - excessive fatigue
   - drowsiness
   - euphoria

   A litter should be used if possible for all but the mildest cases.

   b. The main objective in handling hypothermia is to warm the body core evenly and without delay. However, doing it too rapidly can disrupt body functions such as circulation.
   - The outer layer of clothing should be removed when entering a warm shelter
   - The remaining clothing should be loosened to permit sweat to evaporate, and changed if wet
   - Alcohol and caffeinated drinks should not be consumed
   - Anyone on medications, such as blood pressure control or water pills, should consult a physician about possible side effects of cold stress

   c. If medical help is not immediately available: keep the person quiet, but awake if possible; avoid unnecessary movement; and if it is necessary to move a hypothermia victim, use a litter - the exertion of walking or rough handling could aggravate circulation problems or cause irregular heartbeats.

   d. The sudden return of the cool blood pooled in the extremities to the heart can cause shock. Do not rewarm the core and the extremities at the same time. In a case of mild hypothermia where the person is conscious, the body may be packed with heat packs or warm towels at the neck, groin, and armpits. As the extremities begin to recover warmth give conscious victims sweet, warm drinks. Avoid caffeine or alcoholic drinks.
5. Water immersion victims. Floatation is the most important factor in water immersion survival, but may not be available if not provided in advance (see protective clothing notes below).

   a. It is especially important to keep your head dry

   b. Avoid thrashing about and assume the HELP position (Heat Escape Lessening Posture) by crossing wrists over chest and draw in knees close to your chest to avoid losing body heat. By using the HELP position, the head, neck, armpit, and groin areas are protected which are all high heat loss areas.

   c. If others are in the water with you, huddle together to reduce heat loss, aid in rescue, and boost morale.

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COLD STRESS INJURY AND TREATMENT

INJURY	SYMPTOMS	POSSIBLE CAUSES	TREATMENT
Hypothermia	Pain in the extremities; uncontrollable shivering; reduced body core temperature; cool skin; rigid muscles; slowed heart rate; weakened pulse; low blood pressure; slow irregular breathing; memory lapses; slow, slurred speech; drowsiness; incoherence; lack of coordination; diminished dexterity and judgment.	Exposure to low air temperatures; exposure to high winds; water immersion; inadequate clothing; allergies; recent alcohol consumption; smoking; prescription medications; exhaustion; dehydration.	Remove person from wind, snow, rain; minimize use of energy by person; keep person awake; remove wet clothing; get person into dry clothing; wrap blanket around person; pack neck, groin, armpits with warm towels; do not rewarm extremities and body at the same time; give sweet warm drinks to conscious person; remove person to medical facility.
Frostbite	Whitened areas on skin; burning sensation at first; blistering; affected part cold, numb, and tingling.	Exposure to cold; age (very young or old); underlying disease.	Cover the frozen part; provide extra clothing and blankets; bring person indoors; place the part in tepid water or rewarm with *warm packs; if no water is available, wrap gently in a sheet and blanket or place fingers under armpits; discontinue warming when the affected part becomes flushed and swollen; give sweet warm fluids to conscious person; if feet are affected, put on dry socks; if cheeks are affected, cover cheeks with warm hands; do not rub the part with anything; do not use heat lamps, hot water bottles, or place near hot stove; do not break blisters; obtain medical assistance immediately.
Chillblain	Recurrent localized itching, swelling, and painful inflammation of the fingers, toes or ears; severe spasms.	Inadequate clothing; exposure to cold and moisture, underlying disease.	Remove to warmer area; consult physician.
Frostnip	Skin turns white.	Exposure to cold.	Remove to warmer area; refer to treatment for frostbite.
Acrocyanosis	Hands and feet are cold, blue, and sweaty.	Exposure to cold; inadequate clothing; underlying disease.	Remove to warmer area; loosen tight clothing; consult physician.
Trench Foot	Edema of the foot; tingling; itching; severe pain; blistering.	Repeated exposure to cold and moisture.	Remove to warmer area; refer to treatment for frostbite; consult physician.
Raynaud’s Disease	Fingers turn white, numb and stiff; intermittent blanching and reddening of the fingers and toes; affected area tingles and becomes very red or reddish purple.	Exposure to low air temperature and high winds; inadequate clothing; underlying disease; stress.	Remove to warmer area; consult physician.

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C. Evaluating Cold Exposure Hazards

1. Common sense will dictate how much clothing to wear and when to get into a warm area in most cases. However, some work environments require more complex evaluations.
2. Evaluating a work environment to determine the degree of cold stress involves measuring air temperature, wind speed, and the amount of energy expended by the worker.
3. Air temperature can be measured by an ordinary bulb thermometer. Wind speed can be measured in a variety of ways but can also be estimated as follow:
   5 mph - light flag moves
   10 mph - light flag fully extended
   15 mph - raises newspaper sheet
   20 mph - blowing and drifting snow
4. Table 2 in the Cold Stress section of the ACGIH TLV booklet estimates effective temperature using actual temperature and wind speed. This booklet also provides additional guidelines for controlling cold exposure hazards.

D. Preventing Cold Stress

1. Reduce manual workload. When cold stress is a concern, eliminating manual operations as much as possible should reduce personnel exposures. Power tools, hoists, cranes, or lifting aids should be used to reduce the metabolic workload and to reduce the duration of human exposure. Fatigue is also a compounding stress factor.
2. Dehydration. Working in cold areas causes high water losses through the skin and lungs, because of the dryness of the air. Increased fluid intake is essential to prevent dehydration. Warm, sweet, caffeine-free, non-alcoholic fluids, in addition to water, should be available at the work site for fluid replacement and caloric energy.
3. Warm locations for breaks. For outdoor work such as beach cleaning, where it will be difficult to warm the work area, it is particularly important to provide frequent breaks in a warm location. These locations should also be stocked with warm fluids to help warming and prevent dehydration. A work-rest schedule should be implemented using Table 3 in the Cold Stress section of the latest edition of the ACGIH TLV booklet for guidance. Providing movable spot heaters close to the work area can also be effective, and can also prevent secondary hazards from carbon monoxide when workers attempt to warm themselves near running engines. If fine work is to be performed with bare hands, special provisions should be made to keep the worker's hands warm using such things as warm air jets, radiant heaters, or contact warm plates.
4. Indoor/outdoor wind breaks and shelter. The work area should be shielded if the air speed at the job site is increased by winds, draft, or ventilating equipment. For example, bird/mammal rehabilitation may be conducted in large warehouse type buildings where heating may be difficult. Barriers to reduce drafts should enclose wet workstations (such as washing or drying stations).

5. Scheduling and task management. Schedule the coldest work for the warmest part of the day. Move work to warmer areas whenever possible. Assign extra workers to highly demanding tasks. Make relief workers available for workers who need a break. The buddy system is required for all waste site operations. This is particularly important when working in stressful environments. Minimize sitting still or standing around for long periods. Older workers need to be extra careful in the cold. Additional insulating clothing and reduced exposure time should be considered for these workers. Sufficient sleep and good nutrition are important for maintaining a high level of tolerance to cold.
6. Protective clothing/equipment.
   a. General considerations.
      Provisions for additional total body protection are required if work is performed in an environment at or below 4° C (39.2°F)
      At air temperatures of 2°C (35.6°F) workers who become immersed in water or whose clothing gets wet should be given dry clothing immediately and treated for hypothermia
      Continuous exposure of skin should not be permitted when the air speed and temperature results in an equivalent chill temperature of -32°C (-25.6°F).
   b. Insulation. It is essential to preserve the air space between the body and the outer layer of clothing to retain body heat. The more air pockets each layer of clothing has the better the insulation.
      i. Outer layer should be windproof and waterproof. Outer layers should not prevent sweat evaporation.
      ii. Dirty or greasy clothing loses much of its insulation value. Air pockets are crushed or filled, and heat can escape more easily.
      iii. Any interference with the circulation of blood reduces the amount of heat delivered to the extremities. All clothing should be loosely worn and be unrestrictive.
   c. Chemical protective clothing (CPC) considerations. While CPC is important for protecting personnel from hazardous exposures, it is important to remember that CPC ensembles have undesirable, as well as desirable impacts on the cold stress on personnel.
      i. Undesirable effects. The desired insulating effect of clothing is negated if skin or clothing is wet. Protective clothing (for cold or chemical protection) can also add to the work load/fatigue of workers. When cold stress is a concern, care should be exercised in selecting ensembles particularly for those parts of the ensemble protecting the trunk of the body.
      ii. Desirable. Liquids conduct heat better than air and have a greater capacity for heat than air. For example, a spill of cold gasoline on skin can freeze the tissue very quickly. Chemical resistant gloves, such as neoprene with cotton inserts, should be worn to prevent this localized cold stress.
   d. Priority clothing. The most important parts of the body to protect are the feet, hands, head and face. Keeping the head covered is important because as much as 40% of body heat can be lost when the head is exposed.
   e. Ensemble options. The following items should be considered for addition to worker ensembles in cold environments:

i. A cotton T-shirt and shorts under two-piece cotton and wool thermal underwear. Two-piece long underwear is preferred because the top can be removed and put back on as needed.

ii. Socks with high wool content. Use thin inner socks and thick outer socks. If cold, wet feet are a concern, the socks should be changed during the mid-shift break.

iii. Wool or thermal trousers (lap trousers over boot tops to keep out snow or water).

iv. Felt-lined, rubber-bottomed, leather-topped boots, with a removable insole (for heavy work). For chemical protective boots, air insole cushions and felt liners (steel/shank boots should be avoided unless needed for specific safety reasons).

v. Wool shirt or sweater over a cotton shirt.

vi. Wool knit cap (watch cap) or (if hard hats are required) specially made hard hat liner.

vii. Face mask (vital when working in cold wind). Note: Face protectors must be periodically removed so the worker can be checked for signs of frostbite.

viii. Double-layered goggles with foam padding around the edges (extremely cold environments).

ix. Insulated gloves.

60 degrees F, or lower, for sedentary work
40 degrees F, or lower, for light work
20 degrees F, or lower, for moderate work
0 degrees F, or lower, wool mittens should be used instead of gloves

f. Ensembles for work when water immersion may occur.

i. Floatation devices are extremely important to avoid unnecessary swimming that will increase the rate of body heat loss.

ii. Air trapped between layers of clothing will provide buoyancy and heat insulation, but Personal Floatation Devices (PFDs) offer the best chance for survival in cold water. Type III PFDs include float coats and cold water immersion suits that provide floatation and thermal protection.

iii. Position throwable floatation devices in boats or work areas near water.

g. Selection of materials.

MATERIAL	ADVANTAGES	DISADVANTAGES	WEAR IN
Wool	Stretches without damage. Insulates well when wet.	Heavy weight. Absorbs moisture. Skin irritant.	Layer 1-3
Cotton	Comfortable. Lightweight	Absorbs moisture.	Layer 1-2
Silk	Lightweight. Durable. Good insulator. Washes well.	Expensive. Does not transfer moisture well.	Layer 1
Nylon	Lightweight. Durable. Water-resistant.	Impervious to perspiration. Flammable.	Layer 3
Down	Lightweight. Durable. Good insulator when dry.	Expensive. Hard to dry. Poor insulator when wet.	Layer 2-3
Polyester	Does not absorb moisture (insulates even when wet).	Heavier than down. Does not compress as well as down.	Layer 2-3

Reference M
BIOLOGICAL HAZARDS (BITES, STINGS, AND POISONOUS PLANTS)

OVERVIEW
A variety of plants and wildlife will be encountered at most spill sites.

Plants
1. Avoid contact with all plants as much as possible. Poison ivy, poison oak and poison sumac are hard to identify and may be hidden by other plant growth.
2. Train all personnel to recognize poisonous plants and to wear appropriate protective clothing when handling.
3. Train personnel in basic first aid for plant contact.

Wildlife
1. Examples of wildlife possibly encountered at a spill site include: stray dogs; bears; moose; beaver; otters; snakes; Birds; fish; skunks and other small animals; alligators; nutria; and, insects.
2. Avoid contact with all wildlife, particularly oiled, injured or dead wildlife. Report visual observation of such wildlife to supervisor.
3. Discuss wildlife hazards at the site during pre-entry briefings to ensure cleanup personnel are aware of preventive and first aid measures.
4. Identify personnel with allergies to wildlife and plants, particularly those allergic to insect stings and bites. Be prepared to provide immediate first aid to these individuals if needed.
5. Train all personnel to recognize wildlife, especially poisonous snakes and insects.
6. Response and rescue of wildlife will be made by personnel who have training in handling wildlife.
7. Train personnel in basic first aid for bites and stings. First aid should be administered by trained first aid responders if possible.

FIRST AID FOR BITES, STINGS, AND POISONOUS PLANT CONTACT

Personnel briefed on first aid procedures must understand that “FIRST” aid implies that further treatment will probably be needed from trained/qualified medical personnel. See the American Red Cross Standard First Aid Training Manual or the American Academy of Orthopedic Surgeons’ “Emergency Care and Transportation of the Sick and Injured” for additional information and updated procedures.

Employers of persons required to perform first aid must have an Exposure Control Plan which complies with OSHA’s Bloodborne Pathogen Standard. (29 CFR 1910.1030) The employer must ensure adequate training has been provided on the Exposure Control Plan, the OSHA Standard, and in the use of “Universal Precautions.” Response team members assigned to staff first aid locations must be trained in the above before participating in first aid activities.

A. Bee Stings: Persons with a severe allergy to bee stings should carry an emergency treatment kit and should notify supervisor of allergy upon arrival on site.

   First Aid

   1. Wash the wound with soap and water.

2. If symptoms of allergic reaction are present, request medical assistance and treat for shock.
3. If stinger remains embedded, try to remove it without squeezing it (this may inject more poison into the wound). Avoid using tweezers since it may squeeze the venom sac.
4. Scrape the stinger out with a plastic card (e.g., credit card or driver's license).
5. Use a cold pack to reduce/limit swelling. Do not place a cold pack directly on the skin! Place gauze pad or clean cloth on the skin to prevent direct skin contact with the pack.
6. Keep the wounded area below the level of the heart to slow the venom's spread.
7. Do not administer caffeinated beverages or alcohol since this will dilate blood vessels, enhancing spread of poison.

B. Spider Bites:
   1. Wash the wound with soap and water.
   2. Request medical assistance to address symptoms. The person usually recovers after several days of illness.
   3. If symptoms of allergic reaction are present, treat for shock.
   4. A cold pack may be helpful if the bite is quickly recognized.

C. Ticks:
   1. Wash the wound with soap and water.
   2. If symptoms of allergic reaction are present, request medical assistance and treat for shock.
   3. Try using alcohol, oils, or a heated paper clip to encourage the tick to release its grip. Grasp the tick and remove it quickly when it shows signs of letting go (the tick may wiggle its legs in an attempt to withdraw from the skin). If the head remains under the skin, soak the area several times daily and use tweezers to attempt to remove.
   4. If fever, rashes, or headaches develop within several weeks, contact medical personnel.

D. Animal Bites/Rabies:
   1. Get medical attention immediately to address infection hazards and/or need for vaccination.
   2. Determine when person last had tetanus immunization (contact unit holding medical records for assistance).
   3. Interview victims and witnesses to attempt to identify the specific animal that inflicted the bite.
   4. General first aid for animal bites:
      I. Control serious bleeding. Apply pressure using a gauze pad. Use of tourniquets is not a advised unless absolutely necessary.
      II. Wash your hands before touching a wound. Personnel should wear rubber gloves and face shield for working around human blood.
      III. Wash wounds that are not bleeding heavily. Use plain soapy water. Trained medical personnel must clean serious wounds.
      IV. Cover with clean dressing and bandage.
      V. Rabies treatment must be administered by medical personnel. Prompt treatment is essential since there is no cure for rabies if it is allowed to develop in a wound. Rabies shots must be started quickly in order to prevent infection by building up immunity.

F. Poisonous Snakes:
1. Get medical attention immediately to address poisoning and infection hazards.
2. Determine when person last had tetanus immunization (contact unit holding medical records for assistance).
3. Interview victims and witnesses to attempt to identify the specific type of animal that inflicted the bite.
4. General first aid for snake bites:
   - I. Use of tourniquets is not advised.
   - II. Wash your hands before touching a wound. Personnel should wear rubber gloves and face shield for working around human blood.
   - III. Wash wounds that are not bleeding heavily. Use plain soapy water. Trained medical personnel must clean serious wounds.
   - IV. Cover with clean dressing and bandage.
   - V. Serious health effects of poisonous snake bites will be greatly reduced by keeping the victim as calm as possible and seeking prompt medical attention.
   - VI. Keep the victim still. This will slow the spreading of venom.
   - VII. Place the bite area below the level of the heart to slow the spread of venom.
   - VIII. Wash the bite area with soap and water.
   - IX. Use a splint to immobilize the bitten area if it is on an arm or leg.
   - X. Use a cold pack if medical attention may be delayed. Do not place a cold pack directly on the skin! Place a gauze pad or clean cloth on the skin to prevent direct skin contact with the cold pack.
   - XI. Treat for shock if necessary.
   - XII. Do not administer caffeinated beverages or alcohol since this will dilate blood vessels.
   - XIII. Do not use incisions or suction to attempt to draw out poison.
   - XIV. Seeking prompt medical attention and keeping the victim still are the two most important keys to minimizing this health risk. However, the need to move the victim toward medical attention will also tend to spread the venom. As a general rule, do not move the victims toward medical care unless this will delay treatment by more than a half hour.

G. Poisonous Plants:
1. Do not scratch. Scratching will only spread the poison and work it into the skin.
2. If these plants are accidentally touched, the plant sap should be washed off the affected area with soapy water immediately. Remove and wash any clothing that came in contact with the plant.
3. Medical attention may be needed if prolonged or serious conditions result.
4. Calamine lotion, hydrocortisone cream, or a cool compress may reduce the discomfort.

Appendix E: See Separate Document

PART 1 - OIL SPILL RESPONSE SUPPORT PLAN

A. EXXON CO. - USA, OIL SPILL RESPONSE - AVIATION SUPPORT

This material has been prepared to assist Company personnel in rapidly locating and arranging for charter aircraft in response to a Company designated emergency situation. It is consistent with the Company's Aviation Operations Guide, and should be considered part of the Company's overall Emergency Response Plan as defined by affiliate/regional management.

In the event of an emergency response situation, the area field office or designated representative will need to determine and arrange for aircraft according to the specific transportation needs dictated by the emergency. Consideration should be given to both fixed wing and rotary wing aircraft with emphasis on supporting key people involved with the emergency response.

B. REQUEST FOR EMERGENCY AVAIATION SERVICE

Aviation should be contacted as soon as possible for assistance in evaluating and coordinating transportation. Aviation contacts are listed with applicable telephone numbers where they may be reached during and after business hours, weekends and holidays.

1. When the aviation department or group assigned responsibility for aviation logistics receives a request for emergency aviation support, the following information should be obtained:
   Date__________ Time__________Person calling ______________________________
   Phone Number_______________________ ELIRT Group _________________________
   Services Requested ____
   ____
   ____

2. Aviation Services should be contacted in the following order:

Aviation Services - Houston	Office	After Hours
R. E. Killian, Manager	281-654-6025	281-222-0158

Appendix F - AVIATIONS OPERATIONS GUIDE

C. APPROVED AIRCRAFT TYPES

A listing of approved aircraft types (airplanes and helicopters) is provided in Part 2 of this section. Aircraft are described in terms that will assist in planning and matching aircraft capabilities to the specific emergency response mission. (Speed and distances in nautical miles and performance characteristics are conservatively stated.)

1. Aircraft - Airplane
   The multi-engine aircraft described in Part 2-A are approved for day/night IFR operations, and are to be operated with a crew of two instrument rated pilots. Turbine powered airplanes are recommended, although piston powered aircraft may be used subject to review by aviation services.

2. Aircraft - Helicopter
   <u>Single Engine Helicopter</u>
   Helicopters described in Part 2-B are approved for day visual flight operations (VFR) only. Performance is based upon helicopters configured for offshore operations and include floats, 30-minute fuel reserve and passenger weights of 200 lb. per pax. Payload increases approximately 100 lbs. For helicopters that are not float equipped.

   <u>Twin Engine Light/Medium Helicopter</u>
   Helicopters described in Part 2-C are also approved for daytime visual flight operations (VFR) only. These aircraft are best suited for environments where twin engine is preferred over single engine i.e., greater distances offshore, cold water operations, or mountainous terrain. Performance data based on a 30-minute fuel reserve and a payload weight of 200 lb. per pax.

   <u>Transport Helicopter</u>
   Twin-engine transport helicopters described in Part 2-D, are normally approved for both visual and instrument flight operations.

APPENDIX G - SECURITY

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Security Expectations

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APPENDIX H

Severe Weather Plan

ExxonMobil Pipeline Company

Severe Weather Plan

For Coastal Areas

Last Revision: 7/06

16. Table of Contents

Introduction

ExxonMobil Pipeline Company (EMPCo) personnel will reference the Severe Weather Plan for basic guidelines while preparing for hurricane season, and during and after a severe weather event such as a hurricane, tropical storm, tornado, or flood. This plan includes phases of a hurricane, responsibilities of key personnel, and other pertinent information. Each storm does not threaten all areas equally, but sound judgment should be used in deciding what to do for each area or system. Clearly, the purposes and objectives of the plan are varied, and it does not cover every event, site or situation. However, when used for guidelines, it should be a useful tool which will:

1. Define the operations required to:
    - A. Begin preparedness for hurricane or severe weather
    - B. Shut down operations
    - C. Evacuate
2. Define the responsibilities for completing these phases in an orderly manner within the necessary time requirements for personnel and equipment safety.
3. Give employees and supervisors additional data regarding policies on:
    - A. Communication systems maintained
    - B. Handling operations
4. Give basic guidelines to complete the preparations necessary in an orderly manner to protect:
    - A. Personnel
    - B. Company property.

The guidelines are not intended to be all inclusive, nor to limit in any manner the function or responsibility of any pre- or post-storm activities. Rather, they are intended to be used as stated, as *guidelines*.

Each **Area Supervisor, Field Supervisor/Terminal Superintendent** and all other supervisors should review these guidelines each year by April 15. This would allow for completion of the items required by the Field and to make changes and modification prior to June 1.

It is also recommended that each June Safety Meeting, at all locations, be dedicated to the explanation of this plan and/or changes from the previous year, if any, to all personnel.

Pre-Hurricane Season Preparations

Readiness prior to hurricane season can help minimize hazardous conditions during a storm, reduce property damage and aid with evacuation efforts, if required. When the following tasks are accomplished before a hurricane, time and personnel will be available to handle actual emergencies and other urgent situations as they occur. All supervisors shall insure these items are completed in a timely manner, preferably prior to June 1.

Recommendations	Responsibility
1. Monitor weather conditions in the Gulf of Mexico, distribute weather information electronically, and advise Operations Mgmt. of any alert conditions (see page 9).	**Emergency Preparedness and Response Advisor**
2. Operations Mgmt. will initiate communications company-wide upon evaluation of Regional Response Coordination Team (RRCT) advisories.	**Operations Manager**
3. Incorporate hurricane emphasis topics and severe weather plan review in group safety meetings prior to hurricane season.	**Area Supervisor** **Field Supervisor/Terminal Superintendent**
4. Formulate site-specific severe weather plans (GI, SMI, Mont Belvieu, Beaumont, Quintana, Webster, Corpus Christi, Sorrento, Empire, Burns, Meraux, South Bend, New Iberia, Projects, etc.).	**Area Supervisor** **Field Supervisor/Terminal Superintendent** **Projects Manager**
5. Remove all unnecessary loose materials and secure seldom used material from all stations and field office yards.	**Area Supervisor** **Field Supervisor/Terminal Superintendent** **Projects Manager** **Tech Leader**

Recommendation	Responsibility
6. Maintain all stations and buildings in best possible condition by making repairs and modifications necessary to preserve original strength.	**Area Supervisor** **Field Supervisor/Terminal Superintendent** **Projects Manager** **Tech Leader**
7. Perform facilities integrity inspections; make necessary repairs on tank stairways and other tank appurtenances.	**Area Supervisor** **Field Supervisor/Terminal Superintendent** **Tech Leader**
8. Stock an ample supply of rope for tying down operating equipment, lumber for boarding windows and doors, plastic sheeting to protect equipment, etc.	**Area Supervisor** **Field Supervisor/Terminal Superintendent** **Tech Leader**
9. Notify supervisors of any potential hazardous situation that exists or that may develop so corrective action can be taken.	**All Personnel**
10. Examine windings on all generators for proper voltage and make repairs as required.	**Area Supervisor** **Field Supervisor/Terminal Superintendent** **Tech Leader**
11. Perform preventive maintenance on emergency generators. Tests should include changing antifreeze, oil, run test under load, check and change belts and any other repairs as required.	**Area Supervisor** **Field Supervisor/Terminal Superintendent** **Tech Leader**
12. Diesel in above-ground fuel tanks for generators may need to be changed.	**Area Supervisor** **Field Supervisor/Terminal Superintendent** **Tech Leader**

13. All free-standing hoist frames should be secured for the duration of hurricane season.	**Area Supervisor** **Field Supervisor/Terminal Superintendent** **Tech Leader**

Recommendation	Responsibility
14. Maintain lists of local vendors who can supply emergency equipment and supplies, if needed. Pre-arrange to secure equipment where necessary.	**Area Supervisor** **Field Supervisor/Terminal Superintendent** **Tech Leader**
15. Ensure appropriate personnel have identification badges to allow re-entry into impacted areas in the event of a disaster.	**Area Supervisor** **Field Supervisor/Terminal Superintendent**
16. Update as needed, portable generator requirements for coastal systems, and supplier information.	**RRCT and Procurement Group** **Terminals and Pipeline Engineering**

Severe Weather Information for Houston Employees

When severe weather or any other emergency or natural disaster is expected or has occurred in the downtown Houston area, the communications systems listed below will be updated with the latest status and information regarding any work schedule changes. Instructions concerning what precautions need to be taken, severity of the situation, and who should report to work will be updated on a regular basis throughout the emergency.

- ExxonMobil's Emergency Information Line (656-7777)
- http://empa.na.xom.com/PubAffairs/houston/hazardous_weather.htm
- Area Radio Stations:

  KTRH 740 AM

  KIKK 650 AM

  KIKK 96.0 FM

  KPRC 950 AM

ExxonMobil Building emergency situations during work hours, such as severe weather or a fire, will be coordinated by the ExxonMobil Global Real Estate and Facilities Services.

- The fire alarm and intercom systems will be used as appropriate
- The Fire Warden network may be used to transmit weather related information that does not warrant the use of the building communications system, and can also be used to relay information after emergency conditions have improved.
- If conditions warrant early release of employees from the ExxonMobil Building, managers and supervisors will be notified of the appropriate timing.

Severe Weather Information for Employees

A partial list of hurricane precautions employees should be aware of:

- Know the hurricane risks in your area. Pre-identify storm surge and flood prone areas. Pre-plan to minimize those risks.
- Learn safe routes inland in the event evacuation becomes necessary.
- Learn the locations of official shelters in your area.
- Review the needs and working conditions of emergency equipment such as flashlights and battery powered radios. DO NOT use candles or gas lamps in your home during an emergency -- they are a fire hazard.
- Be sure that you have adequate clean water and non-perishable foods on hand.
- Obtain and store materials such as plywood, tape, rope, etc., to properly secure your home, if needed.
- Clear loose and clogged rain gutters and down spouts, and trim weak trees and shrubbery that could damage your home in the event of high winds.
- Review your insurance to be sure it provides adequate coverage, and have a copy readily available to show insurance adjusters if needed.
- If a hurricane watch or warning is issued, monitor the radio and television closely for information; fuel and service your family vehicles, remove or secure loose items in your yard or on porches or patios, and check and replenish food, water, batteries, first aid and other emergency supplies.
- Closely monitor and follow instructions issued by local officials.

Alert Definitions

EMPCo uses a "Phased Approach" to Hurricane Preparedness based on geographic location, strength, and probability of landfall of hurricanes to assist Management and other personnel to prepare for an approaching storm or hurricane.

The order of priority is: (1) to protect the lives and safety of all personnel, and then (2) to protect property.

Severe weather terms and EMPCo's defined phases of alert are described below:

	Wind Velocity, MPH
Tropical Depression	38
Gale Warning	39-54
Storm Warning	55-73
Tropical Storm	39-73
Hurricane	74 +

(For more detailed definitions, see Appendix)

PHASE I — Initiation of phase 1 will start with the onset of hurricane season on June 1 each year. The Phase I alert will remain in effect until November 30 (later if Management deems it necessary).

PHASE 2 — A tropical depression, storm, or hurricane has formed and it is predicted that it *could pass through or near EMPCo's Facilities within 120 hours or less.*

PHASE 3 — When a tropical depression, storm, or hurricane has formed and it is predicted to affect EMPCo Facilities within 96 hours. Evacuation of designated. There is ***imminent danger to personnel and evacuation is necessary.***

PHASE 4 — When a hurricane has formed and it is predicted to affect EMPCo facilities within 72 hours. Shutdown and evacuation of affected facilities should be expected and non-essential personnel will be released.

Phase 5 — This phase is for Post Storm Damage Assessment and Start-up. Damage assessments and repopulation of facilities will be conducted as soon as it is safe to do so after the storm passes or as weather permits.

Phase I

General Information

Phase I is automatically initiated at the beginning of hurricane season on June 1st.

All **Supervisors** should maintain a log of relevant action taken for shut down preparations and during actual shut downs.

Company vehicle fuel tanks should be kept at least 3/4 full.

Actions required by individuals responsible for shutdown preparations are listed on the following pages. Phase I preparations can normally be completed in six to ten hours.

Management

The **Operations Manager** or **Area Manager** will supervise and coordinate the necessary actions under a Phase I alert according to the following:

1. Notify all Field Operations Supervisors, Products Movements Manager, Projects Manager, and Management when Phase I is initiated.
2. Hold briefings, as required, to review weather bulletins and preparatory plans.
3. Monitor preparations in the field.
4. Plan work considering possible weather related disruptions. Plan personnel assignments considering employees' personal property protection needs.

The **Operations Control Center Manager** will supervise and coordinate the necessary actions under a Phase I alert according to the following:

1. Monitor weather reports and communicate essential information to Management. Product Movements Manager will notify Field Operations Management and Projects Manager when Phase I conditions could occur within six hours.
2. Issue weather advisories company-wide as directed by Management.
3. Determine and monitor the status of all OCC-controlled equipment and facilities.
4. Coordinate ballasting of all pipeline breakout tanks.
5. Monitor company communications as needed.

Field Supervision

Area Supervisor, Field Supervisor/Terminal Superintendent, Tech Leader

Field Supervision will insure that the following actions are performed, as applicable:

1. Prepare to tie down all equipment and material that may be blown or washed away. Inspect tie-down ropes on all boats, and replace where necessary.
2. Fill all storage tanks which are <u>not necessary</u> for operations with water, diesel, crude oil or whatever is appropriate.
3. Maintain all tanks necessary for operations **<u>at least</u>** one third full, except at Pasadena Station. Pasadena Station will be operated as normal operations dictate as long as Phase I is in effect and the weather conditions are equal to or less than a tropical storm and land fall is not projected to be in the Houston Area within 72 hours. The Product Movements Manager should verify that enough product is at Pasadena Station to equalize all tanks to a <u>10 foot minimum</u> if it is projected that a tropical storm will arrive in the Houston Area within a 72 hour time period. Additional fill is preferred if possible at all sites. Close the firewall drains and open the roof drains.
4. Alert all extra personnel (contractors, etc.) to be ready to leave on short notice and to prepare their equipment for a storm or evacuation, whichever is appropriate.
5. Check fuel, batteries and <u>operation</u> of emergency generators and portable pumps. Keep a list of vendors who can supply additional equipment if needed.
6. Keep a list of every employee and contractor who is working in the field and the locations where they are working.
7. Continue operations; however, be prepared to stop on short notice.
8. Alert all personnel assigned to small construction or maintenance jobs to be ready to be reassigned to other tasks, as needed.
9. Evaluate need to reserve appropriate numbers and sizes of trailer-mounted generators for emergency use, where necessary, at local suppliers. Contact Contracts Group.

Field Supervision (Continued)

10. Check on supplies inventories/status with Materials Clerk (see next page).

27. Obtain re-entry passes from local emergency management agencies, where necessary, for essential EMPCo personnel requiring access into the area in the event of a disaster, if not already done so.

28. Ensure that all appropriate Operations Program (e.g. PLC's, Flow Computers, Loop Controllers, etc.) back-ups are current.

29. Ensure latest CPTS data has been uploaded in the LAN.

Materials Clerk

1. Inventory and obtain supplies that are necessary to prepare for a hurricane, to protect equipment and to use during and after the hurricane. Some of the suggested supplies are flashlights, batteries, battery-operated radios, first-aid kits, containers for drinking water, fire extinguishers, motor oil, gasoline, diesel, rope, lumber for boarding windows, plastic wrapping and tape, etc.
2. Check response trailer inventories and re-supply as necessary.
3. Monitor and record significant communications to and from other Field Operations units and Houston. Keep track of hurricane activity.

Phase II

General Information

Phase 2 is initiated by **Field Operations Management** when it has been established that the path of the hurricane or storm could take it through or near EMPCo's facilities.

All **Supervisors** should maintain a log of relevant action taken for shut down preparations and during actual shut downs.

Company vehicle fuel tanks should be kept at least 3/4 full.

Actions required by individuals responsible for shutdown preparations are listed on the following pages. Phase I preparations can normally be completed in six to ten hours.

The **Area Manager** will schedule a meeting or conference call with the Area Supervisors, Field Supervisor/Terminal Superintendents, and the Tech Leaders, as appropriate, to plan for an orderly shutdown if required. **Area Supervisors and/or OCC Manager,** designated by the Area Manager, will maintain regular communication with producers, other companies, refineries, etc. in order to keep suppliers and customers informed of EMPCo's actions and plans.

Management

The **Operations Manager** or **Area Manager** will supervise and coordinate the necessary action under Phase II alert according to the following:

1. Notify all Field Operations Supervisors, OCC Manager, Projects Manager, and Management when Phase II is initiated.
2. Hold briefings, as required, to review weather bulletins, producers operations, and other plans.
3. Monitor preparatory activities in the field.
4. Apprise EMPCo Management and OCC of decisions and actions being implemented.

The **Emergency Preparedness and Response (EP&R) Advisor** will supervise and coordinate the necessary actions under Phase II alert according to the following:

1. Constantly monitor weather reports and communicate essential information to Management on a regular basis.
2. Issue weather advisories company-wide as directed by Management.

The **OCC Manager** will supervise and coordinate the necessary actions under Phase II alert according to the following:

1. Determine and monitor the status of all OCC-controlled equipment and facilities. Prepare for systems shut down.
2. Coordinate ballasting of all pipeline breakout tanks.

Field Supervision

Area Supervisors and **Field Supervisor/Terminal Superintendents** will coordinate and supervise the action required under a Phase 2 alert according the following:

1. Inform field personnel that Phase 2 has been initiated, and poll employees as to their needs regarding evacuation, special assistance, etc.
2. Notify all needed personnel to report to work and if required, prepare a 24-hour work schedule.
3. Update lists of employees and contractors (names, numbers and company affiliations) who are working in the field and the locations where they are working, in the event an evacuation is ordered.
4. The Area Supervisors, Field Supervisor/Terminal Superintendents, and/or OCC Manager, designated by the Area Manager, will communicate with producers, other companies, refineries and plants to inform them of EMPCo's action and plans
5. Shut down all non-essential operations. Secure and tie down equipment as necessary. Coordinate all shutdowns with Operations Management and the company involved, on a case-by-case basis.
6. Dismiss all non-essential contract personnel.
7. Start and run all emergency generators to insure they are in operable condition.
8. After production is shut-in, or a system shutdown, **read and record** all sales meters, tank levels, etc. Ensure latest CPTS data is uploaded to the LAN.
9. Be certain all station tanks are **at least** one third full, except Pasadena Station. Pasadena Station will continue to operate as normal except that a minimum of 10 feet will be maintained if the hurricane is projected to be within 72 hours of the Houston Area. The Product Movements Manager should verify that there is sufficient product available at Pasadena Station to equalize all the tanks to 20 feet should the storm be projected to hit the Houston Area within a 72 hour time period. Additional fill is preferred if possible at all sites. Be certain that all small service tanks are full. Verify that all tank firewall drains are closed and that tank roof drains are open.

Field Supervision continued

10. Wrap or cover electric motors, generators, electrical gear, personal computers, or other critical equipment with plastic sheets. Place portable generators in a protected and accessible area.

11. Important records and other paperwork should be moved away from windows and covered with plastic and/or stored for the best possible protection.

12. Close and secure all doors, compressor houses, control buildings, etc. Close all fan louvers. Tape small windows and board up all large windows.

13. Secure, ballast, or relocate boats to allow for high winds and tides.

14. Monitor the Company's radio. Keep the radio as clear as possible so it can be used when urgent messages need to be communicated.

15. Use the telephone as much as possible to transmit pertinent information such as personnel location and system status.

32. Locate and reserve appropriate size/number of emergency generators as necessary.

17. Texas Coastal Area:

    - Secure for post-storm use appropriate sizes and numbers of portable generators for Bayport, Webster, Pasadena, Mont Belvieu, Quintana Island and other appropriate locations.

    - Relocate critical portable equipment located at Baytown to Pasadena (or further inland if determined necessary).

    - Relocate small boats located at Baytown to Pasadena.

    - Arrange for transfer of essential supplies to Pasadena and Mont Belvieu for support of a 10-person task force for three days.

18. Louisiana Coastal Area:

    - Secure for post-storm use appropriate size and number of portable generators for Baton Rouge, Anchorage, Sorrento, Meraux, Empire, Sunset/New Iberia/South Bend, and Raceland/Grand Isle areas.

    - Grand Isle: put up storm windows.

Field Supervision continued

18. Louisiana Coastal Area (Continued):

- Port Sulphur: secure boats in slip at Port Sulphur (allow proper slack in mooring to allow for high tides).

- Clovelly: secure Lenora H boat against vertical bumper system at Clovelly Import Station, tie other boats alongside the Lenora H.

- New Iberia/South Bend: move Quintana boat (Anna Catherine) to Garden City Station. Prepare to move outboard motor from South Bend.

- Sorrento: stay in close contact with Refinery. If the Dome is to remain operational, it will be manned with two Operators, one Senior Tech and an Field Supervisor/Terminal Superintendent, using three company vehicles with radios and cellular phones. Emergency equipment and provisions will be provided. OCC will be asked to keep the Operators informed of all pipeline pressures on a regular basis as long as communications exist. Close contact with all associated plants will also be maintained as long as possible. If the Dome is to be shut down, the wells will be shut in and the pipelines will be shut down in close coordination with affected plants. All systems will be left in a minimum risk condition if evacuation becomes necessary.

- Anchorage: close contact with OCC and the Refinery will be maintained. Assist the Refinery if they decide to put oil in all of their tanks. Check the emergency generator for proper operation and adequate fuel. Make contact with Placid and Clarco and advise them of EMPCo's plans. If it is decided to stay in operation, Anchorage Terminal will be manned with two operators and a company vehicle with radio (and cellular phone if available). If the Terminal is to be shut down, OCC must be advised of the need to shut down all incoming pipelines to Anchorage. All systems are to be left in a minimum risk condition if evacuation becomes necessary.

Field Supervision of Electrical and Mechanical Operations

The **Area Supervisors** and **Field Supervisor/Terminal Superintendents** will coordinate the activities of the electrical and mechanical operations with the respective supervisors.

1. Notify all of the Technicians that Phase II has been initiated. Schedule the needed Technicians to report to work and to plan to be on a 24-hour schedule until the hurricane alert is over.
2. Suspend all light maintenance work. Reassign personnel to finish or shutdown all heavy maintenance. Dismiss all contract personnel not needed for severe weather preparations.
3. Assist Field Supervisor/Terminal Superintendents, Tech Leaders and others, as needed, to start and run all generators, portable equipment, boat motors, etc.
4. Be certain an ample supply of motor gasoline and diesel fuel for emergency generators, portable equipment and Company vehicles is available.
5. Monitor the Company's two-way radio on all channels. Keep the radio as clear as possible so it can be used when urgent messages need to be communicated.
6. Use the telephone as much as possible to transmit pertinent information such as personnel location and system status.
7. Secure appropriate numbers and sizes of portable forced air heaters.
8. Test load diesel-powered emergency generators to insure proper operation.
9. Determine the need to reserve and/or secure portable generators (5 kW) and large generators (100 kW - 250 kW). If need is determined to exist, locate and secure such equipment (these should have already been pre-located during Phase I).

Projects Manager

The **Projects Manager** will direct the following activities, as applicable to their respective work activities/projects:

1. Notify Project Technicians and contractors that Phase II has been initiated. Schedule the needed Technicians to report to work and to plan to be on a 24-hour schedule until the hurricane alert is over.

2. Suspend all activity that is non-essential. Reassign personnel to finish all major construction work or to shut down the work as quickly as possible. After essential tasks are completed, dismiss all contract personnel.

3. Provide assistance to Area Supervisors and Field Supervisor/Terminal Superintendent as needed. This may include starting and checking generators, portable equipment, boat motors, procuring supplies, etc.

4. Monitor the Company's two-way radio system. Keep the radio as clear as possible so it can be used when urgent messages need to be communicated.

5. Use the telephone as much as possible to transmit pertinent information such as personnel location and system status.

Terminals and Pipeline Engineering

The **Terminals and Pipeline Engineering** will provide technical assistance to Management and other departments as requested, including the following:

1. Communicate with the Corps of Engineers and Civil Defense Office as needed.
2. Provide technical assistance with pipelines, valves, equipment location and function, etc., as requested by Field Operations.
3. Assist in determining and monitoring the status of pumping stations and other equipment where necessary.
4. Send engineers to critical locations for technical assistance, when requested by Field Operations.

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6. Monitor the Company's two-way radio on all channels. Keep it as clear as possible.

Phase III

General Information

Phase III will be initiated by **Field Operations Management** when a hurricane or developing tropical storm is moving toward EMPCo facilities and there is imminent danger to personnel or property. Normally, this phase is associated with the National Weather Service's issuance of a "Hurricane Warning" (12 to 24 hours before landfall).

All stations and systems *not* controlled by OCC will be shut down and all personnel will evacuate. All systems which are controlled by OCC will be shut down except those specifically requested by customers and approved by Management, on a case-by-case basis. In this event, a small task force which will be appointed by Management will be assigned to manually shut down these systems in case of telecommunication trouble, but not later than three (3) hours before hurricane arrival. Consider time required for manual motor operated valve closures.

The **Operations Manager (or Area Manager)** will communicate the decision to initiate the Phase III alert to EMPCo Management, other Field Operations Pipeline Areas, and OCC.

Management

The **Operations Manager (or Area Manager)** will supervise and coordinate the necessary action required under Phase III alert according to the following:

1. Notify all Field Operations Supervisors, Products Movements Manager, Projects Manager, and Management when Phase III is initiated.
2. Provide supervision of system shutdown and evacuation of personnel.
3. Decide which systems can remain operational and for how long prior to the developing tropical storm or hurricane's projected landfall.
4. Select a task force to manually shut down systems with telecommunication trouble, after regular evacuation phase.
5. Communicate decisions and actions to EMPCo Management, OCC, and other Field Operations Pipeline Areas.

The **Products Movements Manager** will supervise and coordinate the necessary actions under Phase III alert according to the following:

1. Constantly monitor weather reports and communicate essential information to Management on a regular basis. Product Movements Manager will notify Field Operations Management and Projects Coordinator when Phase III conditions could occur within 6 hours.
2. Issue weather advisories company-wide as directed by Management.
3. Determine and monitor the status of all OCC-controlled equipment and facilities. Prepare for and implement systems shut downs where necessary.
4. Ensure filling of all pipeline breakout tanks has been completed.

Area Supervisors and Projects Manager

Once the decision has been made to proceed with Phase III and Supervisors have been notified of that decision, **Area Supervisors, Projects Manager** will direct and coordinate the procedures required under Phase III alert, as applicable to their respective work activities:

1. Unless instructed otherwise, all systems are to be shut down, all equipment is to be secured or evacuated, and all nonessential personnel are to be evacuated.
2. Coordinate system shutdown with OCC.
3. Ensure that **all** station tanks are **at least** one third full, including Pasadena Station. Additional fill is preferred at all sites. Be certain that all small service tanks are full.
4. Pump out all sumps and fill sumps with water, if available.
5. De-clutch and close suction valves on all EMPCo hand-run units. Close supply valves on any gas units.
6. Lock out/tag out electrical equipment.
7. Shutdown LAN and any computer equipment; see Page 27 for details.
8. If an emergency task force is formed to manually shut down critical systems, personnel must leave the danger area no later than three hours prior to the projected landfall of the hurricane, unless otherwise approved by the Operations Manager.
9. Instruct all personnel to keep their supervisor informed of their location during and after an evacuation, and to return to work after the storm has passed.
10. Grand Isle/South Bend:
    - IHTI is to be responsible for evacuating the helicopter from GI.
    - Coordinate with producers an orderly shutdown.
    - Once production is shut in, notify producers of status and establish procedures for re-start.

Area Supervisors and Projects Manager continued

Grand Isle/South Bend (Continued):

- Put all units, including the GI VRS, in the OFF position. Pull and lock out/tag out electric disconnects.

[redacted] (b) (3), (b) (7)(F)

- Ensure proper PLC back-ups are current.
- Close valves upstream of all meter runs.
- Notify Area Supervisor and OCC of preparations when complete.
- Evacuate with critical files and records to the Raceland Office.
- If necessary, coordinate evacuation transportation options (boat/helicopter) with ExxonMobil Production's Grand Isle Base operations.

IOS Computer Equipment Protection Procedure

Upon Operations Management's instruction to shutdown operations because a hurricane is imminent and evacuation of company facilities is necessary, the following procedures will be used to protect sensitive IOS computer and telecommunications equipment.

General Procedures:

[redacted]

- Turn off and disconnect from the outlet all computers, terminals, printers and statmux equipment.
- Move equipment away from doors and windows and place 2-1/2 feet above ground level floors.
- Cover all equipment with plastic sheets that are secured as much as possible.
- **Do not** cover any equipment until it has been turned off and allowed to cool.

Special Procedures:

These procedures apply to Personal Computers and LAN Equipment:

- Backup all personal computer data files to floppy disks or tape and store them in a location safe from water and storm damage.
- Make a current LAN backup tape. All tapes should be taken off-site by designated personnel.
- Ensure CPTS laptop data is uploaded to the LAN.
- Any documentation, manuals, program diskettes and related information should be placed in a safe, dry location.

[redacted]

IOS Computer Equipment Protection Procedure continued

- The data cables from the modems to the telephone equipment do not need to be disconnected.
- Upon return to the office, examine the exterior of all equipment for physical or water damage. If there is any evidence of damage or water in the equipment, do not attempt to power it on -- contact your PC Coordinator.

Post-Storm Cleanup

General Information, Post-Storm Cleanup

Emergency procedures described in EMPCo's Emergency Response Plan (Core Manual, Vol. 1) should be followed as post-hurricane action guidelines. This Plan covers emergency situations in detail, however recommendations specifically for hurricanes and storms are as follows:

1. Job Safety Analysis

   Prior to initiating work in the field, **Supervisors** are to meet with their employees and contractors to review and address potential safety concerns associated with post-storm cleanup and repair activities. **Safety of employees and the public is paramount during cleanup and repair, followed in priority by environmental protection and asset protection and repair.** Special care will have to be taken to avoid potential risks associated with, among other things, high winds and water, downed power lines, vehicle accidents, contaminated water supplies, snakes, etc.

   Authority for re-entry into storm-impacted areas will reside with **Area Managers** and **Area Supervisors**. Employee safety is a primary consideration for impacted area re-entry. Contact with local emergency response agencies/personnel should be made in determining safety concerns for re-entry. Transportation options should also be considered.

2. Damage Assessment and Report

   Area Supervisors and **Field Supervisor/Terminal Superintendents** will inventory damage to their facilities, evaluate risks associated with damage repair activities, establish a priority of work needed according to the systems' importance, develop a plan for accomplishing that work, and then report the findings to Operations Management as soon as possible. Operations Management will provide applicable information to Public Affairs, if necessary.

   Supervisors will also poll their employees and establish an EMPCo assistance list to help employees with extraordinary damages, needs, etc.

3. Facilities Cleanup and Repair

   -**Field Operations Management** will designate a facilities cleanup and repair task force. This task force may require assistance from other Areas.

   - Check out all pipelines and above ground facilities prior to startup, by aerial patrol, site visits, visual tank inspections, substation inspections, etc.

General Information, Post-Storm Cleanup

continued

- Any tank gauges or tank stairways that have been damaged or destroyed must be repaired immediately. Dents need to be pulled out of tanks; tanks with floating roofs should be repaired first. Tank firewalls should be drained and inspected for erosion or other damage as soon as possible.

- Check out, meg and dry electric motors prior to starting. Water could collect in some motors, which would cause damage upon starting. Critical spares for motors which are 25HP and above are available from Bayport, and spares for larger motors are available from Houston Storage.

- If a station is shutdown because of damaged motors or loss of electrical power, temporary equipment may be required. This applies to gathering system locations as well as trunk line stations.

- Tighten any loose connections (flanges, tanks, tubing, etc.)

- For locations with inadequate power supplies, install temporary generator(s).

- Check out and repair or replace transformers, fuses, disconnects, other electrical appurtenances as needed.

- Change bearing oil for large motors and pumps impacted by the storm prior to start up.

- Clean debris from all sumps, drains, floating roofs, etc.

- Check out and repair or replace communications, controls, other instrumentation equipment as needed.

- Seek technical support where needed for non-routine repairs. Help develop non-routine repair and operating procedures.

4. Facilities Start Up

- Start up must be conducted during daylight hours unless otherwise approved by Management.

- Review isolation procedures to ensure reversal of all hurricane preparation measures.

- Check out hydraulics. Involve Engineering where necessary.

- Verify OCC communications for start up.

General Information, Post-Storm Cleanup

continued

- Conduct second aerial line patrol (during or immediately after start up). If aerial surveillance is not possible (due to weather or other), Area Manager approval must be obtained prior to start up.

- Develop and carry out local area start up plan. Start up facilities step wise.

- Verify normal operating conditions with OCC and customers.

5. Other

- Products Movements Manager will reassess delivery schedule/commitments and adjust as necessary.

Appendix

Weather Terms

Tropical Disturbance Moving area of thunderstorms in the tropics that maintains its identity for 24 hours or more.

Tropical Depression Highest constant wind speed 38 miles per hour (33 knots).

Tropical Storm Constant wind speed ranges 39-73 miles per hour (34-63 knots).

Hurricane Constant wind speed of 74 miles per hour (64 knots) or more.

Gale Warning Winds of 39-54 miles per hour (33-48 knots) are expected.

Storm Warning: Winds of 55-73 miles per hour (48-64 knots) are expected. Gale and Storm Warnings indicate the coastal area to be affected by the warning, the time during which the warning will apply, and the expected intensity of the disturbance. When gale or storm warnings are part of an advisory, they may change to a hurricane warning it the storm continues along the coast.

Hurricane Watch If the hurricane continues its advance and threatens coastal and inland regions, a hurricane watch is added to the advisory, covering a specific area and duration. A hurricane watch means that hurricane conditions are a real possibility; it does not mean they are imminent. When a hurricane watch is issued, everyone in the area covered by the watch should listen for further advisories and be prepared to act quickly if hurricane warnings are issued.

Hurricane Warning When hurricane conditions are expected within 24 hours a hurricane warning is added to the advisory. Hurricane warnings identify coastal areas in which winds of at least 74 miles per hour are expected to occur. A warning may also describe coastal areas in which dangerously high water or exceptionally high waves are forecast, even though winds may be less than hurricane force.

When the hurricane warning is issued, all precautions should be taken immediately. Hurricane warnings are seldom issued more than 24 hours in advance. If the hurricane's path is unusual or erratic, the warnings may be issued only a few hours before the beginning of hurricane conditions. Precautionary actions should begin as soon as a hurricane warning is announced.

General Assignments of Responsibilities, Post-Storm

Operations Manager	Responsible for entire Field Operations, which includes coordination of cleanup and repair task force; assures key personnel and authorities are contacted; communicates to the President of EMPCo.
Area Manager	Assist Operations Manager with coordination of task force, travel to affected sites and directly coordinate field personnel. Interact with authorities and media, and communicate current developments to Operations Manager.
Area Supervisors **Field Supervisor/Terminal Superintendents** **Tech Leaders**	Assure affected pipeline systems are shutdown and appropriate valves are closed; keep accurate records of system failures, notify local police and fire departments determine extent of damage, coordinate damage repair and clean up.
Operations Integrity Department Coordinator	Will immediately notify local, State and Federal agencies if the system failure may result in pollution incidents; assist with accurate record keeping and submit appropriate reports when necessary
Terminals and Pipeline Engineering	Keep accurate records of system failure and submit reports to Operation Manager. Provide personnel for procuring needed equipment, supplies, etc. Accumulate data that pertains to system failure; inform Area task force with current and forecast weather conditions. Provide technical assistance regarding failures and repairs. Provide assistance in transporting cleanup material and equipment to site.
Projects Manager	Projects Manager supervise field operations and projects, including determination of the affected location, contact and dispatch manpower and equipment to the site for necessary work, and return the site to its original state, for their respective areas of responsibility.

Elevation of Stations

Mont Belvieu	66 Feet
Daisetta	80 Feet
Hull	65 Feet
Sorrento	5 Feet*
Hebert	15 Feet*
Baytown Crude	25 Feet*
Friendswood Office	27 Feet
Webster Station	15 Feet*
Pasadena Station	28 Feet
Quintana	8 Feet*
South Bend	5 Feet*
Garden City	5 Feet*
New Iberia	15 Feet*
Sunset	50 Feet
Grand Isle	3 to 5 Feet*
Empire	3 Feet*
Meraux	3 to 5 Feet*

* Likely to subject to flooding. Flooding could be from excessive rain in low lying or poorly drained areas or storm surge in coastal areas. Storm surge could vary from 0 to as much as 25 feet. Even a tropical storm can cause extensive, very dangerous flooding (Tropical Storm Allison, 2001 Houston, TX).

Hurricane Data

June 1 is the beginning of the Atlantic hurricane season and it continues through November 30. Because of our relatively close proximity to the Gulf of Mexico, it is advisable to make preparations early before there is a threat of a storm. An inventory of emergency supplies should include the following items:

A portable radio and enough batteries to last several days.

A flashlight with enough batteries to last days (Avoid candles as they present a fire hazard).

Canned goods and non-perishable foods that can be prepared without cooking.

Enough bottled drinking water to last several days.

Material such as tape to secure glass openings.

Additional precautions, taken before the threat of a storm, will help with the preparations and recovery in the event of a hurricane:

Know the elevation of your home and work place above sea level and learn the potential maximum storm surge in your area.

Know the location of the nearest emergency shelter.

Plan at least two emergency evacuation routes to and from your home. Remember, one of them may be flooded.

Hurricane Force Categories

Category One:	74 to 95 mph - Minimal
Category Two:	96 to 110 mph - Moderate
Category Three:	111 to 130 mph - Extensive
Category Four:	131 to 155 mph - Extreme
Category Five:	More than 155 mph - Catastrophic

APPENDIX I

ACRONYMS AND GLOSSARY

APPENDIX I

ACRONYMS AND GLOSSARY

ACOE	U.S. Army Corps of Engineers
ACP	Area Contingency Plan
AGA	American Gas Association
AMPD	Average Most Probability Discharge
ANSI	American National Standards Institute
API	American Petroleum Institute
bbl	Barrel
C/RP	Crude / Refined Products
CART	Containment Action Response Trailer
CFR	Code of Federal Regulations
CMT	Crisis Management Team
COTP	U.S. Coast Guard Captain of the Port
CWA	Clean Water Act
DFG	Department of Fish and Game
DOC	Department of Commerce

DOI	Department of Interior
DOT	U.S. Department of Transportation
dwt	Dead Weight Ton
ELIRT	Exxon Emergency Local Interfunctional Response Team
EMPCo	ExxonMobil Pipeline Company
EMPRT	ExxonMobil Pipeline Response Team
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right To Know Act
ERST	Environmental / Regulatory / Safety / Training
ERP	Emergency Response Plan
ESF&H	Environmental Safety, Fire & Health
ESRT	Emergency Spill Response Team
FOLR	Fuel Oil Loading Rack
FORT	Fully Operational Response Trailer
FOSC	Federal On-Scene Coordinator
FS	Field Supervisor
FWPCA	Federal Water Pollution Control Act
FWS	Fish and Wildlife Service
HAZWOPER	Hazardous Waste Operations and Emergency Response

HCS	Hazard Communication Standard
HEPA	High Efficiency Particulate Air
HSC-ELIRT	Houston Ship Channel ELIRT
HVL	Highly Volatile Liquid
HWM	Hazardous Waste Manifest
IBRRC	International Bird Rescue Research Center
IC	Incident Commander
ICS	Incident Command System
IRT	Initial Response Team
LEL	Lower Explosive Limit
LEPC	Local Emergency Planning Committee
LMR-ELIRT	Lower Mississippi River - ELIRT (see ELIRT)
LOTF	Large Oil Transfer Facility
LPG	Liquefied Petroleum Gas
LPG/Chem	Liquefied Petroleum Gas / Chemical
LVP	Low Vapor Pressure
MMPD	Maximum Most Probable Discharge
MMS	Mineral Management Service
MOU	Memorandum of Understanding

MSDS	Material Safety Data Sheet
MSRC	Marine Spill Response Corporation
MTR	Marine Transportation-Related Facility
NARRT	ExxonMobil North America Regional Response Team
NCP	National Contingency Plan
NFPA	National Fire Protection Association
NIIMS	National Interfunctional Incident Management System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRC	National Response Center
NRDA	National Resources Damage Assessment
OCC	(EMPCo’s) Operations Control Center (Formerly OTCC)
OID	Operations Integrity Department
OPA-90	Oil Pollution Act of 1990
OPS	Office of Pipeline Safety (part of DOT)
ORT	Onsite Response Team
OSC	On-Scene Commander
OSPRA	Oil Spill Prevention and Response Act (1991)
OSHA	Occupational Safety and Health Administration

OSRO	Oil Spill Removal Organization
OSRV	Oil Spill Response Vessel
OWOCRS	Open Water Oil Containment Recovery System
PEL	Permissible Exposure Limit
PFD	Personal Floatation Device
PIC	Post-Incident Critique
PPE	Personal Protective Equipment
PREP	National Preparedness for Response Exercise Program
QI	Qualified Individual (as defined by OPA-90)
RCRA	Resource Conservation and Recovery Act
ROW	Right-of-Way
RRT	Regional Response Team
PHMSA	Research and Special Programs Administration
SARA	Superfund Amendments and Reauthorization Act
SAT	Shoreline Assessment Team
SCADA	Supervisory Control and Data Administration
SCAT	Shoreline Cleanup Assessment/Advisory Team
SE-ELIRT	Southeast - ELIRT (see ELIRT)
SHR	Safety and Health Responder

SOSC	State On-Scene Coordinator
SPCC	Spill Prevention Control and Countermeasure Plan
SUPSALV	U.S. Navy Supervisor of Salvage
STEL	Short-Term Exposure Limit
STRCC	Spill Team Response, Containment, and Cleanup
TCLP	Toxicity Characteristic Leaching Procedure
TNRCC	Texas Natural Resources Conservation Commission
THC	Total Hydrocarbons
TL	Tech Leader
TSD	Treatment, Storage, and Disposal
TTLR	Tank Truck Loading Rack
TWA	Time-Weighted Average
USC	United States Code
UCS	Unified Command System
UEL	Upper Explosive Limit
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
VOSS	Vessels of Opportunity Skimming System
WCD	Worst Case Discharge

WOW	Wildlife on Wheels
YR-ELIRT	Yellowstone River ELIRT

GLOSSARY

The following are definitions of words commonly used in the marine, petroleum, and environmental fields; many have been used in this manual.

Absorption:

The process by which one substance draws into itself another substance. Example: a sponge picking up water; an oil absorbent pulling in petroleum products.

Acute Toxic Effect:

The effect on man of a single exposure of short duration to high concentrations of poisonous compounds or vapors.

Adsorption:

The process by which one substance is attracted to and adheres to the surface of another substance without actually penetration its internal structure.

Adverse weather:

The weather conditions that will be considered when identifying response systems and equipment in a response plan for the applicable operating equipment. Factors to consider include significant wave height, ice, temperature, weather-related visibility, and currents within the COTP zone in which the systems or equipment are intended to function.

API:

An arbitrary scale expressing the gravity or density of liquid petroleum products. (By the American Petroleum Institute)

Ambient Conditions:

Normal or typical surrounding temperature and pressure conditions.

Anadromous Fish:

Those that spend part of their lives in fresh and salt water, usually entering fresh water to spawn, with the fry (young) returning to the sea.

Aquatic:

Living in or frequenting the water.

Aromatic Hydrocarbons:

Hydrocarbons characterized by unsaturated ring structures of the carbon atoms. Commercial petroleum aromatics are benzene, toluene, and xylenes. Aromatics are the heaviest, have the highest boiling points and are the most toxic of the crudes.

Average Most Probable Discharge:

A discharge of the lesser of 50 barrels or 1% of the volume of the worst case discharge.

Barrel:

A common unit of measurement of liquid in the petroleum industry; it equals 42 U.S. standard gallons.

Berm:

A raised shoulder or dike around a tank or tank farm, providing a reservoir should any oil be discharged from the tanks.

Biodegradable:

The property of a material to decompose naturally.

Boiling Point:

The temperature at which the vapor pressure of a substance is equal to atmospheric pressure.

Boom (Containment):

A mechanical device used to contain and hold oil or other substances from spreading. Basic components of an oil containment boom are floatation, a skirt, ballast and tension member.

1. Floatation: Every oil containment boom requires a floatation section in order to keep the boom on the surface of the water. The floatation unit in the case of many booms acts as the freeboard portion of the boom.

1. Skirt: The skirt of fin provides the bottom barrier portion of the boom which prevents the oil from passing by the containment boom. The skirts vary in their depth below the water depending on their particular application.

1. Ballast: Ballast is used along the bottom or lower edge of the skirt in order to keep the skirt in a vertical position in the water. This ballast is made in a variety of sizes and materials, from pieces of lead to continuous links of chain or cable.

1. Tension Member: the tension member is a cable or chain running the length of the boom and serves to carry the loads imposed on the boom. This tension member can be positioned at the water line or, in many cases, is positioned at the bottom of the boom and acts to provide the secondary function of ballast as well.

Bottom Tension:

Term to describe the function of a type of tension member for a containment boom. The tension member, placed at the bottom, is several inches shorter that the overall length of the boom. This causes the bottom to be under tension and take a definite “set” in the water against a current.

Canister:

A container with a filter, sorbent, or catalyst which removes specific containments from the air drawn through it.

Captain of the Port (COTP):

Means the US Coast Guard officer commanding a Captain of the Port Zone; or that person’s authorized representative.

Carcinogen:

A chemical substance or agent capable of causing or producing cancer.

Cargo Handling:

The loading, discharging, and transferring of cargo.

Cartridge:

A small canister.

Centigrade (Celsius):

The standard Metric temperature scaled based on water freezing at 0° and boiling at 100°. The Centrigrade and Fahrenheit scales are related by the equation: F = (9/5) x C + 32 or C = (5/9) x F –32

Combustible Gas Indicator:

An instrument used to detect explosive gas/air mixtures; it usually measures concentration in terms of the Lower Explosive Limit (LEL).

Combustible Liquid:

Any liquid having a flash point above 80° F.

Command Post:

A site located at a safe distance from the spill site where response decisions are made, equipment and manpower deployed, and communications handled. The Incident Commander and the On-Scene Coordinators may direct the on-scene response from this location.

Commandant:

Means the Commandant of the Coast Guard or an authorized representative.

Compatibility:

A measure of the degree to which structural material, contaminants and other cargoes react with a particular chemical cargo.

Contiguous Zone:

The entire zone established by the US under Article 24 of the Convention on the Territorial Sea and the Contiguous Zone, but not extending beyond 12 miles from the baseline from which the breadth of the territorial sea is measured.

Countermeasure:

An action taken to prevent oil spillage, to clean-up a spill, or to otherwise mitigate spill impacts.

Decomposition:

Breakdown of a material or substance by heat, chemical reaction, electrolysis, decay or other processes.

Decontamination:

The removal of hazardous substances from personnel and their equipment necessary to prevent adverse health effects.

Density:

Density is the term meaning the mass of a unit volume. Its numerical expression varies with the units selected.

Discharge:

Any spilling, leaking, pumping, pouring, emitting, emptying, or dumping.

Dispersant:

The term used to describe chemical or other agents which, when agitated with oil, break the oil into small droplets/particles, which then disperse into the water column.

Distillate Fuel Oils:

A general classification for one of the overhead fractions produced from crude oil in conventional distillation operations. The so-called light heating of oil, diesel fuels and gas oils come from this fraction.

District Commander:

The officer of the USCG designated by the Commandant to command a Coast Guard district, or an authorized representative.

Emulsion:

A mechanical mixture of two liquids which do not naturally mix, as oil and water. Water-in-oil emulsions have the water as the internal phase and the oil as the external. Oil-in-water emulsions have water as the external phase and the internal phase is oil.

Entrainment:

To carry along with or under. Mechanically, as in fine drops of oil being carried along with water underneath an oil containment boom.

Evaporation Rate:

A term used to express the relative state of evaporation for a chemical when compared to the known evaporation rate of standard liquid.

Facility:

Either a onshore facility or an offshore facility and includes, but is not limited to structures, equipment, and appurtenances thereto, used or capable of being used to transfer oil to or from a vessel or public vessel. A facility includes federal, state, municipal, and private facilities.

Facility Operator:

The person who owns, operates, or is responsible for the operation of the facility.

Flammable:

Capable of being ignited and burning in air.

Flammable Liquid:

Any liquid which gives off flammable vapors at or below a temperature of 80° F.

Flammable Range:

The limits between the minimum and maximum concentrations of vapor in air which form explosive or burnable mixtures. Usually abbreviated LEL (Lower Explosive Limit) and UEL (Upper Explosive Limit).

Flashpoint:

The lowest temperature at which and oil gives off sufficient vapor to form a mixture which will ignite, under standard conditions.

Gas Free:

The condition of a tank, compartment or container that has been tested using an appropriate gas detector and found to be sufficiently free, at the time of the test, of toxic or explosive gases for a specified purpose.

Hazardous Area:

An area in which vapor may be present continuously or intermittently in sufficient concentrations to create a dangerous (flammable and/or toxic) atmosphere.

Heavy Ends:

The higher-boiling components of a mixture of hydrocarbons.

Hot Work:

Any activity producing flames or temperatures likely to be sufficiently high to cause ignition of flammable gas. This includes any work involving the use of welding, burning or soldering equipment; blow torches; some power-driven tools; equipment with internal and external combustion engines; and like fire-producing operations.

Safe Work Permit:

A document issued by an authorized person permitting specific work for a specific time to be done in a defined area employing tools and equipment which could cause ignition of flammable gas. (See Hot Work).

Hydrocarbons:

Compounds contain carbon and hydrocarbons are gases a room temperature, but with increasing molecular weight; they change to liquid and finally solid form.

Ignitable:

Capable of being set afire.

Incident Commander (IC):

The one individual in charge at any given time of an incident. The incident commander will be responsible for establishing a unified command with all on-scene coordinators.

Incident Command System:

A method by which the response to an extraordinary event, including a spill, is categorized into functional components and responsibility for each component assigned to the appropriate individual or agency.

Incompatible:

Materials which could cause dangerous reactions from direct contact with one another.

Industrial Hygiene:

The study and control of occupational factors that may cause sickness, impaired health, or significant discomfort of employees.

Ingestion:

The act of introducing a substance into the body via the digestive system.

Inhalation:

The process of drawing air into the lungs; breathing.

Inland Area:

The area shoreward of the boundary lines defined in 46 CFR part 7, except the Gulf of Mexico. In the Gulf of Mexico, it means the area shoreward of the lines of demarcation (COLREG lines) defined in §§80.740 – 80.850 of title 33 of the CFR. The inland area does not include the Great Lakes.

Inland Waters:

State waters not considered coastal waters; lakes, rivers, ponds, streams, underground water, et.al.

Irritants:

Chemical substances which may cause inflammatory responses or reactions of the eyes, skin, or respiratory system.

Knot:

Nautical measure of speed, equal to approximately 1.2 mph.

Lead Agency:

The government agency that assumes the lead for directing response activities.

Light Ends:

The lower-boiling components of a mixture of hydrocarbons.

Lightering:

The pumping or transferring of oil from cargo compartments of a tank vessel to another vessel and/or barge.

Local Government:

Any county, city, town, village, or other political subdivision of the State.

Longshore Current:

The wave-generated current in the nearshore zone flowing parallel with the shore.

Lower Explosive Level (LEL):

The minimum concentration of a vapor in air which forms an explosive mixture.

Marine Transportation Related Facility (MTR facility):

An onshore facility, including piping and any structure used to transfer oil to or from a vessel, subject to regulation under 33 CFR 154 and any deepwater port subject to regulation under 33 CFR 150.

Maximum Extent Practicable:

The planning values derived from the planning criteria used to evaluate the response resources described in the response plan to provide the on-water recovery capability and the shoreline protection and cleanup capability to conduct response activities for a worst case discharge from a facility in adverse weather.

Maximum Worst Probable Discharge:

A discharge of the lesser of 1,200 barrels or 10% of the volume of a worst case discharge

Mobile Facility:

Any facility that can readily change location, such as a tank truck or tank car, other than a vessel or public vessel.

Monitoring Device:

Any fixed or portable device used to monitor for a discharge of oil onto the water, within or around a facility, and designed to notify operating personnel of a discharge of oil.

Natural Resource:

Land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to or otherwise controlled by the state, federal government, private parties, or a municipality.

Navigable Waters:

Waters of the United States and their adjoining shorelines and tributaries that are subject to the ebb and flow of the tide and/or are presently used, have been used

in the past, or may be susceptible for use to transport intrastate, interstate, or foreign commerce.

Nearshore Area:

The area extending seaward 12 miles from the boundary lines defined in 46 CFR part 7, except in the Gulf of Mexico. In the Gulf of Mexico, it means the area extending seaward 12 miles from the line demarcation (COLREG lines) defined in §§80.740 – 80.850 of title 33 of the CFR.

Nonpersistant or Group I Oil:

A petroleum based oil that, at the time of shipment consists of hydrocarbon fractions:

1. At least 50% of which by volume, distill a temperature of 340◦ C (465◦ F); and
2. At lest 95% of which by volume, distill at a temperature of 370◦ C (700◦ F).

Non-petroleum Oil:

Oil of any kind that is not petroleum based. It includes, but is not limited to, animal and vegetable oils.

Ocean:

The offshore area and nearshore area as defined in Appendix A, NVIC 7-92.

Offshore Area:

The area beyond 12 nautical miles measured from the boundary lines defined in 46 CFR part 7 extending seaward to 50 nautical miles, except in the Gulf of Mexico. In the Gulf of Mexico it is the area beyond 12 nautical miles of the line of demarcation (COLREG lines) defined in §§ 80.740 – 80.850 of title 33 of the CFR extending seaward to 50 nautical miles.

Offshore Facility:

Any facility of any kind located in, on, or under any of the navigable waters of the US other than a vessel or a public vessel.

Oleophillic:

Substance having an affinity for oil.

Oil:

Petroleum, in crude or refined liquid form.

Oil Spill Removal Organization (OSRO):

An entity that provides response resources.

On-Scene Coordinator:

The person responsible for the spill response activities of a single or group of agencies. This person is responsible for coordinating that agency's or group's activities with those of other OSC's through the ISC and IC. There may be more than one OSC at a spill (e.g., DEQ OSC, federal OSC, responsible parti OSC) but only one IC.

- **State On-Scene Coordinator**

DEQ spill responder responsible for spills of oil and hazardous substances occurring in Louisiana state,

- **Federal On-Scene Coordinator**

USCG for coastal waters/Mississippi River; EPA for inland waters and lands.

Operating Area:

Refers to rivers and canals, inland, nearshore, Great Lakes, or offshore geographic location(s) in which a facility is handling, storing, or transporting oil.

Operating Environment:

Refers to rivers and canals, inland, Great Lakes, or ocean. These terms are used to define the conditions in which response equipment is designed to function.

Organic:

A chemical term indication almost all compounds that contain one or more carbon atoms. Certain materials which contain carbons are considered organic compounds.

PEL:

Permissible Exposure Limit – the legal exposure limit established by OSHA for regulated chemicals. PELs are published by OSHA in 29 CFR 1910.1000. When exposures are maintained at or below the PELs, OSHA believes that nearly all workers may be repeatedly exposed day after day with no adverse effects.

Persistent oil:

A petroleum based oil that does not meet the distillation criteria for a non-persistent oil. For the purposes of NVIC 7-92, persistent oils are further classified based on specific gravity as follows:

1. Group II – specific gravity less than .85
2. Group III – specific gravity between .85 and less than .95
3. Group IV – specific gravity .95 to and including 1.0
4. Group V – specific gravity greater than 1.0

Person-in-Charge (PIC):

An individual designated as person in charge of oil transfer operations under § 154.710 (for facilities) or § 155.700 (for vessels).

Pollutant:

Any material entering the water which is not normal part of the local environment, or which is not a concentration that is not normal to the local environment.

Post-Emergency Response:

The portion of a response performed after the immediate threat of a release has been stabilized or eliminated and cleanup of the sites has began.

PPM:

Parts per million is a unit used for expressing concentrations of gas and vapors in air. PPM indicates the number of molecules of gas or vapor contained in a million molecules of air. It may also be used to express the concentration of a substance in liquid or solid.

Primary Response Contractors or Contractors:

An individual, company, or cooperative that has contracted directly with the plan holder to provide equipment and/or personnel for the containment or cleanup of spilled oil.

PSI:

Pressure expressed in pounds per square inch.

Qualified Individual:

An English-speaking representative(s) of the facility identified in the plan, located in the US, available on as 24-hour basis, familiar with the implementation of the facility response plan, and trained in his/her responsibilities under the plan. This individual should be able to arrive at the facility in a reasonable time.

This person and at least one alternate must have full written authority to implement the facility's response plan via documentation that provides for:

1. Activating and engaging in contracting with identified oil spill removal organization(s);
2. Acting as a liaison with the predesignated Federal On-Scene (FOSC), and
3. Obligating, either directly or through prearranged contracts, funds required to carry out all necessary or directed response activities.

The owner or operator of a facility may designate an organization to fulfill the role of the qualified individual and at least one alternate. The organization should then identify a qualified individual and at least one alternate qualified individual in accordance with the procedure previously outlined for a facility designated qualified individual.

The qualified individual is not responsible for:

1. The adequacy of response plans prepared by the owner or operator
2. Contracting or obligating funds for response resources beyond the full authority contained in their designation from the owner or operator of the facility (NVIC 7-92)

Regional Response Team:

The federal response organization (consisting of representatives from selected federal and state agencies) which acts as a regional body responsible for planning and preparedness before an oil spill occurs and providing advice to the FOSC in the event of a major or substantial spill.

Release:

Primarily used to describe a discharge or outage of gases or HVL's but also used to describe spills or discharges.

Residual Fuel Oils:

Product remaining after the removal, by distillation or other artificial means, of an appreciable quantity of the more volatile components of crude petroleum. Commercial grades of burner fuel oils No. 5 and 6 are residual oils and include bunker fuels and Navy special.

Respirator:

A device designed to protect the wearer from the inhalation of harmful atmospheres.

Response Activities:

The containment and removal of oil from the water and shorelines, the temporary storage and disposal of recovered oil, or the taking of other actions as necessary to minimize or mitigate damage to the environment.

Response Resources:

The personnel, equipment, supplies, and other capability necessary to perform the response activities identified in a response plan.

Responsible Party:

Any person, owner / operator, or facility that has control over an oil or hazardous substance immediately before entry of the oil or hazardous substance into the atmosphere or in or upon the water, surface, or subsurface land of the state.

Restoration:

The actions involved in returning a site to its former condition.

Rivers and Canals:

A body of water confined within the inland area that has a project depth of 12 feet or less, including the Intracoastal Waterway and other waterways artificially created for navigation.

Separator Tank:

A tank used to statically separate dissimilar cargo.

Skimmer:

A suction device that floats on or near the surface of the water, selectively recovering oil from the water surface.

Slop Tank:

A tank designated to store oily waste for subsequent ecologically – approved disposal.

Solvent:

A liquid which will dissolve or disperse other substances.

Sorbent:

A substance that will take up and hold liquid by either adsorption or absorption.

Specific Gravity:

The ratio of the weight of a liquid of body to the weight of an equal volume of water at 4°C or other specified temperature.

Spill Management Team:

The personnel identified to staff the organizational structure identified in a response plan to manage response plan implementation.

STEL:

Short Term Exposure Limit, when referring to the air-borne concentration of a substance to which workers can be exposed to continuously for a short period of time without suffering adverse health effects.

Substantial threat of a discharge:

Any incident or condition involving a facility that may create a risk of discharge of fuel or cargo oil. Such incidents include, but are not limited to storage tank or piping failures, aboveground or underground leaks, fires, explosions, flooding, spills contained within the facility, or other similar occurrences.

Surfactant:

A condensation of the descriptive phase surface-active agent. Some characteristics are:

1. Surfactant molecules or ions from oriented monolayers at phase interphases.

2. Surfactants cause a lowering of surface tension.

3. Solutions of surfactants exhibit some combination of the following functional properties: detergency, foaming, wetting, emulsifying, solubilizing, dispersing.

Tank Barge:

Any tank vessel not equipped with means of self-propulsion.

Tank Vessel:

Any vessel specially constructed or converted to carry liquid bulk cargo in tanks.

Terrestiral:

Means relating to land as distinct from air and water.

Threshold Limit Value (TLV):

The highest concentration of a harmful substance in air to which it is believed a person may be exposed for eight hours for an indefinate period without danger to health.

Transfer:

Any movement of oil to, or from or within a vessel by means of pumping, gravitation, or displacement.

TWA:

Time Weighted Average is an exposure limit TVL (i.e. TVL-TWA 3ppm-per 8 hour day).

Unified Command:

The method by which local, state, and federal agencies and the responsible party will work with the Incident Commander to:

- Determine their roles and responsibilities for a given incident.
- Determine their overall objectives for management of an incident.
- Select a strategy to achieve agreed upon objectives.
- Deploy resources to achieve agreed upon objectives.

Upper Exposure Limit (UEL):

> **The maximum concentration of vapor in air which forms an explosive mixture.**

Vacuum Pump:

> **A pump which evacuates the air form equipment or tanks.**

Vapor:

> **The gaseous form of a substance which is normally a liquid or solid when it is at atmospheric pressure and room temperature.**

Vapor Pressure:

> **The force exerted when a solid or liquid is in equilibrium with its own vapor, depending on its composition and temperature.**

Ventilation:

> **The replacement of air in an enclosed space by natural or forced means, particularly the replenishment of oxygen for breathing purposes.**

Venting:

> **The process of air release to and from cargo tanks.**

Vessel Operator:

> **A person who owns, operates or is responsible for the operation of a vessel.**

Viscosity:

The property of liquids which causes them to resist instantaneous change of shape, or instantaneous re-arrangement of their parts, due to internal friction. The resistance which the particles of liquid offer to a force tending to move them in relation to each other. Viscosity of oil is usually expressed as the number of seconds at a definite temperature required for a standard quantity of oil to flow through a standard apparatus.

Viscous:

Thick, resistant to flow, having a high viscosity.

Volatility:

The tendency for a liquid to vaporize.

Water Spray:

Water divided into coarse drops by delivery through a special nozzle.

Weathering:

The exposure of crude oils or light oils to the weather, with subsequent evaporation of the light volatile constituents resulting in loss; in some cases, oxidation and polymerizing effected are noted also, particularly with cracked and asphaltic oils. Emulsifaction with water may also take place.

Wetlands:

Shallow tidal flats or swamps that are inundated most of the time with fresh, brackish or salt water.

Worst Case Discharge:

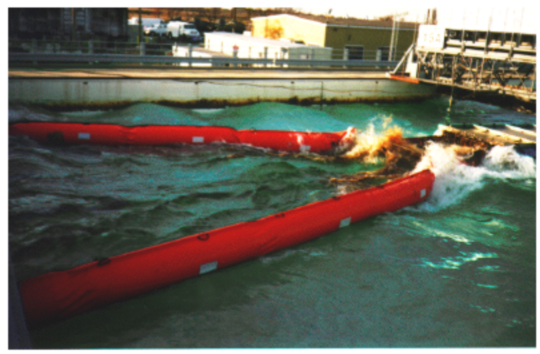
The largest foreseeable discharge of oil, including a discharge from fire or explosion, in adverse weather conditions. This volume will be determined by each pipeline operator for each response zone and is calculated according to § 194.105

APPENDIX J

OIL SPILL RESPONSE IN FAST CURRENTS

Oil Spill Response in Fast Currents
A Field Guide





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A Field Guide

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16. Abstract (MAXIMUM 200 WORDS)

From 1992 to 1996, over 58 percent of oil spills larger than 100 gallons have occurred in waters that routinely exceed one knot. Efforts to quickly deploy effective fast-water spill response have been hampered by the lack of technology and adequate training. The objective of this guide is to serve as a training aid and a field manual to increase the effectiveness of fast-water responses. It was developed with the cooperation of multiple government agencies, U.S. Coast Guard units and commercial spill response firms.

This document starts with a decision guide to determine what techniques can be used in various spill response scenarios. Additional details are provided for hydrodynamic issues, individual tactics, fast-water skimmers and support equipment such as boats and anchors. The appendices provide additional background information needed to make decisions during a response in fast-water conditions.

This guide is designed to be useful for responders as well as those who monitor responses. Whenever possible, figures are accompanied by pictures to provide a full explanation of each tactic or methodology.

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FIGURES

TABLES

CHAPTER 1. INTRODUCTION

1.1 Purpose

The purpose of this guide is to provide advice, strategies and tactics to spill planners, responders and monitors/field observers to improve spill response in swift currents greater than one knot. The guide is largely a consolidation of research conducted for the United States Coast Guard concerning technology assessment of fast-water oil spill response in more practical application terms (Coe and Gurr, 1999). Technology and tactics are presented in a practical scheme to show how to improve oil spill response capabilities for currents from one to five knots.

1.2 Objective

The objective of this guide is to provide specific methodologies and techniques that have shown effective in fast water conditions. This guide is intended for personnel who have previous oil spill response training with hands-on experience; however, it does not cover all of the topics needed for a complete spill response. The recommendations in this guide should not take the place of procedures in local contingency and safety plans but should be considered when updating these plans.

1.3 Background

Controlling and recovering oil spills in fast moving water above one knot is difficult to accomplish because oil entrains under booms and skimmers in swift currents. Fast water accelerates many spill processes necessitating quicker and more efficient responses compared to stagnant water or slow moving current conditions. The severity of the impact of oil depends on many factors including the properties of the oil itself. Natural conditions such as current speed, turbulence, temperature and wind also influence the behavior of oil in water. Some physical and chemical properties of oil are important to consider when developing a spill response strategy, selecting tactics and choosing the best equipment. Spilled oil properties and processes that affect its behavior are in multiple references and sources on the Internet (see References). Appendix D contains a brief description of how processes are affected by fast water.

More experience and skill is needed to successfully complete responses. Timely response efforts are required in order to minimize environmental damage, economic losses and associated cleanup costs. Some containment and control devices slow or divert the surface current and oil without causing entrainment, which allows recovery with most conventional skimmer designs. Specialized fast-water skimmers can also remove oil as it passes by at high speeds. Oil can also be diverted away from sensitive areas or to containment or recovery devices near shore where currents are slower due to bottom frictional effects. In some cases the techniques and equipment presented for fast-water conditions can also be applied successfully as high-speed recovery systems in slow current conditions, thus improving oil recovery rates and coverage factors where advancing systems are used.

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1.5 Organization and Use of the Guide

This guide is organized in a sequence that informs you of the need, concerns, limitations and methods to effectively respond to an oil spill in swift currents. It outlines the specific challenges and provides viable strategies and tactics to combat those problems. Aids are provided to assist with planning and implementing a response. Recommendations are given to help you make informed decisions on all aspects of effectively responding to fast-water oil spills. Table 1-1 is a chart that will connect you directly to the appropriate chapter by clicking on it for the CD version.

Table 1-1. Quick reference table.

CHAPTER 2. DECISION APPROACH

2.0 General Guidelines

This chapter provides a method to decide what techniques or methods are the most appropriate for conditions and operating environments that are encountered. This process should be used to develop effective contingency plans and also during actual spill responses. The tables and lists contained in this chapter have links to other parts of this document.

2.1 Decision Steps for Selecting Fast Water Strategies:

The steps needed to activate a response are contained in this section. Refer to the remainder of the guide for specific use and implementation methods.

1. **Gather information:** Use the list in Appendix A for reminders. The table and worksheet can be printed out and the information filled in as needed.

2. **Determine Oil Trajectory:** Where is the oil going? Use Area Contingency Plan and/or Environmental Sensitivity Index to identify areas to be protected or where oil can be recovered along the route of the oil trajectory. Determine the time of oil impact on land and identify locations where a protection or collection strategy is warranted. Look for natural collection points.

3. **Identify Potential Tactics:** Use Table 2-1 to select tactics that can be used for each location. Table 2-2 contains a brief description of factors that should be considered. For additional details, refer to other sections of this guide. If multiple tactics are applicable, evaluate with respect to the equipment available in combination with the next step below.

4. **Risk/benefit analysis:** Conduct a human health risk assessment (see example in Appendix K) and a net environmental benefit analysis for each strategy and alternative at each location.

5. **Choose the final strategy**: Select the option that yields the highest net human health and environmental benefit.

6. **Implement strategy:** Place equipment and personnel into position. Preposition equipment in optimal locations whenever possible.

7. **Monitor and adjust strategy as appropriate.**

Table 2-1. Fast current scenarios and tactics.

Scenario	Amplifying Information	Tactics	Page
Rivers/Canals (Non-Tidal): Depth is greater than typical boom skirt depth May have tidal influence, but current always goes in same direction	Current speed dependent Vessel traffic dependent	Single Diversion Boom • Current < 2 knots use boom skirt of 12 inches • Current > 2 knots use boom skirt 6 inches or less	13
	Currents over 2 knots	Cascading Diversion Boom • Use short skirts, shorts boom lengths and sufficient overlap	17
	Collection areas available on both sides	Chevron Booms • Open for vessel traffic • Closed if no traffic	18
	Currents less than 2 knots and river is wide	Single Diversion Boom Exclusion Boom for Sensitive Areas Encircle & Divert to Collection Area	13 13 19
	Sufficient room to maneuver	Skimmers for Collection	46
	No Vessels Available	Boom Vane Flow Diverters	42 64
	Special Conditions	Air and Water Jets	60
	Isolated Areas	Sorbents and Pom-Poms	59
Rivers/Canals-(Tidal): Depth is greater than typical boom skirt depth Current reverses direction	Current speed dependent Vessel traffic dependent Special methods needed to compensate for tides	Diversion Boom – need double set • Current < 2 knots use boom skirt of 12 inches • Current > 2 knots use boom skirt 6 inches or less	21
	Currents over 2 knots	Cascade Boom - may need double set • Use short skirts, shorts boom lengths and sufficient overlap	17
	Collection areas available on both sides	Chevron - may need double set • Open for vessel traffic • Closed if no traffic	18
	Currents less than 2 knots and river is wide	Encircling	19
	Isolated Areas	Sorbents and Pom-Poms	
	Sufficient room to maneuver	Skimmers	46
	No Vessels Available	Boom Vane Flow Diverters	42 64
	Special Conditions	Air and Water Jets	60
	Isolated Areas	Sorbents and Pom-Poms	59
Small streams, creeks, culverts: Depth is less than boom skirt depth	Dependent upon flow rate (see Appendix J)	Single Diversion for volume greater than about 10 cubic feet/second	25
	Block for low volume flow	Sealing • Fill • Dams • Weirs	25
	Design for volume	Overflow/Underflow dams	25
	Low Flow	Sorbents and Pom-Poms	59

Table 2-1. Fast current scenarios and tactics (continued).

Scenario	Amplifying Information	Tactics	Page
Coastal Areas: Near shore wave dependent Includes near shore and straits Various depths Usually tidal		Single Diversion Boom • Current < 2 knots use boom skirt of 12 inches if no waves	29
	Currents over 2 knots	Cascade Boom • Use short boom lengths and sufficient overlap	31
	Currents less than 2 knots and river is wide	Encircling	19
	Sufficient room to maneuver	Skimmers	46
		VOSS/SORS	46
	Isolated Areas	Sorbents and Pom-Poms	59
Harbors/Bays: Near shore wave dependent Depth is usually greater than typical boom skirt depth	Use river techniques in specific areas Current speed dependent Vessel traffic dependent	Single Diversion Boom • Current < 2 knots use boom skirt of 12 inches if no waves • Current > 2 knots use boom skirt 6 inches or less if no waves	13
	Currents over 2 knots	Cascade Boom • Use short skirts, short boom lengths and sufficient overlap	17
	Currents less than 2 knots and area is large	Encircling	19
	Sufficient room to maneuver	Skimmers	46
	Special Conditions Isolated Areas	Air and Water Jets Sorbents and Pom-Poms	61 59
Breach ways and Harbor Entrances: Various depths Usually tidal	Current speed, vessel traffic and wave dependent	Single Diversion Boom • Current < 2 knots use boom skirt of 12 inches if no waves • Current > 2 knots use boom skirt 6 inches or less if no waves	35
	Currents over 2 knots	Cascade Boom • Use short skirts (if no waves), shorts boom lengths and sufficient overlap	35
	Collection areas available on both sides	Chevron - • Open for vessel traffic • Closed if no traffic	18
	Block for low volume flow	Sealing • Fill • Dams • Weirs	25
	Design for volume	Overflow/Underflow dams	25
	No Vessels Available	Boom Vane Flow Diverters	42 64
	Isolated Areas	Sorbents and Pom-Poms	59

Table 2-2. Factors and effects for oil spill trajectory.

Factors Influencing Oil Trajectory	**Effect**
Wind	• Increases speed of flow, and determines direction with current vector
Culverts, Eroded cuts, Inlets, Oxbows, Recesses	• Changes flow direction • Capillary flow into recessed areas • Good collection points
River bends/curves	• Flow outside of bend is faster/deeper • Flow inside of bend is slower/shallower
Tributaries	• Increases flow downstream • Decreases flow upstream • Below & above tributaries are good collection points (due to eddies)
Eddies	• Good collection points in vicinity of eddy
Islands	• Constricts flow, increases speed • Eddies form below islands
Sloughs, Oxbows, Jug handles	• Reduces main current flow • Good natural collection points
Obstructions, Dams, Debris barriers	• Effects speed & direction of current, depending on configuration

CHAPTER 3. HYDRODYNAMIC CONSIDERATIONS

3.1 Reading Currents and Flow Patterns

Selection of a good location to deploy the oil containment system is dependent upon prior planning and understanding of the currents. Drift studies, oceanographic surveys, river runoff histories, tidal current tables and charts, and computer modeling are all useful tools to understand the flow patterns and to develop strategies. The day of the spill may present different current and circulation patterns or other factors that require accurate field observations. Reading the currents and flow patterns require practice and understanding of the hydrodynamics involved. Several things may be helpful to define these patterns. Selection of a containment area where a lower current exists is desirable. This will allow wider deflection angles and reduce drag forces on the boom.

3.2 Natural Collection Sites

Natural collection sites should be identified and categorized in Area Contingency Plans (ACP) as part of the planning process to select control points for spill response operations. This can be effectively accomplished by surveying the coastline and then conducting an investigation of promising sites by land or water. Viable control points should afford favorable currents, helpful circulation patterns and effective logistics support such as roads, wide-open banks, sufficient water depth for fully loaded vessel and good mooring selections. These sites also collect oiled debris that will complicate the collection and removal process. Cleaning the site before the oil arrives is recommended.

3.3 Estimating Current and Deflection Angles

An accurate determination of current direction and velocity is important in order to select the proper tactic and deploy the equipment correctly. Current meters can be used to measure the velocity, but they are not always practical during a spill response. The current velocity profile can be estimated by observing the incline of buoys, floating debris, and the amount of turbulence around buoys and pilings. Current speed can be calculated by timing the movement of floating debris over a measured distance. The chip log technique only requires floating debris, a tape measure or two buoys spaced a measured distance apart, and a stopwatch (see Appendix F).

Oil will be lost under a boom when the current exceeds about .75 knots. This value is independent of boom skirt depth. Wind loads are not significant in high-current areas but the loads created by wind-induced currents can affect the equipment performance so the effect of the wind must be included. Appendices D and H provide a method for calculating the combined effect of the current and wind-induced flow. This method can also be used to calculate relative velocity for ship motion if a Vessel of Opportunity Skimming System (VOSS) system is used. Once the current is known, the angle for boom deployment can be determined. Oil losses can be minimized if the angle is set at a maximum angle as shown in Figure 3-1 and in Appendix F.

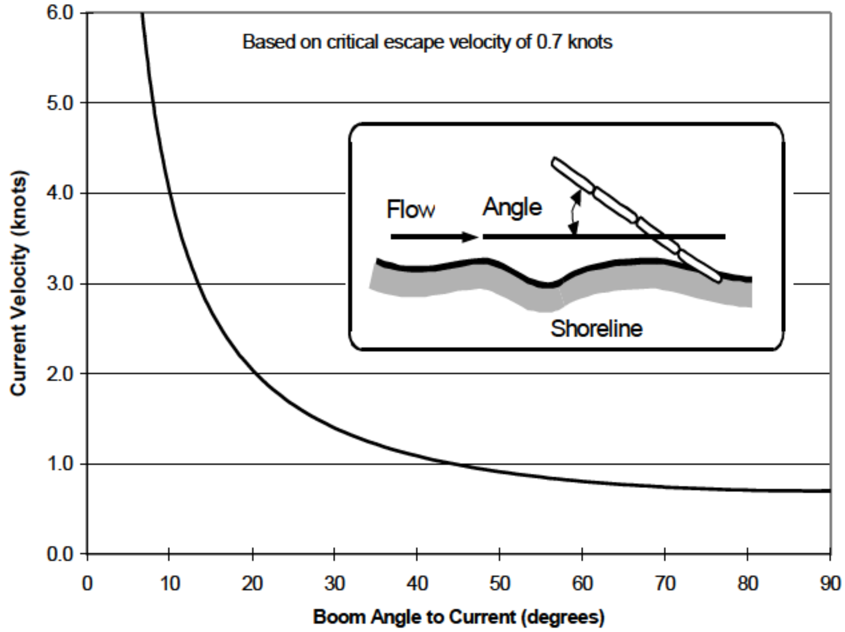


Figure 3-1. Maximum boom deployment angles required to prevent oil entrainment.

To estimate an angle, use the triangle and table below. The length of the sides can be estimated using lengths of boom, line or boat lengths. For example, to get a 14-degree angle, secure the upstream end of the boom about one boat length off the shore, and then move down the shore four boat lengths and secure the other end of the boom. More exact angles can be set using surveying instruments. Another alternative is to determine boom angles at pre-selected booming sites so that decisions do not have to be made during an emergency.

X	ANGLE
1	45.0
2	26.0
3	18.0
4	14.0
5	11.0
6	9.5
7	8.0
8	7.0
10	5.7
20	3.0
30	2.0

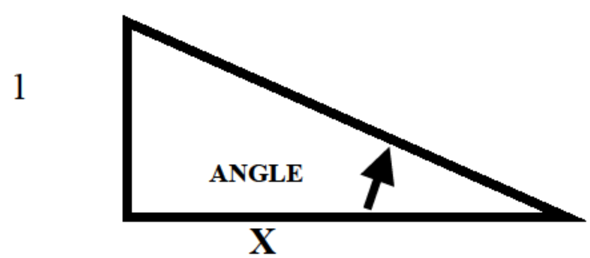


Figure 3-2. Angle measurement.

3.4 Forces on Boom and Rigging

The major force exerted on a boom is caused by the water drag on the skirt. Wave forces can increase the drag by a factor of two or three depending upon the wave height, period and loading dynamics. Wind force is less than current and waves, but it is also a factor. In high current situations, draft is sometimes increased by water piling up on the boom causing some submergence and increased drag forces often resulting in mooring failure, see Figure 3-3. In this situation, the 100-foot section of 4 x 6 diversion boom (4-inch floatation and 6-inch draft) could not take the hydrodynamic load. A replacement section 50-feet long was able to withstand the reduced forces without submerging.

Figure 3-3. Boom submergence failure in swift current.

3.4.1 Current Drag Forces on Boom

The effects of current velocity and boom draft on boom drag force can be seen in Table 3-1. Drag increases with draft in a linear fashion while current increased drag more dramatically, to the square of the velocity. The high values given in Table 3-1 also show why the recommended angles provided in Figure 3-1 are so important.

Table 3-1. Current drag force on one-foot boom profile to current.

	Boom Drag Force (pounds)			
Velocity (knots)	Draft 0.5 Feet	Draft 1.0 Feet	Draft 1.5 Feet	Draft 2.0 Feet
0.5	0.7	1.3	2.0	2.7
1.0	2.7	5.3	8.0	10.7
1.5	6.0	12.0	18.0	24.0
2.0	10.7	21.3	32.0	42.6
2.5	16.7	33.3	50.0	66.6
3.0	24.0	48.0	72.0	95.9
3.5	32.6	65.3	97.9	130.6
4.0	42.6	85.3	127.9	170.6
4.5	54.0	107.9	161.9	215.9
5.0	66.6	133.3	199.9	266.5
5.5	80.6	161.2	241.8	322.5
6.0	95.9	191.9	287.8	383.8
6.5	112.6	225.2	337.8	450.4
7.0	130.6	261.2	391.8	522.3

For a quick approximate load on a boom that is anchored at an angle of between 10 and 30 degrees to the current, use the following formula (Hansen, DeVitis, Potter, Ellis, and Coe, 2001).

$$T = K * A * V^2$$

where:
- T = tensile force, lb_f
- K = constant, $lb_f /(ft^2 \times knots^2)$
- A = projected area of the submerged portion of the boom, ft^2
- V = tow speed, knots

The projected area of the boom was calculated based on the boom draft, and the length of the boom normal to the water current (i.e., the direction of travel):

$$A = d * L * \sin \theta$$

where:
- A = projected area of the submerged portion of the boom, ft^2
- d = boom draft, feet
- L = boom length, feet (100 ft)
- θ = diversion angle (10°, 20°, 30°)

It is recommended that values of 2 be used for K in calm water and 3-4 when waves are encountered. A detailed method to calculate forces on booms and attachment points is given in Appendix G.

CHAPTER 4. SCENARIOS & TACTICS

Strategies are general plans to be applied to a particular scenario. Tactics are the specific methods and equipment selected to accomplish the strategy for a specific situation. Efforts leading up to this guide included a general evaluation of tactics and methods by the American Society of Testing and Materials, (ASTM) Committee F20 on Hazardous Substances and Oil Spill Response. The results are provided in Appendix L.

4.1 Rivers/Canals

Currents are highest in the deep channels of the river and diminish as depth decreases near shore due to bottom friction effects. Oil will generally follow the higher current flow downriver. It will be distributed much like river debris in areas where slow current, eddies and alternate watercourses exist. Differential surface velocities tend to separate the oil into elongated ribbons and stretch it out over long distances downstream. Changes in water levels (stages) due to runoff and dam releases can dramatically change the currents and flow patterns. Collection sites may have to be moved if significant changes of the river height occur during the spill event. In small to medium size rivers, recovery equipment is generally affixed to the riverbank or structures in the river. The water with the spilled oil is doing the work moving the oil into slower current areas guided by the deflection boom, Figure 4.1.

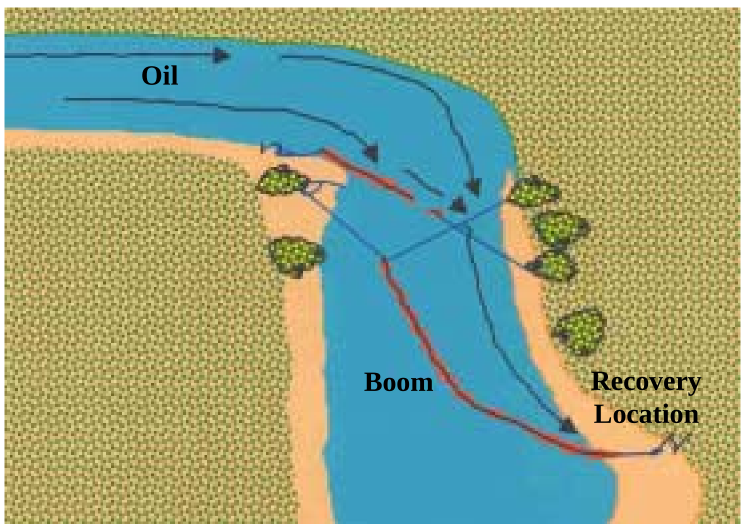


Figure 4-1. Oil collection (DOWCAR, 1997).

In larger rivers, a combination of fixed and self-propelled response equipment is usually required. Make sure that the equipment will not go aground with a full load of oil or debris. The following characteristics of a river affect decisions regarding strategies and tactics:

- **Eroded Cuts** are formed into banks where the flow changes direction. These may be good natural collection pockets if access is available.
- **Flow** of a river tends to form deep fast-flowing channels on the outboard side of the curves in the river. Very often, the banks are steep in these locations while the inboard side is often shallow with sandy banks with slower currents. Always try to deflect the oil to the slow side (the inner bank at a curve) of the river, as shown in Figure 4-2.
- **Tributaries** feed into the main river and often cause the current to increase downstream of the intersection, Figure 4-2. Diversion and containment of oil should be accomplished upstream of the intersection point where currents are lower. There are usually eddies above and below a discharging tributary that may be natural collection points. Low flow tributaries or inlets may be very useful for collection of diverted oil from the main river if they are not sensitive areas.

- **Islands** cause constriction in the river flow, which usually results in higher currents around islands. Oil should be contained and recovered before or after such constriction areas. Back flow and eddies often form on the downstream side of islands, which may facilitate recovery in low current areas, Figure 4-2.
- **Sloughs** are small diversions off the main river that lead back to the river downstream. If the slough widens or deepens, currents usually diminish facilitating oil recovery. In these situations, oil can be diverted into these natural collection areas.
- **Man-made structures** such as piers and marinas tend to trap oil and make recovery much more difficult. Oil should be diverted around such structures. Revetments covered with stone material or concrete mats designed to prevent erosion can make anchoring difficult and if oiled they are difficult to clean. Silt and sand collect behind dikes in eddies and floating oil may collect there. Working near sandbars behind islands and dikes should be done with caution since the bars may be unstable and unable to support weight of people and equipment. Dams and locks can form collection points for oil, but high current flooding conditions often require that they remain open to prevent flooding over river banks and levees.

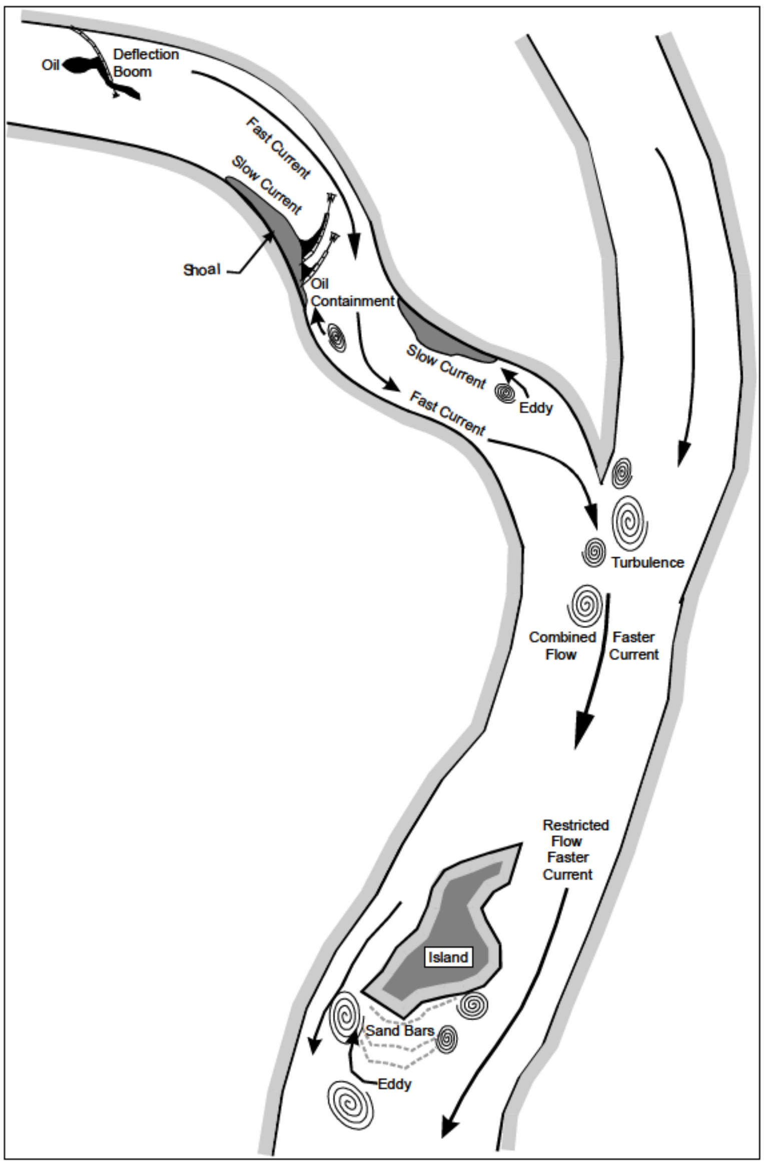


Figure 4-2. Typical river flow patterns and boom deployments.

4.2 Inland Rivers (no tides)

Tactics used for both containment and exclusion are dependent upon the desired effect and the direction the deflection system is deployed. Containment is preferred. Exclusion may protect the sensitive area but the oil is still free to do damage elsewhere. Some tactics are specifically for narrow non-tidal bodies but still can be used on wide rivers and along the coast.

Tides are not a factor on inland rivers above a point that the riverbed slope exceeds the high tide range. This makes response a little more manageable because the entire flow of the surface currents does not change direction in a cyclical manner. There will still be reverse flow on inland rivers in eddies and possibly in some backwater inlets and tributaries depending upon the hydrodynamic forces, wind driven currents and in some cases snow melt. These reverse flows will remain constant during the response unless rain increases the water level or strong winds dramatically shift. Published currents are difficult to find and are not generally accurate as a predictive tool due to the variable water runoff. The United States Geological Survey (USGS) has quite a bit of near real-time river stream flow and stage height data available through the Internet at http://water.usgs.gov/public/realtime.html. They also provide the data in graph form along with historical averages. Seasonal trends provide general high current periods. Local knowledge or river cross-sectional area data, however, is required to convert stream flow (cubic feet per second) data to surface velocities for a particular river station.

4.2.1 Diversion Booming

Diversion booming can be used for containment or exclusion. Containment booming moves oil from fast flow areas in the center of the river to calm water in a protected inlet along the bank. This approach allows the use of conventional containment and recovery techniques. If a natural collection point is not available, a sump collection area can be dug out of the bank. The boom can be deployed in a single long section as shown in Figure 4-3 or as multiple booms staggered across a river or harbor. As discussed earlier, the maximum deflection angle must be maintained to prevent oil entrainment. It is better to limit the boom draft for deflection applications. Boom with draft greater than six inches is not recommended for currents above 1.5 knots. For currents of three knots and greater, boom with only a short chain pocket and no more than three inches draft is recommended to maintain shallow deflection angle to the current. The requirements for anchoring will depend upon the situation. Details about anchoring methods are contained in Chapter 8.

Figure 4-3. Oil collection with diversion booming to shore (DOWCAR, 1997).

Boom should be trenched into the bank to prevent oil loss at the shoreline. Plastic sheeting or another boom should be used along the shore to keep the beach clean at the apex. Lightweight durable skimmers and power packs are recommended for easy transport and reliability. Typical skimmers include disk and drum skimmers to reduce water collection. Small weir skimmers, vacuum (VAC) trucks, air conveyor systems or portable VAC units can be used, however, these systems collect more water than oil unless self-adjusting floating skimmer heads are used or the oil is thickened in the pocket before skimming.

Deflection booming is used to keep oil away from water intakes and environmentally sensitive areas as seen in Figures 4-4 through 4-6. Fewer booms may be required than those used for containment, but the oil may be directed to another sensitive area.

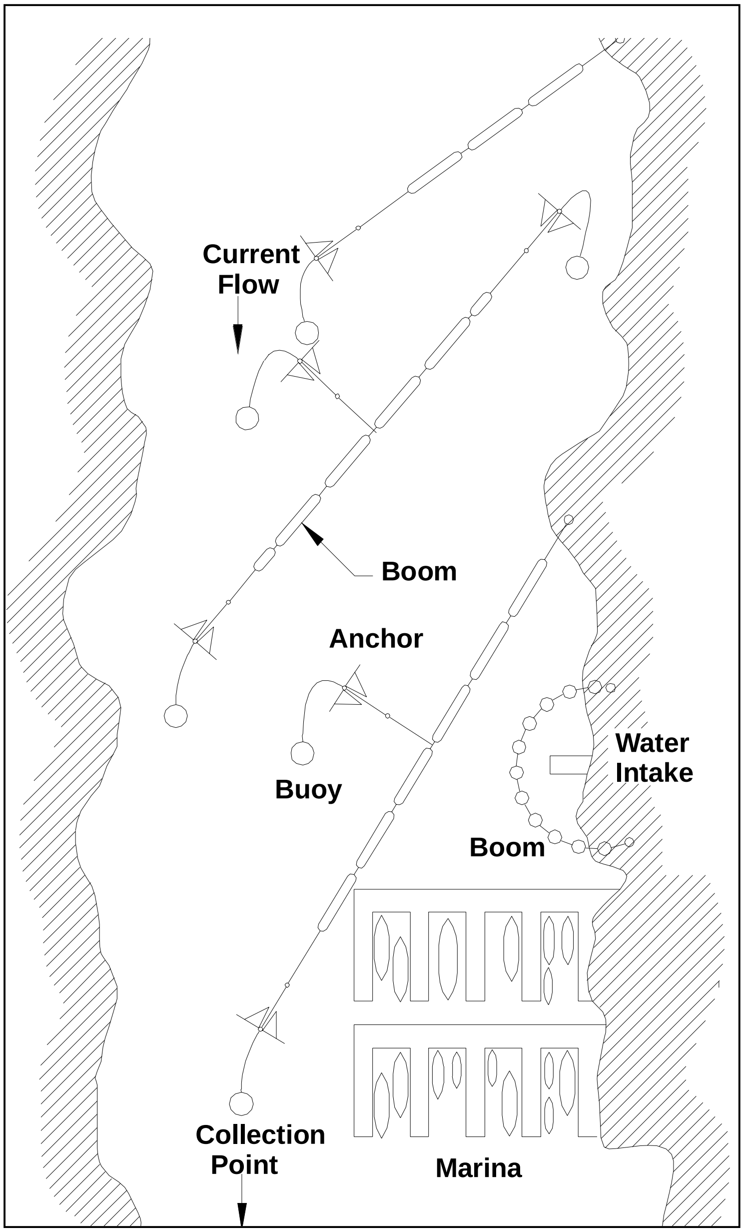


Figure 4-4. Exclusion booming around sensitive areas.

Figure 4-5. Exclusion booming of inlet.

Figure 4-6. Exclusion booming of side stream.

4.2.1.1 Double or Parallel Booming

Two booms deployed in parallel will tend to deflect oil more effectively at steeper angles to the current. Entrained oil will tend to collect in the quiescent area between the two booms. When a low current area is not available for diversion, a collection pit can be dug into the bank to facilitate oil containment and skimming as seen in Figure 4-7. If the upstream boom is effective, a sorbent boom can be used downstream to collect residue.

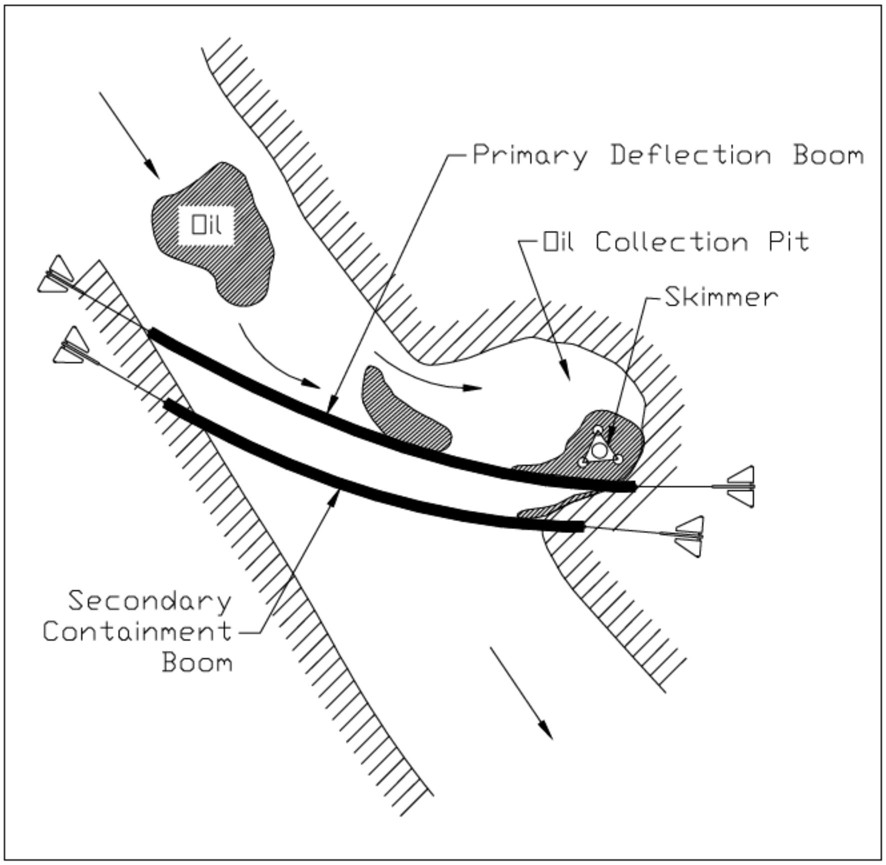


Figure 4-7. Two parallel diversion booms and collection pit.

4.2.2 Cascade Diversion Booming

Cascade booming can be used when a single length of boom is difficult to handle or the loads are too high, especially when the currents exceed three knots. Multiple sections of boom are displayed to overlap (see Figures 4-8 and 4-9) so that the next boom deflects oil lost from under or around the previous upstream boom. This technique is most useful for covering large areas or for high-speed currents.

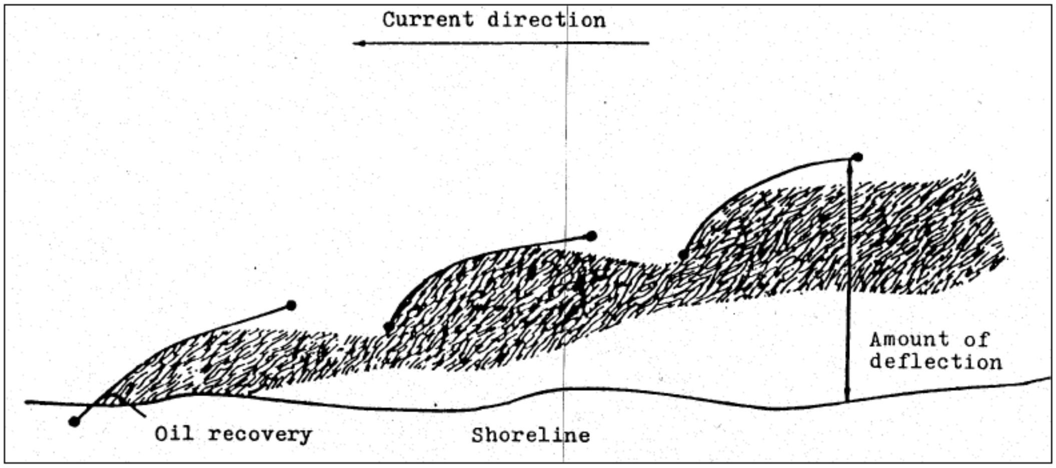


Figure 4-8. Cascade diversion booming (Exxon, 1992).

Figure 4-9. Cascade diversion booms deployed.

4.2.3 Chevron Booming

Chevron booming is used when deflection to both sides of a small bay, channel or river is desirable (Figure 4-10). It is effective in currents up to two knots and it can be deployed quickly. The angles of the booms to the current must still meet the criteria given in Figure 3-1. Losses can be reduced to some extent by double booming behind the first cascade system. Use of boom deflectors between 50-foot boom sections would assist with keeping the boom angled into the current and allow containment at a higher velocity. The two chevron tactics described below are shown Figure 4-11.

Figure 4-10. Chevron booming.

4.2.3.1 Closed Chevron

The standard closed chevron uses one anchor point in the center of a channel. Two sections of boom are attached to the mid-channel anchor, Figure 4-11. They trail downstream to opposite banks, where they are secured to shore anchor points. The shape of the boom is controlled by tension on the boom. Additional anchors along the boom are usually not used. The length of boom obtains the desired angle. This method is most effective when permanent mooring points are in place and the boom can be deployed very quickly. Use of chevrons at locations where rivers widen increases the amount of boom needed, but the lower current in these areas make containment and recovery easier.

4.2.3.2 Open Chevron

An open chevron uses two mid-channel anchors separated by a distance that allows vessels to pass between them safely, Figure 4-11. Each boom forms a single leg to the opposite shore. The booms can overlap to some extent to prevent oil from getting by. This operation takes more time to deploy; however, it is recommended where vessel passage is desired. This tactic can also be deployed from each shore with boom deflectors and/or boom vanes in lieu of anchors.

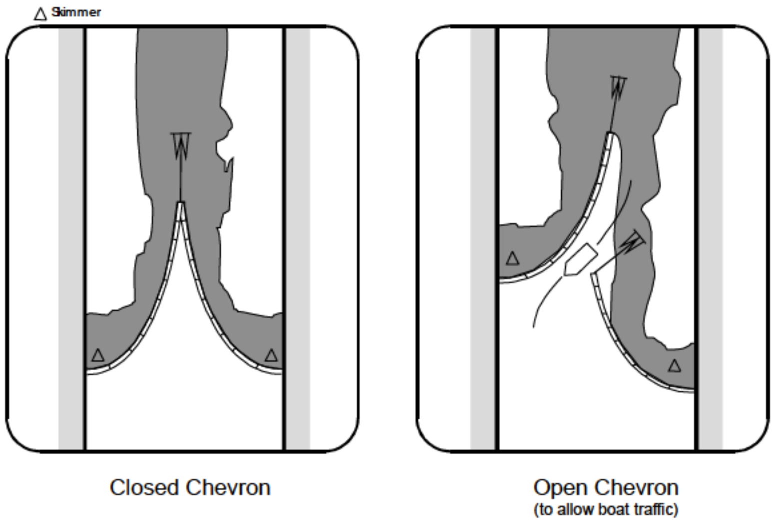


Figure 4-11. Closed and open Chevron booming tactics.

4.2.4 Encircle and Divert

In wide rivers and coastal areas boom can also be used to encircle the large oil patches that move with the current. A patch of oil can be encircled by one boat by using a sea anchor to resist boom movement while the boat circles the oil as seen in Figure 4-12. The oil is then slowly diverted at a velocity less than one knot relative to the surface current into a low current eddy or inlet for skimming. A high level of competency is needed to be able to quickly execute this technique and should only be used as a last resort due to the complexity of the maneuvers required.

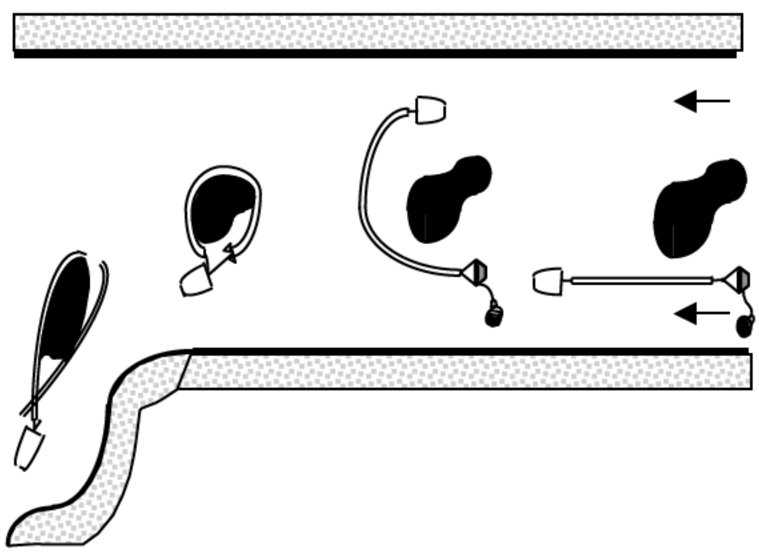


Figure 4-12. Procedure used by one boat to capture oil and divert it to slower waters (Coe and Gurr, 1999).

One method of fabricating a drogue system is shown in Figure 4-13. The actual configuration is dependent upon the size of the vessel and the length of boom. The use of two boats provides better control and requires less training to perform (see Figure 4-14).

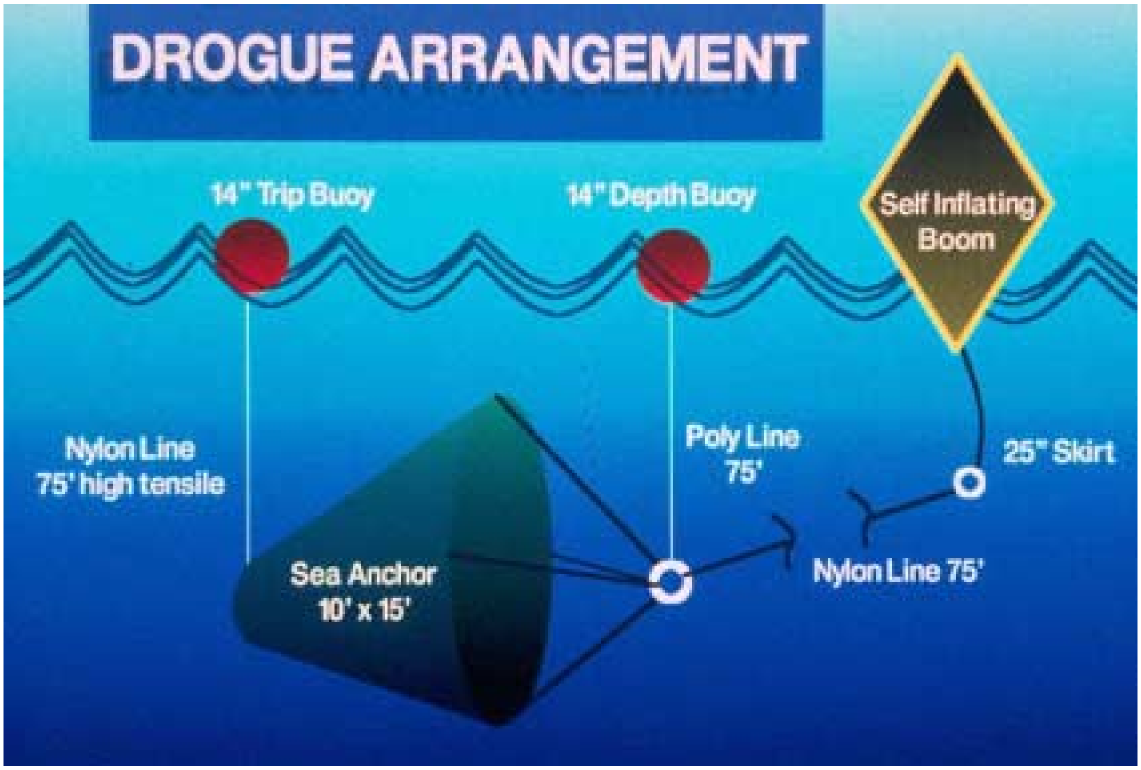


Figure 4-13. Sea anchor and boom configuration for one boat capture (McCarthy).

Figure 4-14. Use of two boats for oil spill capture.

4.3 Rivers/Canals (Tidal)

The presence of tides on a navigable river will significantly complicate an oil spill response. Approximately every six hours the tidal currents will change from maximum flood to maximum ebb tide. This requires constant tending of the deflection boom as the current changes. Tidal current reversals often require that the equipment be repositioned on each tidal change, up to 4 times in each 24-hour period. Maximum currents in fast water tidal rivers vary between 1 and 3 knots, which is lower than the inland rivers. The ebb current is usually slightly stronger than the flood tide due to fresh water runoff. Rains will dramatically increase ebb tides while diminishing and delaying flood tides. Local conditions can dramatically change the time and magnitude of maximum currents and slack water. Strong winds can pile up water against coastal areas and accentuate high tides or reduce low tides depending upon the timing.

The same methods used in non-tidal areas can be utilized in tidal areas with some modifications. In tidal areas, all booms must be stabilized to stay in place during slack and reversing currents. The configuration should not rely on the force of the current to maintain its shape. One method to control spilled oil from a point source in a tidal situation is shown in Figure 4-15.

Inlets, attached bays and tributaries are generally sensitive areas that must be protected during flood tides to prevent oil from entering. Oil that has been collected during an ebb tide by a diversionary boom angled to the shore will be lost on a reversing flood tide unless it is skimmed or contained from escaping. Booms often have to be moved as the tide starts to shift in order to protect sensitive areas or contain oil during the flow reversal. Booms should be configured to withstand and be effective in the most severe current predicted for the next tidal cycle. If the boom is to remain in the same position during both tides then it should be anchored on both upstream and downstream sides to keep it in place and to prevent anchor dislodgment.

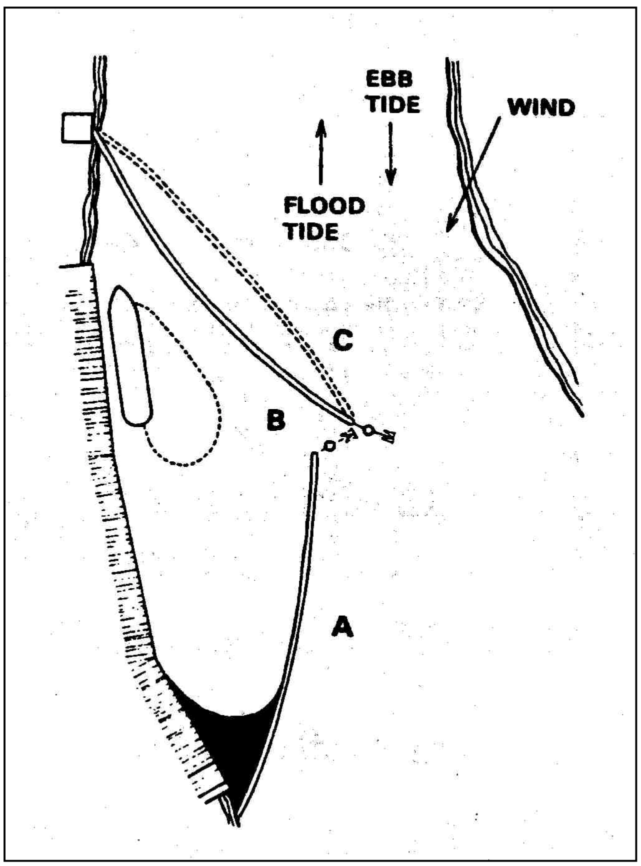


Figure 4-15. Double booming arrangement in tidal river (National Spill Control School, 1998).

The other major problem caused by tidal cycles is the change in water levels. Multiple booms may be needed to handle oil movement for both high and low tide levels (see Figures 4-16 and 4-17). Tidal seal booms (see section 4.3.1) are made specifically for this type of application.

Figure 4-16. Boom at high tide.

Figure 4-17. Boom at low tide.

4.3.1 Tidal Seal Booms

Although originally designed for tidal conditions, tidal seal booms can be used under low flow conditions. A typical design (see Figures 4-18 through 4-20) uses water ballast to settle on the bottom. This technique is most useful for culverts on a tidal estuary. These booms can also be attached to conventional boom as shown in Figure 4-18.

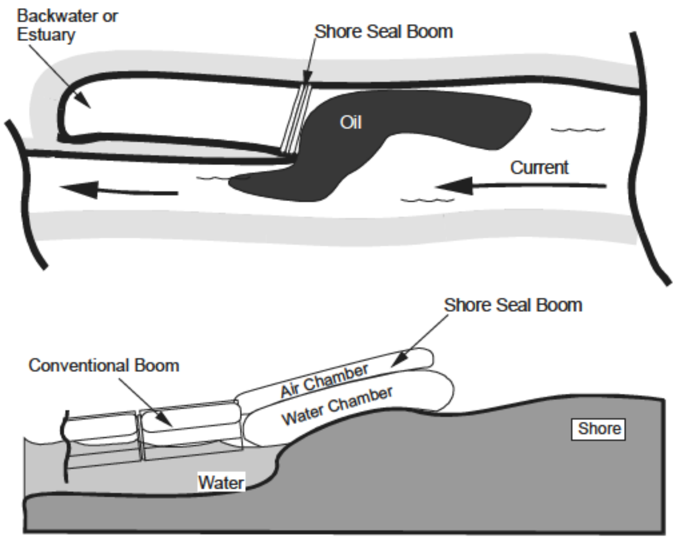


Figure 4-18. Shore seal boom protects shallow inlets and seals.

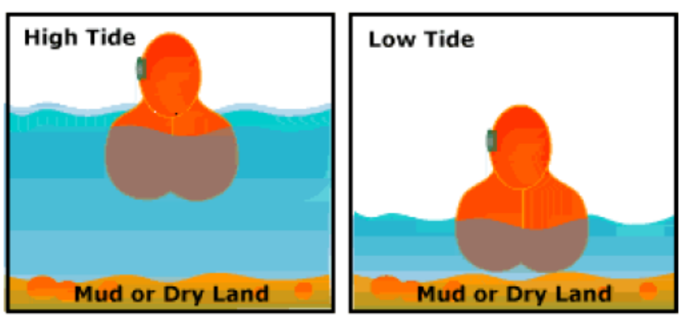


Figure 4-19. Shore seal boom during tidal fluctuation (Texas Boom Company, Inc. 1997).

Figure 4-20. Deployed tidal boom.

4.3.2 Other Techniques

Open water techniques such as Encircling (section 4.2.4) and Skimmers (see Chapter 6) can also be used in the tidal areas. Cascade Diversion booming (section 4.2.2) and Chevron booming (section 4.2.3) can be used when protecting a particular area, but care must be taken to control the oil on the reverse tide. In many cases, a complete second boom configuration has to be deployed. Whenever possible, these systems should be deployed outside of channel mouths instead of the narrow neck to reduce the flow velocity that the boom encounters.

4.4 Small Streams/Creeks/Culverts

Shallow streams and culverts are susceptible to spills from pipelines, storage facilities, highway accidents and storm drains. Boom is generally ineffective in shallow water where the draft is greater than about one-third of the water depth. The restricted flow under the skirt increases the flow, which increases oil entrainment. For low flow rates or small spills, standard booms, especially the sorbent type, can be used. Filled fire hose can also serve this function. A rule of thumb for low flow rate is less than 10 cubic feet per second. Methods to estimate the flow are provided in Appendix J. Above this flow rate, underflow dams, overflow dams or sorbent barriers can be used. Under very low flow conditions, a berm can be built that completely stops the flow. Changing weather conditions can drastically alter the flow so caution should be taken during severe weather. All of these techniques require constant monitoring to ensure that the oil does not reach the intake. In some conditions, a combination of techniques can be used such as using a sorbent barrier backed by an underflow dam.

Underflow Dams

Dams can be built in shallow rivers, culverts and inlets using hand tools or heavy machinery as available. Pipes are used to form an underflow dam to allow water passage out while oil stays behind, as seen in Figure 4-21. The inlet of the pipe is cut at an angle to permit a larger entrance area for the water in order to reduce the inlet velocities and the possibility of oil draw down due to formation of vortices. Caution should be taken to prevent whirlpools from forming and pulling the oil down. Face the cut pipe opening down (or insert a 90 degree angle) to help eliminate this. This technique is effective for water bodies less than two feet deep where flow volume can be accommodated by pipe flow (see Figures 4-22 through 4-25). This method can also be used in deep, narrow culverts.

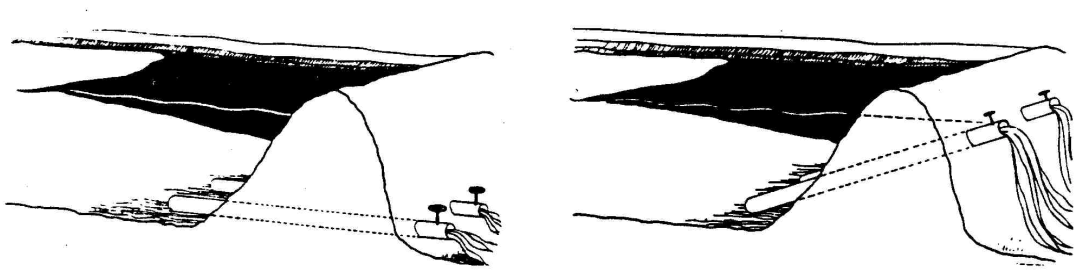


Figure 4-21. Earth underflow dam (DOWCAR, 1997).

Figure 4-22. Sandbag underflow dam.

Figure 4-23. Underflow dam with debris boom.

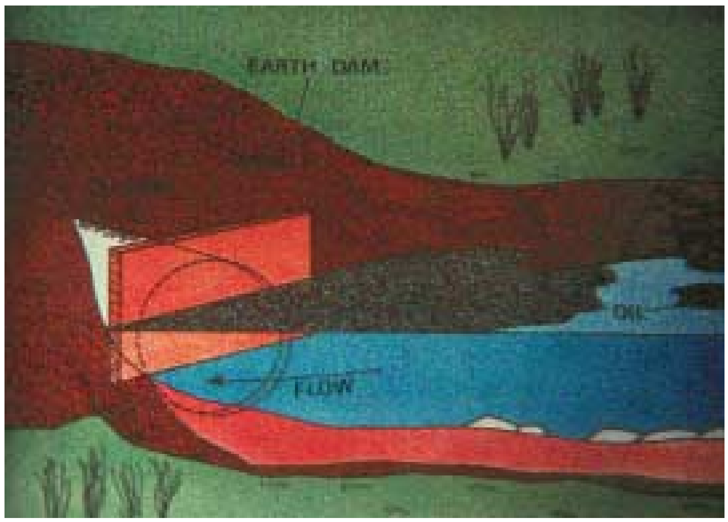


Figure 4-24. Wooden underflow dam.

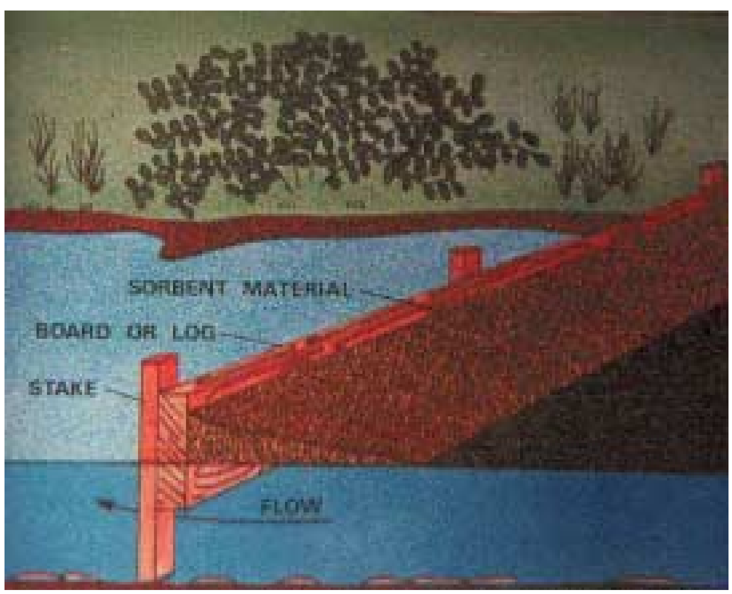


Figure 4-25. Underflow dam with sorbent material.

Overflow Dams

An overflow dam can be utilized if a pump is available and the flow of the stream is low, Figure 4-26. This method allows more control over the amount of water that is moved past the dam.

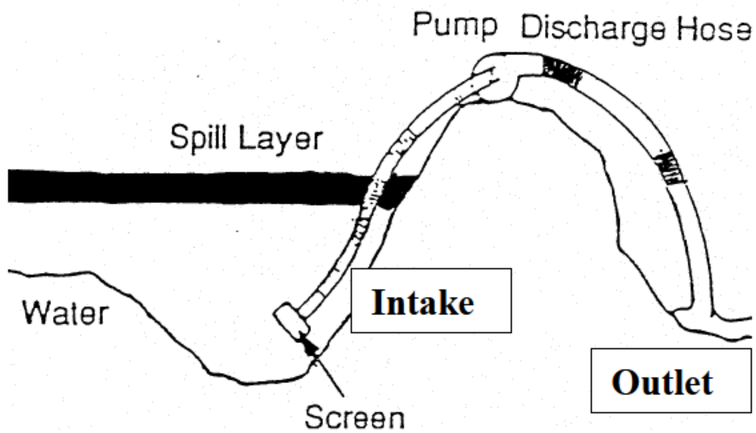


Figure 4-26. Overflow dam (National Spill Control School, 1998).

Berms

Berms can be built in shallow rivers, culverts and inlets using hand tools or heavy machinery as available. It can be used to totally block the flow into and out of a sensitive area. In this case, outflow from the area must be very slow. This technique is effective for water bodies less than two feet deep. Berms can also be used as a diversionary system at angles to the current to divert flow and oil from sensitive areas. Erosion of the berms can occur which may require maintenance to prevent breakthrough.

Sorbent/Filter Barriers

Sorbent barriers can be used for small spills in areas with low flow rates. The sorbent sandwich barrier is shown in Figures 4-27 through 4-29. Any type of fencing or screening can be used to stabilize the sorbents. Silt barriers, hay or other similar materials can also be used.

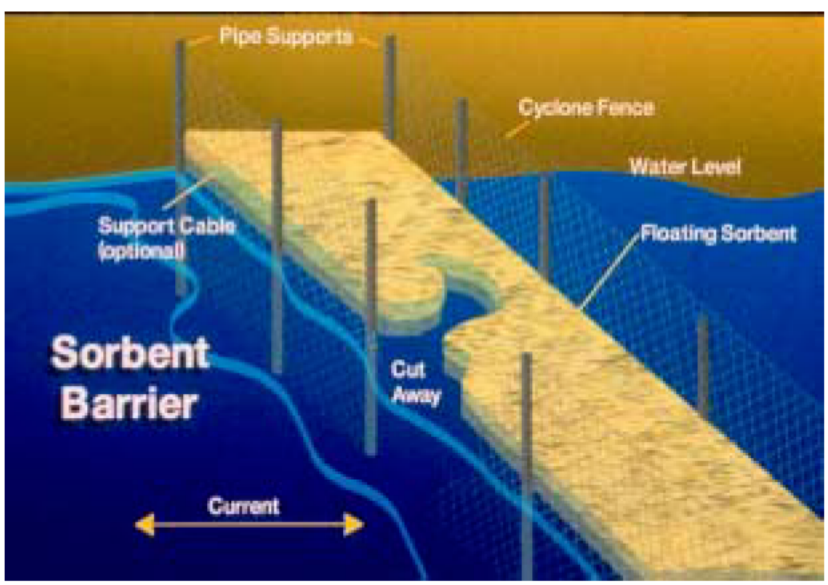


Figure 4-27. Sorbent barrier.

Figure 4-28. Sorbent barrier.

Figure 4-29. Hay filter barrier.

Tidal Seal Booms

Short sections of tidal seal booms can be used to seal off shallow streams and culverts (see sections 4.3.1).

4.5 Coastal Areas

Coastal regions have cyclical tidal currents that complicate response efforts due to constantly changing current velocity and direction. A great containment site on one tide could be easily cleared of oil when the current reverses on the next tide. River runoff, wind shifts and dramatic changes in barometric pressure will affect tidal currents significantly from prediction tables. Local knowledge and awareness of changing weather patterns are required to make informed decisions on ideal collection locations and determining where exclusion boom is required. Control points are likely to change during a spill event.

The techniques used for rivers and canals need to be modified for use in coastal areas. Water depth is usually greater along the coast than in rivers and bays, thus requiring more anchor chain and line to moor boom. Open sea conditions bring the potential for higher wind-driven waves and swells. This will necessitate the use of larger freeboard and deeper draft boom. Higher drag forces on deep-draft boom will complicate the response in fast water by deforming the shape of the boom requiring more anchor attachment points along the boom and larger anchors. Heavier anchoring equipment is needed to handle the waves and deeper water that may be encountered. Waves also make recovery more difficult. Boats are required to place equipment offshore. Incline submergence plane and oleophilic skimmers are more effective in waves than surface slicing and weir skimmers. Self-adjustable weir lips follow wave motions and maintain higher efficiencies in waves. Boom diversion systems can amplify waves making skimming more difficult. Tests of offshore oil booms have shown that a reserve buoyancy to weight ratio of at least 20 to 1 is required in high seas states offshore (Nordvik, Sloan, and Stohovic, 1995). Typically, oil will move at 3.5 percent of the wind velocity downwind with no other currents present. Appendix D shows calculations for calculating wind drift.

Inlets to marshes, rivers and harbors are usually constricted resulting in high currents during maximum ebb and flood tides. Oil containment should be conducted in lower current locations inside or outside of these inlets. Tidal gates or similar structures may be helpful to protect sensitive areas. When waves increase offshore, the only recourse is open water containment outside the inlet using advancing systems and several fixed diversionary control points inside the opening. Tidal currents are generally lower than inland river currents, however, they can routinely exceed one knot. The most challenging areas are at the mouth of inlets where velocities increase and directions change. If oil is originating from an inland water body source, it can be swept down the coast to new areas or return to the originating water body depending upon the local tidal current conditions.

Harbors are generally high traffic areas where many spills originate. In addition to selection of containment locations, consideration has to be given to control or restriction of vessel traffic. Points, islands and shoreline indentations can be used to facilitate containment and diversion of oil. The downstream side of flow obstructions will have reduced currents and eddies that can be used to assist with oil containment. Once oil has started to enter the harbor or inlet, the response methods will be similar to rivers and canals.

4.5.1 Single Diversion Boom

The main factor in diversion in coastal areas is waves. Most booms do not work in breaking waves. A diversion boom configuration as seen in Figure 4-30 can be used for ripple waves. A shore seal boom (see Figure 4-18) would be more efficient than a standard boom in the shallow water zone. For a more severe wave environment, a V-shaped arrangement (see Figure 4-31) should be used to keep oil out of the wave zone. The apex could be located outside of the waves if a skimmer is available. Lack of sufficient tension in the boom will result in pockets forming (see Figure 4-32) and loss of oil.

Selection of mooring point locations on the boom should be done to ensure the boom remains stable. Typical mooring points use end connectors with bridles to stabilize the boom. Additional mooring connection points along the boom for deflection applications should also be made at the center of the drag force or by using bridles connected to top and bottom tension members. This may require a support bar at the boom to prevent the bridle from collapsing the skirt under load. Using boom with a deeper draft will usually increase stability; however, drag is dramatically increased with draft, which is undesirable in high-speed currents. Some manufacturers offer fast current boom with holes cut in the bottom of the skirt or net for the lower end of the skirt to add stability but at reduced drag. However, this design may cause turbulence, thereby facilitating oil entrainment.

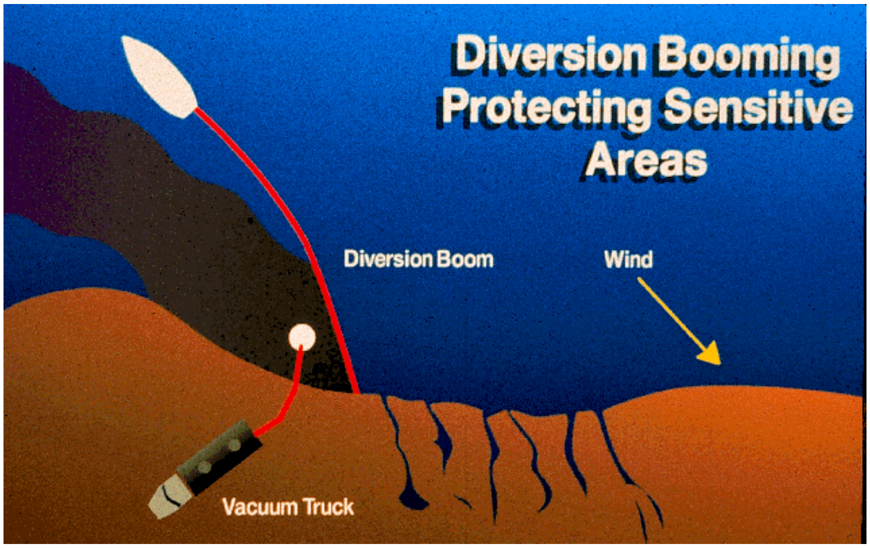


Figure 4-30. Diversion booming.

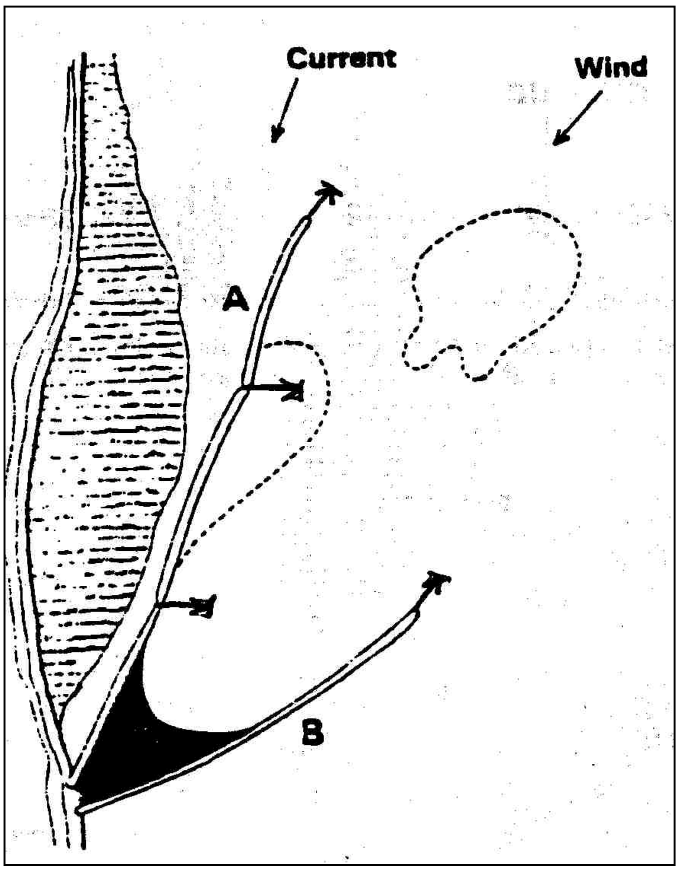


Figure 4-31. Correct booming near shore (National Spill Control School, 1998).

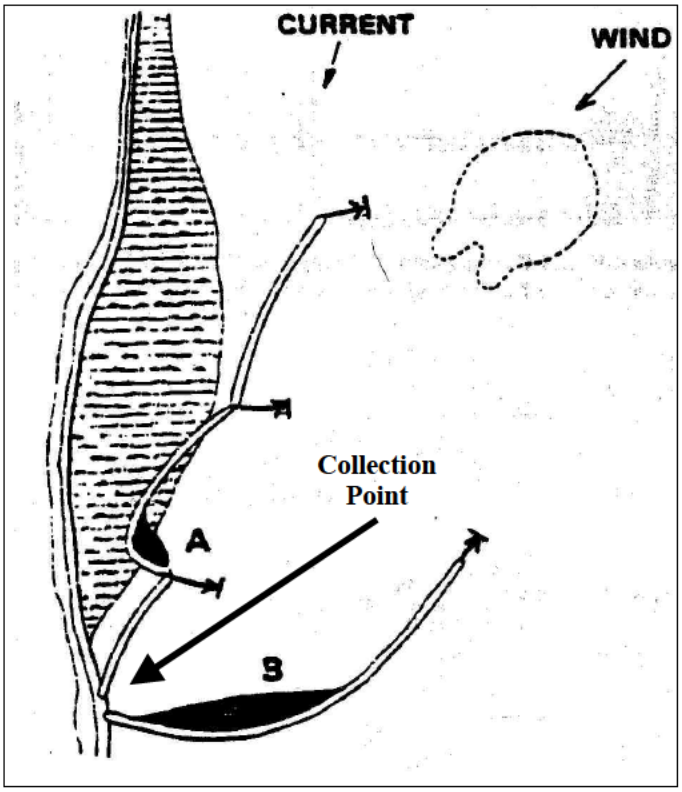


Figure 4-32. Pockets forming as result of incorrect booming.
(Note that oil is not arriving at collection point)

4.5.2 Cascade Boom

A cascade boom system can be used if current and wind are consistent and especially if directed along the shore (see Figure 4-33). The booms can be used to protect sensitive areas or to deflect the oil to skimmers that cannot approach the shore (see Figure 4-34).

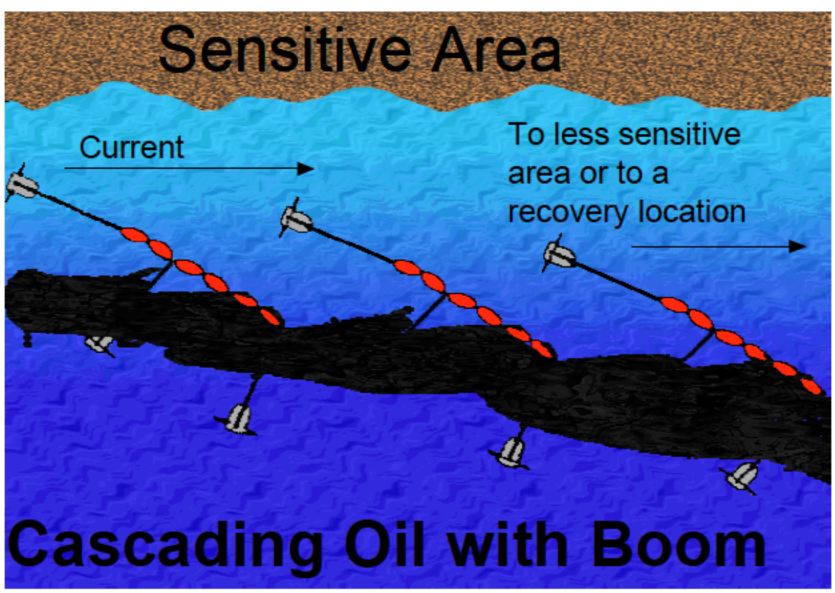


Figure 4-33. Cascaded deflection booms (U.S. Navy, 1991).

Figure 4-34. Cascading booms in open area.

4.5.3 Exclusion Booming

Exclusion booming (see Figures 4-35 through 4-37) may be used for inlets and sensitive coastal areas. Tidal currents vary in these large areas, but maximum flood and ebb tides range from 1 to 2 knots with higher velocities at choke points and inlet entrances.

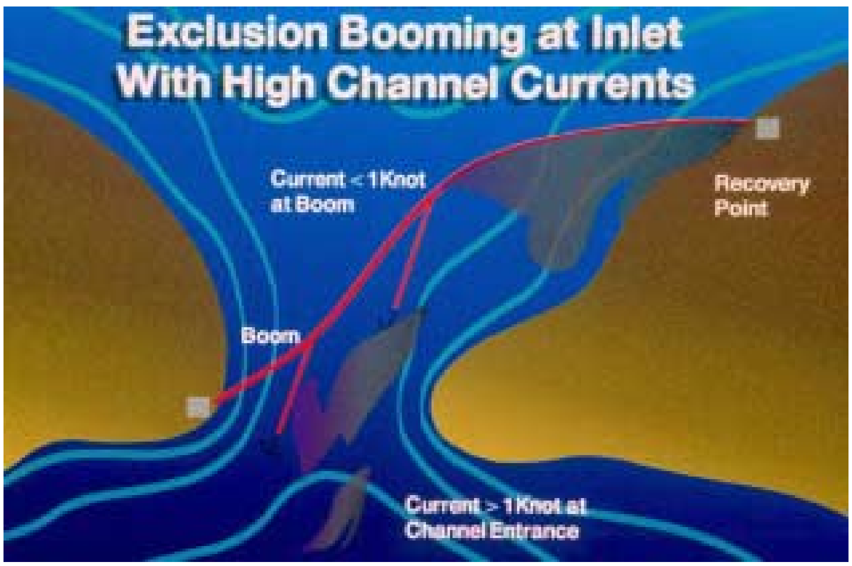


Figure 4-35. Protecting inlets with exclusion booming.

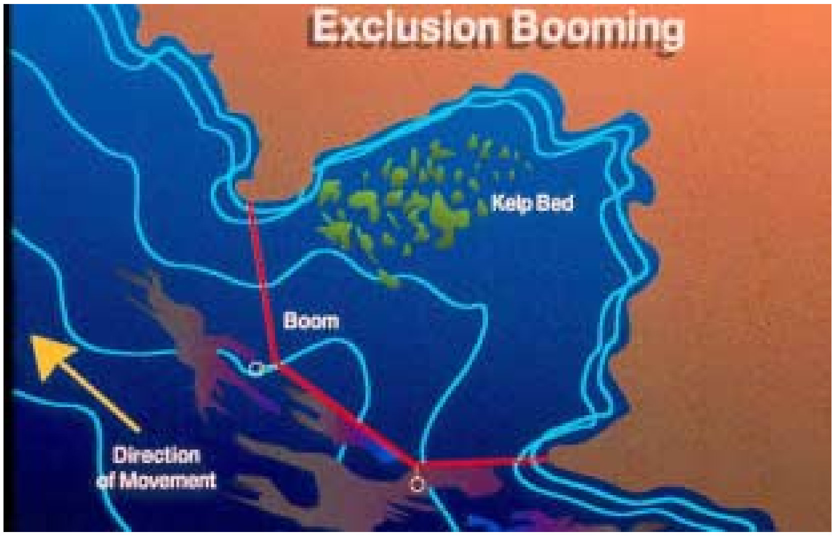


Figure 4-36. Exclusion booming.

Figure 4-37. Exclusion booming.

4.5.4 Other Techniques

Open water techniques such as Encircling (see paragraph 4.2.4) and Skimmers (see Chapter 6) can also be used in the Coastal zones.

4.6 Harbors/Bays

All of the techniques used in the rivers and the coastal areas can be adapted for use in open harbors and bays. Areas with a low wave environment and higher currents can directly use the river approaches given in sections 4.2 and 4.3. Areas with waves and varying currents should use the approaches for coastal areas in section 4.5. Special arrangements may be needed to keep oil from getting beneath piers and away from structures built to protect anchorage. In situations where the water becomes shallow, ensure that cleanup equipment can transit out of the area when filled with a full load of oil.

These techniques include:

- 4.2.1.1 Double or Parallel Booming
- 4.2.2 Cascade Diversion Booming
- 4.2.3 Chevron Booming
- 4.2.4 Encircle and Divert
- 4.5.1 Single Diversion Boom
- 4.5.3 Exclusion Booming
- 6.1 Fast Water Skimmers

4.7 Breachways and Harbor Entrances

There are several options to protect a harbor or breachway from an ocean or coastal spill entering during a flood tide. The first line of defense is to deflect oil past the harbor entrance (see Figure 4-38). Oil can also be trapped and contained by setting up diversion boom to deflect oil to the shoreline outside the harbor entrance. Long shore currents may be helpful since they can transport oil along the coast into collection booms that are properly placed. Once the oil has started to enter the harbor or breachway entrance, the response methods similar to rivers and canals can be used.

Generally, oil should be herded away from piers, marinas and breakwaters as they are difficult to access and to clean. In some situations, wharves and bulkheads with solid, easy to clean surfaces can be used as collection and diversion sites. Large vessels or barges can be positioned to assist with flow control and oil diversions.

Figure 4-38. Booming in beachway.

4.7.1 Single Diversion

The first but most difficult place for a diversion boom is right at the entrance (see Figure 4-39). This approach minimizes the oiling of the shoreline, but the boom may be exposed to waves. The deployment angle is determined using Figure 3-1. Boom tension calculations are shown in Appendices F and G. A secondary location would be just inside of the opening as it widens and the current slows. This lower current permits a steeper boom angle, but may require more booms.

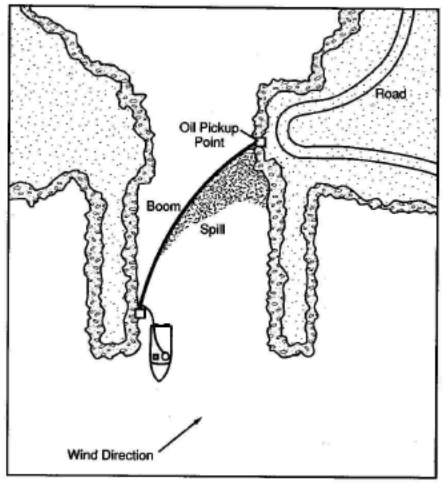


Figure 4-39. Booming harbor or tidal inlet (Exxon, 1992).

4.7.2 Cascade Systems

For larger or deeper entrances, those wider than 200 yards, cascade systems can be used. They may need to be combined with other methods as seen in Figures 4-40 and 4-41. The concept of this type of arrangement is to deflect the oil into the slower current areas and seal the sensitive areas. Additional boom would be needed to keep oil from floating back out during an ebb tide. Planning should occur well ahead of any spills and contingency plans should be implemented for training to ensure that the plan is viable as this type of response is very complex and challenging.

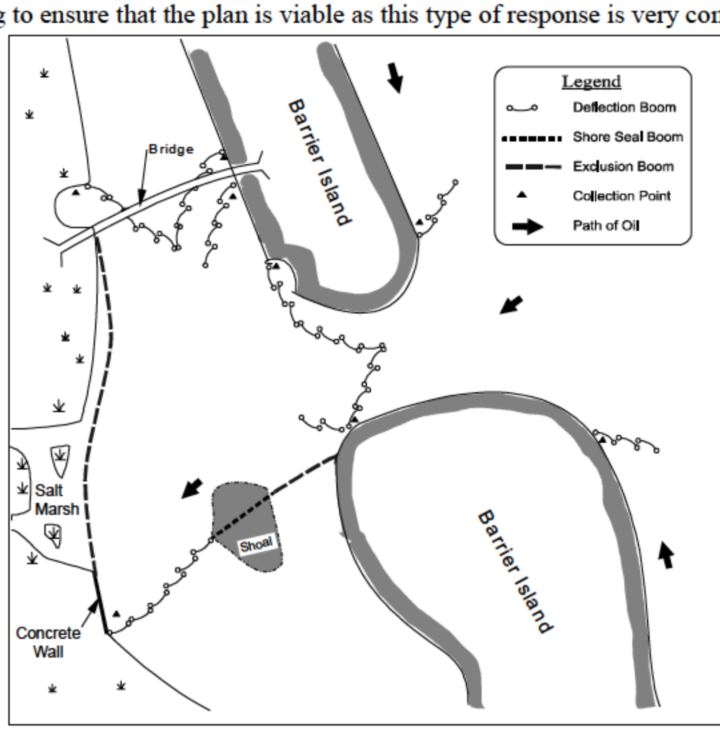


Figure 4-40. Barrier Island inlet spill response strategy (Hayes and Montello, 1995).

Figure 4-41. Cascade boom in inlet.

4.7.3 Blocking

For small, non-navigable inlets, the use of dams and weirs can be employed in the same manner they were deployed for small creeks and culverts (see section 4.4). Due to changing tidal cycles and possible waves, more concise control of the flow is needed. Pumps should be utilized and the method should not rely on gravity feed. Multiple dams may be needed, especially to keep oil that is already in an area from escaping and affecting other areas. Intertidal (sealing) boom works as a quick dam in almost any location.

CHAPTER 5. BOOMING TECHNIQUES

Many organizations, companies and individuals have developed techniques for particular applications. See Appendix L for ASTM Committee F20 evaluation of techniques.

5.1 Cascade Booming DOWCAR Technique

This technique (U.S. Navy, 1991) has been perfected and taught by DOWCAR Environment Management, Inc. of Taos, New Mexico for many years. It can be effective in currents up to 5 knots with a trained crew. This procedure can be used across waterways up to 600 feet wide. All boom anchors and tending lines are attached to shore for better control. They recommend using short 50-foot sections of 4 by 6 foam boom (4-inch floatation, 6-inch draft) when currents exceed 3 knots, Figure 5-1. This prevents excessive mooring, loading and boom shape distortion. Use 3/8-inch polypropylene mooring lines to prevent excessive drag in high current. Small boats and a ferry line system are used to move people and equipment across the river. Special mountain climbing equipment such as ascenders is used in conjunction with pulleys to grab onto the mooring line and pull out the slack.

To position the boom properly, two upstream and two downstream lines are attached to each boom section to provide complete control from shore. A trained crew can boom a 200-foot wide river with a current of 3 knots in approximately 45 minutes. Systematic procedures for booming a narrow river using the DOWCAR tactic are presented in Appendix E.

Figure 5-1. Deploying cascade boom in a narrow river (DOWCAR, 1997).

5.2 Overlapping J-Shape Booming

This tactic is used where cascade booming is desired in wide rivers or along the coast. It is similar to the DOWCAR technique but requires submerged anchors and the use of powered boats to deploy them. It can also be used offshore for exclusion away from sensitive areas. The benefits of all cascade systems are that loads are lower on individual booms requiring smaller anchors, and if one boom is taken out by debris the rest of the system remains in place. This affords easier adjustments when problems develop. If vessel passage is desired, the spacing between booms can be increased. Short sections of 50 to 100 feet lengths are recommended to keep the desired shape. Mooring lines of submerged anchors cannot be tensioned as well as shoreline anchors resulting in a slack boom condition that usually forms a J-shape. Oil often entrains under the downstream end of the boom where the angle exceeds the maximum deflection angle for the current. This requires that the booms downstream be overlapped a greater distance to capture the oil which is lost upstream as seen in Figure 5-2. Use of multiple anchors is difficult in fast-currents over 2 knots so planning and training are required.

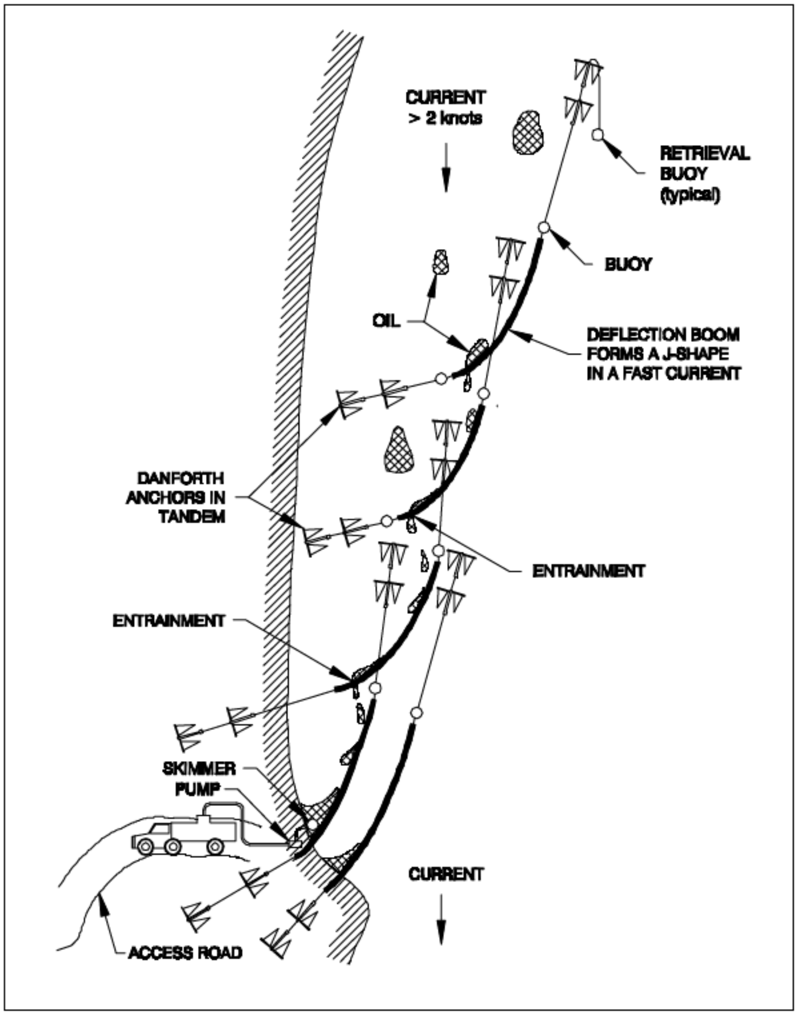


Figure 5-2. Cascade J-shape deflection booming requires more overlap. (Coe and Gurr, 1999)

5.3 Continuous Boom

Long sections of continuous boom require less setup rigging than cascade booming and are usually deployed more quickly. The disadvantages are that it is difficult to keep it from bellowing out and to handle. This causes oil entrainment when the boom angle exceeds the maximum deflection angle for the current.

5.3.1 Trans Mountain Pipeline Tactic

The Trans Mountain Pipeline in British Columbia, Vancouver, Canada, has adopted and modified a version of the Canadian Petroleum Producers (CPP) (Coe and Gurr, 1999) deflection booming technique. They use continuous sections of 6" X 6" (6-inch buoyancy and 6-inch skirt) foam boom for deflection and containment on fast flowing rivers. The boom distortion is reduced by attaching shoreline ropes to the boom at intervals and pulling the boom downstream to keep it straight. The shoreline ropes attach to the boom with special bridles. The ends of the bridle are separated by a light pipe with snap hooks on each end that snap to rings on the top and bottom of the boom. The pipe keeps the boom from collapsing when shoreline ropes are pulled to shore under tension. This process puts a large force on the boom anchor line upstream, so a 3/8-inch cable is used to take this high tensile load to the anchor. A tow paravane is attached to the leading edge of the boom for added buoyancy. Three mooring techniques are depicted in Figure 5-3: (1) bridge, (2) cable ferry and (3) anchors.

The cable ferry system allows for changes in the deflection angle to compensate for changing currents and to avoid large debris. Use shallow draft self-adjusting weir, disk or drum skimmers in the apex of the boom. Suction trash pumps remove oil collected by the skimmer. A 200-foot wide fast-water river can be protected in approximately 25 minutes using this technique. For wider rivers, a second layout of the boom system shown can be set up downstream on the opposite bank.

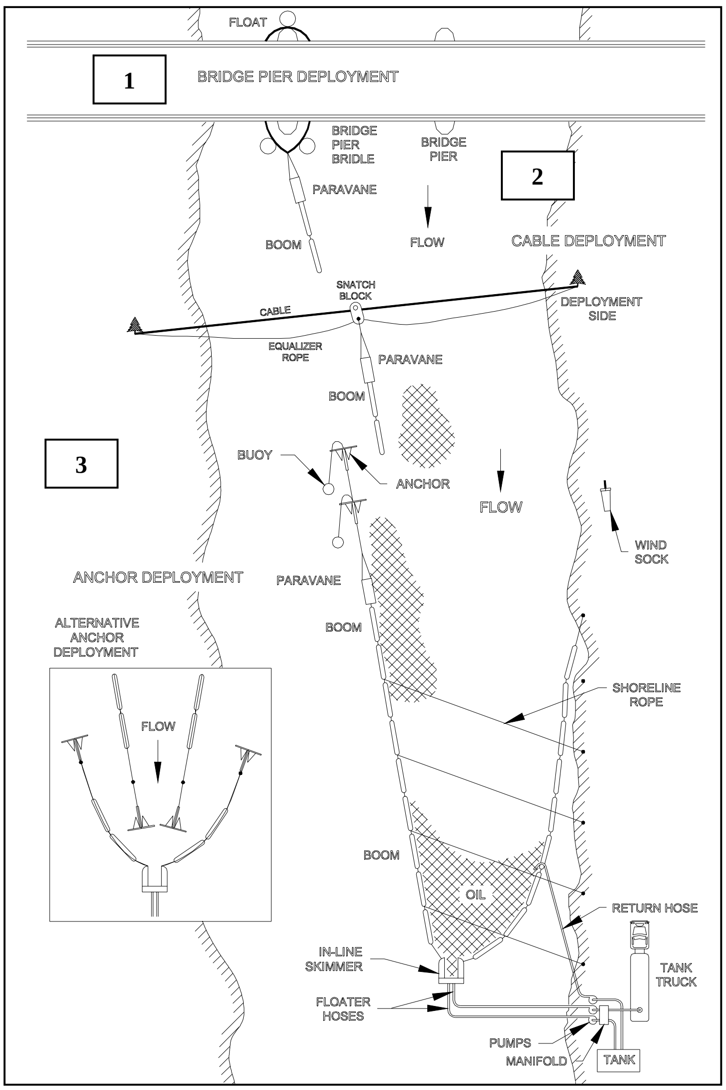


Figure 5-3. Transmountain pipeline tactic.

5.4 Multiple Anchors

Multiple anchors are required on long sections of deflection boom deployed away from the shoreline as shown in Figure 5-4. The use of multiple anchors prevents the boom from bellowing out and reduces loads on end anchors. This shape-keeping tactic allows boom to maintain a consistent deflection angle to prevent oil entrainment in swift currents. This tactic can be used for deflection of oil to shore or into an inlet with slower currents where it can be more readily contained. This tactic can also be used in deeper water to exclude and direct oil away from sensitive areas or inlets. In reversing tidal current areas, additional anchors are also required on the opposite side of the boom to ensure it stays in place after the tide changes. The liability is that debris or a strong current can dislodge or completely take out the entire system. Adjustment of the anchors takes time to get the correct deflection angle and boom shape. The use of multiple anchors makes this method difficult to use at higher speed currents over 2 knots.

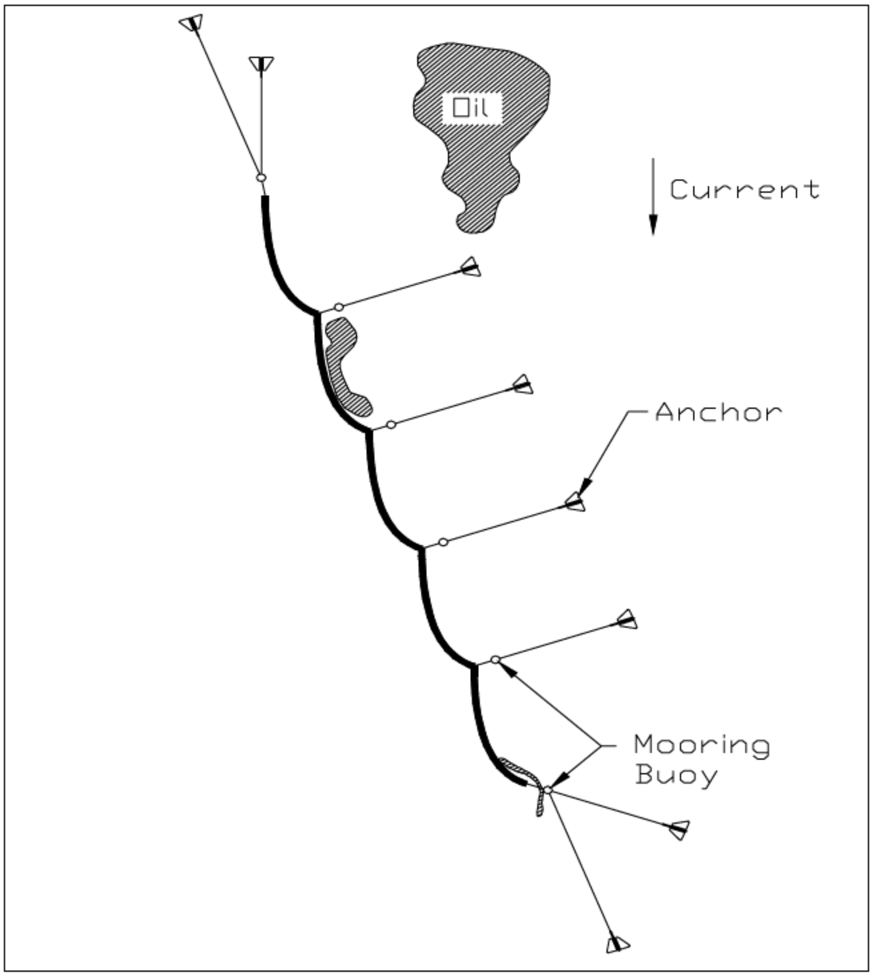


Figure 5-4. Multiple anchors on sections of boom.

5.5 Boom Deflectors

Boom deflectors (see Figure 5-5) allow quick deployment of deflection boom with a long continuous run and only requires one upstream anchor line. They are useful where fast response is needed and deployment of multiple anchors or cascade booming is too difficult. The deflectors are placed between each section of boom using 50-foot sections for speeds over 2 knots. A floating arm extends out the downstream side of the deflector body and pushes the boom into the current. The push on the deflector corresponds to the speed of the current and the angle set on the deflector. In faster currents a shallower boom angle and thus less extension of the deflector arm is required. The boom is deflected up to a maximum of 20 degrees into the current. The number of deflectors is based on the number of boom sections and not on the speed of the current or the amount of oil being contained.

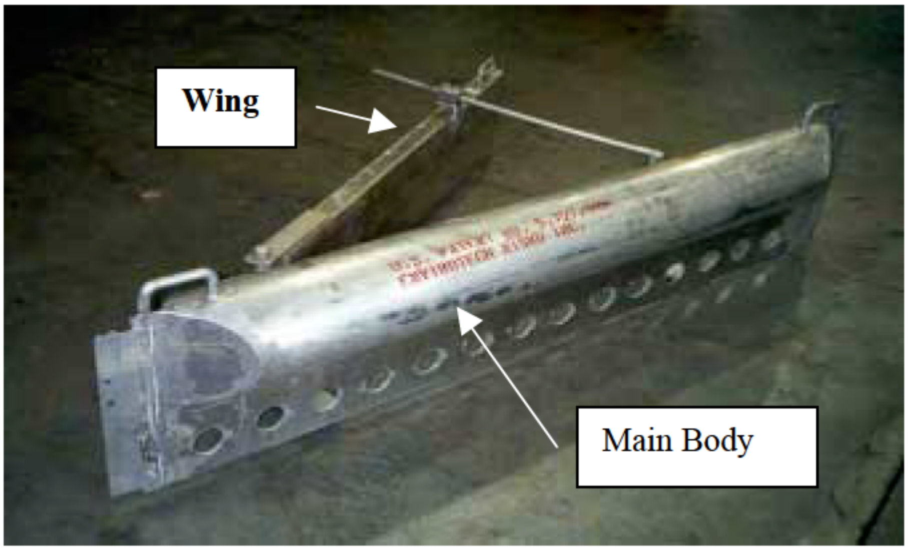


Figure 5-5. Boom deflector.

Boom deflectors are effective in currents up to 8 knots and require a minimum current of 1.5 knots to work well. They were developed and patented by Envirotech Nisku Inc. of Alberta, Canada. Recently, deflectors were successfully demonstrated in tests conducted on the Columbia River in Washington, Figure 5-6. These tests were sponsored by the USCG (Hansen, 1999). There are no ropes connected to the shore to snag debris or inadvertently deflect oil to shore upstream of the skimmer, Figure 5-7.

Figure 5-6. Boom deflectors push the boom into the current.

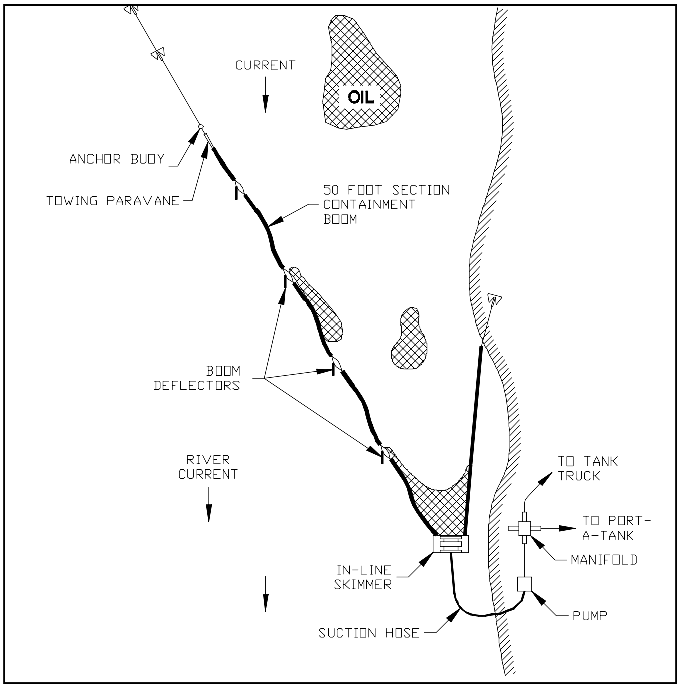


Figure 5-7. Boom deflectors can be used without multiple anchors.

5.6 Boom Vane

The boom vane (see Figure 5-8) allows a diversionary boom to be deployed from shore without use of anchors and boats. The boom vane pulls the boom off the shore by developing hydrodynamic forces from the current passing over the paravanes. It consists of a frame with vertical curved paravanes, which float upright. A stabilizing arm with a control fin is controlled by a person on shore (see Figure 5-9). Pulling on the control line flips the fin and causes the boom vane to stall and return to shore. Release of the line again restores the fin and the boom vane returns out to the channel. It also shows promise for use with advancing sweeps using high speed skimmers to keep the boom pulled out from a vessel without the use of rigid and bulky outriggers.

The Coast Guard evaluations on the Columbia River (Hansen, 1999) and in Martha's Vineyard (Hansen, 2000) showed the boom vane to be effective in high currents (Figure 5-10). It requires a minimum current velocity of approximately 1 knot to develop enough lift force to pull a boom into the current. The Boom Vane is built by ORC of Frolunda, Sweden. It is distributed in the United States by QualiTech Environmental of Chaska, Minnesota and overseas by ORC.

Figure 5-8. Boom vane is quickly assembled.

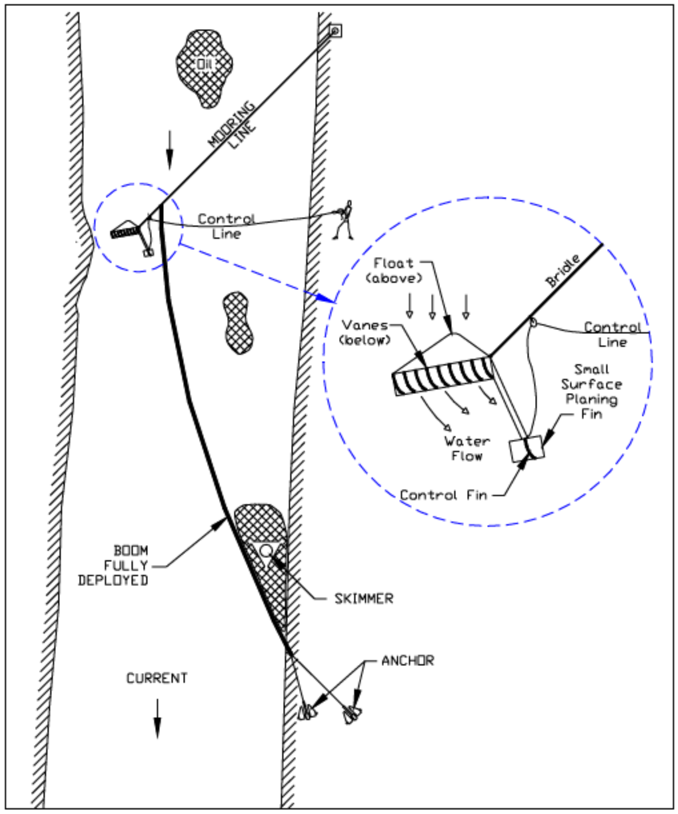


Figure 5-9. Boom vane deploys and retrieves deflection boom from shore to allow vessel passage (ORC AB, 2000).

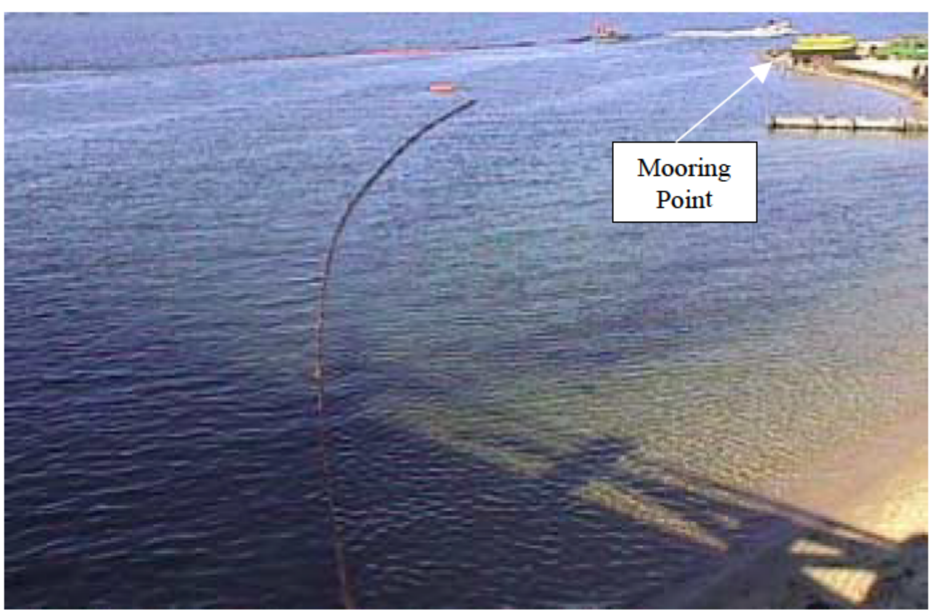
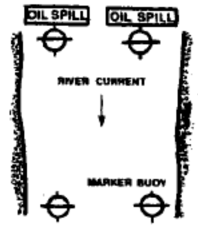


Figure 5-10. Boom vane deployed in Martha's Vineyard.
(Mooring line is attached to point of land in upper right-hand part of picture)

5.7 PROSCARAC River Boom Deployment Scheme (PROSCARAC, 1992). The final configuration is shown in Figure 5-11.

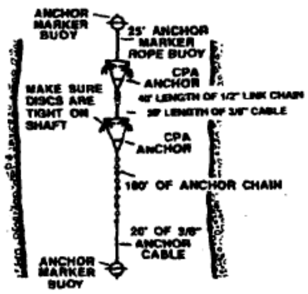
Step 1

Install anchor buoys at upstream and downstream ends of control points.



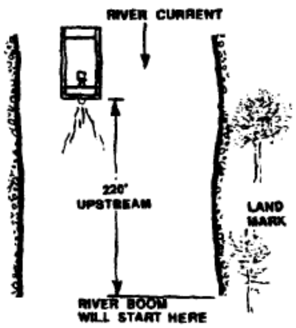
Step 2

Connect two CPA anchors together on work barge deck with appropriate cable. Anchor chains and anchor marker buoys together.



Step 3

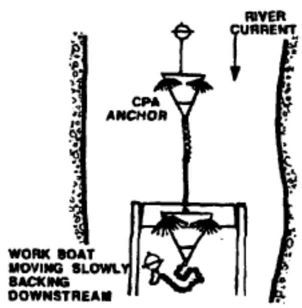
Mark approximate location where river boom will be deployed using a fixed landmark. Move upstream approximately 200 feet.



Important – Never set anchors out farther than the maximum deflection angle and boom length allowed by the current conditions.

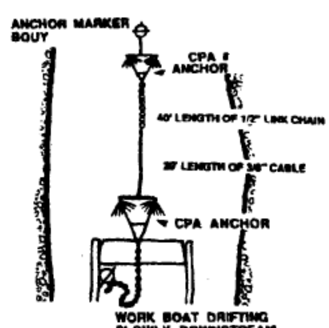
Step 4

Put out anchor marker buoy, deploy front SPA anchor, once anchor is on bottom workboat slowly drifts downstream – do not get the or rope into teeth of anchor.



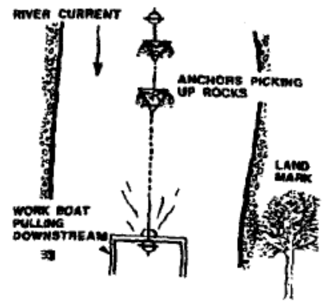
Step 5

As chain from front CPA anchor tightens, start deploying rear CPA anchor. Be careful not to tangle rope or chain into anchor.



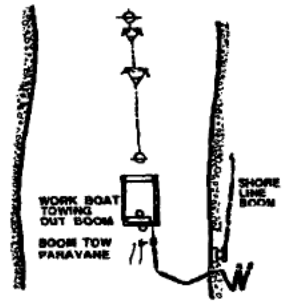
Step 6

After both anchors are in river, hook work boat onto anchor cable marker buoy and start pulling anchors downstream to set them.



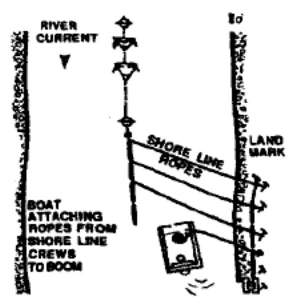
Step 7

After the CPA anchors are set, tow the river boom to the anchoring cable for attachment.



Step 8

After the river boom is attached to the anchor, attach shoreline ropes or cables to the boom.

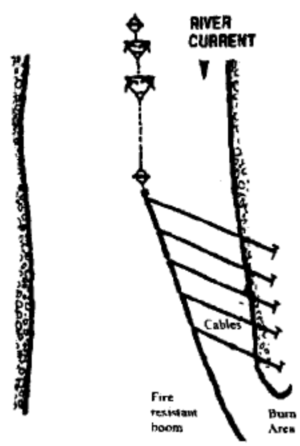


Step 9

After the shoreline ropes or cables are attached, pull the boom toward the shore. Ensure that the angle of the boom doesn't exceed the critical angle.

Step 10

Burn is conducted once boom is in place. After the burn is complete, boom and anchors are removed and all equipment cleaned and returned.



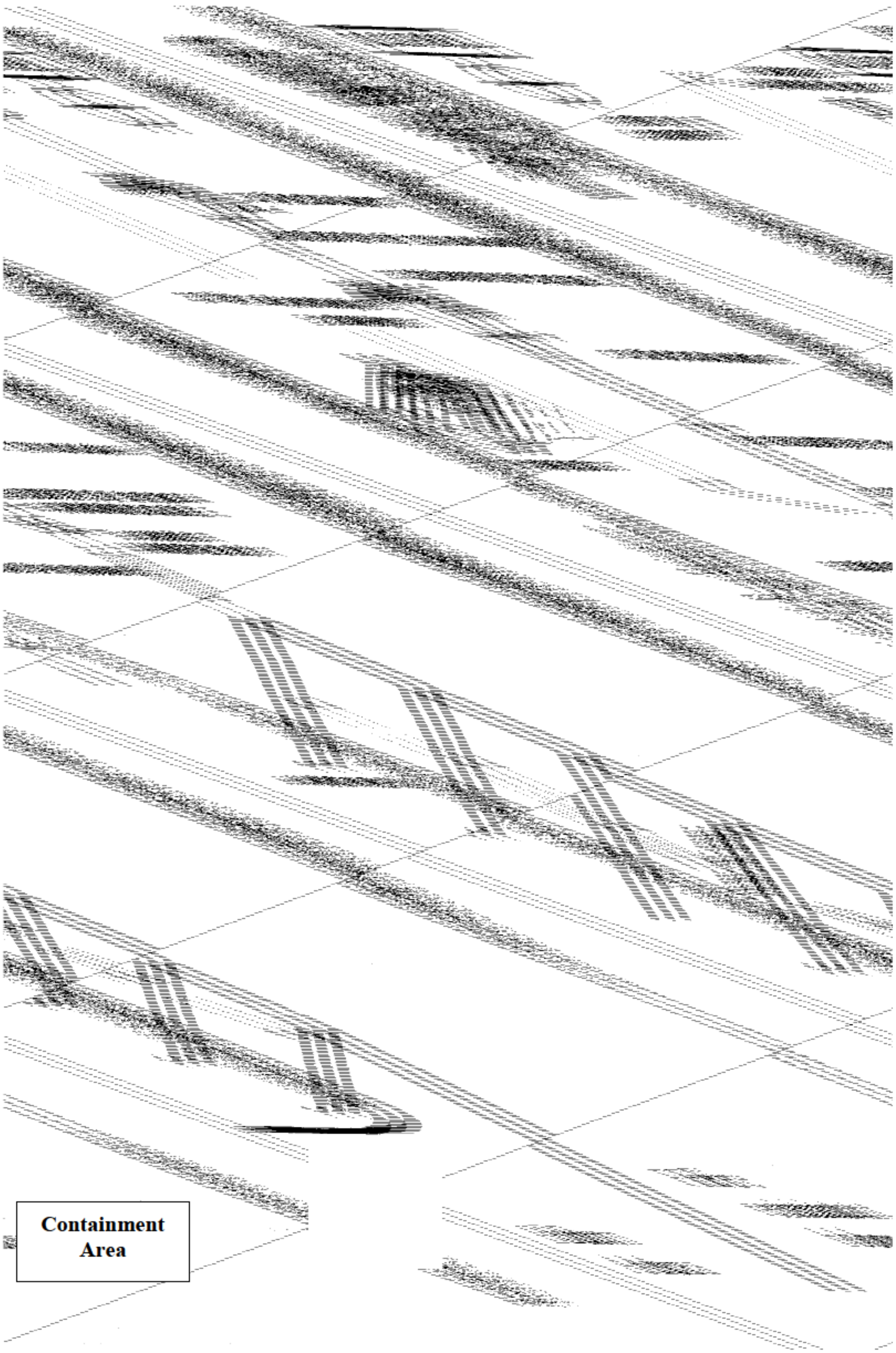


Figure 5-11. River boom deployment schematic.

CHAPTER 6. SKIMMING TECHNIQUES

Environmental damage and cleanup costs are much more extensive once oil drifts ashore dictating that every effort should be taken to collect the oil while it is still on the open water before beaching. The figures in this section are not complete enough to show all of the details of a particular technique or skimmer. The manufacturers will be able to provide additional details concerning individual units. General information about skimmers that have been designed and evaluated is contained in reference (Schulze, 1998). The ASTM evaluation is contained in Appendix L. Environmental conditions will vary so planning and training should be conducted to determine which individual methods works the best for the typical scenarios expected to be encountered.

6.1 Fast Water Skimmers

High-speed skimmers are devices that can collect and remove oil from the surface water flowing at a relative velocity of one knot or greater to the skimmer. They can be used in a stationary mode in swift currents or as high-speed advancing skimmers. Several representative types of skimmers are presented that have proven successful at oil removal in fast currents. Inclusion of a skimmer type or brand is not an endorsement of that skimmer or company. Exclusion of any type or brand of skimmer does not necessarily mean it cannot be effective in swift currents.

6.1.1 V-shape Boom with Attached In-line Skimmer

The V-shape boom shown in Figure 6-1 is kept in shape by nets attached to the foot of the boom. Faster skimming speeds are attained by attaching an in-line skimmer to an open apex. The boom can be deployed in a VOSS configuration with outriggers or towed by two smaller boats. V-Shape boom is built by NOFI Tromso AS and is sold by All Maritime of Bergen Norway as the Vee-Sweep™. A similar product called Fast-Sweep™ is manufactured by Oil Stop, Inc. of Harvey Louisiana. A variety of floating skimmers can be placed within the closed apex if an in-line system is not available. A vessel using a similar arrangement is shown in Figure 6-2.

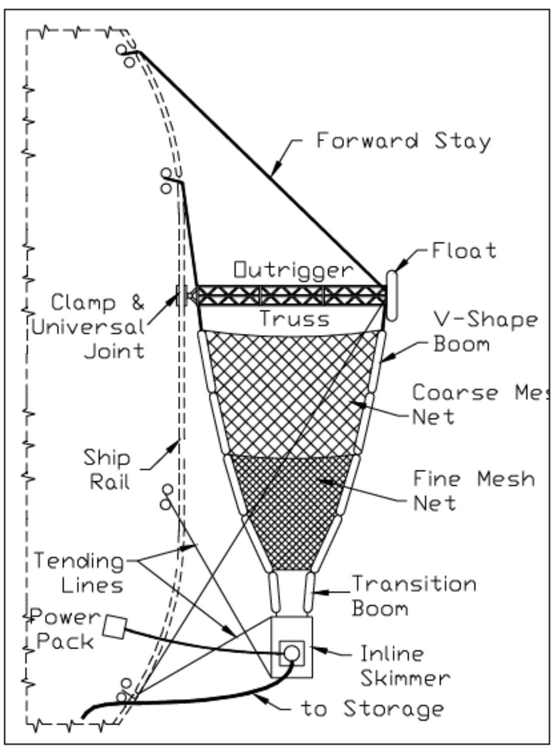


Figure 6-1. In-line skimmer attached to V-shape boom in VOSS configuration.

Figure 6-2. USCG VOSS system.

6.1.2 V-shape Boom with Tapered Channel Separator

A wide mouth (20-meter) V-shape boom keeps its shape in fast water by a net attached to the bottom of the skirt. A tapered separation channel and storage area capable of holding 20 metric tons is attached to the open apex of the boom. This system is designed to operate at speeds up to four knots either moored in a current or advanced by two vessels as seen in Figure 6-3. This maneuver is very difficult unless practice and training are conducted with the individual vessels and their operators. The inflatable boom has a high freeboard and reserve buoyancy that is suitable for use offshore, in bays and on large navigable rivers with waves. It can accommodate several different types of floating skimmers in the temporary storage chamber or it can be used without a skimmer. The storage chamber has a slotted fabric bottom that regulates water escape out the bottom and limits oil entrainment escape. Caution must be taken to prevent the net from snagging the bottom in shallow water. The system was tested at Ohmsett in 1999 and collected over 88 percent of the oil encountered in calm conditions at 3.5 knots (DeVitas, Nolan, and Hansen, 2000) (see Figure 6-4). The equipment was also evaluated by the Canadian Coast Guard in February, 2000 (Counterspill Research, 2000). The qualitative tests indicated that the system could operate in 20-knot winds and at speeds up to 4-5 knots. It is produced by All Maritime of Bergen, Norway and is distributed in the United States by Applied Fabrics Technologies, Inc. of Orchard Park, New York.

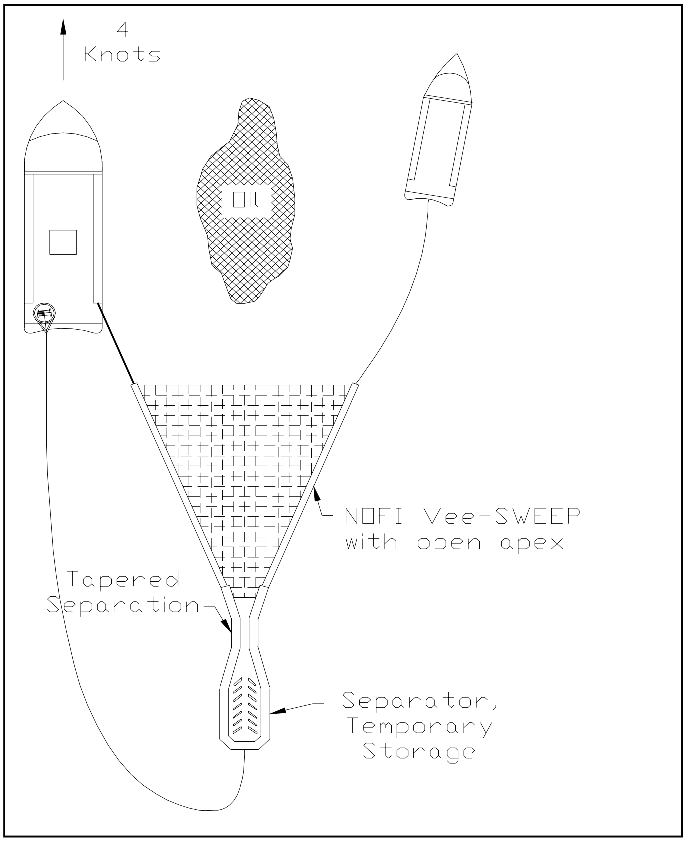


Figure 6-3. The NOFI Vee Sweep™ with tapered channel separator.

Figure 6-4. NOFI Current Buster™ in Ohmsett tank.

6.1.3 Wide-Mouth V-Shape Boom

Using Cross Bridles with Attached Skimmer

Wide-mouth boom can also be held in shape with cross bridles (Coe and Gurr, 1999). These should be fabricated of premeasured chain or wire cables. They can be used as advancing collection systems with attached skimmers and anchored in currents as seen in Figure 6-5. This is a difficult configuration to safely deploy in higher currents. A shallow-draft transition boom allows water to escape thus reducing the flow velocity of oil into the attached skimmer. A self-propelled skimmer can tail behind the boom in lieu of the attached skimmer when being operated in an advancing mode.

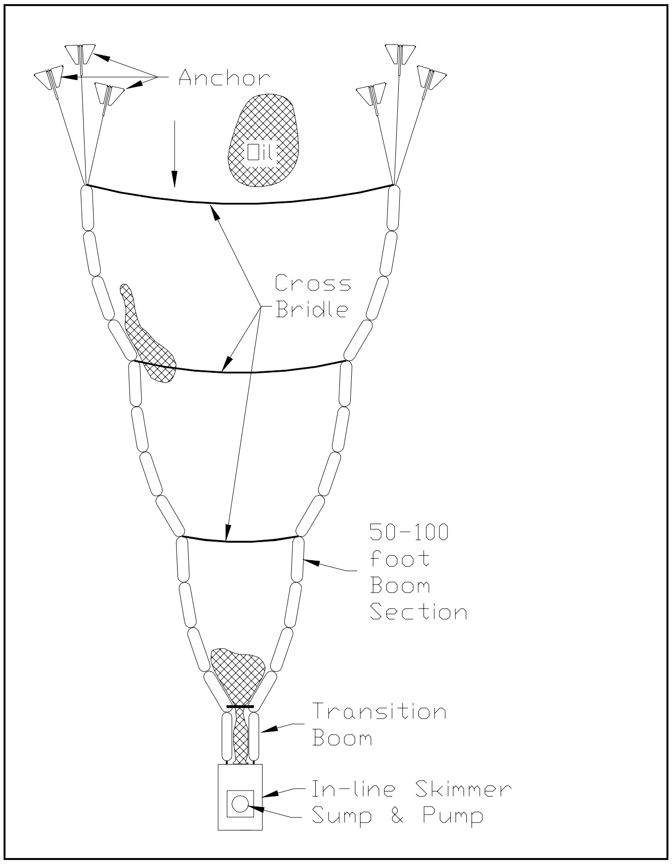


Figure 6-5. Wide-mouth V-shape boom with attached skimmer.

The speed limitations are dependent upon the angle of the boom and the effectiveness of the skimmer. The liability of this type sweep system is that the long bridles take time to deploy and can also snag on the bottom. Bridles may also cause discontinuities in the boom shape causing eddies and premature oil entrainment where they attach to the boom.

Using Boom Deflectors and a Trailing Skimmer

Wide mouth V-Shape containment systems that use boom deflectors (see Section 5.5 Boom Deflectors) to keep their shape have several advantages over the bridle system. There are no long bridles to snag on the bottom or to rig during deployment. This allows the sweep to be deployed more quickly. The design also provides more flexibility and maneuverability for the boats to open and close the mouth of the sweep as required for oil collection or debris avoidance. When a trailing skimmer configuration is used, two drogues are needed at the end of each boom to provide resistance to keep the boom from forming a U-shape at the apex opening, Figure 6-6. The trailing skimmer collects the oil that is concentrated by the deflection boom. This assists with maneuverability of the system and offloading logistics. The self-propelled skimmer can also tow a barge or temporary storage device for added capacity. Short 50-foot sections of boom are required with boom deflectors for optimum performance. Trained personnel should determine towline and boom lengths using the actual equipment involved.

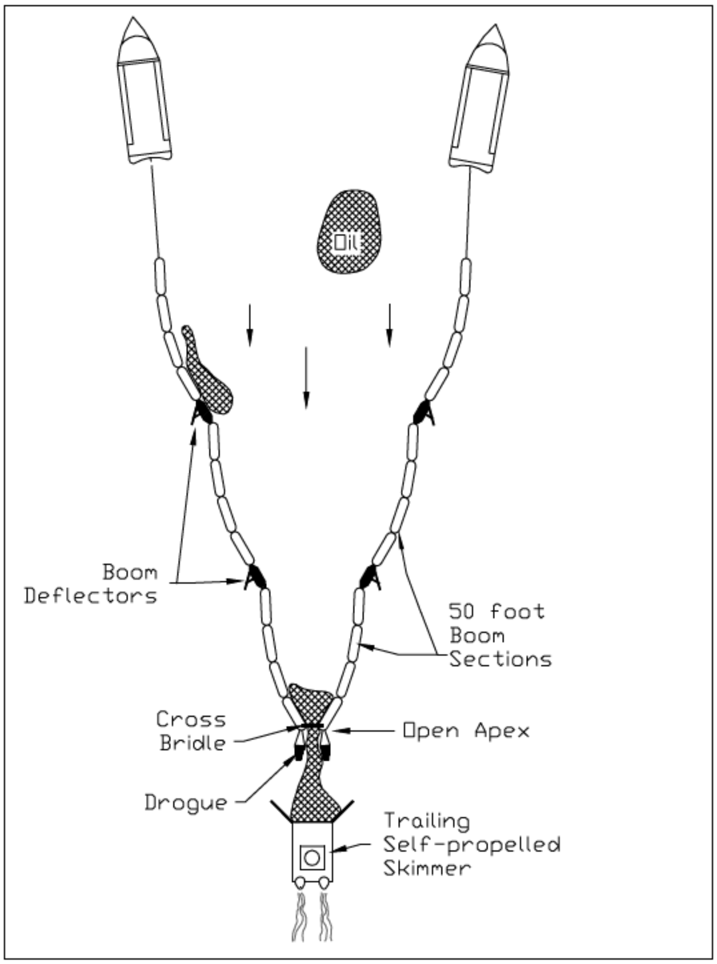


Figure 6-6. Boom deflectors and wide-mouth V-shape sweep systems.

6.1.4 Inclined Plane

Inclined or submergence plane skimmers force the oil to follow an incline below the surface of the water. The buoyancy of the oil causes the oil to rise and separate from the surrounding water. These skimmers are usually more effective in waves because the oil is displaced from the surface of the water before separation. Both light and viscous products are collected efficiently. There are two types of inclined plane skimmers, static and dynamic, as seen in Figure 6-7.

Static Inclined Plane

The static inclined plane skimmer consists of a fixed incline at the bow. It separates oil during three phases while advancing or held stationary in a current. It can operate in 1 to 5 knots and is effective in both light and viscous oils. It is not effective in static conditions. If the oil is very dense, it may go under the collection well during high-speed operation due to its limited buoyancy. The skimmer, as shown in Figure 6-8, uses a hydrodynamic induction bow foil that assists with oil entry down the plane. It helps reduce bow wave interference. At speeds above 3 knots, operation is recommended without deflection boom or with a short shallow-draft deflection system. The Hydrodynamic Induction Bow (HIB) skimmer has no moving parts except for the pump, so reliability is high and maintenance is low. It can be configured as a VOSS skimmer with or without a side sweep system, as an inline skimmer in the apex of a boom or as a self-propelled unit. Hyde Marine Inc, of Cleveland, Ohio, distributes it as the Hydrodynamic Induction Bow (HIB) skimmer. It is available in several lengths and displacements, however, it cannot be used as a portable skimmer.

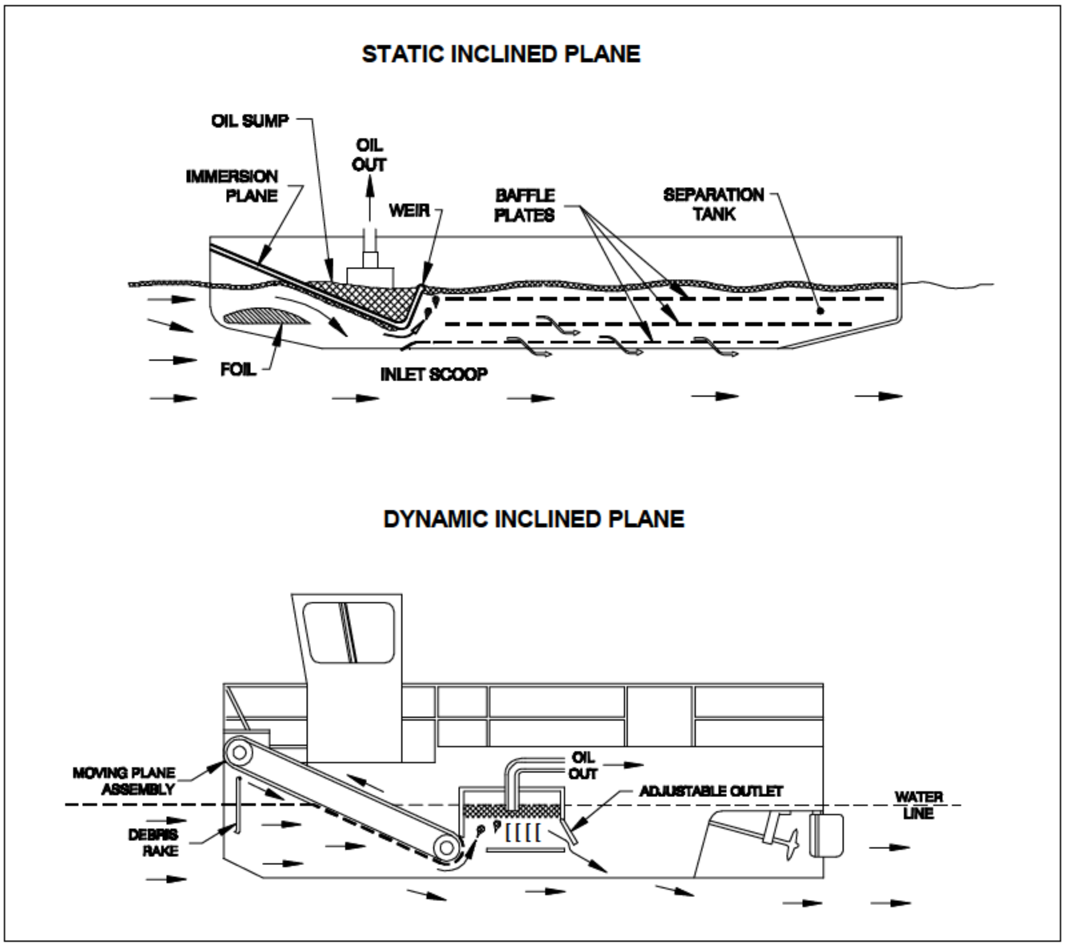


Figure 6-7. Inclined plane skimmers (static and dynamic) (Coe and Gurr, 1999)

Figure 6-8. 28-foot HIB static inclined plane skimmer.

Dynamic Inclined Plane

The dynamic inclined plane (DIP) skimmer operates at 0 to 4+ knots. A belt is rotated down the submergence plane at the speed of the vessel over the water. This facilitates the flow of oil down the incline and up into the collection well. Although the belt adds mechanical complexity, it allows oil to be collected in stagnant water by inducing flow to the collection well. The DIP has shown to be most effective with heavy oils by collecting over 90 percent of heavy Sundex oil at Ohmsett at speeds up to three knots (DeVitas, Nolan and Hansen, 2000). If the oil is very dense, it may go under the collection well during high-speed operation due to its limited buoyancy. The dynamic inclined plane skimmer is commercially available through Slickbar of Seymour, CT. It has been produced as a self-propelled or drag-along design in various capacities and displacements.

There are many configurations of the DIP skimmer ranging from small portable units to large ships. The USCG recently procured six DIP skimmers for the USCG VOSS (although they are not operational at this time). These High Speed Skimmers attach to the apex of the Fast Sweep™ V-shaped boom (Figure 6-1) as an in-line skimmer (Figure 6-9) in rough water conditions as tested in Ohmsett. A shallow-draft transition boom is used to attach the sweep to the skimmer.

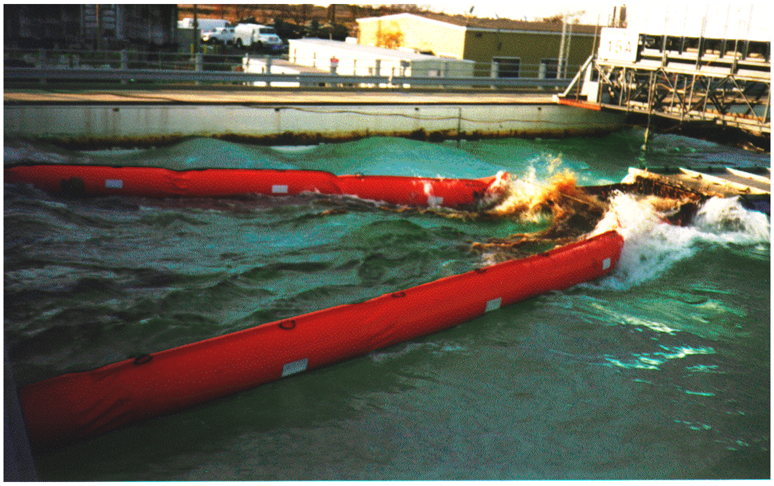


Figure 6-9. Fast-Sweep™ boom with USCG high-speed DIP skimmer.

6.1.5 Rope Mop Zero Relative Velocity (ZRV)

A rope mop consists of oleophilic fibers that are woven into a rope that floats on the surface of the water. A set of ropes is suspended between catamaran hulls as seen in Figure 6-10. They are propelled between the side hulls at the speed of the vessel over the water. Oil adheres to the rope and it is brought aboard where water continues to drop off along the way. The oil is then completely removed from the rope when it is pressed as it goes through a wringer up near the bow of the skimmer. They can recover oil over a wide viscosity range but are most effective with medium to heavy viscosity oils. Mops function well in a variety of wave conditions, in debris and broken ice and are more efficient when recovering heavier oils.

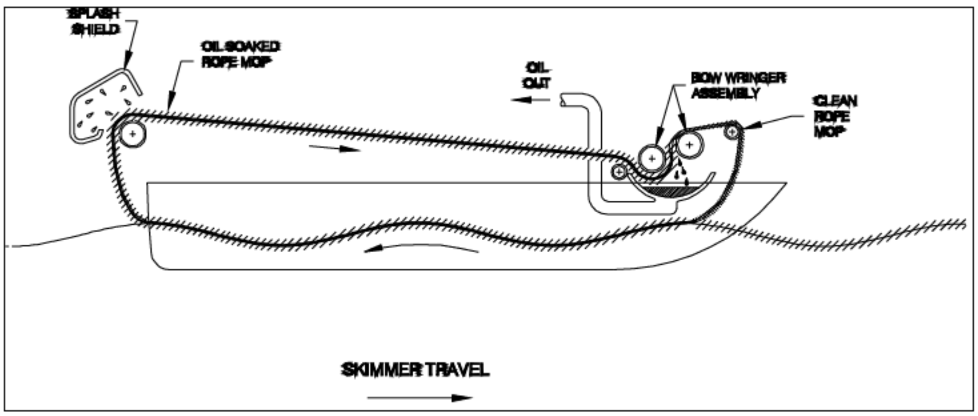


Figure 6-10. Typical rope mop ZRV design (Coe and Gurr, 1999).

Although there have been several types of ZRV skimmers (belt and rope) developed over the years, only the rope mop ZRV is commercially available today. Ro Clean/Desmi A/S of Odense S, Denmark produces a variety of Pollcat rope mop ZRV skimmers in multipurpose workboat configurations. Oil Mop Inc. (OMI) of Belle Chasse, Louisiana also manufactures a variety of these skimmers including smaller portable units.

A prototype rope mop system call the Stream Stripper was developed by Ro Clean/Desmi and tested at Omsett in 2000 (Hansen et. al, 2001). It is a lightweight system that is 19 feet long and has 13 mops mounted between two catamaran hulls. The mops can be powered by a paddle wheel mounted at the stern or a hydraulic motor mounted at the bow. Throughput efficiency was over 80 percent for heavy oil at three knots. At four knots, the paddle wheel arrangement recorded TE performance of over 60 percent. It is not commercially available.

6.1.6 Expansion Weir

The expansion weir uses several methods to remove and separate oil in a fast current. A diversion boom funnels oil into the narrow mouth of the skimmer. A surface slice is taken using a deflector to separate the concentrated oil from the water below. The water is forced to expand into a larger collection area that causes the velocities to slow, facilitating gravity separation of the oil. A floating weir lip further separates the oil from the water in a sump in the aft section of the skimmer where a pump or suction hose removes the oil. Water exits just forward of the weir towards the rear of the skimmer, which is controlled by a manually adjustable hydroplane. Vikoma International of Isle of Wight, United Kingdom manufactures the Fasflo skimmer (Figure 6-11). Two different sizes are available for rivers and coastal applications. This system was evaluated at Ohmsett in 1999 and performed well up to 2 knots (Devitas, Nolan, and Hansen, 2000).

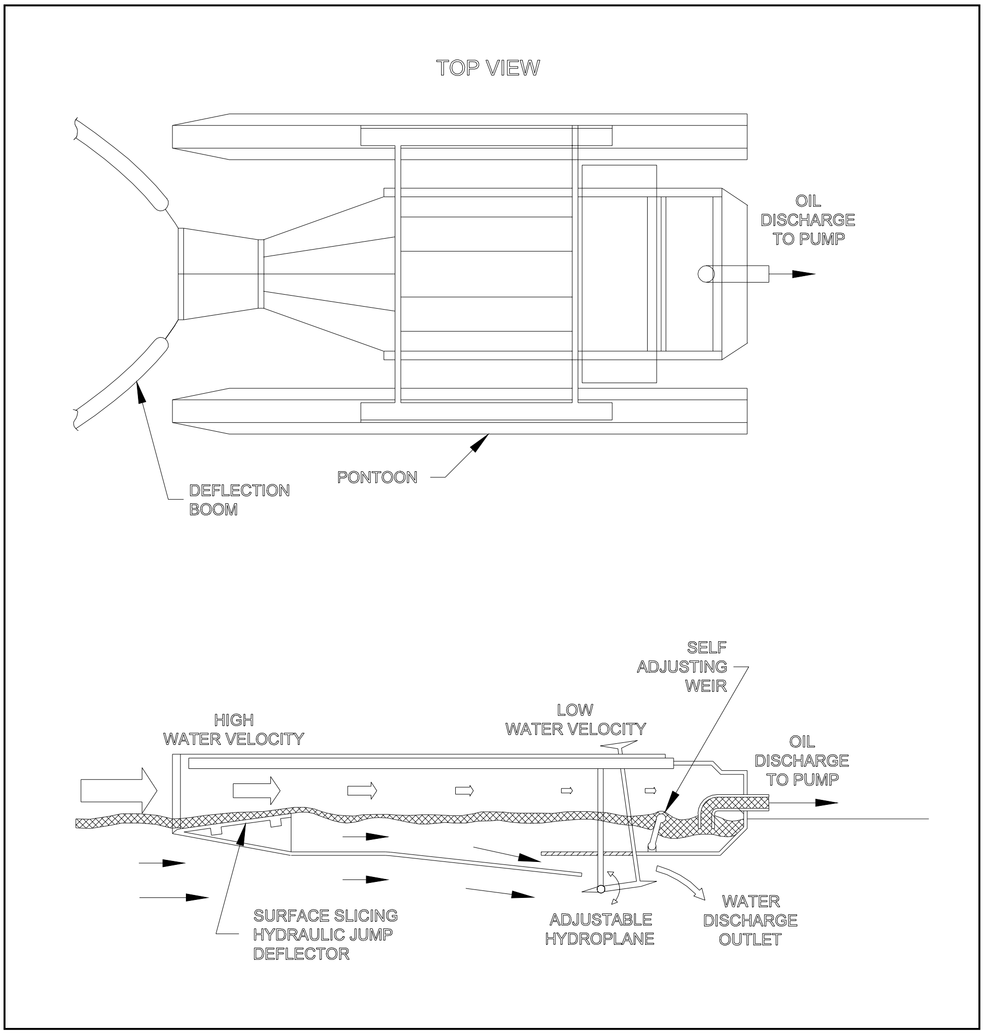


Figure 6-11. Fasflo expanding weir skimmer (top and profile view).

6.1.7 Circulation Weir

A quiescent zone circulation weir skimmer called the Blomberg High Speed Circus can be used for high-speed sweeping or as a stationary system deployed in fast flowing waters to collect and concentrate oil in an artificial lagoon that facilitates oil recovery with a high recovery efficiency (PROSCARAC, 1992). It is operated as a rotation chamber for oil/water separation. The Circus is used with a boom off one side that deflects oil into the circular lagoon as seen in the VOSS configuration, Figure 6-12. The boom was recently developed by Blomberg Offshore AS of Frolunda, Sweden. It is distributed in the United States by QualiTech Environmental of Chaska, Minnesota and overseas by ORC of Frolunda, Sweden.

Figure 6-12. Blomberg High Speed Circus on a VOSS.

The shallow guiding boom has a draft about one half the height of the entrance opening in the side of the skimmer and the skimmer has a bottom plate that prevents fast flowing water below it from entraining the oil out of the protected lagoon. This configuration allows the water to exit under the boom while oil remains in a circular pattern on the surface (Figure 6-13). The oil is forced to the center of the lagoon where it is removed by a floating weir lip attached to a positive displacement screw pump or suction hose. This system is designed to function in 0.5 to 3-knot currents and is available in several sizes. It can also be used on the side of a riverbank, bulkhead or along a coastal area. The concept has also been incorporated into a catamaran vessel. This system recovers oil that enters between the hulls using deflectors to divert oil into two hull quiescent chambers. It is also equipped with an automated debris removal system as a dual-purpose vessel. A small version of this system was tested at Ohmsett with good results at 2 knots (DeVitas, Nolan, and Hansen, 2000).

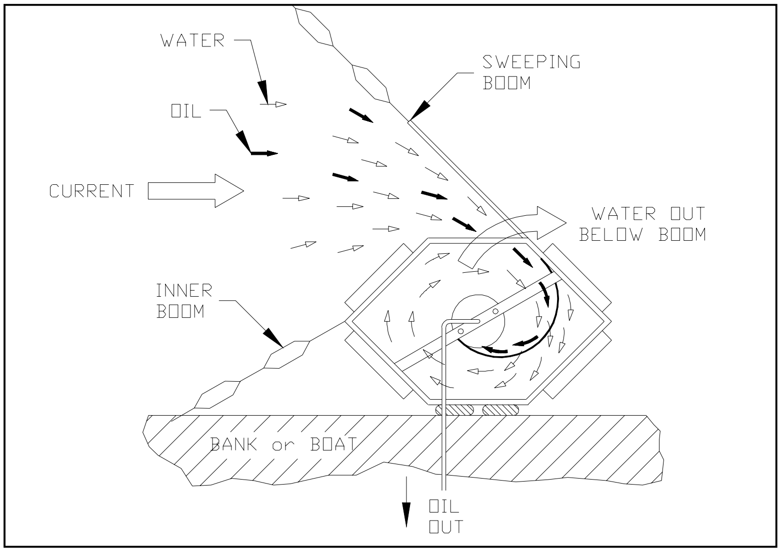


Figure 6-13. Blomberg High Speed Circus shelters oil from the current.

6.1.8 Recovery Channel with Conveyor Brush

The Lori skimmer uses an oleophilic brush-conveyor system that rotates up into the slick to pick up oil and debris on the bristles of a brush. Several continuous loop brushes are mounted on chains. Oil is scraped and squeezed off the brushes by finger-like cleaners at the top where the oil is gravity fed into a sump and storage tank. The skimmer is effective in higher currents because the area where the brushes contact the oil is protected from entrainment in a recovery channel that has a bottom plate. The oil is deflected into the channel by the hydrodynamic flow of the water through the rotating brush conveyor. Clarified water recirculates back to the collection area. The channel is located inside a dedicated skimming vessel (Figure 6-14), or inside a removable side collector unit for VOSS applications. These skimmers are effective in currents up to 3 knots. They recover heavy oil and emulsions very well, but are less effective in light and medium viscosity oils (Mar, Inc., 1994). Recovery efficiency is high and brush skimmers are not adversely affected by waves. The Lori Skimmer is manufactured by Oy LMP Patents Ltd. AB of Loviisa, Finland and distributed in the United States by Hyde Marine, Inc. of Cleveland Ohio.

Figure 6-14. Lori Brush Skimmer in dedicated skimming boat.

6.1.9 Lifting Filter Belt

A lifting belt skimmer uses a porous oleophilic belt that rotates oil up an open incline. An induction pump behind the belt helps draw the oil into the system as water passes through the belt and oil is deposited on it, Figure 6-15. The oil and debris are scraped and squeezed off the belt at the top where oil flows into a collection well and a screen catches debris. The flow created by the induction pump also permits oil collection in still water. These units, manufactured by Marco Pollution Control of Seattle, Washington, are usually self-propelled advancing skimmers. They can skim up to 3 knots but effectiveness drops off above 2 knots. The downward slope of the belt tends to force the skimmer down into the water at higher speeds (Lichte and Breslin, 1998). The type of oil that these systems can handle is dependent upon the belt that is installed.

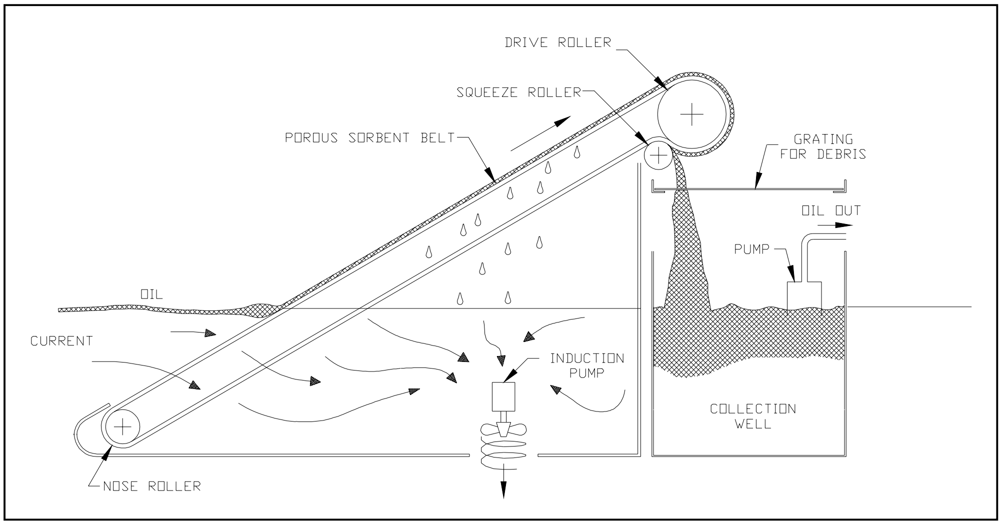


Figure 6-15. Filter Belt™ skimmer design.

CHAPTER 7. SPECIAL CONDITIONS/ALTERNATE TECHNIQUES

There are some conditions in which standard booms cannot be used. These include areas with ice or other debris or obstructions. This chapter describes some alternate techniques that may be useful in those situations. More information on responding to spills around ice is contained in references (Coe and Gurr, 1999) (Arctic Council, 1998).

7.1 Oil Under Sheet Ice

The scenario to remove the oil is to deflect it to a collection trough or opening cut in the ice. A current meter can be inserted into these holes sequenced across the river to determine the current profile for selection of the proper boom and slot diversion angles to prevent oil entrainment. Current measured just below the ice should be used for determining the deflection angle used (see Figure 3-1). Exploratory holes should be drilled to determine the proper bearing capacity of the ice sheet using the appropriate safety chart before heavy equipment or personnel are deployed. Oil velocity under and adjacent to the ice is less than the average water velocity below it.

7.1.1 Trenching Ice

The technique of cutting long slots approximately four feet wide through an ice sheet 28-inches thick at a 30-degree or less angle to the current has proven to be an effective method for capturing oil flow under a thick sheet in a one knot current (Figure 7-1) (Allen, 1979). The oil flows down the slot to the downstream end where it can be recovered with a skimmer. A second slot angled to the opposite side of the river will provide complete coverage. Usually a chain saw with a 48-inch length is needed to cut the ice. The engine may need extra care to be protected from getting wet. The effectiveness of oil collection in slots cut in thin ice in the field is unknown. However, cutting slots in thin ice will alter its structural properties and should only be done using extreme caution (Figure 7-2).

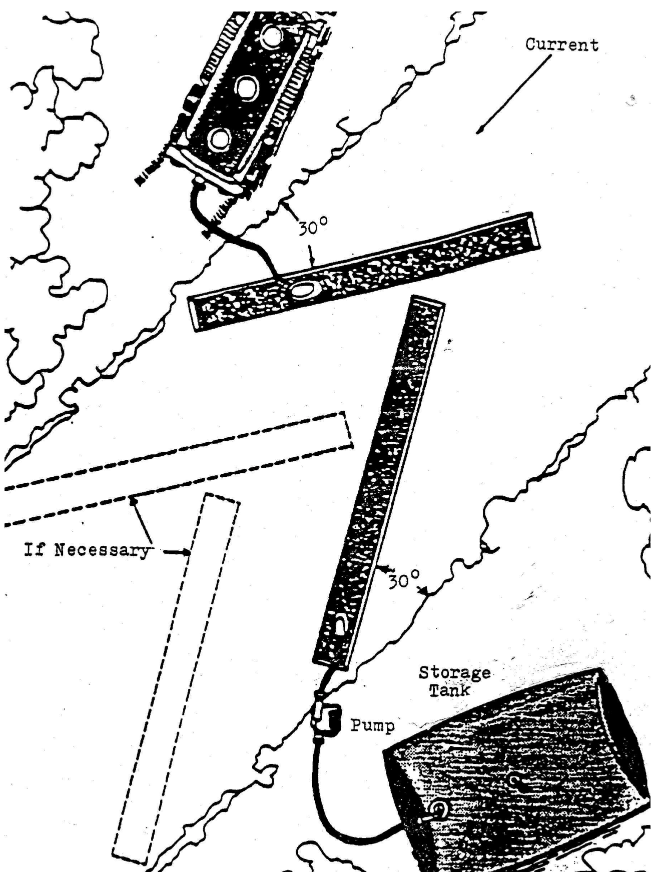


Figure 7-1. Slots cut in ice for oil recovery.

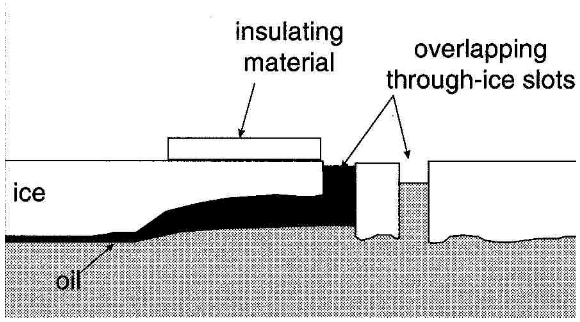


Figure 7-2. Cross-section of ice slots.

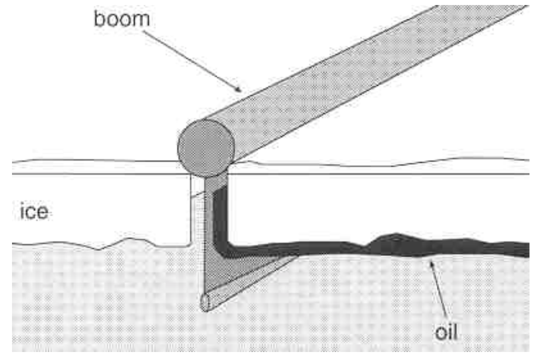


Figure 7-3. Boom deployed in ice slot.

Plywood or booms (see Figure 7-3) can be used as diversion booms in sheet ice. Two 2 by 4-inch boards are nailed on opposite sides along the length of the sheet at the desired height of the boom. A diversion slot is cut perpendicular to the ice sheet slightly larger than the width of plywood sheet thickness. The sheets are then slid into the slots so that they extend approximately one foot into the water below the ice. This technique can be used to divert oil into the ice slot described above or to shore where the ice is cleared for collection and skimming operations.

7.2 Oil in Broken Ice

The strategy response to oil in broken ice is similar to that used in debris conditions. Inflatable boom is susceptible to punctures from sharp corners on the ice, so foam-filled boom or rigid structures are recommended. The coverage of broken ice on water may prevent the use of conventional boats. Boom fabricated from logs have been used in a diversionary mode to create a clear area for oil containment with conventional boom downstream on small rivers with light ice cover (Telford and Quam, 1979).

7.3 Sorbent Applications

Conventional sorbent boom is used for recovery of trace amounts of oil and sheen in stagnant or slow moving water or as some call it, a "polishing technique." They are typically made with limited strength that cannot withstand drag forces associated with swift currents. Their conventional cylinder boom floatation design limits oil collection due to the freeboard and draft away from the thin oil contact waterline and the blocking effect of oil laden sorbent material. Very often only about a one-half inch strip of sorbent near the waterline on the upstream side absorbs oil. Oil is then blocked from penetrating the sorbent material and it entrains under the boom at currents above 0.7 knots as it starts to accumulate in the apex of the boom. Standard melt blown polypropylene (MBPP) boom or pad only picks up seven percent of its total oil sorption capacity while dragging out up to ten times its weight in water. The majority of sorbent material never sees the oil. Mostly water is absorbed or trapped in the boom sorbent material adding weight and drag to the system. Operators find it very difficult to remove water and oil saturated sorbent boom due to its tremendous weight.

Shorter draft is better when it comes to deflection boom. The objective is to move the oil on the surface, not block and deflect the water below it. In the deflection mode at steep angles, oil will not build up against a deflection boom, but it will move downstream against it close to the boundary layer. Shallow draft sorbent boom can be used to deflect oil in high currents. Sorbent deflection boom that is reinforced with a tension member has proven effective deflecting oil in currents up to three knots with deflection angles much larger than predicted. Tests have also been carried out on sheet type sorbents and have shown them to pick up twice their weight in oil at speeds up to three knots (Hansen, DeVitis, Potter, Ellis and Coe, 2001). The sheet boom is designed to reduce drag and increase the surface area contacted by the oil (Figure 7-4). These are made by MYCELEX Technologies, Inc. of Gainesville, GA.

Sorbent sheets or pom-poms can also be used in some situations. If moderate currents exist, these can be staked into the ground and recovered on the next opportunity or tide.

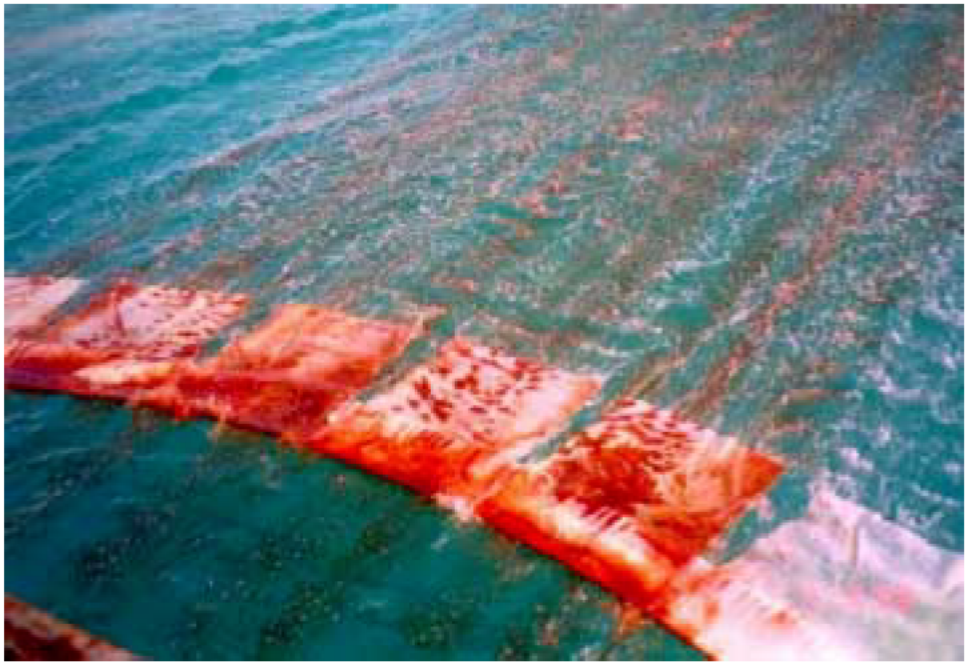


Figure 7-4. Sheet absorbents at 3.5 knots.

7.4 Alternative Methods of Containment or Exclusion

7.4.1 Pneumatic Boom

Pneumatic boom consists of a pipe or hose submerged below the surface of the water that is supplied with compressed air. The air escapes through small holes in the pipe and creates a large number of fine bubbles. The bubbles rise to the surface due to buoyancy, moving water with them and creating a vertical current. The vertical current splits into two currents on the surface moving away from the boom in opposite directions. This surface current will block the approach of oil on the surface of the water as seen in Figure 7-5. Turbulence in the water column can cause oil entrainment.

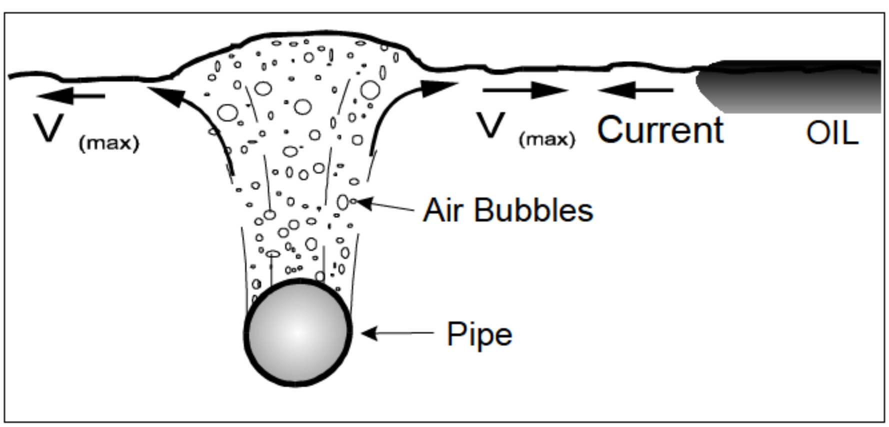


Figure 7-5. Balance of forces between a bubble plume and oil layer.

The maximum surface water velocity, $V_{(max)}$, generated by rising bubbles is related to the airflow rate per unit length of discharge line. In waves, the oil must be kept away from the boom to keep oil from being carried across the boom by orbital motions in the wave field. A current of one knot can be generated with a modest flow rate of two standard cubic feet per minute per foot of discharge pipe (SCFM/FT). This will require 30 hp/ft in 12 feet of water. Airflow rates above five SCFM/FT are not practical because considerably larger and costlier blowers are required to obtain even marginally greater water velocities (Williams and Cooke, 1985). This would require an excessive amount of horsepower, approximately 75 hp/ft. A 1.3-knot current is created with five SCFM/FT (Figure 7-6). The current produced by a pneumatic boom can also be used in a diversionary mode to deflect oil away from sensitive areas or into a containment area. The stagnation line produced will allow most types of floating debris such as pack ice and logs to pass through while maintaining its oil deflection capabilities.

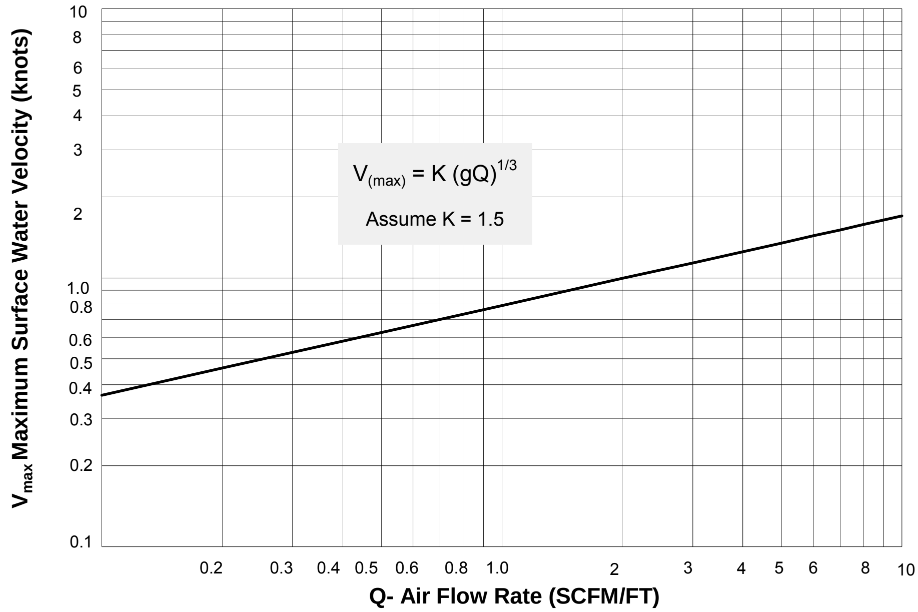


Figure 7-6. Airflow needed for specific currents.

This type of system is best suited for permanent installations around vessel traffic areas or fuel transfer piers for currents less than two knots. This way, it can be ready whenever needed. Regular maintenance is required to keep the air compressor or blower operational and the pipes free from silt. Air pipes on land and near the surface of the water will have to be insulated and/or heated for applications in winter icing conditions. Air bubblers have the added advantage of keeping ice from forming above them if they are kept running continuously. The combination of the warmer water from below that is circulated to the surface by the vertical current and the motion of the water prevents ice from forming.

7.4.2 Water Jet

Water jets can induce surface currents and thereby control the flow and direction of oil movement within certain limitations.

Horizontal

High-pressure water is forced through nozzles that are suspended about one foot above the surface of the water. They can be used perpendicular to the water surface or depressed about 15 degrees (Figure 7-7). Tests conducted showed that both horizontal and depressed spray water jets can contain oil in currents up to 1.2 knots (Laperriere, Whittaker, and Yanagisawa, 1987). The depressed jet, however, required 27 percent less pressure but turbulence could occur if pressure exceeds 1,138 PSI. The water spray system is more efficient than the pneumatic boom system because it creates a surface current in only one direction. The water jet system requires much less power to create the same surface current than pneumatic boom, in some cases ten times the power is required by the pneumatic boom (Comfort, Menon, and Noble, 1979). Control of the water pressure to the jets on the downstream side of the pipe can be used to move the arms into position. Fire and garden hoses can also be used to herd oil into the apex of a boom for skimming.

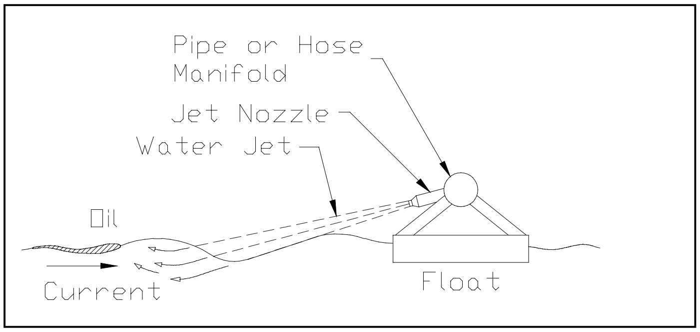


Figure 7-7. Horizontal water jet stops oil in current.

Horizontal water jets can be effective to deflect oil in currents up to two knots in a diversion mode. They may be more effective in permanent installations than deployable free-floating systems. This method may be effective keeping oil out from under piers and low-lying bridges where tidal height fluctuations are less than one foot. They may be most effective as diversion systems suspended in front of high-speed skimmers to concentrate oil into the skimmer and increase its sweep width. Horizontal water jets require maintenance to ensure the jets do not clog or ice up. The high-pressure pump and power pack must also be maintained. Horsepower requirements are approximately three hp/foot of discharge hose with nozzles. Significant logistics are required to transport and deploy equipment needed to use horizontal water jets.

Plunging

A plunging water jet is a high-velocity (35 ft/sec), non-spraying stream of water directed vertically downward into the water. Large and small air bubbles are entrained into the water column. As the air rises to the surface, it creates a vertical current that spreads out in a radial direction on the surface pushing oil away, Figure 7-8. The surface of the water is also higher due to the water entrained by the large bubbles. Small bubbles rise more slowly and continue to contribute to the vertical and radial surface current. Plunging water jets can produce a current that lasts up to one minute. Tests have demonstrated that plunging water jets can be effective as oil deflection devices in front of a high speed skimmer at speeds up to 6 knots (Nash and Johnson, 1981). The jets were most effective when suspended 1.5 to 3 feet above the water. Plunging water jet tests in the St. Claire River, Detroit, were able to divert oil 13 feet in a 4.2 knot current and 35 feet in a 1.6 knot current (Farlow and Cunningham, 1993). Deployment tactics also include boats anchored at a diversion angle with each boat deploying one plunging water jet over the side. This deflects oil in a cascade effect away from a sensitive area or toward a containment area.

Plunging water jets are most effective suspended from vessels to deflect or concentrate oil. They can also be used in permanent installations such as under piers and low-lying bridges to prevent oil passage. They have relatively low power requirements compared to horizontal high-pressure jets and pneumatic boom. Maintenance is required for the pump, hoses and power pack; however, the jets are less likely to be clogged with larger orifices than horizontal jets.

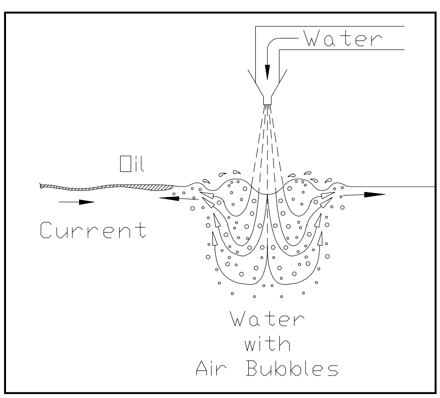


Figure 7-8. Plunging water jet creates counter current to stop oil.

Air jet

An air jet directed at 45 degrees to the surface of the water will move oil on the surface by means of induced water current, Figure 7-9. A linear series of low-pressure air jets supported by a float or suspended by a structure from a boat or skimmer forms a line that will repel oil. The air jet system can be set at an angle to the advancing current in order to divert the oil to a collection system. Air jets directed horizontally can also be used to induce surface currents from a slightly submerged position. Air jet tests conducted from a prototype skimmer required one horsepower per linear foot and showed success at speeds up to 2 knots. However, turbulence was associated with the bow wave of the submerged jet (Freestone, Anderson, and Trentacoste, 1975). Tests of an air jet oil boom were successful in diverting oil at 3 knots with 85 percent efficiency when deployed at an angle of 30 degrees to the current (Cohen, Lindemuth, and Farlow, 1979). In 4-foot waves performance only degraded 5-10 percent. The 33-foot long boom had a shallow draft and low drag. Nozzles were positioned four inches above the surface of the water. The air boom airflow requires low-pressure, high volume air.

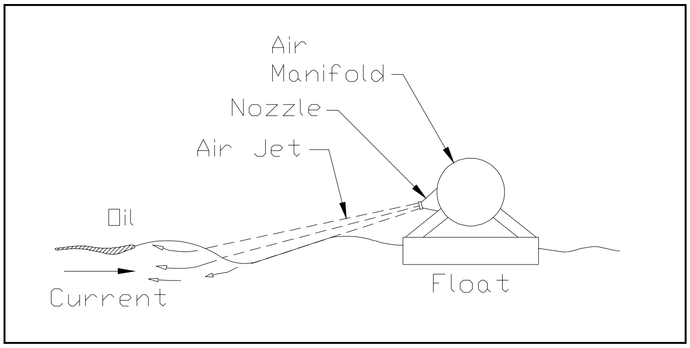


Figure 7-9. Air jet induces water current to stop oil.

This technology is suited for diversion systems in currents up to three knots and in waves. It can be adapted to skimmer systems or used as a stand-alone oil diversion system. Air jets are less likely to clog and fail than water jets and submerged pneumatic boom. Gas powered leaf blowers can be used to move oil away from sensitive areas or into the apex of a boom to facilitate skimming.

7.5 Other Flow Diversion Techniques/Issues

7.5.1 Moored Vessels and Barges

In emergencies when boom is not available, vessels and barges can be substituted to divert current flow and oil into natural collection areas or away from sensitive areas. Generally, bow and stern anchors are required to maintain the desired position. Vessels can be cascaded similar to boom tactics to move oil in the desired direction, Figure 7-10. The vessel should be anchored at an angle to the current to be effective. It will function like a boom and oil will entrain under a boat when the current perpendicular to the hull exceeds approximately 0.7 knots. Use Figure 3-1 as a guide for angle determination at maximum currents expected.

Figure 7-10. Barges deployed on Mississippi River.

7.5.2 Ship Propeller Wash

The water propelled from the stern of a ship or boat while it is moored, will influence the surface current and oil. This technique can be effective to keep oil away from piers, water intakes or other sensitive areas. It is not recommended in shallow areas where the turbulence may mix sediment into the oil causing it to sink. Excessive power may cause turbulence and force the oil to disperse into the water column.

7.5.3 Log Booms

In some river areas, large amount of floating logs may be available. These usually have very little draft so they need to be deployed in multiple locations or with angles shallower than those given for standard boom in Figure 3-1. These can be very useful in capturing debris before it reaches the boom. Boats must be available to periodically clear the debris to permit water to flow under the logs and facilitate oil movement along the boom.

7.6 Flow Diverters

Flow diverters are comprised of a series of paravanes or wing-like hydrofoils positioned vertically. With the control cables anchored, the Flow Diverter (Patent Pending) system can be launched into the current and "flies out" into a steady state angle to the current and deflects the surface water and thus the oil with it.[40] Small debris can pass through them and the oil is diverted according to the angle of attack. Field tests on the St. Lawrence diverted over twice as many plastic pellets as the regular flow into a low current area. A conceptual cascade technique is shown in Figure 7-11 (Eryuzlu and Hausser, 1977). Tests were performed in June of 2000 at Ohmsett. During these tests, four diverters (Figures 7-12 and 7-13) were shown to move oil as much as 19 feet to the side at 5 knots (Hansen, DeVitis, Potter, Ellis and Coe, 2001). This type of equipment can also be deployed from a boat to divert oil into its wake where a trailing skimmer can recover it. More work needs to be done to refine the system because the existing prototype entrains a significant amount of oil at tow speeds over 3 knots. CSC Advanced Marine has teamed with Hyde Marine, Inc. to improve and market this system.

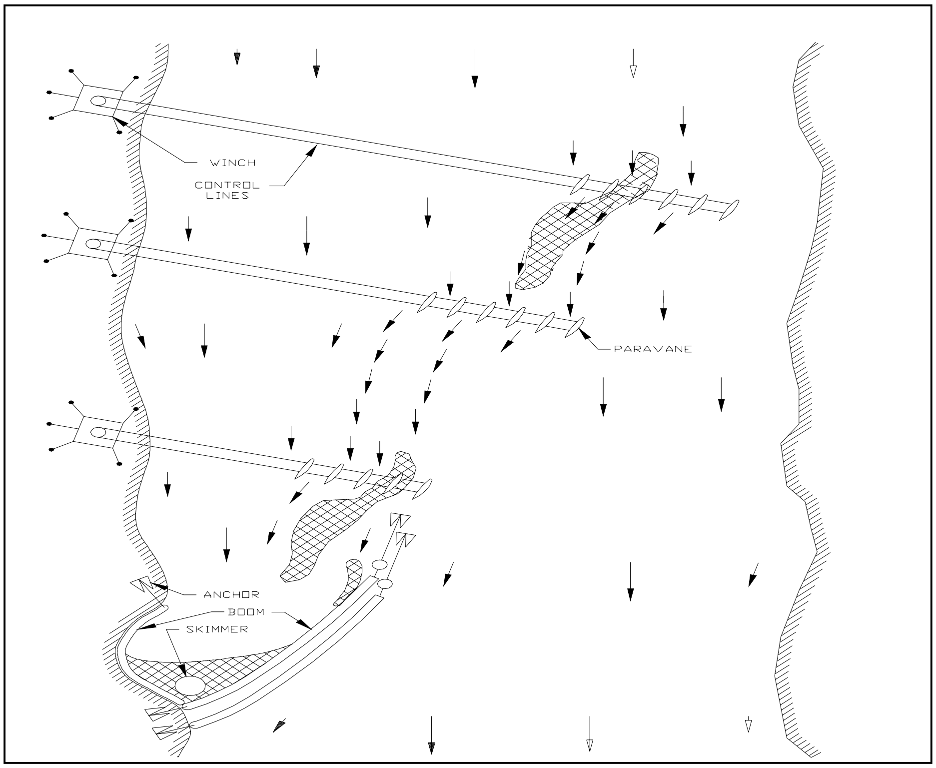


Figure 7-11. Diverters conceptual deployment.

Figure 7-12. Prototype diverters.

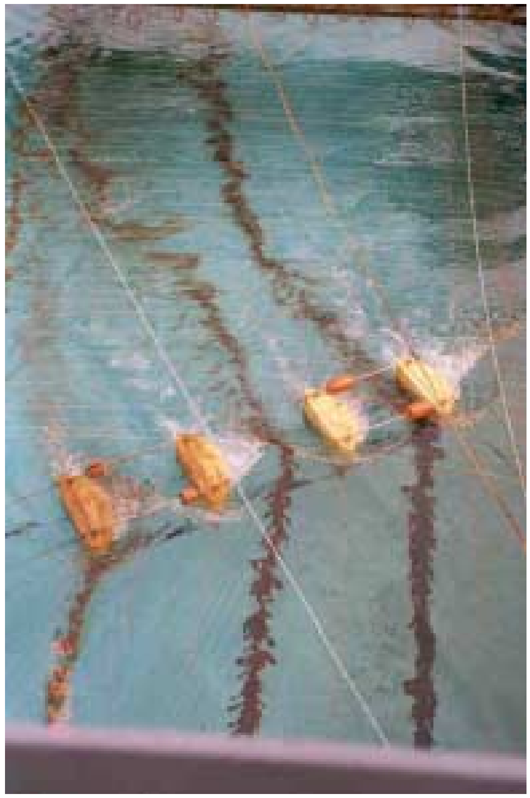


Figure 7-13. Flow diverters at Ohmsett.

7.7 Debris

Tactics are required to contain and remove oil in fast currents with both heavy and light debris. Methods to minimize the oiling of debris and to effectively handle and process this oil-coated debris are presented below (Hancock, Jacobs, and Knapp, 1974).

- Double barriers: Two barriers are deployed in parallel. The first barrier retains debris only while the second barrier retains oil in the quiescence zone between them. Foam filled boom is recommended. Log booms or wire cable can also reduce the amount of debris that a diversion boom may encounter.
- Protective barriers: An upstream barrier that allows water and oil passage but retains debris such as snow fence, chain-link fence and chicken wire can be used with added floatation and/or ballast and attached to the existing boom.
- Diversionary booming: Deflection boom is deployed at an angle to reduce the impact damage from debris. Booms deflect debris and oil to calm water areas for removal and disposal.
- Manual tending: Debris trapped in oil pockets and next to skimmers is removed manually with rakes and nets.
- Debris handling equipment: Cranes, front-end loaders, trucks, barges, automated water intake debris screens and specialized debris handling boats are used for removal of big items and large quantities of oil-soaked debris
- Diversionary water jets and propeller wash: The current moves debris away from collection points.
- Debris and logjams: Diversionary containment boom can be positioned downstream of the jam and collect oil that entrains under the jam.
- Boats: Used to collect debris at a location upstream so that the boom is not threatened.

Transportation of collected debris is accomplished with trucks, boats, barges and sometimes aircraft. The debris must be put in watertight containers or wrapped in plastic to prevent further oil leakage during storage and transportation. Debris should be incinerated near the collection site when a permit can be granted in order to reduce handling costs.

CHAPTER 8. SUPPORT EQUIPMENT

Support equipment in fast-water spill response is geared to delivering and deploying the recovery systems quickly and safely. This requires strong and sturdy equipment to withstand the forces involved in high current situations. Transportation of equipment and debris is accomplished with trucks, boats, barges and sometimes aircraft. Recovered oil must be stored and transported. Good communications between the field teams, other resources and the command center are essential for effective operations.

8.1 Mooring Systems

To form an effective barrier to the oil, containment booms must be held stationary and kept in a fairly straight line without discontinuities that can cause oil entrainment. Small changes in the deflection angle or shape of the boom due to anchor drift can cause the boom to fail due to oil entrainment. Mooring lines that do not stretch under tension are preferred. Whenever possible, anchoring should be done on shore where more control is available for positioning, moving and selecting secure anchor points. Permanent mooring systems should be positioned at critical locations to reduce the amount of time needed to deploy boom. Fixed structures on the shore should be identified or permanent anchoring systems installed. There are a variety of anchors available and their holding power is variable based on bottom type, weight, anchor type, scope of line, and amount of chain. Various configurations of multiple anchors can be used to increase the combined holding power.

8.1.1 Anchoring

Mooring-leg tension should be held close to the bottom to ensure that the anchor holds properly. This is obtained by using the proper scope of line and the appropriate length and weight of chain. Approximately six to eight feet of chain should be attached to the anchor shaft to keep the anchor at the proper angle for digging in and setting properly. Mooring line legs should be at least five to seven times the depth of water in order to hold in swift currents, as shown in Figures 8-1 and 8-4.

The mooring leg should provide a good horizontal restraint to the boom without pulling it down below the surface in swift currents. A buoy is used about 10 feet from the boom to help prevent downward tension. A buoy, paravane or boom guide (see Figure 8-3) can be attached to the leading edge of the boom if additional buoyancy is needed in swift currents. The guides are usually streamlined to prevent turbulence and vortices that will cause oil entrainment. An anchor retrieval line is attached to the crown of the anchor and has a separate buoy. This aids in positioning the anchor during deployment and breaking the anchor free for retrieval. This buoy should be just large enough to keep it from being submerged by the current. The force of the current on a large buoy could cause anchor failure. Permanent anchoring systems should be designed to handle all conditions that may be encountered. Multiple anchors may be required for tidal and ice conditions. When using multiple anchors, it is usually safer to deploy them separately, using the pull of the boat to ensure each is set.

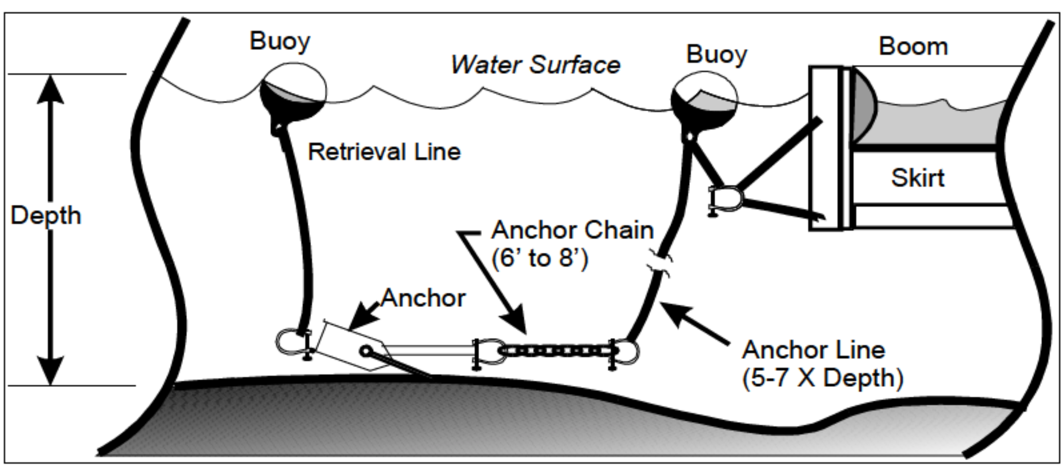


Figure 8-1. Typical boom mooring configuration.

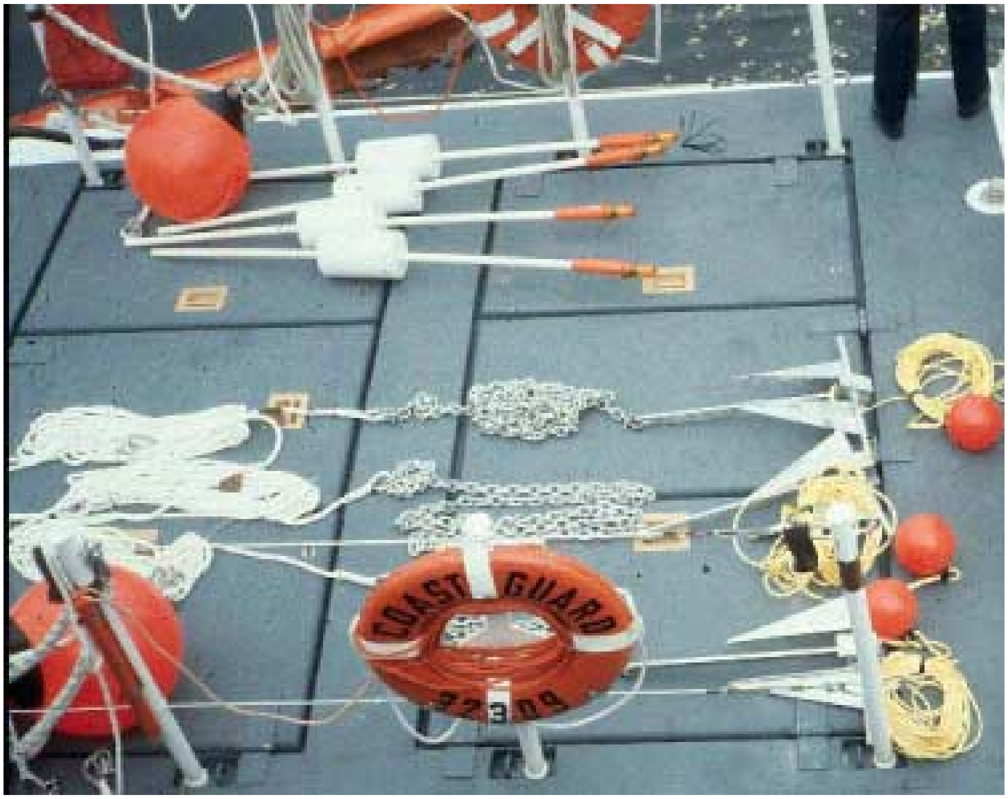


Figure 8-2. Anchor system.

Figure 8-3. Boom guide.

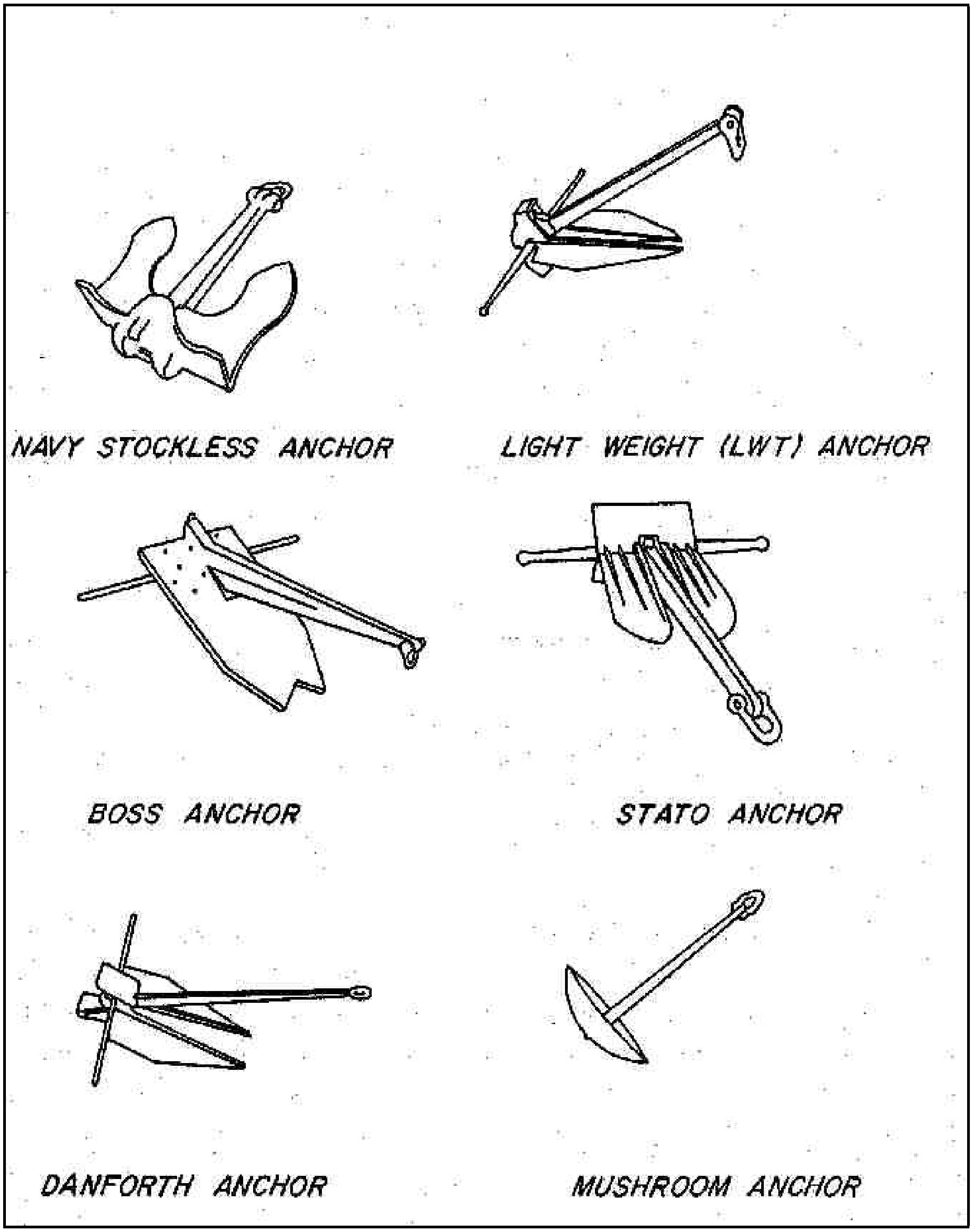


Figure 8-4. Standard anchors (Berteaux, 1991).

The most common anchor found in spill response is an embedment anchor such as the standard steel Danforth®. Specialty type anchors provide greater holding power at lighter weights. Danforth® has specialty anchors such as the High Tensile® and Deepset® that look similar to the standard Danforth® and Lightweight anchor and are more applicable to fast water booming because they have higher holding power and strength. Holding power can be obtained from the manufacturers and some anchors have holding power to dry weight ratios of over 500. Conservative holding power information can be found in Table 8-1 from the U.S. Navy Ship Salvage Manual, Volume 6. Typically, the heavier anchors are used to get the holding power required. Handling the larger anchors is difficult, cumbersome and sometimes dangerous when deploying from a small boat. In some cases, it may be advisable to pay more money for high strength aluminum alloy anchors that weigh about half that of steel anchors with the same holding power. For example, the Fortress FX-55, a 32-pound aluminum alloy anchor rated at 16,000 pounds pullout force, is used by the USCG for offshore boom mooring packages. Some Cooperatives use them for fast-water booming rivers. They take a little longer to settle to the bottom when deployed compared to steel anchors of similar size. Additional chain or lead weights can be added to get the anchor to the bottom faster. Other anchor types available are shown in Figure 8-4. The mushroom anchor is effective in mud. Holding power can be increased by adding more anchors in line or at angles to the mooring line shackle. A three-anchor mooring configuration on a shoreline is shown in Figure 8-6. This configuration will also allow use of lighter anchors making deployment easier ashore or from a boat in the water. A popular anchor used in many river responses is the rake anchor (see Figure 8-5). This type of anchor can provide a better embedment and is less susceptible to failing.

Table 8-1. Anchor holding power as a multiple of dry weight for 100 pounds (U.S. Navy(a), 1990)

Anchor Type	Soft Soils	Hard Soils
Danforth®/LWT	12.6	31.6
STATO/NAVMOOR	27.7	25-33
Navy Stockless	3.5	11

Figure 8-5. Rake anchor.

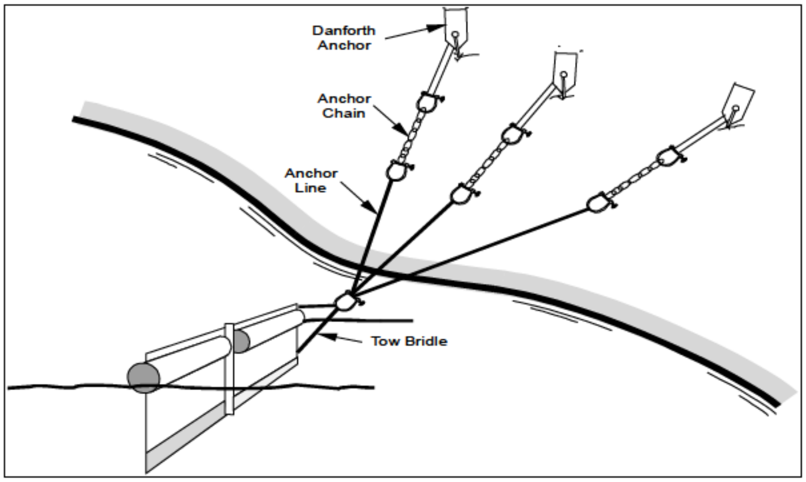


Figure 8-6. Mooring boom with multiple anchors (Alaska Clean Seas, 1998).

Selection of lines is very important for fast-water moorings. Lines that have polypropylene tend to float and thus have less of a chance of snagging on the bottom but may snag debris at the surface. Synthetic lines handle easier than wire so only use wire rope for arrangements that don't require handling or are permanent. Specialty lines such as Kevlar and Spectra may also be used but may be susceptible to abrasion if they don't have a protective jacket. Choose a line that works best for the situation. Some nominal strength values are given in Table 8-2 although the manufacturer's specification may vary. Standard recommendations for working strength are about one-quarter to one-half of these values.

Table 8-2. Nominal breaking strengths (pounds) (U.S. Navy(b), 1990).

Diameter (inches)	Manila	Polypropylene (Three-Strand)	Nylon (Triple Strand)	Nylon (Double Braid)	Polyester (Double Braid)
5/16	900	1700	2300	3400	2400
½	2380	3800	5600	8500	5750
5/8	3960	5600	8910	15200	9000
1	9000	13000	23000	26500	26800
2	22500	32000	60000	74000	69900

8.1.2 Shoreline

Shoreline moorings are preferred over setting anchors in the water because better selection can be made and control is easier. A big rock, tree or man-made structure can usually handle the required load. The next choices are steel pipes, fence posts or T-stock that can be pounded into the soil. These posts are staggered in line along the booming direction and connected to each other with lines to prevent them from pulling out (Figures 8-7 through 8-9). A fence post hammer is effective and safe for pounding in posts. Use a round turn at the base and top of the aft supporting stakes and a clove hitch at the top of the forward stake. A loop of several turns is used around the bottom of the forward post. A D-ring, bowline or sheet bend is used in the loop for attachment of the mooring line. Attaching floats to the mooring lines will help keep them from snagging on the bottom and makes them visible on the surface.

A log about three feet long and at least 6-inches in diameter can be used as a deadman anchor. The deadman should be buried horizontally about three deep into the bank perpendicular to the applied load. The line attached to the center of the log should be trenched into the soil adjacent to the log. Conventional anchors can also be buried to increase their load bearing capacity. Screw type anchors are recommended for rocky shores. Spade anchors are useful for attachment of boom tending lines that lead to the shore.

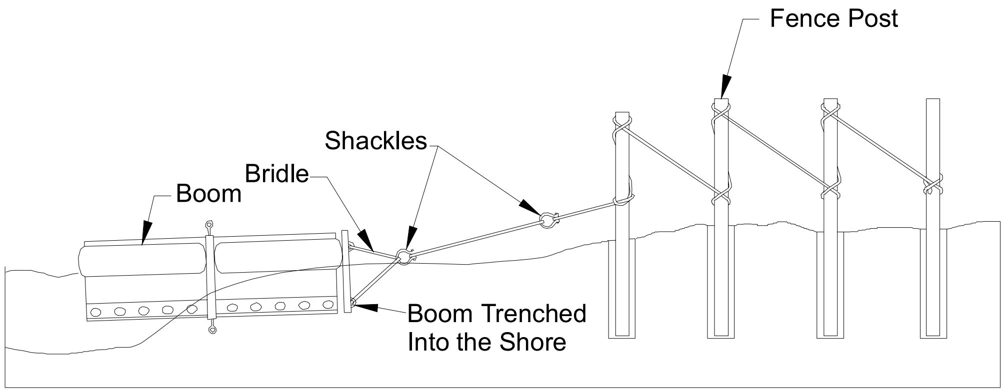


Figure 8-7. Typical shoreline boom mooring system using posts (Alaska Clean Seas, 1998).

Figure 8-8. Multiple anchors used to moor boom.

Figure 8-9. Multiple booms being anchored (DOWCAR, 1997).

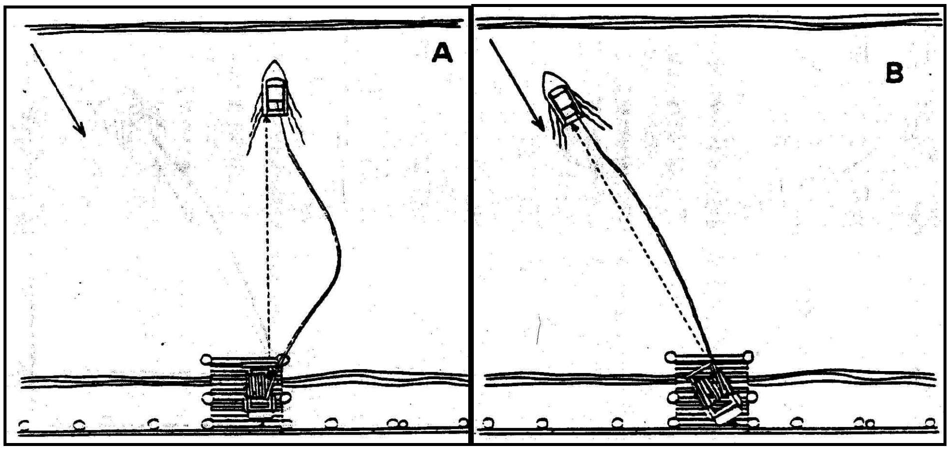
8.1.3 Mooring Techniques

There are many techniques to set and attach boom to get the proper angle and shape. The upstream lead anchor should be set first with the boom trailing parallel to the current. If the boat can hold all of the equipment and boom, the vessel moves to the anchor location, sets the anchor and backs down deploying the boom. A load should not be placed on the mooring line until the anchor is on the bottom. The anchor can be lowered by the mooring line from a small boat. However, the current may move it quite a distance before it sets. A preferred method is to use the anchor retrieval line attached to the crown of the anchor to position it while it is just off the bottom. Then releasing the line will ensure that it sets close to the desired location. Quick release hooks placed on the mooring buoy assist with making connections quickly. A spotter on shore should direct the boat to help with anchor placement. The downstream anchor is then set again using the anchor retrieval line to assist with placement and adjustments.

Another method to deploy an anchor from a small boat is to fake down the boom on shore with the anchor and line ready to go as seen in Figure 8-10. The anchor release line is attached to the stern of the vessel. If sufficient amount of boom or line is available to keep slack in the boom, the vessel should tow out slowly, taking account of the current and wind. If additional boom or line is not available to provide slack, towing the anchor quickly away from the shore causes the Danforth® anchor to plane on the surface. When tension is on the boom and it is at the desired angle, the retrieval line is released by cutting a safety attachment line to drop the anchor in place. The shore crew then pulls in on the shoreside mooring line to set the anchor.

Figure 8-10. Boom faked out in zigzag with anchor attached.

Taking a line or boom across a river can be a dangerous operation. Whenever possible, the lead line should be pulled across, and safe and proper line handling techniques should be used. Sometimes a vessel is required to deploy a boom across a wide river or body of water. The boat should cross at an angle to the current, as seen in Figure 8-11, to reduce the load on the vessel and equipment.



Wrong Deployment Angle **Correct Deployment Angle**

Figure 8-11. Boom deployment approach (National Spill Control School, 1998).

8.2 Boats and Power Selection

Power, maneuverability and speed are necessary to get safely out of trouble quickly in the dangerous conditions common in swift currents. The open bay and coastal regions invite higher waves and require larger boom and boats. It is very important to have enough horsepower to respond to these high forces when towing boom. Boom drag and mooring angle considerations should be used to determine the boat bollard pull required for the scenario and operating area at hand. Speed is essential in order to get to the spill site quickly when transiting against high currents. Adequate horsepower should be selected with assistance from the boat manufacturer and based upon the calculated towing forces required (maximum boom drag) with a margin of safety of approximately 30 percent. For outboards, one horsepower is required for 15 pounds of force exerted on a boom while approximately 20 pounds of force is exerted for each horsepower of an inboard workboat. Systems with kort nozzles can double these values. This will vary based upon the boat and propulsion type. Boats powered by standard jet drives can expect to provide only about one horsepower for 8-10 pounds of force. Jet drives specifically designed for towing can increase these values up to 20 pounds of force.

If a boat is being overwhelmed by the drag force on a boom as shown in Figure 8-12, reduce the drag by collapsing the sweep width profile to the current. After maneuvering into position the boom can be opened again to maintain station or anchored as required. If control cannot be maintained, the boom length or draft should be reduced or another boat selected that is more powerful.

Figure 8-12. A 12-inch draft boom is too much for this boat and motor.

There are two configurations for putting boom into position, and the methods used to calculate the tow forces required are very different. The configuration that is mostly used is the straight-line/transit tow. Using standard drag coefficients, the drag per foot of inflatable or foam-filled boom is given in table 8-3. For example, 100 feet of boom with a 4-inch skirt in 5 knots of current results in a load of 66 pounds. If this same boom is towed on end upstream at 5 knots against the 5-knot current, the load is 265 pounds and a boat with at least 17 horsepower (265 divided by 15) is required plus additional power for the boat drag. Fence boom drag forces may be slightly less than those listed but booms with many appendages can be twice as high. Wave chop can increase the values given in the table below by up to three times.

Table 8-3. Pounds of force per foot of boom (towed from end).

Skirt Depth	Current (knots)									
(inches)	1	2	3	4	5	6	7	8	9	10
4	0.03	0.11	0.24	0.42	0.66	0.95	1.30	1.69	2.14	2.65
6	0.04	0.16	0.36	0.64	0.99	1.43	1.95	2.54	3.22	3.97
8	0.05	0.21	0.48	0.85	1.32	1.91	2.59	3.39	4.29	5.29
12	0.08	0.32	0.71	1.27	1.98	2.86	3.89	5.08	6.43	7.94

The second method that is used to position a boom is with it in a "U" configuration. This may occur (although not recommended) when stretching boom across a body of water. Tests at Ohmsett were performed for simple "U" configurations with openings of about one-third of the boom length. Based on tests, a simple relationship was developed correlating the tensile force developed in a boom versus the projected area of the submerged portion of the boom and the tow speed (Potter, McCourt, and Small, 1999):

$$\mathbf{T} = \mathbf{K} * \mathbf{A} * \mathbf{V}^2$$

where:
- **T** = tensile force, lb_f
- **K** = constant, $lb_f/(ft^2 \times knots^2)$
- **A** = projected area of the submerged portion of the boom, ft^2
- **V** = tow speed, knots

The values to use for K are 1.7 for calm water, 4.3 for protected waters in regular waves, and 4.7 for open water under harbor chop conditions. For shallow angle boom arrangements, see Appendix F for additional calculations.
Boats and barges should be selected to make the tasks easier and safer to perform. Vessel configurations that allow for boom and equipment to be easily pulled overboard and retrieved through a bow or stern ramp that can be lowered to the water's edge are very useful. Boat stability, working area, visibility, deck arrangement, freeboard, sea keeping, propulsion type and horsepower are all-important factors. Towing points should be located forward of the rudder or outboard motor for good maneuverability. If this is not possible, rig a slack bridle across the two stern cleats and behind the outboard. Place a shackle over the bridle and attach the boom towline to that shackle. The shackle will slide back and forth on the bridle to allow the boat to turn under load from the boom.

8.3 Temporary Oil Storage

The preferred method for oil storage and removal are tank or VAC trucks and barges. If they are not available or access is restricted then temporary oil storage is required. Oil storage by use of portable tanks and bladders is useful for locations that need storage quickly. These devices are relatively lightweight and can be transported by truck, boat or aircraft to the spill site. They are made of reinforced fabric and are more susceptible to damage by groundings and abuse than barges. Towable bladders can be used behind skimmers. Inflatable barges with open tops facilitate debris handling and oil offloading. Oil pits can also be dug with earth moving equipment. Portable open top tanks can be quickly assembled on shore over level ground.

8.3.1 Floating Oil Storage

Shallow Water Modular Barges

Several types of small barges used for shallow water can be transported by truck to the spill site. They have less drag in swift water and can take much more abuse than fabric temporary-storage devices. Some are designed to attach to each other in a side-by-side or end-to-end modular form.

Inflatable barges

Temporary storage devices (TSDs) are bladders or barges that float and can be towed for storage of recovered oil. They can be packed in a small space and transported quickly to a spill response site by land, sea or air. Once at the staging area, an inflatable barge can be unpacked, inflated, and launched in approximately two hours. If a beach is available, barges can be launched without a crane. The barge has an open top with a removable cover that facilitates offloading of viscous oil and soft debris and this feature makes cleaning easier. The TSDs can be deployed along side or behind a vessel. Barges can be towed empty to the scene at 15 knots and once filled it can be towed at approximately 5 knots. Various sizes are available from several manufacturers. The Coast Guard has purchased from Lancer Ltd. of Auckland, New Zealand 55 inflatable barges that can each hold 100 metric tons (26,000 gallons) of oil. They are 50-feet long, 22-foot wide with a freeboard of 3 feet and have a draft of 8 feet when full. Two of the barges are stored with each USCG VOSS, and the additional barges are located with each of the three Coast Guard Strike Teams.

Bladders

Bladders (see Figure 8-13) have the same logistics advantages of inflatable barges but do not always require blowers for inflation. Most use some foam floatation for stability. They can be unpacked and deployed in approximately one hour. There are many manufacturers of floating bladders but only a few make very large capacity units. Some are robust enough to be used for storage of oil on land or on the deck of a vessel but it should be secured to prevent it from rolling. Care must be used to prevent puncture of the bladder fabric. Hose connections and sometimes hatches are provided for filling and offloading.

8.3.2 Shore-Side Storage

Tank, Air Conveyors and Vacuum Trucks and Portable VAC Units

Tank, vacuum (VAC) and air conveyor trucks are the preferred method for shoreside oil storage and removal when road access is available. Portable VAC units are useful in remote locations and can be used to fill 55-gallon drums that can be sealed. Oil is generally pumped directly into the tank truck from the skimmer or portable transfer pump. Ensure that the tank truck is clean of debris or any other material before using.

Figure 8-13. Sea slug barge floating bladders.

The air conveyor, VAC truck and portable VAC units can function as a skimmer pump source. The VAC suction hose can be fitted with various types of nozzles and floating skimmer heads. The floating suction and weir skimmer heads are recommended for increased efficiency, however they cannot be used in swift currents. They can be easily be clogged by debris and if suction is lost, the height that the oil can be lifted is reduced. A spare fill hose is recommended and a method to free debris or back flush the fill hose is needed. The air conveyor hose uses a large diameter opening and cannot use a skimmer head because it would restrict airflow that it needs to operate. The hose can remove oil and debris off the surface by being positioned a few inches above the oil. The vacuum truck is limited to a maximum lifting height of approximately 30 feet due to the limits of a vacuum at atmospheric pressure. The portable units generate less lifting suction pressure and have a lift capability of 15 to 20 feet. The air conveyor system, however, can convey oil and debris much higher because it relies on airflow to lift. Conveyor systems can handle very viscous oil. Vacuum and conveyor units tend to collect a lot of water but the water can be decanted back into the collection area if local permits allow.

Portable Tanks

Open top portable tanks can be set up quickly on cleared level ground to provide temporary storage of recovered oil. When pumping up very high banks they can be used to pump the oil in stages to the desired level to reach a truck on a road above. They cannot be used on vessels.

Lined Pits

Pits can be dug in the ground with heavy equipment adjacent to the recovery area and lined with plastic. Some jurisdictions require two layers of plastic with sorbent pads below the liners. Recovered oil can then be temporarily pumped into the pits until trucks or barges can be brought in. This procedure usually requires local permits. Decontamination can be difficult and expensive.

Bladders

As discussed above, some floating bladders can also be used on land. Other products are only designed for land operations. It is a good idea to construct a temporary berm around the bladders in case one ruptures or leaks.

CHAPTER 9. SPECIALIZED METHODS AND TECHNIQUES

Some support equipment is unique to fast water operations. Laser range finders built into binoculars are very useful to determine distances required for booming strategies and calculating the number of boom sections and mooring line lengths required. They can also be used to determine distances between distant objects, angles between objects and declination angles to objects. Standard binoculars are used to quickly scope out good staging areas and shoreline mooring points. Binoculars are available with a compass readout that is helpful to select a mooring point to obtain the desired boom deflection angle. A stopwatch and tape measure are needed to measure the current velocity accurately using floating debris. An anchor and light line with two small floats attached 100 feet apart is handy for measuring the current with a chip log as discussed in Appendix F.

Line handling equipment is required to deploy lines across inlets and rivers in order to move equipment and people. There are various methods to get a line across a wide water area. The first step is to get a lightweight tag line across the inlet or river. Once the tag line is across, heavier lines can be pulled over. Do not underestimate the drag force exerted on a long line in a swift current. Use of a small boat, throwing a line with a weighted end or using a line-throwing gun are typical methods to get a tag line across. Experienced swift-water small boat personnel outfitted with the proper safety equipment can get across currents towing a light line using row boats, outboards, canoes or kayaks. Weighted lines and projectiles from line throwing guns should be used with caution to prevent injuries. Use padded projectiles marked with florescent paint to minimize the chance of injuries.

9.1 Equipment and Practices Adapted to Fast-Water Response

Special techniques and equipment are needed for pulling boom across a swift current and applying the high tension required to get the desired deflection angle and minimize the boom catenary. Mountain climbing and other specialized equipment are useful in some situations. All equipment must be checked to ensure that it can handle the expected loads.

Use the smallest diameter line or cable that will take the load. The drag on mooring and tending lines of diversionary boom can be significant as the diameter increases. Significant catenary in the boom can sometimes be attributed to drag on a long mooring line in addition to the boom drag. Shallower draft boom and shorter sections used for cascade booming allows lighter small diameter mooring lines to be used. Higher strength synthetic materials can also help reduce the diameter while retaining the desired strength. Wire rope can be used but this requires gloves to handle and special tightening equipment. Boom tending lines that run perpendicular to the current have lighter loads and can be smaller in diameter. When the lines are at the surface they can inadvertently deflect oil away from the apex and snag debris. Spare shackles can be placed on these tending lines to weight them down below the surface to prevent interference of oil flow into the apex. Larger draft boom should not be used because it requires a more shallow deflection angle to keep it from bowing out and becoming useless for deflection.

Mechanical leveraging devices can also assist with tightening mooring lines to reduce boom catenary angles. Several devices are available that use hand-operated leverage and pulleys to haul in a line or cable. A Grip Hoist™ is used in the USCG VOSS package to lift a skimmer with a cable on a davit. A Come-Along™ is another ratchet type device that uses mechanical leverage to exert large forces by one person. Some pulleys can be attached to a line without running the bitter end of the line through them. When these devices are being attached to other lines, it is useful to have multiple anchor points in line so they can take temporarily handle the mooring line tension.

Ascenders with handgrips can be used to assist gripping line while hauling in the last few feet of a boom mooring line. These can be put on a line that is tied off at both ends. They usually have holes in the handle that can be used for attaching other equipment. Ascenders are also available without handles solely for attaching lines or pulleys to the main line. Several different types of ascenders available are shown in Figure 9-1. Each provides a good handhold that can be quickly slid up the line when slack is taken out.

Figure 9-1. Ascenders used in gripping mooring lines.

Figure 9-2. Ascenders in use for tightening lines (DOWCAR, 1997).

Other Tricks of the Trade:

A loop of rope can also be effective to grab a line when ascenders are not available by wrapping around the line and inside its own loop. This technique reduces the effective line strength by as much as one-half.

A portable gas powered winch can greatly assist pulling the catenary out of a deflection boom. Care should be taken to prevent pulling out anchors, snapping mooring lines, or breaking the boom when using powered equipment.

The boom skirt can be rolled up and tied around the floatation to reduce drag and facilitate deployment. Deploy the boom so that the current faces the smooth backside of the rolled up skirt. After deployment, cut enough of the ties loose starting at the apex to permit the boom to bow out due to increased drag on the skirt. Leave the remainder of the skirt tied. The floatation and compressed skirt are enough to deflect oil at shallow angles.

Using shorter sections of boom and a more shallow draft boom for the cascade tactic also helps keep the boom in its desired shape and reduces the load on anchors.

It is difficult to overcome the drag forces when towing boom with a wide belly or “U” configuration into the current. Maneuvering the boats together to collapse the boom allows transit into the current. When moving upstream, boom and vessel drag can also be reduced by staying close to shore where currents are slower.

Use shorter bridle when towing and anchoring to maintain control.

9.2 Computer Support

Many types of oil spill drift models are available that can help with the planning process. Computer programs are also used to track resources during a spill and handle logistics requirements. Strategies, boom placement locations and equipment requirements can be integrated into existing models to assist with managing field deployments. Several organizations have developed a computer program to compute forces on booms in various configurations. Portable laptop and palm size computers can be brought into the field to use as required. The availability and diversity of these computer systems make them more useful to planners and responders with specific needs.

Trajectory models are only as good as the wind and current data that they use. It is important that for response applications, the model is capable to receive updated overflight spill location information as well as changing environmental data. Local knowledge of hydrodynamic circulation patterns and anomalies are helpful to supplement the models. Drift models are more applicable to coastal estuaries, coastal rivers and open water response, not inland rivers where runoff is less predictable. These models are not refined enough to predict effectiveness of booming and skimming strategies in complex fast-water conditions. However, many will provide accurate average surface current and direction predictions that will assist with the initial planning for strategies and tactics.

APPENDICES

Appendix A. Table and Worksheet for Fast Water Response

The following tables are included as references in order to make a rapid assessment of spill conditions, the selection factors involved in determining an effective response and the tactics associated with the applicable scenario.

Selection Factors for an Effective Response

Selection Factor	Related Sub-Factors	Checklist Notes
• Nature of the spill	❖ Amount and type of oil ❖ Time & place of oil impact (ETA) ❖ Weathering/emulsion issues ❖ History of spills	
• Weather forecast	❖ Wind affects oil drift and sea state ❖ Rain affects currents in rivers and coastal areas ❖ Temperature., oil evaporation rate & people endurance ❖ Visibility	
• Type and Nature of Water body	❖ River, lake, swamp, inlet, bay, ocean, etc. ❖ Presence of debris or ice ❖ Navigable or not, traffic type & density	
• Shoreline	❖ River (winding, width, etc.), estuary, strait, headland, harbor, inlet, island, etc. ❖ Natural collection points ❖ Sensitive areas	
• Shoreline type	❖ Salt marshes & mangroves, sheltered tidal flats, sheltered rocky coasts, exposed tidal flats and vegetation, gravel beaches, beaches, etc. ❖ Other threatened or historical areas	
• Environment	❖ Current speed and direction ❖ Tidal action: height, cycle time, reversing currents, slack water, etc. ❖ Waves: height, wave direction, period, breaking or non-breaking, etc.	
• Bottom	❖ Water depth and contours ❖ Bottom type (relating to habitat damage and anchoring potential)	
• Man-made structures and commercial enterprises	❖ Piers, breakwaters, bulkheads, bridges, etc. ❖ Water intakes (drinking water, desalination, etc.) ❖ Floating houses, casinos, commercial & recreational traffic ❖ Commercial logs, fish hatcheries, etc. ❖ High traffic volume water commerce	
• Available resources/Logistics (Response Time to Plan and Deploy)	❖ Response organizations: On Scene Coordinator (OSC), Responsible Party (RP), Oil Spill Response Organization (OSRO), etc. ❖ Estimated Time of Deployment (ETD) ❖ Response equipment, locations and availability (effectiveness in fast-water conditions) ❖ Boats (HP for speed & towing in currents) ❖ Response personnel, their training, location & availability (experience in swift currents) ❖ Logistics support network & equipment ❖ Repair and Maintenance facilities ❖ Communications	
• Accessibility	❖ Land accesses (bridges, roads, shoreline grade, shoreline vegetation, etc.) ❖ Water access (boat ramps, marinas, fuel, boat draft, specialty vehicles such as jet boats, air cushion vehicles, airboats, etc. ❖ Air accesses (airports & areas for helicopters) ❖ Approval may be needed	
• Safety	❖ Personnel Safety ❖ Site specific issues such as accidental ignition sources	
• Debris	❖ Collection and disposal procedures ❖ Natural Collection Points	

FAST WATER WORKSHEET	1. Incident Name:	2. Date/time prepared:	3. Operational Period	4. Attachments

5. Fast Water Type	Rivers/Canals (non-tidal) ☐ Rivers/Canals (tidal) ☐ Small Streams/Culverts/Creeks ☐ Coastal areas ☐ Harbors/Bays ☐ Breakwaters and Harbor entrances ☐ Other (specify):

	Oil Type	Oil Amount	Temperature F	Humidity %	Evaporation in 24 hours %	Wind (mph)	Visibility (Ft)	Rain, Sleet, Snow	Water (F) Temperature	Other
6. Background Info										

7. Safety Hazards	Confined Space ☐ Noise ☐ Heat Stress ☐ Cold Stress ☐ Electrical ☐ Animal/Plant/Insect ☐ Ergonomic ☐ Ionizing Rad ☐ Slips/Trips/Falls ☐ Struck by ☐ Water ☐ Violence ☐ Excavation ☐ Biomedical waste and/or needles ☐ Fatigue ☐ Other (specify)
8. Personal Protection	Life Jackets ☐ Oil resistant gloves ☐ Shoulder length resistant gloves ☐ Level D ☐ Eye protection ☐ Cold WX Gear ☐ Level C ☐ Splash Suits ☐ Hearing protection ☐ Fall protection ☐ Water ☐ Sun screen ☐ Wet Suits ☐ Dry Suits ☐ Portable first aid kits ☐ Other (specify)

9. Potential Booming Locations	ETA Oil Impact	Natural Collection Point	Shoreline wave energy	Current Speed & Direction	Access	Water Depth	Tidal Influence	Bottom Amenable to Anchors	Debris, Ice	Shore Sensitivity	Historical Economic Concern	Nav Traffic	Strategy Selection
		Yes ☐ No ☐	High ☐ Med ☐ Low ☐		Land ☐ Water ☐ Air ☐		High ☐ Med ☐ Low ☐	Yes ☐ No ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	
		Yes ☐ No ☐	High ☐ Med ☐ Low ☐		Land ☐ Water ☐ Air ☐		High ☐ Med ☐ Low ☐	Yes ☐ No ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	
		Yes ☐ No ☐	High ☐ Med ☐ Low ☐		Land ☐ Water ☐ Air ☐		High ☐ Med ☐ Low ☐	Yes ☐ No ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	
		Yes ☐ No ☐	High ☐ Med ☐ Low ☐		Land ☐ Water ☐ Air ☐		High ☐ Med ☐ Low ☐	Yes ☐ No ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	
		Yes ☐ No ☐	High ☐ Med ☐ Low ☐		Land ☐ Water ☐ Air ☐		High ☐ Med ☐ Low ☐	Yes ☐ No ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	
		Yes ☐ No ☐	High ☐ Med ☐ Low ☐		Land ☐ Water ☐ Air ☐		High ☐ Med ☐ Low ☐	Yes ☐ No ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	
		Yes ☐ No ☐	High ☐ Med ☐ Low ☐		Land ☐ Water ☐ Air ☐		High ☐ Med ☐ Low ☐	Yes ☐ No ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	High ☐ Med ☐ Low ☐	

10. Selection Strategies	**Current < 2 Knots**	**Current > 2 Knots**	**Room to Maneuver**	**Collection Possible on Opposite Sides**
Rivers/Canals (non-tidal)	Single Diversion Booming (Skirt < 12 inches) (SDB<12) Sorbents (isolated areas) (SRB) Exclusion Booming (EXB) Encircle Booming (ECB)	Single Diversion Booming (Skirt < 6 inches) (SDB<6) Cascade Booming (CSC)	Skimmers (SK)	Chevron Booming (CHV)
Rivers/Canals (tidal)	Double SDB<12, ECB, SRB	Double SDB<6, CSC	SK	CHV
Small Streams /Creeks/Culverts	Fill, Dams, Weirs Underflow/Overflow Dams (UFD/OFD) SRB		SK (small)	
Coastal Areas	ENC, SDB<12 (no waves), SRB	CSC	SK	
Harbor/Bays	SDB<12, ECB, SRB	SDB<6, CSC	SK	CHV
Breakwaters/Harbor Entrances	SDB<12, ECB, SRB, Fill, Dams, Weirs, UFD, OFD	SDB<6, CSC	SK	CHV

Prepared by:	**Notes: Use codes in section 10 to complete strategy section in section 9.**	Page _____ of _____

Appendix B. Definitions

advection	The horizontal (surface) and sometimes vertical (subsurface) transportation of oil caused by currents, turbulent mixing and wind.
Area Contingency Plans	These are planning documents that are developed by each area committee in all locations throughout the country. Their general format is set by the National Response Team (NRT), but the details and content of each varies.
ASTM	American Society for Testing and Materials --This organization sets industry standards through Committee F 20 on Hazardous Substances and Oil Spill Response.
boom deflectors	Aluminum devices with a wing, which can be deployed between boom sections to help keep the boom straight.
boom vane	A device that is flown like a kite into the current with a boom attached. It replaces the anchor and rigging hardware.
chevron	Boom deployment method used when access to both shorelines is available.
convergence line	A line on the water surface where floating objects and oil collect. A convergence can be the interface between two different types or bodies of water, or it can be caused by significant changes of depth and tidal changes.
critical velocity	Velocity at which oil starts to entrain under a boom when the boom is perpendicular to the current. A conservative value of 0.7 knots is used in this guide.
dispersion	The breaking up of an oil slick into small droplets that are mixed into the water column due to breaking waves and other turbulence. This process is accelerated when dispersant chemicals are used.
emulsification	The formation of a water-in-oil mixture. This occurs over time as the slick weathers and surface mixing occurs. Oil viscosity greatly increases making collection and pumping the emulsion or “chocolate mousse” very difficult. Some emulsion can contain up to 70 percent water but they become stable and will not separate unless heat or chemicals are applied.
entrainment	The loss of oil from containment when it is pulled under a boom by the water passage below. Entrainment typically occurs from booms deployed perpendicular.
fast water	Water where surface currents are one knot or greater.
ICS	Integrated Command System --The organization to be used for major responses as dictated by the NRT and USCG as part of the National Interagency Incident Management System (NIIMS).
slough	Tributary diversion of a river that branches out but that returns to the river downstream.
weathering	A combination of physical and environmental processes affecting oil such as evaporation, emulsification, dissolution and dispersion that act on spilled oil to change its physical properties and composition.
windrows	Streaks of oil that line up in the direction of the wind. Windrows typically form early during a spill when the wind speed is at least 10 knots. A very thin sheen is more likely to form in windrows.
VOSS	Vessel of Opportunity Skimming System --This system that can be mounted on a variety of vessels. Planning is usually needed to ensure the equipment is compatible with the vessel's arrangement.
ZRV	Zero Relative Velocity --A type of skimmer that has the belt or mop speed adjusted to match the speed of the current.

Appendix C. Conversion Tables

Table C-1. Conversion Tables.

VOLUME

1 U.S. Gallon = 231 in^3 = 0.1337 ft^3
1 BBL = 42 Gal = 5.615 ft^3
1 BBL = 158.97 L = 0.159 m^3
1 gal = 3.785 L
1 L = 0.26 gal
1 "ton" of oil = 1,000 L = 1 m^3 = about 264 gal
1 m^3 = 6.29 BBL = 264.2 gal
1 ft^3 = 0.0283 m^3 = 7.48 gal
1 m^3 = 10^6 cm^3 = 10^3 L
Imperial gallons X 1.2 = U.S. gallons
U.S. gallons X 0.83 = Imp. gallons
Gallons X 0.0038 = m^3

VOLUME RATE

L/hr X 0.0063 = BBL/hr
L/hr X 0.0044 = gpm
L/s X 3.6 = m^3/hr
Tons/hr (or m^3/hr) X 4.4 = gpm
Tons/hr X 6.3 = BBL/hr
BBL/hr X 0.159 = m^3/hr
gpm X 1.43 = BBL/hr
BBL/hr X 0.7 = gpm
L/sec X 15.9 = gpm
gpm X 0.23 = m^3/hr
gpm X 1.43 = BBL/hr
gpm X 34.29 = BBL/day
m^3/hr X 16.7 = L/min
m^3/hr X 6.29 = BBL/hr
L/min X 0.06 = m^3/hr
L/min X 0.377 = BBL/hr
gpm X 3.785 = L/min
BBL/day X 0.11 = L/min
BBL/day X 0.0292 = gpm
m^3/sec X 10^{-3} X 3.6 = m^3/hr

AREA

1 hectare = 10,000 m^2 (a 100 m square)
1 acre = 43,560 ft^2 = 0.4047 hectares
1 hectare = 2.471 acres
1 ft^2 = 0.0929 m^2

AREA APPLICATION

gallons/acre X 9.35 = L/hectare
L/m^2 = thickness in mm
Area (ft^2) X Thickness (inches) X 0.623 = Volume (gallons)

SPILL ENCOUNTER RATE

Spill Encounter Rate (BBL/hr) = (Sweep Width [ft]/6076) X Skimming Speed (knots) X Slick Thickness (mm) X 21,570

Spill Encounter Rate (m3/hr) = (Sweep Width [m]/1,852) X Skimming Speed (knots) X Slick Thickness (mm) X 3,430

LENGTH

1 inch = 2.54 cm = 25.4 mm
1 foot = 30.48 cm
1 foot = 0.3048 m
1 meter = 3.2808 feet
cm X 0.0328 = FT
1 statute mile = 0.87 NM
1 nautical mile = 6,076 feet
1 kilometer = 0.54 nautical miles
1 NM = 1.852 km = 1,852 m
1 NM = 1.15 Statute miles
1 micron = m X 10^{-6} = mm X 10^{-3}
1 fathom (6 ft) = 1.829 m
1 m = 0.547 fathoms

DISTANCE RATE

1 knot = 1.69 ft/sec
ft/sec X 0.593 = knots
m/sec X 1.94 = knots (about 2 X)
m/s X 3.28 = FT/sec
mph X 1.5 = ft/sec
knots X 51.4 = cm/sec

WEIGHT

1 pound = 0.45 kilograms
1 kilogram = 2.2 pounds
lb/ft X 1.48 = kg/m
kg/m X 0.672 = pounds/ft
1 metric ton = 1,000 kg
1 long ton = 2240 pounds

Appendix D. Processes Accelerated in Swift Current

The most obvious effect that a fast current has on oil is the transport or drift of oil in the direction and speed of the surface current. Other less obvious consequences of fast water are the accelerated effects on the oil weathering process (see Figure D-1) (Exxon, 1992).

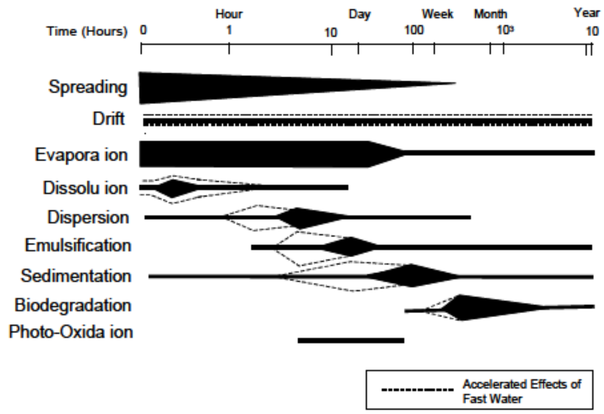


Figure D-1. Effects of fast water on oil spill processes.

Oil drift or advection is directly affected by current velocity because oil is swept along by the surface current. Drift is influenced by the currents and circulation anomalies associated with the water body, including one or more of the following: river currents, tidal currents, long shore currents, eddies, seiche currents and wind driven currents. Wind drift is calculated using 3.5 percent of the wind velocity in Table D-1.

Table D-1. Wind drift of oil.

Wind Velocity	Wind Drift Current
(knots)	(knots)
10	0.35
20	0.70
30	1.05
40	1.40

Spreading is not generally affected by currents because it is dependent upon oil viscosity, surface tension, slick thickness and gravity forces.

Evaporation is not affected by fast water unless related turbulence drives the oil into the water column where evaporation cannot occur.

Dissolution will be increased through turbulent mixing and oil entrainment into the water affording more oil/water contact for the dissolution process to occur.

Dispersion of oil droplets into the water column is accelerated by turbulence. The increased surface area of oil to water resulting from dispersion increases the rate of dissolution and sedimentation.

Emulsification of water and oil is accelerated by fast currents and associated turbulent mixing. Emulsified oil dramatically increases in volume due to captured water and viscosity also increases quickly making retrieval and pumping oil more difficult.

Sedimentation reduces buoyancy and sometimes causes oil to eventually sink. The rate of sedimentation is further accelerated in turbulent waters where bottom roughness, constriction points, waterfalls and higher currents exist.

Biodegradation may be accelerated when turbulent mixing and dispersion creates small oil droplets.

Photooxidation may be reduced if turbulent mixing removes oil from the surface.

Appendix E. Cascade Tactic for Booming a River (DOWCAR, 1997)

Overview

This DOWCAR cascade booming technique is recommended for rivers 600-foot wide or less. All three team leaders, the incident commander and the ferry system operator should have two-way radios for communications. All personnel shall have appropriate safety equipment that includes as a minimum: life jacket, hardhat, safety glasses, work gloves, knife and steel toe rubber boots. Beware of lines under tension because they may part. Select mooring points that are strong. If available, the base of large trees and boulders should be used for boom anchor points. Use multiple anchors if required for the main upstream and downstream anchor points. Follow the setup and deployment of cascade booming in Figures E-1 and E-2.

Team A Duties in Cascade Boom Deployment

Setting up for Boom Deployment:

Lay each boom section out along the shoreline. Leave a 10-foot overlap between each boom section.

The first boom should be closest to the water's edge with each succeeding boom laid on the inland side of the previous one, (Figure E-2).

Establish the main anchor point at the containment area. The first boom should be anchored here within 5 to 10 feet of the downstream end of the boom on shore and then entrenched in place after deployment. Shore sealing (water ballast) boom can also be used as the first boom, instead of entrenching, where tidal fluctuations are significant.

Place towing bridles and tie anchor lines onto the downstream end of each boom. Lay them along the shore while walking back to the main anchor point.

If any diagonal lines from the upstream end of the boom are crossed, be sure to weave your line under them.

If additional anchor points are needed, place them inland of the initial anchor point no more than 12 inches apart.

In some cases, you may want to put a second (safety) line on the downstream end of the boom. It will help keep the downstream end of the boom from slipping under the downstream boom. It can be secured anywhere on shore perpendicular to the boom.

Safety lines are generally run under the downstream anchor lines and forward "diagonal lines" are run over the upstream anchor "pull line."

During Boom Deployment:

The Team Leader should stand near the anchor line tie-down point and take direction from the Incident Commander. If any adjustments are needed in the line, Team Members should release or pull in while the Team Leader issues commands to adjust the boom properly.

Someone may also be needed to tend the safety line during deployment. Team A leader must be in a position so that Team Members at both lines can hear them.

Team B Duties in Cascade Boom Deployment

Setting up for boom deployment:

Assist Team A in laying the boom sections along the shoreline leaving a 10-foot overlap between the boom sections.

On the upstream end of each boom section, connect a towing bridle, buoy and two lines. One line will be long enough to go across the river to Team C. It is referred to as the "pull line." The other "diagonal line" will be tended by Team B.

If any lines from the downstream end of the boom are crossed, place the upstream lines over them.

The Team C pull line should be laid along the shoreline parallel to the boom. Each succeeding line should be inland of the previous one. String the line upstream to the ferry system and then add enough rope to cover the distance across the river.

The diagonal line should be secured on the near shoreside about 30 to 50 feet upstream from the end of the boom. Be sure there is enough line to release the boom out into the water. Each succeeding boom will need additional line as more width of the river is boomed.

During boom deployment:

The B Team Leader should stand near the diagonal line tie-down point listening to the Incident Commander. As adjustments are required in your line, Team Members should release or pull in as directed by the Team Leader.

Team C Duties in Cascade Boom Deployment

Setting up for boom deployment:

Team C is responsible for setting up the Ferry System (Figure E-3) and anchor points on the far shoreside of the river for the pull lines of each boom. The Ferry System is a set of three lines strung across the river and connected with a pulley. It is used for moving things across the river. It consists of a static line with a near-shore ferry line and a far-shore ferry line attached to a pulley that runs on the static line.

The static line must be strung across the river using a boat, bridge or line-throwing gun. If a line gun is used there must be a person on the far shore. The static line must be free of knots and strung tightly out of the water. Place the near-shore end of the static line upstream and higher than the far-shore side. This will take advantage of gravity and the current forces when pulling the pull lines and boom across the river. Once the static line is in place, repeat the process to get the far-shore ferry line across the river. The near shore ferry line and the pulley can be attached on the near shoreside to complete the system. After the ferry system is complete as shown in Figure E-3, all Team C members except one should go the far shoreside.

The ferry system operator on the near shoreside should have a two-way radio or use a predetermined hand signal system for directions on when to send the pull line for each boom across the river.

When ready the Team Leaders should contact the Incident Commander. The Team C leader shall work with the Incident Commander to select the anchor point for the first boom. Succeeding anchor points for additional booms should be selected after the previous boom has been deployed.

During boom deployment:

Once the Incident Commander has indicated that he or she is ready to deploy a boom, they will give the signal or command to the team members on the ferry line to release the ferry line with the boom's pull line.

The boom pull line should be taken off the ferry system and moved to the anchor point, secured, and all of the slack should be pulled out of the line. The Team C leader should then contact the Incident Commander to let them know that slack is out of the line and wait for the command from the Incident Commander to pull the boom into position. This will require a lot of effort. It is usually accomplished by pulling the line through the anchor system and down the shore adjacent to the pull line. Pulleys can be used to make it easier to take the final slack out of the boom.

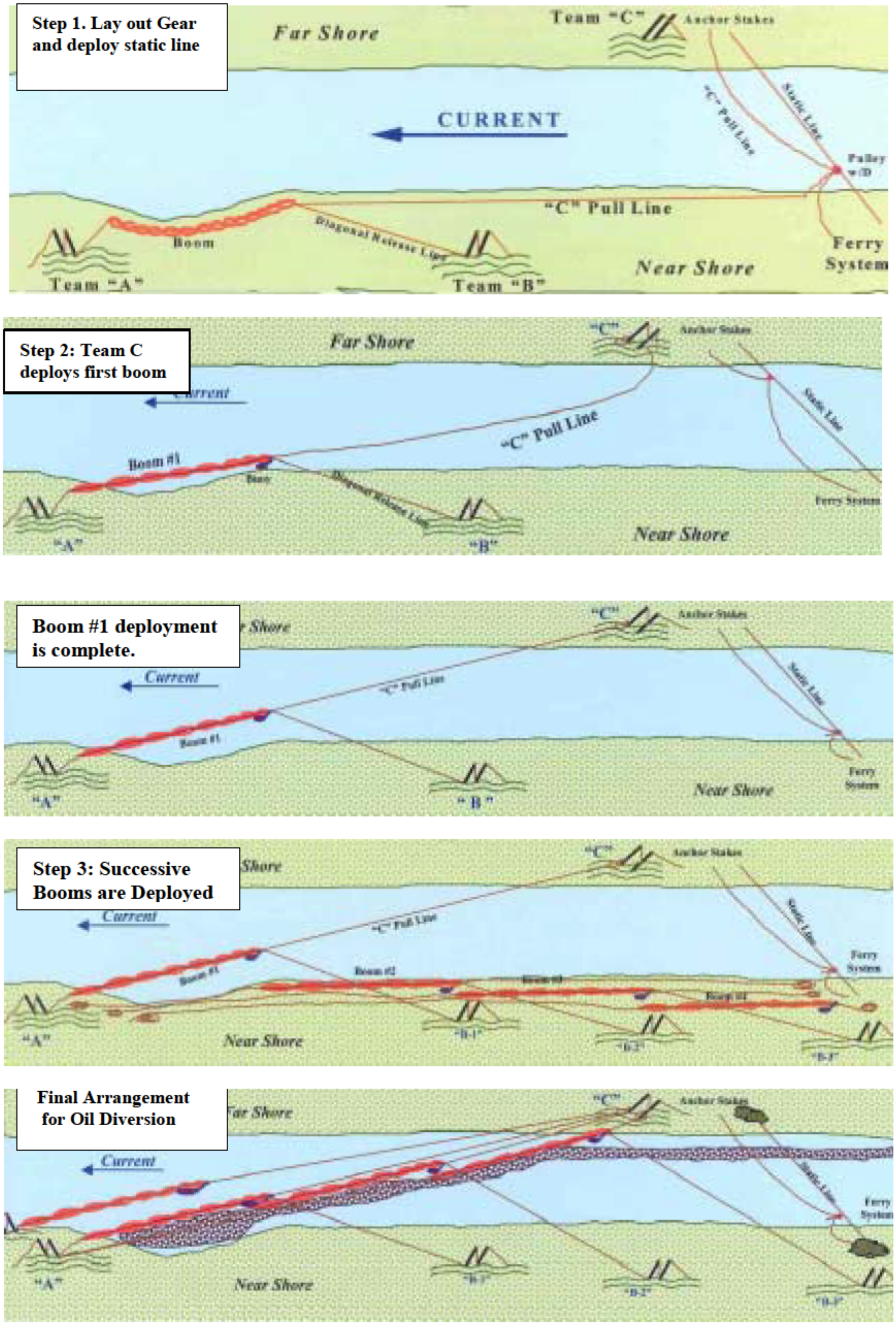


Figure E-1. Sequence of DOWCAR system deployment.

Equipment is deployed along shore.

First boom is deployed.

Fourth boom is deployed.

Final configuration.

Figure E-2. Photographs of boom deployment.

Figure E-3. Ferry system deployed.

Appendix F. Current Estimation and Mooring Line Issues

This appendix provides some basic information about calculating current velocity and considerations for boom tension. Methods are first provided for current velocity and maximum boom deflection angle calculations. Then methods to calculate mooring line forces for booms in a "U" configuration are described. This arrangement is not normally used in fast water since the tensions are very high and the oil will most likely escape under the apex of the boom.

Current Calculations

Table E-1 presents the time for floating debris to drift 100 feet. This is most accurately determined by anchoring a line with two floating buoy markers attached at a spacing 100 feet apart. Floating debris is then thrown into the water approximately 20 feet upstream of the first buoy marker. Determine the time it takes the debris to transit the distance between the two marker buoys in seconds. This assumes that the minimum escape velocity under a boom perpendicular to the current (90 degrees) is 0.7 knots. Table F-1 also provides an estimate of the length of boom required for deflecting oil at a specified angle for a 100-foot profile (perpendicular width) to the current. It also provides an estimate of the number of anchors or shoreline tiebacks required for that length of boom assuming anchor points are required every 50 feet.

Table F-1. Current chip log and maximum boom deflection angle.

Time to Drift 100 Feet (seconds)	Velocity (ft/sec)	Velocity (m/sec)	Velocity (knots)	Max Boom Deflection Angle (degrees)	Boom Required for 100-foot Profile to Current (feet)	Anchors if Placed Every 50 feet (number)
6	16.7	5.1	10.00	4.0	1,429	30
8	12.5	3.8	7.50	5.4	1,071	22
10	10.0	3.1	6.00	6.7	857	18
12	8.3	2.5	5.00	8.0	714	15
14	7.1	2.2	4.29	9.4	612	13
17	5.9	1.8	3.53	11.4	504	11
20	5.0	1.5	3.00	13.5	429	10
24	4.2	1.3	2.50	16.3	357	8
30	3.3	1.0	2.00	20.5	286	7
40	2.5	0.8	1.50	27.8	214	5
60	1.7	0.5	1.00	44.4	143	4
>86	≤1.2	≤0.35	≤0.70	90.0	100	3

Mooring Angle Considerations

The additional forces exerted on a boom caused by the mooring line angle are often neglected, but they become very large at shallow angles. A boom in a slack "U" configuration has mooring lines parallel with the current or at 0 degrees. The total tension load on each mooring line is simply the drag force on the boom divided by two. As the orientation of the boom mooring line relative to the current approaches 90 degrees, the tension on each mooring line increases dramatically. Tension in each mooring line is calculated for a 6-inch draft boom at various current speeds with a 100-foot projected sweep width (boom profile) to the current as seen in Figure F-1.

Symmetrical Boom

Boom Draft – 0.5 feet

Mooring line tension at different boom drafts can be calculated by dividing the boom draft in feet by 0.5 and multiplying that number by the value from the table below. For example, a boom draft of 1 foot (1/0.5=2) would double all values in the table below.

Boom profile to the current – 100 feet

This is the effective sweep width of the boom or projected sweep width as seen in Figure F-1.

Angle of the boom mooring line to the current

An angle of 0 degrees represents a boom in a slack U configuration with the mooring lines parallel to the current. As the angle is increased, the shape of the boom flattens out and mooring line angle approaches 90 degrees perpendicular to the current.

Table F-2. Mooring line loads.

Mooring Line Angle	Each Mooring Line Tension (pounds force)					
(degrees)	1 knot	2 knots	3 knots	4 knots	5 knots	6 knots
0	137	547	1,231	2,188	3,419	4,923
5	137	549	1,235	2,196	3,432	4,942
10	139	555	1,250	2,222	3,471	4,999
20	146	582	1,310	2,328	3,638	5,239
25	151	604	1,358	2,414	3,772	5,432
30	158	632	1,421	2,526	3,948	5,685
40	179	714	1,607	2,856	4,463	6,427
45	193	774	1,741	3,094	4,835	6,962
50	213	851	1,915	3,404	5,319	7,659
60	274	1,094	2,462	4,376	6,838	9,846
70	400	1,599	3,598	6,397	9,996	14,394
80	788	3,150	7,088	12,600	19,688	28,350
85	1,569	6,276	14,121	25,104	39,226	56,485
89	7,836	31,342	70,520	125,370	195,890	282,081

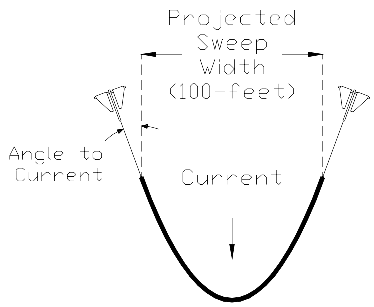


Figure F-1. Projected boom sweep.

Appendix G. Diversion Boom Mooring Line Force Worksheet

Calculating tension forces on a boom used in a deflection mode is much more difficult due to the asymmetrical shape of the boom, the deflection angle to the current and the catenary of the boom mooring lines. The process described below will provide a worst-case estimate for tension.

Table G-1. Mooring Line Force Worksheet

Column #	Instructions
1	Estimate maximum current in the waterway using tidal current tables or a chip log Table F-1.
2	Determine the maximum deflection angle allowed for that current using Table F-1 or Figure 3-1
3	Determine what projected deflection width is required per boom (not boom length) or Table G-2
4	Select a boom draft based on equipment available, weather and drag considerations.
5	Determine drag force per projected foot width of boom using Table G-3.
6	Calculate Total Boom Drag Force by multiplying column (3) times column (5).
7	Estimate Boom Catenary Angle (smaller angles are better but higher boom and mooring tension result).
8	Determine the Tension Force Multiplier using Table G-4.
9	Total Tension is calculated by multiplying column (6) by column (8) (this assumes two end moorings. Note 1
10	Force on each mooring line: divide column (9) by 2 (end moorings). Notes 1&2
11	Determine total length of boom required for projected sweep width desired (3), using the maximum deflection angle (2) and Table F-1 or G-2. Additional anchors along the boom, boom deflectors or shoreline tie backs will usually be required for boom lengths greater than 100 feet depending upon the conditions.
*Notes:	1. If total tension on the boom (9), exceeds the tensile breaking strength of the boom or the mooring system cannot provide the required holding force (10), then several actions can be chosen: Use a more shallow boom, decrease sweep width, or use a larger catenary angle which could cause entrainment 2. Mooring loads and total boom tension can also be reduced by using additional mooring points along the length of deflection boom, however, the maximum boom tension and mooring line loads cannot be easily calculated.

Column #	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Location or Scenario Description	Max Current Expected (knots)	Max Deflection Angle (degrees)	Projected Deflection Width (feet)	Boom Draft Desired (feet)	Force per Foot of Boom (pounds)	Total Boom Drag Force (pounds)	Boom Catenary Angle (degrees)	Tension Force Multiplier (#)	Total Tension on Boom (pounds)	Force on Each Mooring Line (pounds)	Total Length of Boom Req. (feet)
Math Help	*Table G1*	*Table G-1*	*Table G-2*		*Table G-3*	*(3) X (5)*		*Table G-4*	*(6) X (8)*	*(9)/2 moorings*	*Table F-2*
Example	2 Knots	20.5	34	0.5	10.7	363.8	15	3.9	1418.8	709.4	

Example

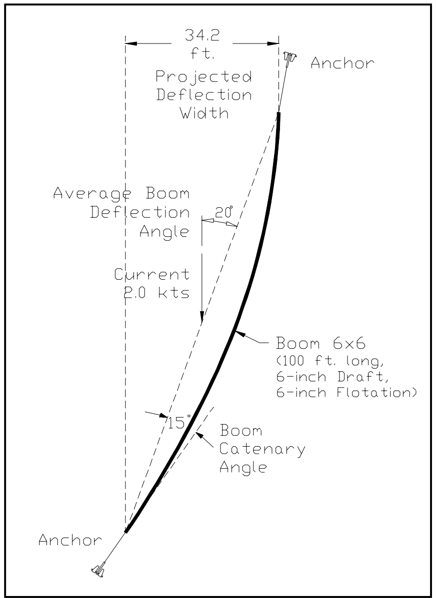


Figure G-1. Example.

Anchor Selection: A 100-foot section of 6-inch draft boom is deployed at an angle of 20 degrees in a two-knot current. The estimated catenary angle of the boom mooring line is 15 degrees as seen in the figure to the left. The incremental drag force from Table G-3 is 10.7 pounds/foot. The projected area of the 100-foot boom section to the current at a 20-degree angle to the current is 34.2 feet as determined from Table G-2. Total drag force on the boom is 10.7 lbs./ft X 34 ft or 363.8 lbs. The tension force multiplier for a boom catenary angle of 15 degrees from Table G-4 is 3.9. Total tension on the boom is 363.8 lbs. X 3.9 or 1,418.8 pounds. Each mooring line will see approximately half that load or 709.4 lbs. The boom selected for this application should have a minimum breaking strength of 1,784 pounds to prevent damage using a 25 percent safety factor (1,427 X 1.25 = 1,784 lbs.). Each anchor system should be capable of holding 900 lbs. safely.

Boom Length: Divide width of river (or covered area) by the Projected Deflection Width (Table G-2, Column 3) to get the number of boom sections required. For example, if the river is 340 feet wide, divide 340 by 34 and get 10. About 1000 feet (100X10) of boom is needed. For a cascade technique, if a 20 percent overlap is needed, then add 20 percent (or 200 feet) to the overall boom length.

Table G-2. Projected deflection boom width to the current.

Mean Boom Angle to the Current* (degrees)	Projected Boom Width to the Current* (feet)	
	50-foot Section	100-foot Section
10	8.7	17
20	17.1	34
30	25.0	50
40	32.1	64
50	38.3	77
60	43.3	87
70	47.0	94
80	49.2	98
90	50.0	100

Table G-3. Current drag force on one-foot boom profile to current.

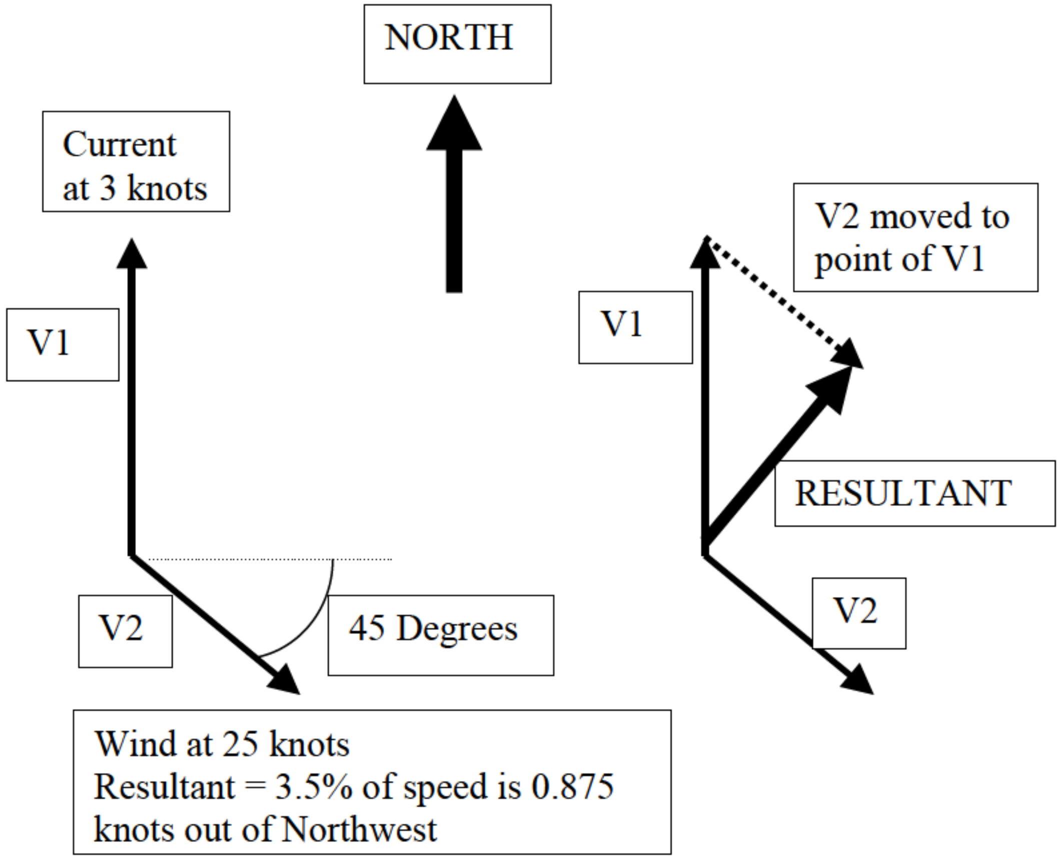
Velocity (knots)	Boom Drag Force (pounds) Draft 0.5 Feet	Draft 1.0 Feet	Draft 1.5 Feet	Draft 2.0 Feet
0.5	0.7	1.3	2.0	2.7
1.0	2.7	5.3	8.0	10.7
1.5	6.0	12.0	18.0	24.0
2.0	10.7	21.3	32.0	42.6
2.5	16.7	33.3	50.0	66.6
3.0	24.0	48.0	72.0	95.9
3.5	32.6	65.3	97.9	130.6
4.0	42.6	85.3	127.9	170.6
4.5	54.0	107.9	161.9	215.9
5.0	66.6	133.3	199.9	266.5
5.5	80.6	161.2	241.8	322.5
6.0	95.9	191.9	287.8	383.8
6.5	112.6	225.2	337.8	450.4
7.0	130.6	261.2	391.8	522.3

Table G-4. Tension force multiplier for boom catenary angles.

Boom Catenary Angle (degrees)	Tension Force Multiplier
85	1.0
65	1.1
60	1.2
50	1.3
45	1.4
40	1.6
35	1.7
30	2.0
25	2.4
20	2.9
15	3.9
10	5.8
5	11.5
4	14.3
3	19.1
2	28.7
1	57.3

Appendix H. Vector Analysis for Currents and Wind

The speed of the water past a boom can be calculated by using vector analysis. A vector is represented by a line having direction and magnitude. The effect of the wind is determined by multiplying the speed in knots by 3.5 percent. The two vectors can then be added in the manner described below. A calculator should be used to ensure correct results.

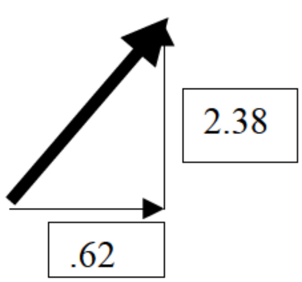


Graphically, the vector V2 is moved so that its tail is on the point of V1. This can be performed graphically by using parallel rulers. The resultant relative current is shown in bold. Using geometrical equations, the vectors are broken down in components in the y (north-south) direction and in the x (east-west) direction.
For the example above:

In the Y direction: $V1(y) = 3$ knots
$V2(y) = -\cos(45)\ .875 = .62$
$V1(y) - v2(x) = 2.38$ knots

In the X direction: $V1(x) = 0$
$V2(x) - \sin(45)\ .876 = .62$

The resulting current looks like:



The length of the vector is:
$= SQRT[(.62)^2 + (2.38)^2] = 2.45$ knots
Angle - $\tan^{-1}(2.38/.62) = 3.8$ at 75 Degrees

Another example using a radar transfer-plotting sheet can be found on page 2-20 of the U.S. Navy Salvage Manual.

Appendix I. Heavy Oils

Group V oils are defined in the Federal Register as "persistent" oils with a specific gravity greater than 1. The Coast Guard asked the National Research Council to research heavy oils in 1998 (National Research Council, 1999). The Committee on Marine Transportation of Heavy Oils used the term "nonfloating oil" to describe all oils that do not float on water. These oils move into the water column by the nature of their properties or by becoming mixed with sand or soil. These types of oils can be heavy crude oils, fuels oils, (such as No. 4, no. 6 and Bunker C) as well as asphalt, coal tar, carbon black coke and pitch. The committee found that from 1991-1996, approximately 23 percent of products spilled in United States waters were nonfloating oils, and barges accounted for about 80 percent of these spills. The committee also determined that tracking subsurface oil is difficult and few of the containment and recovery techniques are effective, especially in fast currents. The report can be accessed from the Internet (see reference section).

A general approach is provided by Brown (Brown, Owens, and Green, 1997) and is modified in the table below.

Table I-1. Guide to heavy oil response.

SITUATION ASSESSMENT	REMARKS
Can the oil be accurately located?	Visual - not very useful in fast currents unless oil stays at bottom and divers can locate Photobathymetric techniques - not good for changing bottom Water Column Sampling - only provides quick look Acoustic - has not been proven Grab Samples - good for bottom deposits Bottom Trawls - difficult to determine pre-existing conditions *In Situ* Detectors - only provides point evaluation but may be useful built near intakes
How long will the oil likely stay there?	Need knowledge of oil and local area
Is the oil likely to move, be eroded or be buried?	Very likely in fast currents
What are the environmental effects of the submerged or sunken oil?	Sensitive areas or wildlife Intakes
POSSIBLE OBJECTIVES (select only one)	
Allow to weather and disperse naturally	Reasonable for small spills with limited sensitive areas
Contain and recover all of the oil	Time-critical
Contain/recover as much oil as practical and safe	Time-critical
SELECT APPROPRIATE STRATEGIES OR TOOLS	
Containment	
Physical Barrier	If shallow enough, use dams or trenches
Silt Curtain	Not very good in fast currents, but multiple curtains could slow down or force oil to surface
Pneumatic Curtain	Difficult in fast current
Net Booms	Not effective in fast currents
Shrimp Netting	More effective when filled with debris but difficult to handle in fast currents.
Removal	
Vacuum pumps and air lift	Good for small areas, pump to shore provides more recovery options
Dredges	Consider environmental effects
Clamshells	Good for large pieces
Physical	Divers collect hard pieces, visibility is usually limited in currents
FEASIBILITY ANALYSIS	
Is the operation feasible logistically and is it safe?	Logistics are important
Are the appropriate resources available?	Contingency planning required
Can the objective be met with any degree of confidence?	Training needed
Will there likely be a net environmental benefit?	Determine the impact

As the table indicates, in shallow water with low flow rates, curtains and dams can be used. For known trouble areas or near intakes, dams and trenches can be pre-built but need to be maintained. Most of the removal techniques may require the use of divers to local the oil, but visibility is usually limited in fast currents and the manpower and logistics requirements are high.

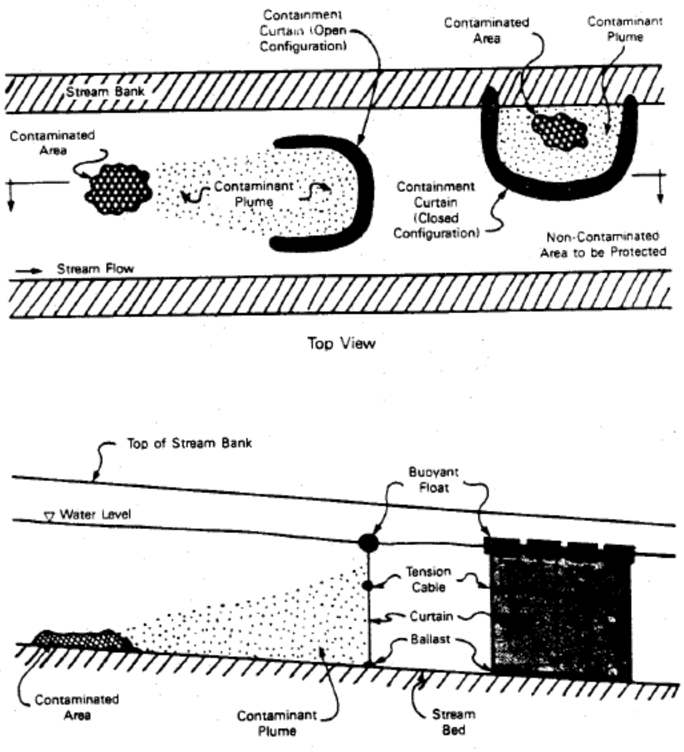


Figure I-1. Plume containment (U.S. EPA, 2000).

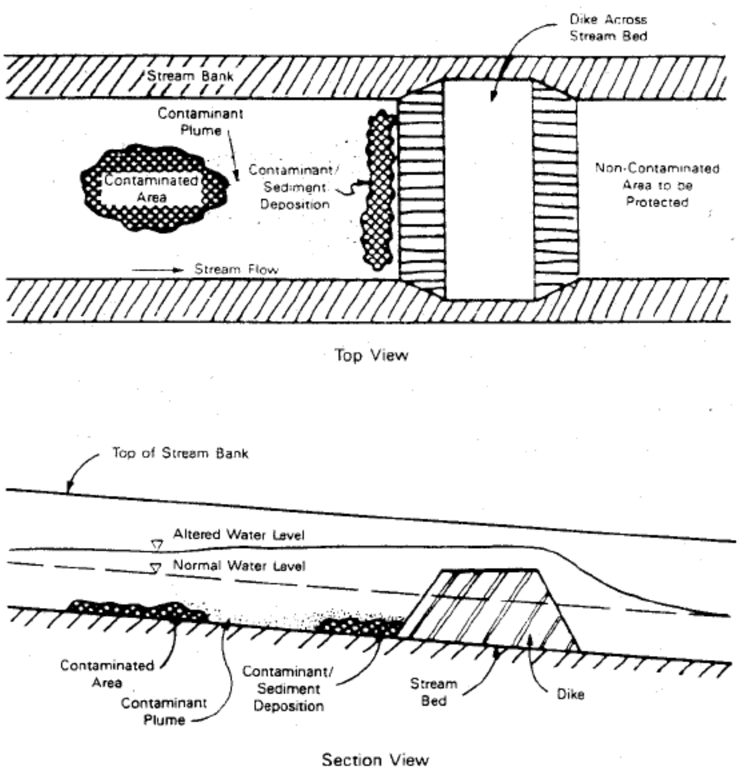


Figure I-2. Bottom containment (U.S. EPA, 2000).

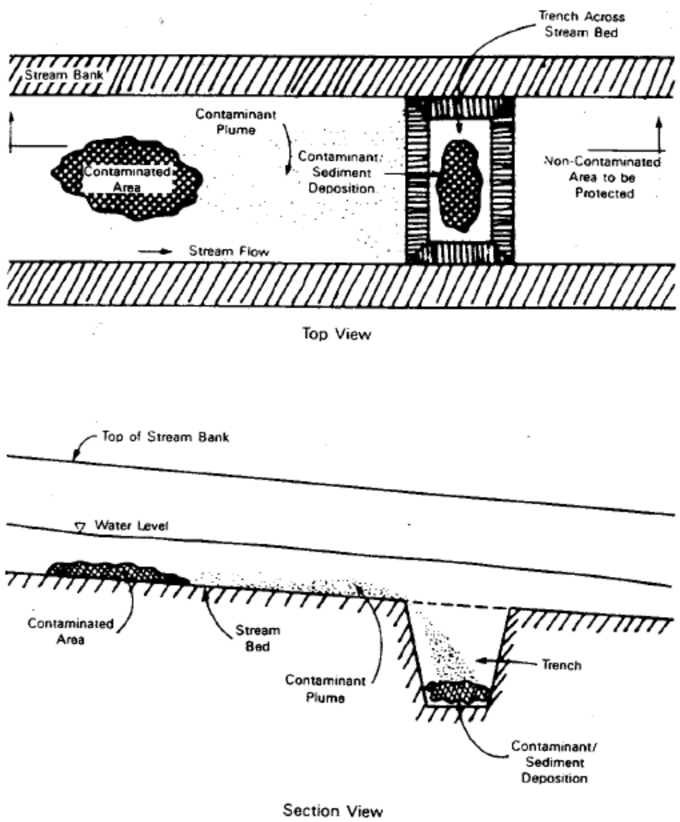


Figure I-3. Trench containment (U.S. EPA, 2000).

There are many barriers to an effective response for nonfloating oils. These include the lack of contingency planning and the absence of information and resources available for a response. Discussions should be held with area committees, resources identified and training conducted so that the response can be started quickly and conducted safely.

Appendix J. Culvert Calculations

The major parameter in dealing with small streams and culverts is the flow rate, usually given in cubic feet per minute. There are many configurations for flow through a culvert and the results vary depending upon the input source, the slope and the outlet conditions. This appendix will provide some general guidance that will help to approximate flow conditions so that dam dimensions and pump sizes can be estimated[67].

Open Channel Flow

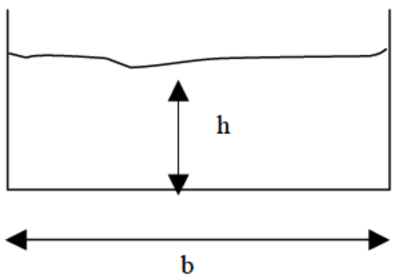
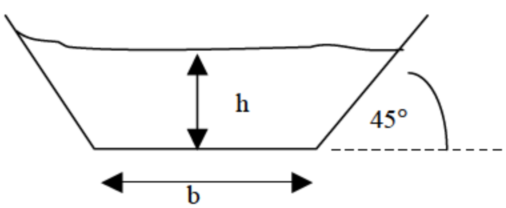
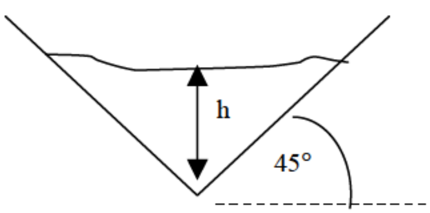
Flow for most streams and culverts can be approximated using the simple formulas for open channel flow. The equation that is used is:

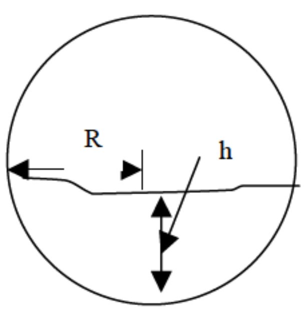
$$\mathbf{Q = V \times A}$$

Where Q = flow in cubic feet per second
V = velocity in feet per second. This can be easily calculated from Table F-1 or using a flow meter.
A = area of stream in square feet.

Some configurations and formulas for areas are given below. Use the ones that are the closest to the type culvert or stream being dammed.

Table J-1. Channel parameters (Streeter andWylie, 1975), (CRC, 1973).

CONFIGURATION	AREA	WETTED PERIMETER
	$\mathbf{A = b \times h}$	$\mathbf{P = b + 2h}$
	$\mathbf{A = by + h^2}$	$\mathbf{P = b + 2.8h}$
	$\mathbf{A = 1/2\ y^2}$	$\mathbf{P = 2.8h}$



If h (water level) is less than R (radius) then:
$A = R^2 \cos^{-1}[(R-h)R] - (R-h)\ [(2Rh-h^2)]^{1/2}$ or see table J-2

If h is larger that R then:
Calculate the total area-= $\pi \times R^2$ And estimate how much of the opening has water and multiply by that fraction

Table J-2. Segments of a circle, given h/D (Baumeister, 1978).

h/D	Arc/D	Area/D^2
.05	.451	.015
.1	.643	.041
.15	.795	.074
.2	.927	.112
.25	1.047	.153
.3	1.159	.198
.33	1.224	.226
.35	1.266	.245
.4	1.369	.293
.45	1.471	.343
.5	1.571	.393

. **Directions** for Arc, multiply D x (arc/D) from chart
for Area, multiply D^2 x (area/D^2) from chart

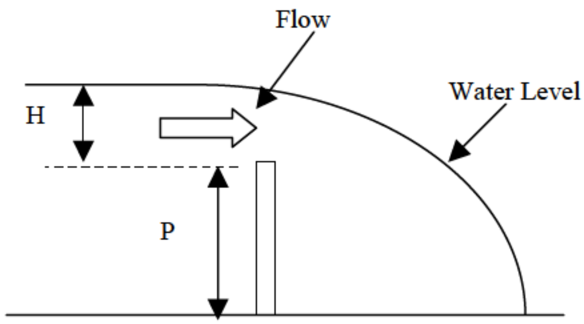
If the velocity cannot be determined because of obstructions, another method to calculate flow is the equation (Baumeister, 1978):

$$Q = \frac{1.5}{n} \times A \times R^{2/3} \; S^{1/2}$$

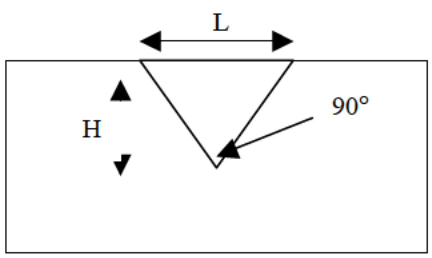
Where n = average roughness factor
Finished concrete = 0.012
Unfinished Concrete = 0.014
Corrugated pipe = .025
Earth and gravel = .03
A = area in square feet
R = hydraulic radius in feet (Area / wetted perimeter, see Table J-1)
S = slope in foot of drop per foot of length.\
For example, if a culvert drops one foot over a 100-foot
Length, the slope is 1/100 or 0.001.

Weirs

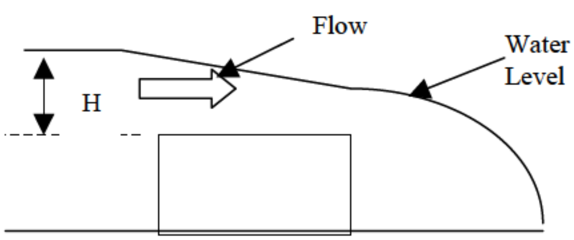
In some situations, if water is flowing so slowly or a slope is difficult to determine, flow can be calculated by the amount of water going over a dam before the oil arrives. The approach taken here is using weir calculations. A weir is a barrier that causes water to back up behind it and eventually flow over it. There are multiple configurations for the shapes and sizes of weirs but three general configurations will cover most of the conditions found in the field. These include the rectangular sharp-crested weir, a V-notch sharp-crested weir and a broad crested weir. The major measurement is to determine the height of the water that is being held back. The arrangements and equations for the three configurations are shown below where L is the width (Streeter and Wylie, 1975):



$$Q = 3.33 \text{ x } L \text{ x } H^{3/2}$$



$$Q = 2.5 \text{ x } H^{2.5}$$



$$Q = 3.09 \text{ x } L \text{ x } H^{3/2}$$

Appendix K. Safety

Safety of response personnel is a primary objective in all spill response operations, and fast water response is no exception. A safety plan must be developed prior to the deployment of resources. Before deploying resources on scene, an operational risk assessment and site characterization must also be performed. Trained health and safety professionals must review the oil properties, toxicity and physical hazards, environmental factors and working conditions prior to deploying resources on scene (Title 29 Code of Federal Regulations, Part 1910.120). Under no conditions should response personnel be subjected to *unnecessary* risks for purely environmental reasons. Fast water response is more complex and inherently more dangerous than response in slower waters. *Fast water response should only be accomplished when the human health risk assessment and net environmental benefit indicate that responding in fast waters is a better alternative overall to recovery on shore or in calmer waters.*

Large brim hard hats and fireman helmets are not recommended because they can act as a scoop in swift water causing neck injuries. Use exposure suits, wet suits or dry suits for response personnel in cold-water conditions. Life jackets with zippers are preferred. Those equipped with clips or snaps are not recommended as they can get tangled with lines. If only life jackets with clips are available, consider wearing them inside out or turn the working end of the clip inwards towards the body to reduce the chance of snagging. A sharp knife, preferably those with one-handed opening design, should always be handy to cut lines if an emergency occurs. Due to the extreme forces on boom and skimmers in swift currents, personnel should avoid lines that are under tension. **Beware of line snap back in both directions**. A method to recover personnel who have fallen in the water should be in place. This should include a rescue boat, line throwers or a safety line. The safety line should be placed at an angle to the current.

Several organizations such as the American Canoe Association, Rescue 3 and PRI provide courses in fast water/swift water rescue (see internet references). In addition, many local Fire Departments have fast water rescue/recovery teams that can provide training in recovery procedures or be activated to assist as a safety measure when working in fast water environments.

Response operations pose many significant hazards and the following table lists some of the more prominent hazards. This list is not all inclusive, but is provided for planners and persons unfamiliar with response operations hazards that may be encountered.

HAZARD	INJURY POTENTIAL	CONTROL
Slips, Trips and Falls	Critical - broken ankles, arms, head injuries, etc.	• Avoidance • Proper footwear • Stabilizing lines • Walking mats • Hard hat/bicycle helmets
Ergonomic (Back strain)	Critical - back injuries, sprains, hernias, etc.	• Proper lifting • Proper tools • Minimal handling • Mechanical Assistance
Heat/Cold Stress, Environmental Exposure	Critical - Frost bite, heat stroke	• Proper clothing (Cold: dry, wet, exposure suits) • Proper eating & drinking • Work/rest periods • Medical Monitoring • Sunscreen/Sunglasses
Flammability	Critical - Fire/explosion	• Air Monitoring • Ventilation • Secure ignition sources • Beware of culverts, enclosed spaces, under piers, bottom of steep river banks

HAZARD	INJURY POTENTIAL	CONTROL
Oil Toxicity: Benzene, Toulene, Ethyl-benzene, Xylene, Polycyclic Aromatic Hydrocarbons, Hydrogen Sulfide, Benzo-a-pyrene, etc.	Critical: Carcinogens, asphyxiants, skin absorbers, dermatitis, eye irritation, central nervous system effects: nausea, dizziness	• Air monitoring • Respiratory protection • Dermal protection • Wait until toxics volatilize, verify through monitoring
Water (drowning)	Critical - death, hypothermia **<u>Consider the following:</u>** • Don't swim against current, Swim perpendicular • Swim on back, feet downstream • Use hands & feet to fend off obstructions • Do not tie rope around swimmer or rescuer • Angle rescue lines down current • Stay on upstream side of the line • Never clip into the line	• Buddy system • Life jackets • Cold weather gear • Fall restraints • Life rings, boat hooks • Rescue boats • Avoid waders • Bicycle helmets can be substituted for hardhats only if no overhead hazards exist. • Avoid slip on fireman boots • Avoid loose clothing
Line Hazards	Critical – death, loss of limbs, eyes, broken appendages	• Keep free lines coiled • Keep (coiled) lines clear of work area • Have knife available to cut lines • Use “tattles” to warn of line breakage • Use safety observer • Use proper line plus large safety margin for force anticipated • Ensure “system” breaks at preferred “weak” link
Equipment Hazards: Power units, pumps, hoses, skimmers, control stands, etc.	Critical and varied: • Eyes from hydraulic lines • Noise from power units • Inhalation of diesel exhaust • Pinch points, cut points resulting in lacerations, bruises and finger loss	• Goggles around hydraulic hoses • Hearing protection • Guards around danger points • Secure lose clothing & remove jewelry • Keep clear of exhaust

Appendix L. Technology Assessment

Technology Ratings

Booming strategies, specialized boom, alternate containment methods and high-speed skimmers are rated in several categories and presented in Table L-1. This is a general summary of their capabilities as discussed throughout the report. The rating process was based upon independent data, manufacturers' information, experience and engineering estimates. Technology names identified with an asterisk indicate that ratings are less reliable because data from controlled tests with oil were not available. Although data were used to determine the ratings whenever possible, rating determinations were made by the author in somewhat of a subjective manner for categories of: ease of deployment, effectiveness in debris/ice and effectiveness in shallow water. All category ratings, however, were reviewed, discussed and in some cases, revised based on input provided by participants at a ASTM F-20 committee meeting workshop. Direct comparison between individual technologies is not recommended due to the variability in the test conditions.

1. Highest Effective Speed

The highest effective speed rating assumes that the equipment being rated is used by people who have been trained and are experienced in fast water response with that technology. The speed in knots represents the highest practical current or speed of advance, as applicable, that the technology can still effectively deflect, contain or skim oil from the water. Calm water conditions are assumed. Effectiveness will generally be diminished at the higher velocities, however, the majority of the oil (more than 50 percent) encountering the device will be controlled or recovered as desired at that upper limit speed rating.

2. Effective in Waves

Effectiveness in waves is dependent upon the oil recovery rate and oil recovery efficiency or deflection/containment capability. Generally, a technology that has good reserve buoyancy, adequate freeboard and draft, or can be decoupled from the influences of waves, will continue to be effective in waves. Short-crested waves usually degrade the performance of equipment more than large long-period swells. A low (L) rating represents effectiveness in calm water conditions up to one-foot short crested waves. A medium (M) rating indicates effectiveness in short crested waves between 1 and 3-feet high, while a high (H) rating represents satisfactory performance in waves 3 to 6-feet high. Effectiveness in these conditions means that the technology will contain or collect the majority of the oil it encounters.

3. Effective in Debris/Ice

Floating debris will cause problems with equipment by damaging it, moving it or rendering it ineffective. Some equipment is less affected by debris and floating ice due to its robust nature or method of containment/recovery. Some skimmers use debris screens that protect the pump but often require manual tending to remove the debris. A high (H) rating means that the skimmer will continue to function well in floating debris and ice with minimal manual tending required. Medium (M) rating represents a degraded performance level in debris, while a low (L) rating indicates serious problems with performance in debris. Both M and L ratings require significant manual tending to remove debris.

4. Effective in Shallow Water

Effectiveness in shallow water indicates the technology has a low or no draft requirement and that it will effectively contain, deflect or remove oil as designed. A yes (Y) indicates that a skimmer or boom system is manufactured that is effective in 2-feet deep water or it is not limited by a water depth of two feet. It is possible that some skimmers or boom systems receiving a no (N) rating could be produced by the manufacturer to function in shallow water (if requested by a customer).

5. Ease of Deployment

The ease of deployment rating reflects the amount of complexity, training required, people and logistics involved to deploy and use the technology successfully. The more resources and training required to deploy the technology and use it effectively, the lower the rating. The faster a technology can be deployed with a minimum number of people and support equipment, the higher the rating. Generally, technology with a good (G) or a very good (VG) ease of deployment rating will continue to be effective close to the highest effective speed rating when using inexperienced personnel.

6. Oil Viscosity Range

A low (L) rating indicates that a skimmer is effective in light oil with a viscosity between 1 and 100 cSt. Medium (M) indicates effectiveness in medium grade oils with a viscosity between 100 and 1,000 cSt, while high (H) means the skimmer was effective at recovering heavy oil with a viscosity between 1,000 and 60,000 cSt. A skimmer was considered effective if tests recorded reasonable recovery rates and recovery efficiencies of at least 50 percent. If a viscosity range is not listed for a skimmer, then the skimmer is not effective at recovering oil in that viscosity range.

7. Oil Recovery Efficiency and Oil Recovery Rate

Skimmer specific performance ratings are based upon independent performance test data when available and manufacturer claims. When data were not available, physics and engineering principles were used to approximate performance. Generally, oil recovery efficiency will decrease and oil recovery rate will increase with speed. Technologies with the higher efficiencies and recovery rates that were not significantly degraded by increases in speed were given higher ratings. Skimmers with comparatively lower efficiencies and recovery rates that degraded quickly at faster speeds were given lower ratings. For details on skimmer performance, see discussions in the High-Speed Oil Skimmers section and cited references. Skimmers that demonstrated a poor (P) performance for recovery efficiency and/or oil recovery rate in currents above one knot were not included in this report and table.

Table L-1. Technology assessment of strategies and equipment (from ASTM Committee F20) (Coe and Gurr, 1999)

Technology Ratings For Oil Containment and Recovery Systems In High Speed Currents (1-6 knots)

Technology Name	Highest Effective Speed (kts.)	Effective in Waves[1]	Effective in Debris/Ice	Effective in Shallow[2]	Ease of Deployment	Skimmer Specific Performance: Oil Viscosity Range[3]	Skimmer Specific Performance: Oil Recovery Efficiency[4]	Skimmer Specific Performance: Oil Recovery Rate[5]	Comments:
Booming Strategies									
Cascade (DOWCAR Environmental)*	4	L	M	Y	F				Short sections independently moored to shore.
Deflection (Trans Mount. Pipeline)*	4	L	M	Y	F/G				Longer sections with shore tiebacks downstream.
Chevron (closed)*	3	M	M	Y	G				Quick to deploy because it uses fewer anchor points.
Chevron (open)*	3	M	M	Y	G				Allows for vessel traffic between openings.
Current Rudder (Blomberg Offshore)*	3	M	H	N	F				Allows for vessel traffic by control of rudder from shore.
Double Boom*	3	M	H	Y	F				Improved containment but hard to keep separated properly.
Boom Deflectors (Envirotech Nisku)*	4	M	M	Y	G				Deflectors used to keep boom at an angle without anchors.
Boom (Specialized)									
Fast Sweep (V-Shaped)	1.5	H	L	N	G				Net across foot of boom keeps it in a V-shape.
Rapid Current Boom (UNH)	2.5	L	L	N	P				Inclined plane, fabric bottom with outlet holes in pocket.
Horizontal Oil Boom	2.5	M	L	N	F				Two booms connected by net & filter fabric.
Holes in lower draft*	2	M	L	N	G				Larger draft with relief holes in lower skirt to reduce drag.
Net in foot of boom (NOFI)	1.3	H	L	N	G				Short vertical net at foot of the boom.
Foam 6" X 6", two tension lines*	4	L	L	Y	VG				Typical fast water diversion boom with upper & lower tension.
External Tension Line foam	2	M	L	N	F				High stability, limited reserve buoyancy.
Shell High Current "Boom"	3	L	M	Y	P				Rigid aluminum perforated inclined plane structure, diversion system.
Alternate Methods									
Pneumatic Boom	1.5	M	H	N	G				High power required (30 hp/ft).
Water Jet (Horizontal)	3.5	M	M	Y	F				Reasonable power requirements (3 hp/ft).
Water Jet (Plunging)	4	M	M	N	F				Reasonable power requirements.
Air Jet	3	M	M	Y	F				Low power required (1 hp/ft).
Flow Diverters (paravanes)	6	H	M	Y	VG				No power, changes surface currents to direction of anchor point.
Floating Paddle Wheel	3	M	M	Y	G				Low power required (0.25 hp/ft), high-energy transfer.
Earth Dam (underflow)*	2	M	M	Y	P				Barrier blocking low flow into an inlet or out of a stream.

Technology Name	Highest Effective Speed (kts.)	Effective in Waves[1]	Effective in Debris/Ice	Effective in Shallow[2]	Ease of Deployment	Skimmer Specific Performance: Oil Viscosity Range[3]	Oil Recovery Efficiency[4]	Oil Recovery Rate[5]	Comments:
Skimmers									
Incline Skimmers									
Dynamic (JBF)	3	M/H	M	Y	G	L,M,H	G	G	VOSS & self propelled versions.
Static (Hyde Products)	5	M/H	M	N	G	L,M,H	G	G	VOSS, low maintenance
ZRV Skimmer									
Rope Mop (Ro-Clean Desmi)	5	H	H	N	G	L,M,H	VG	F	VOSS & self propelled catamarans
Sorbent Belt (USCG)	6	M	M	N	G	L,M,H	VG	F	Very high maintenance but effective
Quiescent Zone									
Expansion Weir (Vikoma)*	3	L	L	Y	G	L,M	F	G	Expansion slows flow
Circulation Weir (Blomberg Circus)*	3	M	L	Y	G	L,M,H	G	G	VOSS, portable lagoon
Brush Conveyor (Lori)	3	M/H	M/H	N	G	M,H	VG	F	VOSS, barge & self-propelled
Streaming Fiber & Belt (USCG)	3	M	L	N	G	L,M	G	F	Fibers slow flow, belt & weir remove oil
Lifting Belt									
Filter Belt (Marco)	3.5	M/H	M/H	Y	G	M,H	VG	F	Self-propelled & induction impeller
Rotating Disk Brush									
Rotating Brushes (Lamor)	3	M/H	M/H	Y	G	M,H	VG	G	VOSS, barge & self-propelled
Surface Slicing									
High Current Oil Boom	6	L	L	N	G	L,M,H	F	G	Weir with foil bow
Multi-purpose Oil Skimmer Sys.	3	M/H	L	N	G	L,M,H	F	G	Wave following weir
Russian Debris Skimmer	3	L	M/H	N	G	L,M,H	G	G	Debris filter, weir and gravity separator tank.
Trailing Adsorption									
Trailing Rope Mop (Force 7)*	4	H	H	N	F	L,M,H	VG	F	Batch processing requires retrieval of rope mops and paravane.
Free Floating Sorbent*	5	H	H	Y	G	L,M,H	VG	F	Free drifting sorbents and recover them downstream

Legend

H High; M Medium; L Low
Y Yes; N No
VG Very Good; G Good; F Fair; P Poor

Notes:

1. Low is effective in calm water to 1 foot waves, Medium is effective in 1 to 3 foot waves, and High is effective in 3 to 6 foot waves
2. Yes indicates that a skimmer or boom system is effective in 2 foot of (shallow) water.
3. Low indicates a skimmer is effective in light oil 1-100 cSt viscosity, Medium 100-1,000 cSt and High 1,000-60,000 cSt
4. Oil recovery efficiency is the percent of oil recovered compared to the total volume or oil and free water collected.
5. Oil recovery rate is the rate of oil collected which is a combination of recovery efficiency and throughput efficiency.

* Controlled tests results with oil were not available so ratings were based on engineering principles, expert opinions and field experience. Technology names with no asterisk were rated based upon data obtained from controlled tests with oil.

Appendix M. Notes

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INTERNET REFERENCES

Related Web-Based Links

The following web-based links have been included in the field guide to provide the user a quick reference to related Internet web pages:

WEBSITE	INFORMATION
• http://water.usgs.gov/public/realtime html	Near real-time river stream flow and stage height data
• http://www.nrt.org/	National Response Team
• http://response.restoration noaa.gov/oilaids.html	NOAA Response Aids
• http://www.epa.gov/oilspill/index htm	EPA Web Site
• http://www.epa.gov/region5oil/datamap html	EPA Region 5
• http://www.uscg.mil/hq/g-m/nmc/response/	USCG Response Publications and ICS Job Aids
• http://www.mms.gov/offshore/	Minerals Management Service (MMS)
• http://www.glo.state.tx.us/oilspill/	Texas General Land Office
• http://www.usace.army mil/	US Army Corps of Engineers
• https://www.denix.osd.mil/denix/Public/News/Army/Dig/toc.html *	US Army Corps Response Manual
• http://www.rdc.uscg.gov/	US Coast Guard R&D Center
• http://www.ohmsett.com/	MMS Ohmsett Facility
• http://www.freshwaterspills net/	Great Lakes Commission
• http://www.nrc.uscg.mil/index.htm	CG National Response Center
• http://www.nap.edu/books/0309065909/html/	NRC, Spills of Nonfloating Oils
• http://www.acanet.org/acanet.htm	American Canoe Association
• http://www.swift water-rescue.com/	P.R.I. Rescue Training Specialists
• http://www.h2orescue.com/	Rescue 3 International
• http://www.arctic-council.org/fldguide/index.asp	Arctic Council Field Guide for Oil Spill Response
• http://www.freshwaterspills net/	Freshwater Spills Information Clearinghouse

* If unable to link, please type in Internet address to access site.

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FRP Review & Revision Logs

In This Section

PHMSA Sequence Number 606

FRP Review Log

FRP Review Log	
Assigned location of this manual is:	Headquarters - Houston, Texas
	Common reference to all copies.
The individual(s) designated to review this manual is:	
Title of Identified Reviewer:	Emergency Preparedness & Response Advisor
	(Print title)
Name of Identified Reviewer:	J. Thomas Budde
	(Print name)
This manual was reviewed as indicated below:	

Name	Date	Remarks
John W. Dunn, III	11-8-02	New Manual. Reviewed, reformatted and revised entire manual.
John W. Dunn, III	11-4-03	Reviewed and revised manual.
John W. Dunn, III	11-16-04	Reviewed and revised manual.
John W. Dunn, III	11-30-05	Reviewed, reformatted and revised entire manual.
John W. Dunn, III	November-06	Reviewed manual.
John W. Dunn, III	October-07	Reviewed and revised manual.
John W. Dunn, III	October-08	Reviewed and revised manual.
John W. Dunn, III	September-09	Reviewed and revised manual.
John W. Dunn, III	April-2010	Reviewed and revised manual.
Eric Julian	November 2010	Reviewed and revised manual.
Eric Julian	November 2011	Reviewed and revised manual.

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Name	Date	Remarks
John Dunn	September 2012	Reviewed and revised manual.
John Dunn	February 2013	Reviewed and revised manual.
J. Thomas Budde	February 2014	Revised in response to Correction Letter

FRP Revision Log

FRP Revision Log	
Assigned location of this manual is:	Headquarters - Houston, Texas
This manual was revised as indicated below:	

Name Date Revision Number	Sections Revised
John W. Dunn, III 11-4-03 #1	• Section 11 and section 12, updated names and phone numbers
John W. Dunn, III 11-16-04 #2	• Section 11 and section 12, updated names and phone numbers
John W. Dunn, III 11-30-05 #3	• Added Review Change Log sheets • Section 11, updated names and phone numbers, added tank table, Changed WCD volume. Added oil summary on page 4, section 11. • Section 12 Updated General Notification Flowchart, Updated Names and Phone numbers • Section 13 Updated Equipment Lists, OSRO and Contractor list • Section 14 Added calculation table for WCD Scenario. Updated WCD volume based on new guidance in the reg • Section 15 Reformatted • Map Section Added new section with maps of entire system.
John W. Dunn, III January 2007 #4	• Section 12, Updated Contact List.
John W. Dunn, III January 2007 #5	• Section 12, Updated Contact List.

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Name Date Revision Number	Sections Revised
John W. Dunn, III October 2007 #6	• Section 12, Updated Contact List.
John W. Dunn, III October 2008 #7	• Section 12, Updated Contact List.
John W. Dunn, III September 2009 #8	• Section 12, Updated Contact List.
John W. Dunn, III April 2010 #9	• Section 12, Updated Expanded Response Personnel Contact List.
Eric Julian, Robert Thompson, Frank Box November 2010 Rev. #10	• Section #11, Updated Contact and pipeline List.
Eric Julian November 2010 Rev. #10	• Section #12, Updated Contact List.
Eric Julian, Charles Holt November 2010 Rev. #10	• Section #13 • Updated OSRO and Contractor list
Eric Julian November 2011 Rev.#11	• Section 12 (Response personnel), 13 (OSRO), 15(Water Resources Table 15-6)
John Dunn September 2012 Rev #12	• Section 11 & 12 Updated Contact data
John Dunn February 2013 Rev #13	• Section 12 Updated Contact data
J. Thomas Budde February 2014 Rev #14	• Section 15, updated sensitive area mapping • Section 14, added historical discharges • Section 13 added OSRO contracts • All Sections Replaced references to RSPA with PHMSA • Section 12 Updated Contract Data

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Section 11 Response Zone Summary

In This Section

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Operator Address

CFR §194.113(b)(1)

Shipping Address
ExxonMobil Pipeline Company
800 Bell Street, PL-EMB- 603F
Houston, Texas 77002

Emergency Hotline (24 hours, 7 Days a Week): 800-537-5200

The field offices for response operations within the applicable geographic operating areas for the Mid-Tex/Bayport Response Zone are:

Houston Area
ExxonMobil Pipeline Company
Friendswood Office (Main Office)
301-A Old Choate Road
Houston, Texas 77034

Qualified Individuals

CFR §194.113(b)(2)

The following are the names and telephone numbers of the Qualified Individual (QI) and the Alternate Qualified Individuals.

Qualified Individuals			
Name/Position	**Office**	**Cellular**	**Home**
Scott Hathaway **(QI)**	281-925-3705	[redacted]	[redacted]
Pat Flowers **(Alt. QI)**	281-332-0914	[redacted]	[redacted]
Robert Thompson **(Alt. QI)**	713-475-0106	[redacted]	[redacted]

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Pipeline Facilities within Response Zone

CFR §194.113(b)(3-4)

Oil Summary: Types of oil transported: petroleum crude oil, gasoline, diesel and jet fuel. (Gasoline, diesel and jet fuel defined as refined products.)

TLC No.	Line	Miles Pipe	Miles ROW	Largest Segment **	Reason For Compliance
109	Baytown- Products 4 – to Aldine 8"	27	21.6	12.8 (10")	San Jacinto River
109	Baytown Products 1 – N. Houston 10"	30	17.42	13.35	San Jacinto River
109	N. Houston – Satsuma 8"	13	13		White Oak Bayou
110	Satsuma-Navasota Refined Products 8"	40.36	40.36	10.08	Spring Creek
115	Baytown-Pierce Junction Refined Products 8", 10"	30.4	30.4	7.0 (8")	Houston Ship Channel
116	Pierce Junction-Colorado River Refined Products 8" (P.J. - Luling)	67.2	67.2	26.7	Brazos and Colorado Rivers
117	Luling-San Antonio RP 6"	51.68	51.68	23.6	San Marcos River, Guadalupe River, and Creeks
169	Baytown #3 - Pasadena 16" Refined Products (Gasolines)	10.2	10.2	8.17	Houston Ship Channel and Harris Cty. F/C Ditch
169A	Baytown #3 - Pasadena 12" Refined Products (Distillates)	10.14	10.14	4.27	Houston Ship Channel and Harris Cty. F/C Ditch
171	Pasadena-Colonial/Explorer 16"/36" Refined Products	4.4	1.5	1.325 (36")	Could migrate to drainage ditch
138	Aldine-Intercontinental Airport Jet Fuel 6"	7.7	7.7	7.7	Drainage Ditches
160	Irving-DFW Airport Refined Products 8"	13.0	13.0	9.84	Several Drainage Ditches
1A	Pierce Jct. (Friendswood)-Webster 12" (Abandoned)	66.0	20.6	10.52 (8")	Several ditches
25	Hwy 59-Baytown 20" (Moore Road-Baytown)	21.8	21.8	7.12	San Jacinto River
34	Anahuac-Turtle Bay-Baytown 6" & 10" (Abandoned)	3.25	3.25	3.11	Trinity River
40 & 40A	South Boling-(Danbury) Webster 8" (Abandoned)	66.4	61.5	15.92 (8")	San Bernard, Brazos Rivers, 1500 bbl leak in 1988
93	Webster-Baytown 8", 10", 12" (Abandoned)	61.5	18.6	6.77 (10")	Houston Ship Channel
63A	Webster-Baytown 16"	20.6	20.6	16.43	Armand Bayou, Houston Ship Channel

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TLC No.	Line	Miles Pipe	Miles ROW	Largest Segment **	Reason For Compliance
200	Webster Station-ARCO Receipt	0.8	0.8	.75	Clear Creek
217	Genoa Jct. - Webster Station 24" Crude Line	10.7	10.7	5.71	Harris County Fld. Control Ditches and Clear Creek
226	Quintana to Bryan Mound 24”	0.76	0.76	0.76	Dow Barge Canal
226A	Bryan Mound to Jones Creek 30”	7.94	7.94	3.9	Dow Barge Canal
226B	Bryan Mound to Texas City (DOE 40”)	45.6	45.6	6.1	Old Brazos River,Oyster Creek; Bastrop, Chocolate, New, Persimmon, Halls, Willow, Basford, and Highland Bayous

TLC = Trunk Line Chart
N/A = Not Applicable
** Longest segment section (in miles) which contains the largest volume between adjacent block valves.

Zone Classification

CFR §194.113(b)(5)

This response zone has been determined to meet the significant and substantial harm classification because at least one line section within the response zone has met at least one of the criteria listed in 194.103(c)(1).

Type of Oil and Volume of the Worst Case Discharge

CFR §194.113(b)(6)

Type of oil: Gasoline

Volume of worst case discharge: (b) (3), (b) (7)(F) [redacted]

Section 12 Notifications

CFR §194.107(d)(1)(ii),(2)

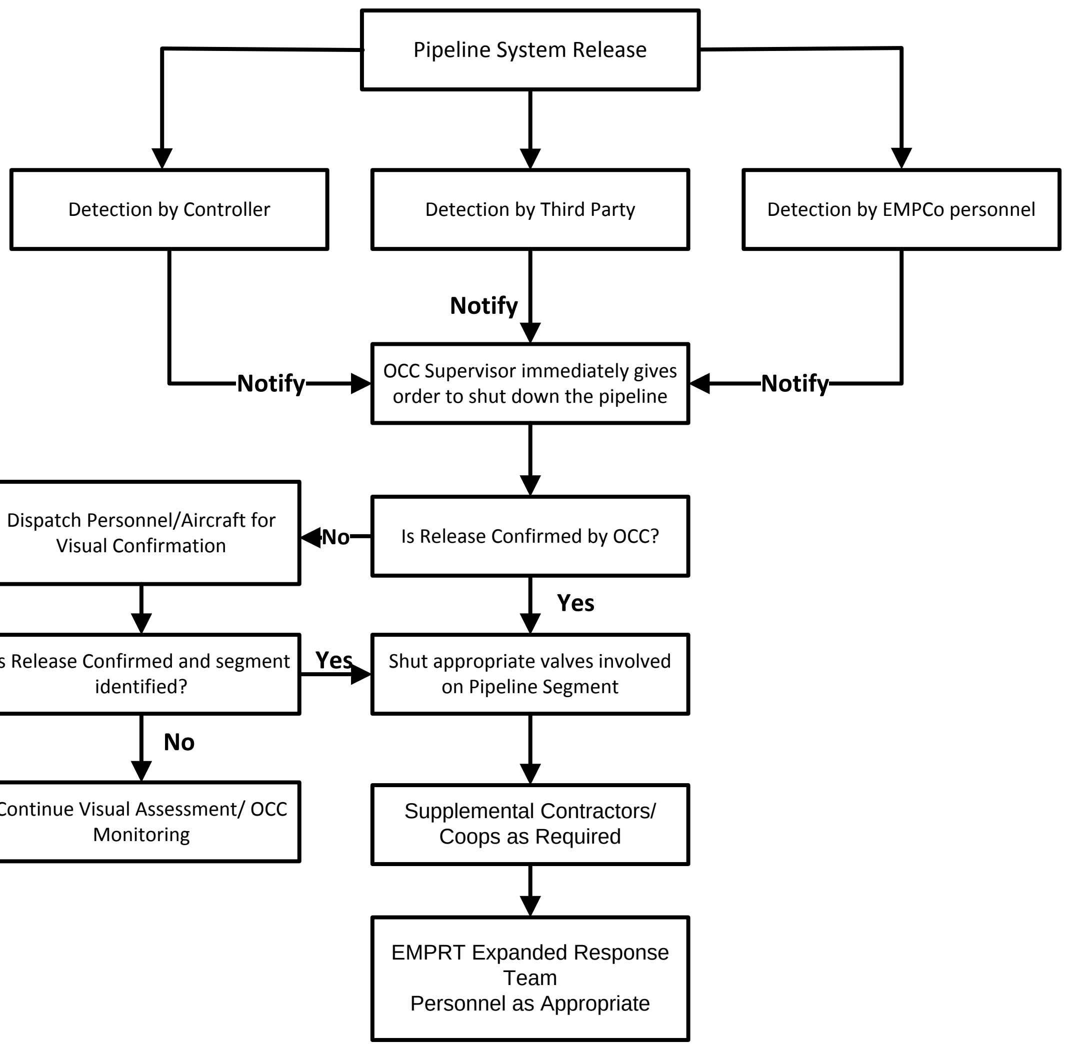
In This Section

Internal Notification

General Notification Flowchart

The following is a general notification flowchart that is to be used as a guide in the event of a reportable incident.

Note: When an abnormal condition is indicated by the hi-low pressure or flow monitors, the OCC will shut the system down in accordance with the OCC Operating Procedures. In some instances, local hi-low alarms will automatically shut a system down when preset limits are exceeded.



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Initial Notification Actions - Texas Telephone Notification Log

Date of Incident:____________________ Description of Incident:____

Verbal notification to Government Agencies (refer to EMPCo's Spill/Release Notification Guide); also, an IIR will need to be completed for reported spills.

CODE	AGENCY	PHONE #	NAME OF PERSON TAKING REPORT	DATE & TIME	CASE Number	NAME OF PERSON MAKING REPORT
Local-1	Local Sheriff/Police	911 (emergency)				
Local-2	Local Fire Department	911 (emergency)				
Local-3	LEPC	See attached list				
FED1	National Response Center	800-424-8802* 202-267-2675				
FED3	MMS, Gulf of Mexico Region	504-736-2591 Pager 504-423-5340				
FED4	OSHA	800-321-6472*				
FED5	OSHA	214-767-4731				
TX1	Texas Commission on Environmental Quality, Emergency Response Ctr.	800-832-8224 512-463-7727				
TX2	TX RR Commission, Oil and Gas Dist. Offices	See Page 19 - 20				
TX3	TX General Land Office	800-832-8224 512-475-1575				
TX4	TX RR Commission Pipeline Safety 24 Hr. Hotline.	512-463-6788				
TX5	TX Dept. of Public Safety, Div. of Emergency Mgmt.	512-424-2000				
TX6	TX Parks & Wildlife Dept.	512-389-4848				

EMPRT Initial Response Personnel

The following table lists members of the location response team who may need to be contacted in the event of a release.

EMPRT Initial Response Personnel

Response Position	Name / Title	Office	Cellular	Pager	Home
QI - Incident Commander	Hathaway, Scott Area Supervisor	713-475-0106	[redacted] (b) (6)	[redacted]	[redacted]
Alt. QI/IC Operations Section Chief; Assessment/ Control; Containment/ Cleanup Director	Pat Flowers Field Supervisor	281-332-0914	[redacted]	[redacted]	[redacted]
Alt. QI/IC Operations Section Chief; Assessment/ Control; Containment/ Cleanup Director	Robert Thompson, Tech leader	281-332-0916	[redacted]	[redacted]	[redacted]
Logistics Section Chief; Casualty/ Repair Director	Mike Stimpson, Tech Leader	713-920-1014	[redacted]	[redacted]	[redacted]
	Frank Morin, Tech Leader	281-332-0918	[redacted]	[redacted]	[redacted]
	Mike Cole, Tech Leader	713-920-1014	[redacted]	[redacted]	[redacted]
Safety Officer	Robert Tuttle Technician (Luling)	210-220-3420	[redacted]	[redacted]	[redacted]
	Maurice Kelly Technician	281-925-3851	[redacted]	[redacted]	[redacted]
	R.W. Kale, Technician (Irving)	972-579-3845	[redacted]	[redacted]	[redacted]

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EMPRT Expanded Response Personnel

EMPCo Operations Control Center (OCC) in Houston, Texas				800-537-5200 24 Hour Emergency Phone Number		
AREA	**NAME**	**OFFICE**	**CELL**	**Alternate (p)ager, (c)ell**	**Sat Phone #**	**HOME PHONE**
President	Pruessing, Gary	713-656-5056	[redacted]			
Public & Government Affairs Manager	Madina, Nick	713-656-5431				
Public & Government Affairs Advisor	Flournoy, A. E. (Amber)	713-656-2108				
		E				
US East Operations Manager	James, Jimmie	703-846-6692				
Area Manager	Fennell, C.S. (Chuck)	703-846-5672				
		Ris				
Risk and Integrity Manager	Jones, Johnita	512-306-7981				
		Operations Control				
Manager	Smith, Pat	713-656-6155				
ROWC Manager	Trice, Joe	713-656-5384				
Regional Manager	McMahon, Kelli	713-656-0649				
		Safety, He				
SH&E Manager	Mark Weesner	713-656-0227				
P-L Safety	Massengale, Thad	713-656-2258				
P-L Safety	Hawthorne, Larry (Doc)	903-654-5345				
P-L Safety	Yates, Kirwin	337-269-5221				
Medical Ind Hyg.	Sheffer, Jennifer	713-656-9850				
Safety/EP&R/ Security	Hinson, Chris	713-656-9750				

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EMPCo Operations Control Center (OCC) in Houston, Texas				800-537-5200 24 Hour Emergency Phone Number		
AREA	**NAME**	**OFFICE**	**CELL**	**Alternate (p)ager, (c)ell**	**Sat Phone #**	**HOME PHONE**
EP&R Advisor	Budde, J. Thomas	713-656-3666	(b) (6) [redacted]			
Environmental Planning Supervisor	Magruder, Brian	713-656-2190	[redacted]			
Air Advisor-Houston	Crawford, Wesley	713-656-2275	[redacted]			
Air Advisor-Houston	Rogers, F. (Frank)	713-656-2232	[redacted]			
Waste	Lee, Janie	7136564629	[redacted]			
Water	Martin, Tim	713-656-3440	[redacted]			
FEA - Northeast	Stanhope, Mallory	713-656-4629	[redacted]			
FEA Midwest and Rockies	Stamatakis, Christina	713-656-2197	[redacted]			
FEA - Austin	Worrell, G. (Gail)	512-708-9689	[redacted]			
FEA - Texas Chemicals & Southeastern Areas	Smith, Marshall	281-925-4285	[redacted]			
FEA - West Coast	Renee K. Nygaard	310-212-4190	[redacted]			
			[redacted]			
Eng Manager	Hermosillo, J.C (Chuy)	7136563874	[redacted]			
Eng Specialists Manager	Rup, M. A. (Mark)	713-656-4234	[redacted]			
Field Eng Manager - Central & Northeast	Shafi, Shazad	713-656-8907	[redacted]			
Field Eng Manager - West	Rodriguez, Edgardo (Gary)	713-656-4272	[redacted]			
Projects Group Manager	Brewer, Carl	713-656-4967	[redacted]			
CADD Coordinator	Blatt, Brian	7136561866	[redacted]			
			L [redacted]			
LAW - General Counsel	Troy Cotton	713-656-3783	[redacted]			

PHMSA Sequence Number 606

EMPCo Operations Control Center (OCC) in Houston, Texas				800-537-5200 24 Hour Emergency Phone Number		
AREA	**NAME**	**OFFICE**	**CELL**	**Alternate (p)ager, (c)ell**	**Sat Phone #**	**HOME PHONE**
Admin. Asst. Fax 713-656-5593	Albert, Janet	713-656-5595	[redacted]			
Counsel	Knull, Anna	713-656-3540				
Counsel	Davenport, S.E.	713-656-6802				
Counsel	Randolph, Johnnie	713-656-8927				
		ExxonM				
Security Advisor (Primary contact)	Davis, Jimmy	281-654-2474				
Security Advisor (Alternate contact)	Rice, Geoff	703-846-4425				
EMI	(Drug Testing Dispatcher)	800-421-3674				
Security	Greenspoint 4, 24 hour	281-654-6220				
		Str				
NARRT Activation Number		**1-866-2**				
NARRT Coordinator	Cliff Doumas	703-846-2513				
EM Chem Emergency Response Contact	Joublanc, Scott	281-870-6649				
BRRF (CHEMNET Team Activation)	Shift Superintendent	225-977-8133				
Baytown (CHEMNET Team Activation)	Shift Supervisor	281-834-5305				
US Strike Team Coordinator	Tomblin, Tommy	281-834-4528				
North East Strike Team	Jim Belrose	519 339-4178				
Central Strike Team - Joliet	Paul Nourie	815-521-7574				

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EMPCo Operations Control Center (OCC) in Houston, Texas				800-537-5200 24 Hour Emergency Phone Number		
AREA	**NAME**	**OFFICE**	**CELL**	**Alternate (p)ager (c)ell**	**Sat Phone #**	**HOME PHONE**
Gulf Coast East Strike Team Baton Rouge	Davidson, Rob	225-977-1383	[redacted]			
Gulf Coast West Strike Team Baytown	Sackett, John	281-834-4050				
Southeastern Strike Team (Houston)	Hansen, Brian	281-654-3685				
USA West Strike Team (California)	Alston, Bill	805-961-4246				
Mid-West Strike Team Montana	Drain, Kelly	406-657-5267				
24 Hour Billings Refinery Number		406-657-5320				
ER Center Fairfax (8						
Fairfax SHE	Cliff Doumas	703-846-2513				
Fairfax SHE	Robert Fick	703-846-7200				
Baton Rouge Refinery	Davidson, Rob	225-977-1383				
Baytown Refinery	R. R. Kovalcik	281-834-4006				
Beaumont Refinery	Jimbo Jennings	409-757-1081				
Billings Refinery	Drain, Kelly	406-657-5267				
Chalmette	Goodwin, Scott	504-281-1861				
Joliet Refinery	Vacant	815-521-7704				
Torrance Refinery	Schibinger, John	310-212-2969				
Ch						
CHEMTREC	Chemical Emergency #	800-424-9300				
EM Chemical ER Coordinator	24/7 ER number					

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EMPCo Operations Control Center (OCC) in Houston, Texas				800-537-5200 24 Hour Emergency Phone Number		
AREA	**NAME**	**OFFICE**	**CELL**	**Alternate (p)ager, (c)ell**	**Sat Phone #**	**HOME PHONE**
EMChem Emergency Response Contact	Joublanc, Scott	281-870-6649	[redacted]			
BRCP (CHEMNET Team	Shift Superintendent Activation)	225-977-8133				
BTCP (CHEMNET Team Activation)	MBPP Security	281-834-9300				

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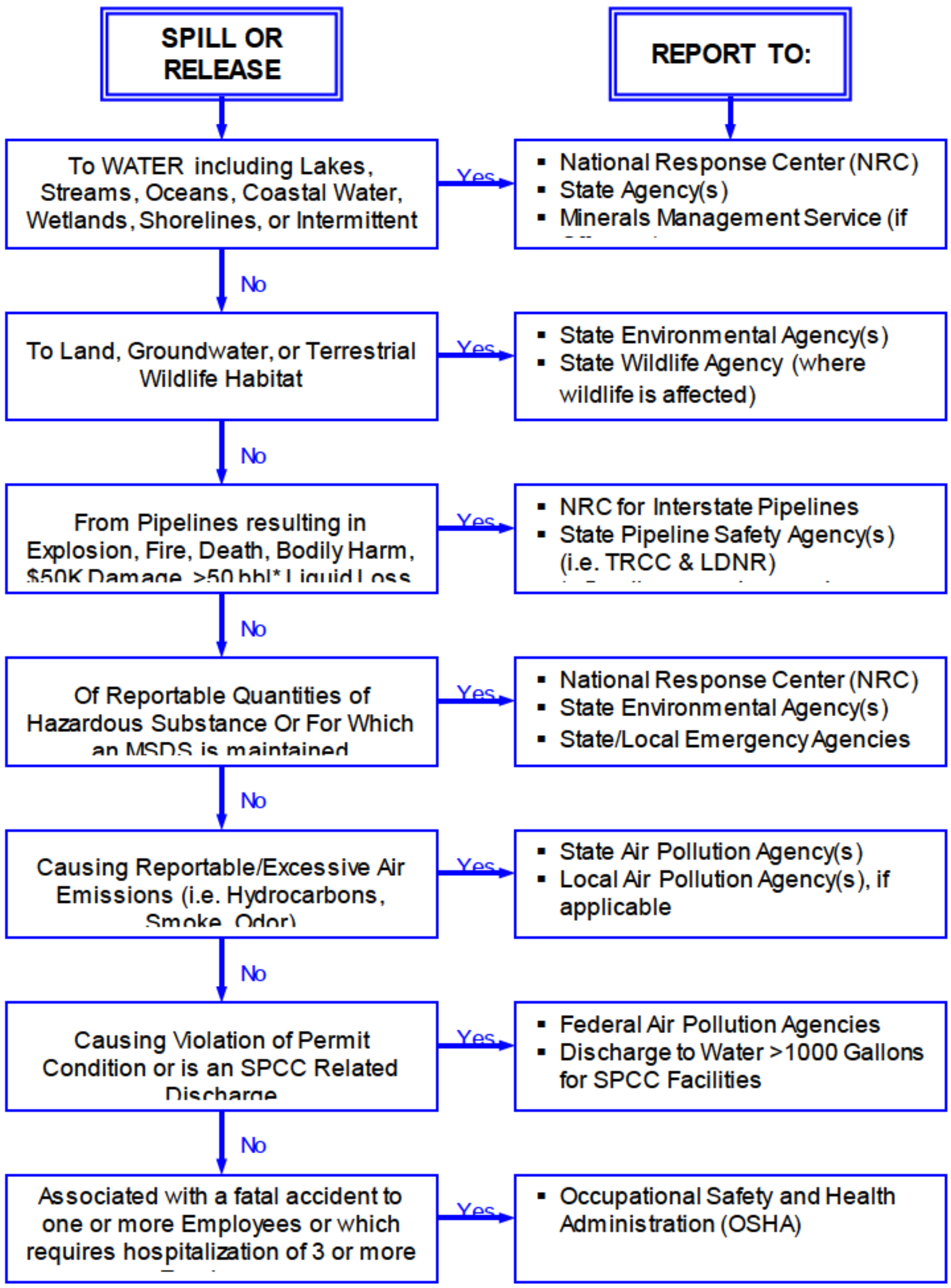
External Notification

General Notification Flowchart (See EMPCo Spill/Release Notification Guide)



Local Agencies / Assistance

CFR §195.402(e)(7)

See EMPCo Spill/Release Notification Guide

County	911 Availability	Local Emergency Planning Committee	Highway Patrol	Sheriff
Bexar	Yes	(210) 206-8532	(210) 335-6010	(210) 335-6010
Brazoria	Yes	(979) 846-1201	(979) 849-2441	(979) 849-2441
Caldwell	Yes	(512) 398-1822	(512) 398-4333	(512) 398-6777
Colorado	Yes	(979) 733-0184	(979) 732-2388	(979) 732-2388
Fayette	Yes	(979) 968-6469 (979) 968-1811	(979) 968-5856	(979) 968-5856
Fort Bend	Yes	(281) 342-6185	(281) 342-6116	(281) 342-6116
Gonzales	Yes	(830) 303-4188 ext. 230	(830) 672-2434	(830) 672-6524
Guadalupe	Yes	(830) 672-6209	(830) 672-6524	(830) 672-6524
Galveston	Yes	(281) 534-8442	(281) 332-2566	(409) 766-2222
Grimes	Yes	(936) 873-4476	(936) 873-2151	(936) 873-2151
Harris	Yes	**See list below**	(281) 517-1220	(713) 221-6000
Montgomery	Yes	(936) 523-3901	(936) 760-5871 (281) 364-4200	(936) 760-5871 (281) 364-4200
Waller	Yes	(979) 826-8282	(979) 826-7647	(979) 826-8282
Wharton	Yes	(979) 532-1123	(979) 541-4500	(979) 532-1550

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Harris County LEPCs		
Bay Area (713) 475-7088	Hillshire Village (713) 973-1779	La Porte (281) 471-3607
Baytown (281) 420-6558	City of Houston (936) 544-7175	Pasadena (713) 475-7088
Bellaire Area (713) 662-8201	Humble Area (281) 446-4928	Piney Point Village (713) 868-7658
Bunker Hill (713) 468-7941	Hunters Creek (713) 465-2150	Spring Valley (713) 465-8323
Deer Park (281) 478-7248	Jacinto City (713) 674-8424	Unincorporated (281) 452-2176
Galena Park (713) 675-3471	Jersey Village (713) 466-2131	Webster Area (713) 332-7474
Hedwig Village (713) 568-7941	Katy Area (281) 391-4010	W. University (713) 662-5836

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EMPCo Facility	Facility Code	Local Police	Local Fire Department	Nearest Medical Facility/Ambulance	County
Aldine Station (713) 448-3960 1014 Gulf Bank	42-240	Sheriff (Only) (713) 221-6000	Little York Volunteer Fire Department (281) 447-1231	Houston N/W Medical Ctr. (281) 440-2145	Harris
ARCO at Texas City	42-507	Texas City Police (409) 948-2525	Texas City Fire (409) 643-5700	Texas City EMS (409) 643-5700	Galveston
Baytown Crude Station (281) 656-3769 (281) 834-3414 (281) 834-4355	42-018	Baytown Police (281) 422-3530	Baytown Fire/EMS (281) 427-8511	San Jacinto Med. Ctr. (281) 420-8888	Harris
Baytown Prods #1 & #4 (281) 834-4359	42-239	Baytown Police (281) 422-3530	Baytown Fire/EMS (281) 427-8511	San Jacinto Med. Ctr. (281) 420-8888	Harris
Baytown Prods #2 & #3 (281) 834-4360	42-201 42-206	Baytown Police (281) 422-3530	Baytown Fire/EMS (281) 427-8511	San Jacinto Med. Ctr. (281) 420-8888	Harris
Baytown Benzene (281) 834-3087	42-502	Baytown Police (281) 422-3530	Baytown Fire/EMS (281) 427-8511	San Jacinto Med. Ctr. (281) 420-8888	Harris
Bryan Mound	42-507	Brazoria County Sheriff (979) 849-2441	Clute Fire Department (979) 265-4741	Brazosport Memorial Hospital (979) 297-4411	Brazoria
Clear Lake Crude (713) 656-6428	42-122	Pasadena Police (713) 477-1221	Pasadena Fire Dept. 911 (713) 477-1122	Pasadena EMS 911 (713) 477-1221	Harris
Friendswood Station (281) 482-1674	42-097	Friendswood Police 911	Friendswood Fire Dept. 911	Friendswood EMS 911	Galveston and Harris
Genoa Junction (713) 910-2916	42-577	Pasadena Police (713) 477-1221	Pasadena Fire Dept. (713) 477-1122	Pasadena EMS (713) 477-1221	Harris
Houston Int'l Airport (713) 443-2575 18240 Aldine-Westfield	42-480	Sheriff (Only) (713) 221-6000	Aldine Fire Department (281) 847-5544	Houston Northwest Medical Center (281) 440-2145 (281) 440-4300 911	Harris
Jones Creek	42-507	Brazoria County Sheriff (979) 849-2441	Clute Fire Department (979) 265-4741	Brazosport Memorial Hospital (979) 297-4411	Brazoria

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EMPCo Facility	Facility Code	Local Police	Local Fire Department	Nearest Medical Facility/Ambulance	County
Luling Station (830) 875-2719	42-204	Luling Dispatcher (830) 875-2411	Luling Dispatcher (830) 875-2411	Luling Hospital Luling Dispatcher (EMS)	Caldwell
Magnet Production (713) 656-4624	42-132	Wharton Police (979)532-3131	Wharton Fire Dept. (979) 532-4811	Wharton Ambulance (409) 532-1884	Wharton
Magnet Pump Station (409) 675-3212	42-132	Wharton Police (979)532-3131	Wharton Fire Dept. (979) 532-4811	Wharton Ambulance (409) 532-1884	Wharton
Marlin Station No Phone	42-235	Sheriff Department (254) 883-1431	Marlin Fire Department (254) 883-1431	Tolbert/Hutchins/Smith Hospital (Marlin) (254) 883-3561	Falls
McQueeney Station (830) 420-2232	42-205	Seguin Dispatcher (830) 379-1224	Seguin Dispatcher (830) 379-1224	Seguin Hospital Seguin Dispatcher (EMS)	Seguin
Milford Station No Phone FM 308	42-248	Waxahachie Sheriff Department (972) 937-6060	Waxahachie Fire Department (972) 937-6060	Baylor Medical Center (713) 797-1230	Ellis
Moore Road (281) 860-0744	42-306	Houston Police (713) 884-3131	Houston Fire Dept. 911	Houston Fire Dept. 911	Harris
Navasota Products Station (409) 825-2089 Hwy 6 - South	42-521	Sheriff (409) 873-2151 Police (936) 825-6124	911 Fire (Only) Non-Emergency (936) 825-7388	Grimes Medical Center (936) 825-6444	Grimes
North Houston Terminal (281) 447-4211 I-45 (North)	42-241	Houston Police Dept. (713) 884-3131	Houston Fire Department 911	Houston N/W Medical Center (281) 440-2145	Harris
Pasadena Station (713) 475-1811	42-238	Pasadena Police (713) 477-1221	Pasadena Fire Dept. 911 (713) 477-1122	Pasadena EMS (713) 477-1221	Harris
Pierce Junction Products (713) 797-5436	42-202	Houston Police (713)_884-3131	Houston Fire Department (713) 227-2323	Houston Fire Department (713) 227-2323	Harris
Pledger Station (713) 656-4360	42-421	W. Columbia Police (979) 345-5121	W. Columbia Fire Dept. (979) 345-3416	W. Columbia EMS (409) 345-3311	Brazoria
Quintana Station (979) 415-0674	42-507	Brazoria County Sheriff (979) 849-2441	Clute Fire Department (979) 265-4741	Brazosport Memorial Hospital (979) 297-4411	Brazoria

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EMPCo Facility	Facility Code	Local Police	Local Fire Department	Nearest Medical Facility/Ambulance	County
San Antonio Terminal (210) 220-3438	42-206	San Antonio Dispatcher (210) 207-7484	San Antonio Dispatcher 210) 207-7484	San Antonio Hospital San Antonio Dispatcher 911	Bexar
Satsuma Station (281) 469-8556 9118 Jackrabbit Road	42-523	Sheriff (Only) (713) 221-6000	Cy-Fair Fire Department (713) 466-6161	Cy-Fair Medical Center (281) 890-4285	Harris
Sugarland Station (281) 980-2859	42-039	Sugarland Police (281) 242-2600	Sugarland Fire Dept. (281) 242-2600	Sugarland EMS (281) 242-2600	Ft. Bend
T.E.T. Products (281) 424-4585		Baytown Police (281) 422-3530	Baytown Fire/EMS (281) 427-8511	San Jacinto Med. Ctr. (281) 420-8888	Harris
Thompsons Station (713) 656-2991	42-117	Richmond Police (281) 342-2849	Richmond Fire Dept. (281) 342-2828	Richmond EMS (281) 342-2100	Ft. Bend
Webster Station (281) 332-1414 (281) 332- 0906	42-001	Webster Police Dept. (281) 332-2426	Webster Fire Dept. (281) 332-3133	Webster EMS (281) 332-3133	Harris

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Spill/Release Notification Form

Initial Report ___ Supplemental Report ___ Final Report ___ Date: _______________

Date **and** Time Spill / Release Discovered ____

Spill / Release Discovered by : ____

Date **and** Time Spill / Release Reported to SHE : ____

Spill / Release Reported to SHE by : ____

Pipeline, Station or Terminal : ____

Spill / Release / Incident Location : ___________

City / Parish or County / State : ____

Nearest Town / City : ____

Driving Directions : ____

Product Spilled / Released : ____

Volume Spilled / Released : ____

Line Size / Description : ____

Volume Recovered : ____

Interstate: ☐ Intrastate: ☐ Regulated : ____

Cause of Spill / Release : ____

Fire: Yes ☐ No ☐ Explosion: Yes ☐ No ☐ Evacuations: Yes ☐ No ☐

Env. Impact: Air ☐ Water ☐ Soil ☐ Number of Injuries: ____ Number of Deaths: ____

Area Manager : ____

Area Supervisor : ____

Field Operations Supervisor / FLS : ____

Legal Description : ____

Land Description : ____

Landowner Notified : ____

Nearest Occupied House : ____

Nearest Main Road / Intersection : ____

Net Volume Lost : ____

Pipe Wall Thickness : ______________ Specification : ____________________

Seam Type : ________________ MOP : ____________________

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Pressure at Time of Spill / Release : ______________ SMYS : ____________________

Weather Conditions : ____

Area of Spill / Release : ________________________ Media Coverage: Yes ☐ No ☐

Spill Costs (in whole dollars):

Public / Private Property Damage ____________

Cost of Emergency Response Phase ____________

Cost of Environmental Remediation ____________

Value of Product Lost ____________

Value of Operator Property Damage ____________

Other Costs ____________

Total Cost ____________

Describe Other Costs: ____

Livestock / Wildlife Impacted: ____

If Water Impacted, Name : ____

Repair Method Used: ____

Method of Clean-up: ____

Next Remediation Steps: ____

Did Spill / Release Reach an HCA: Yes ☐ No ☐ Could It Reach Water: Yes ☐ No ☐

Is Leak / Release on a Segment Identified as a "Could Affect" Segment: Yes ☐ No ☐

Is Pipe Configured for In Line Inspection Devices: Yes ☐ No ☐

Date of Last In Line Inspection: _______________ Type of Tool: ____________________

Cathodically Protected: Yes ☐ No ☐ Type of System: ___________________________

Year Installed: ____ Has a CIS Been Performed: Yes ☐ No ☐ Year of Last CIS: ____

Agency / EMPCo Telephonic and / or Verbal Notifications			
Agency or Company	**Name of Person Taking Report**	**Time of Notification (24 hr format)**	**Assigned Incident or Report Number**

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Written Reports / Notification Letters		
Agency or Company	**Due Date**	**Date Mailed**

Additional Comments:

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* - GPS Coordinates are Required

Instructions / Pointers for EMPCo Spill / Release / Incident Report Form

- The first seventeen lines (highlighted in yellow if completing form on computer) are items needed for initial reporting to agencies and should be provided as soon as possible. Some of the initial items may not be readily known when first notification(s) are made to SHE, so should be provided at a later time when the information can be obtained. For any given spill / release / incident, not every information item will be applicable. Skip those items or enter "N/A".

- If completing this form on a computer, there is default text in some of the data entry fields (with the exception of the notification tables), provided as an example of the data needed. The data entry fields are gray shaded, and as data is entered into the fields, the default text will disappear.

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- GPS coordinates are now required. They tie in to spill tracking by the National Pipeline Mapping System (NPMS) and American Petroleum Institute (API). The format does not matter, it can be converted in SHE if necessary. GPS coordinate formats may look like the following:

1. 13 695512E 4705010N (UTM format)
2. 42.4728°N -102.6216°W (DD.DDD format)
3. 42° 28' 22" N -102° 37' 18" W (DMS format)
4. 42° 28.37' N -102° 37.30' W (DD MM.MM format)

- For some items, it may be necessary to consult with Corrosion Technicians, Facility Engineers, Field ERST Techs / Field Regulatory Specialists or others to obtain the information.

Section 13 Resources

CFR §194.107(d)(1)(v),(2); 194.115

In This Section

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Company Equipment

Communications Systems

In addition to the mobile communication trailers, the following communications systems may be used for notifications and emergency response operations:

- cellular phones — the majority of supervisors and key operations personnel have cellular phones
- land line phones — the manned facilities, and many of unmanned facilities, have land line phones, and
- mobile satellite phones — are located throughout the Regions.

As the need arises, additional communications equipment can be cascaded in from the MSRC.

OSRO

USCG Certified Oil Spill Removal Organizations (OSRO)

USCG Certified OSROs		
Company	**Captain of the Port Zone** *Coast Guard Classification*	**24 hour Phone Number**
ES&H Houston Response Office 202 Preston Avenue Pasadena, TX 77503 Ph: 713.921.7600 Fx: 713.921.7602 Lake Charles Response Office 4141 S. Beglis Parkway Sulphur, LA 70665 Ph: 337.558.7543 Fx: 337.558.7546	**Houston** *Rivers/Canals-MM, W1, W2, W3* *Inland- MM, W1, W2, W3* **Port Arthur** *Rivers/Canals-MM, W1, W2, W3* *Inland- MM, W1, W2, W3* **Corpus Christi** *Rivers/Canals-W2, W3* *Inland-W2, W3*	**(888) 422-3622 or (877) 437-2634** 24-Hour Emergency Response Hotline
Clean Channel Association 3110 Pasadena Freeway Pasadena, TX 77503	**Houston** Rivers/Canals-MM, W1, W2, W3 Inland- MM, W1, W2, W3 **Port Arthur** *Rivers/Canals-MM, W1, W2, W3* *Inland- MM, W1, W2, W3*	**713-534-6195** 24 Hour
Oil Mop 450 Preston Rd. Pasadena, TX 77503	**Houston** *Rivers/Canals-MM, W1, W2, W3* *Inland- MM, W1, W2, W3* **Port Arthur** *Rivers/Canals-MM, W1, W2, W3* *Inland- MM, W1, W2, W3* **Corpus Christi** *Rivers/Canals- W2, W3* *Inland- W2, W3*	800-645-6671 24 Hours Phone: 713-534-7300 Fax: 713-534-7304

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USCG Certified OSROs		
Company	**Captain of the Port Zone** *Coast Guard Classification*	**24 hour Phone Number**
MSRC (MSRC) Marine Spill Response Corporation 1350 I Street, NW Washington, D.C. 2005 Port of Lake Charles 3961 Henry Pugh Blvd. Lake Charles, LA 70605 8400 Old Causeway Road Galveston, TX 77554 Ingleside 1667 Maine Street Ingleside, TX 78362	**Houston** *Rivers/Canals-MM, W1, W2, W3* *Inland- MM, W1, W2, W3* *Open Ocean- MM, W1, W2, W3* *Offshore- MM, W2, W3* *Near Shore- MM, W2, W3* **Port Arthur** *Rivers/Canals- MM, W1, W2, W3* *Inland- MM, W1, W2, W3* *Open Ocean- MM, W1, W2, W3* *Offshore- MM, W1, W2, W3* *Near Shore- MM, W1, W2, W3* **Corpus Christi** *Rivers/Canals-MM, W1, W2, W3* *Inland- MM, W2, W3* *Open Ocean- MM, W2, W3* *Offshore- W2, W3* *Near Shore- W2, W3*	**800-259-6772** (24 hrs.) **800-645-7745** (24 hrs.) Lake Charles, LA 337/478-3853 Fax 337/478-4617 Galveston, TX 409/740-0311 Fax 409/740-0339 Ingleside 361/775-1893 Fax361/775-1895

Contractors & Suppliers

Aircraft, Observation

Air Charter & Patrol Companies					
Barr Air Patrol	Cort Andrews	972-222-0229	214-629-8543		903-695-0320
IHTI - Laffayette, LA (Helicopters - Gulf Coast region)	Domingue, Ron	337-232-2096	337-278-3799	800-428-7823	337-981-8862
IHTI - Grand Isle and Intracoastal City, LA (Helicopters - Gulf Coast region)	Domingue, Ron	337-272-4250	337-278-3799	800-428-7823	337-981-8862

Air Charter & Patrol Companies					
Bristow US LOC - New Iberia, LA (Helicopters - Gulf Coast region)	Kade Monlezun	337-365-6771 ext. 2357			
Mayeux's Flying Service – (New Orleans, LA, Gulf Coast region)	Mayeux, Tim	985-785-9688			
Southern Seaplane (New Orleans, LA, Gulf Coast region))	Lyle Panepinto & Forest	504-394-5633			

Bird/Wildlife Care Equipment

Company Name	Location	Telephone
Clean Gulf	Harvey, LA	888-242-2007
Intl. Bird Rescue Research	Berkley, CA	888-447-1743
Intl. Wildlife Research	Galveston, TX	409-740-4527
Texas State Aquarium	Corpus Christi, TX	361-881-1200
Texas Wildlife Rehabilitation Coalition, Inc	Houston, TX	713-468-8972
Tri-State Bird Rescue and Research	Wilmington, DE	302-737-7241

Boats, Barges, Tugs

Company Name	Location	Telephone
Argosy Offshore	Texas	713-668-3388
Bud's Boat Rentals	Venice, LA	504-392-2558
Buffalo Marine Service	Houston, TX	713-923-5571
Canal Barge Company, Inc.	New Orleans, LA	504-581-2424
Clean Gulf Association	Grand Isle, LA	888-242-2007
Grand Isle Shipyard	Grand Isle, LA	985-787-2801
Higman Barge Lines	Houston, TX	713-552-1101
Kilgore Marine	Lafayette, LA	337-233-6515
Otto Candies	New Orleans, LA	504-469-7700
Seacraft Company	Amelia, LA	985-631-2628
Shipp's Marine	Longview, TX	903-845-3246
Verret Shipyard, Inc.	Plaquemine, LA	225-659-2647

Communications/Radio

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Company Name	Location	Telephone
Auto-Comm Engineering	Lafayette, LA	337-232-9610
Industrial Communications	Corpus Christi, TX	361-853-9943
DFW Communications	Longview, TX	903-757-3666

Contractors, General/Marine/Oil Field

Company Name	Location	Telephone
AFC	Corpus Christi, TX	361-364-2547
Bob Mitchell Contractors	Palestine, TX	903-723-4203
Cain's Hydrostatic Testing	Addis, LA	225-687-7080
East Texas Oilfield	New London, TX	903-895-4425
Grand Isle Shipyard, Inc.	Grand Isle, LA	985-787-2801
Harris Line Service	Longview, TX	903-643-7712
H & K Vacuum Truck	Sinton, TX	361-364-4311
Slick Construction	Eunice, LA	337-457-4803
Tri-Parish Contractors	Addis, LA	225-749-3515
Watkins Construction	Corsicana, TX	903-874-6587
WHC	Lafayette, LA	337-837-8765

Divers

Company Name	Location	Telephone
Global Divers	Sulphur, LA	337-234-3483
Russell Veteto	Corpus Christi, TX	361-887-8851
Professional Divers of N.O.	Belle Chase, LA	504-391-1351

Heavy Equipment

Company Name	Location	Telephone
AFC	Corpus Christi, TX	361-364-2547
Neff Rental	Lafayette, LA	337-237-6318
Cain's Hydro Testing	Addis, LA	225-687-7080
East Texas Oilfield Service	New London, TX	903-895-4425
Grady Crawford	Baton Rouge, LA	225-275-7334
ISC	Baton Rouge, LA	225-756-8001
Reynolds & Kay Inc.	Tyler, TX	903-592-0835

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Company Name	Location	Telephone
Tri-Parish Contractors	Addis, LA after hours	225-749-3515 225-698-9226

Hot Tapping/Plugging/Stoppling

Company Name	Location	Telephone
Topaz of Houston	Houston, TX	800-223-8277
T.D. Williamson	Houston, TX	281-470-0791

Laboratories

Company Name	Location	Telephone
A & B Labs	Houston, TX	713-453-6060
Accu-test	Houston, TX	713-460-3655
Test America Laboratories	Houston, TX	713-460-9600
Trace Analysis	Lubbock, TX	1-800-378-1296

Nitrogen Services

Company Name	Location	Telephone
Air Products	Houston, TX	281-873-5151
Air Liquide	Houston, TX	713-624-8000

Portable Toilets

Company Name	Location	Telephone
AAA Sanitation Service	Tyler, TX	903-593-5909
Waste Management	Houston, TX	281-991-2703

Safety and Industrial Hygiene Contractors/Consultants

Company Name	Location	Telephone

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Company Name	Location	Telephone
CAM Environmental Services	Pasadena, TX Lake Charles, LA Beaumont, TX	713-475-9003
Hagermeyer Safety	Houston, TX	800-482-5536

Scientific Resources/Environmental & Emergency Response Consultants

Company Name	Location	Telephone
CAM Environmental Services	Pasadena, TX Lake Charles, LA Beaumont, TX	713-475-9003
East Texas Testing	Tyler, TX	903-595-4421
AE Com	Houston, TX	713-520-9900

Spill Cleanup Contractors

Company Name	Location	Telephone
C.C.A.O.S.C.A	Corpus Christi, TX	361-882-2656
East Texas Oilfield Services	New London, TX	903-895-4425
Environmental Equipment, Inc.	Houma, LA	985-868-3100
Miller Environmental	Corpus Christi, TX	361-289-9800
*Oil-Mop, Inc. (AMBAR)	Belle Chasse, LA	800-645-6671
Slick Construction	Eunice, LA	337-457-4803

** Contractor has personnel trained to operate CGA equipment.*

Trucks/Transportation/Heavy Hauling

Company Name	Location	Telephone
United Vision	Lafayette, LA	337-837-4561
ACME Truck Lines	Lafayette, LA	337-237-6900
Darby Motors	New Iberia, LA	337-364-8101
United Vision	Houma, LA	985-851-0827

Vacuum/Tank/Trucks

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Company Name	Location	Telephone
PSC Industrial	Stafford, TX	281-476-0291
Badger	Houston, TX	281-714-9588
Shamrock	Daisetta, TX	936-536-1300

Welders/Suppliers

Company Name	Location	Telephone
Big Tex Welding Supplies	Houston, TX	713-644-1203
Magnum Welding & Fabricating, Inc.	Houston, TX	713-991-0591
Northside Welding Works	Houston, TX	281-449-2700
Air Gas Southwest	Aransas Pass, TX	361-882-2531

PHMSA Sequence Number 606

Contracts (OSROs)

Oil Mop Incorporated (OMIES)

STANDARD PROCUREMENT AGREEMENT FOR DOWNSTREAM OR CHEMICAL
SERVICES WITH INCIDENTAL GOODS ("AGREEMENT")

Enabling Articles Of The Agreement ("Articles")

Agreement No: A2279853   Effective Date: 1/15/2011   Expiration Date: 1/14/2016
"Company": Procurement, a division of ExxonMobil Global Services Company, a Delaware corporation
"Supplier": Oil Mop, LLC, a Louisiana Corporation

1. Description of Services and Pricing. "Services" and pricing shall be as follows:
The supplier will provide emergency response spill services including labor, equipment such as marine, response equipment and other related emergency response type work or more fully described in Exhibits A and D if attached or in the applicable Order.

2. Exhibits; Addenda. Exhibits which are marked below are incorporated into each Order issued under this Agreement:
The following addenda are incorporated into each Order issued under this Agreement:

☐	A - Scope of Work; Goods	☐	I - Site Specific Attachments
☐	B - Order Form	☐	J - Contractor Employee Hours Reporting Procedures
☐	C -Change Order Form	X	K - Workplace Harassment
X	D - Compensation	☐	M - Minority/Women Owned Business Enterprise
X	E - Invoicing Procedures	☐	N - Background Checks for Contract Workers
X	F - Federal Contract Supplement	☐	O - Export Controls, Business Ethics & FCPA
X	G - Health and Safety Requirements	☐	Q – Software Licensing Terms
X	H - Drug and Alcohol Policy	X	R - Cellular Telephone Service
		☐	Other:

3. *Notices. Questions, information, and any notices under this Agreement must be directed to the following addresses. Notices regarding this Agreement by one party to the other shall be in writing and either deposited in the United States mail with first class postage prepaid, delivered in person or by private prepaid courier, or sent by facsimile with confirmation. Either Company or Supplier may change its address below by written notice to the other party.*

Company: ExxonMobil Business Support Center Argentina S.R.L.
Address: 265 Della Paolera
City, State, Zip: Buenos Aires, Argentina, C1001ADA
Attn: Sebastian Peralta
Phone: 713-507-8939- ext 6328
Fax: 262-953-7373
E-Mail: sebastián.peralta@exxonmobil.com

Supplier: Oil Mop, LLC
Address: 131 Keating Dr.
City, State, Zip: Belle Chase 70037
Attn: Joseph Christiana
Phone: (504) 394-6110
Fax: (504) 391-7398
E-Mail: jchristiana@oilmop.com

4. *Purpose and Operation. The Agreement consists of the Enabling Articles, the General Terms and Conditions, and the attached Exhibits and Addenda. The purpose of the Agreement is to provide terms and conditions to be incorporated into orders that may be issued by Affiliates (as defined in Section 1 of the General Terms and Conditions)in the United States to request Services from Supplier ("Orders"). Each Order will incorporate the terms of the General Terms and Conditions and the designated Exhibits and Addenda. The Affiliate that issues an Order ("Purchaser") is solely responsible for performance of Purchaser's obligations under such Order. Company shall not be responsible for obligations under any Order except any Order issued by Company designating itself as Purchaser. Each Order will constitute a legal contract between Purchaser and Supplier, separate and distinct from any other Order or this Agreement.*

5. *No Exclusivity or Minimums. This Agreement does not require exclusivity of business dealings by either party or commit any Purchaser to purchase any specific amount of Services. Commitments of Affiliates to purchase, if any, are set forth in Orders.*

6. *Early Termination. This Agreement may be terminated by either Company or Supplier before the Expiration Date upon at least 30 days prior written notice to the other party. Termination of the Agreement does not affect the rights and obligations of Purchasers and Supplier under any outstanding Orders.*

7. *Governing Law. The validity and interpretation of these Enabling Articles will be governed by the laws of the State of Texas, without reference to that State's principles of conflicts of law. The parties hereby agree to submit to the exclusive jurisdiction of the courts of Texas, including municipal, state and /or federal courts as appropriate, with respect to these Enabling Articles.*

8. *Usage Reports. At Company's request, Supplier shall provide usage reports to Company setting out descriptions of Services provided to Purchasers, locations where Services are performed, dollars expended, and such other reasonable usage documentation as Company requests.*

9. *Entire Agreement; Amendment; Assignment. This Agreement constitutes the entire agreement between Supplier and Company concerning the subject matter hereof. The Agreement supersedes all prior negotiations, representations, or agreements, either oral or written, related to this Agreement. Any amendment to the Agreement must be agreed in writing by Company and Supplier. Supplier shall not assign the Agreement, in whole or in part, without the prior written approval of Company.*

10. *Other Terms. Supplier agrees not to use any Affiliate's name, trademark or trade name publicly without written permission of Company. Supplier agrees to hold in confidence all technical and business information made available to Supplier by any Affiliate. This Article 10 shall survive termination of these Enabling Articles.*

The parties indicate their agreement below:

Procurement, a division of
ExxonMobil Global Services Company
By: ______________________
Print Name: ______________________
Authorized Title: ______________________
Date: ______________________

Supplier: Oil Mop, LLC
By: ______________________
Print Name: ______________________
Authorized Title: ______________________
Date: ______________________

Marine Spill Response Corporation (MSRC)

MARINE SPILL RESPONSE CORPORATION‹
SERVICE AGREEMENT

EXECUTION INSTRUMENT

The **MSRC SERVICE AGREEMENT** attached hereto (together with this execution instrument, the "Agreement"), a standard form of agreement amended and restated as of September 27, 1996, is hereby entered into by and between

ExxonMobil Refining & Supply Company, a division of Exxon Mobil Corporation

a Corporation located in Fairfax, Virginia
with its principal offices located at 3225 Gallows, Fairfax, Virginia

(the **"COMPANY"**), and **MARINE SPILL RESPONSE CORPORATION**, a nonprofit corporation organized under the laws of Tennessee (**"MSRC"**), and shall be identified as

SERVICE AGREEMENT No. 6MPA132

IN WITNESS WHEREOF, the parties hereto each have caused this Agreement to be duly executed and effective as of January 21, 2002.

ExxonMobil Refining & Supply Company

By: J.S. Simon

J.S. Simon

Title: President

Address: 3225 Gallows Road

Fairfax, Virginia 22037

Contact: John V. Zimmer, Emergency Response Advisor
Telephone: 703-846-2549 Fax: 703-846-2553

MARINE SPILL RESPONSE CORPORATION:

By: Judith A. Roos
Judith A. Roos
Marketing & Customer Service Manager
455 Spring Park Place, Suite 200
Herndon, Virginia 20170

(703) 326-5617; Fax: (703) 326-5660

ER-MSRC-Agreement-Execution-Document-01-2002.doc; 01/11/02; 10:13 AM

Clean Harbors Environmental Services

JUL-14-00 14:28 FROM:CENTRAL PROFILING ID:617 356 8272 PAGE 2/2

CleanHarbors®

ENVIRONMENTAL SERVICES, INC.
1501 WASHINGTON STREET • P.O. BOX 859048 • BRAINTREE, MA 02185-9048
(781) 849-1800
Visit our Website at www.cleanharbors.com

July 14, 2000

Exxon/Mobil
Attn: Ms. Linda Mobley
601 Jefferson Street
Room 434
Houston, TX 77002

Dear Ms. Mobley:

Please let this letter serve as evidence that the emergency response agreement, executed in July 1993 by Clean Harbors Environmental Services, Inc., with corporate offices in Braintree, Mass., and Exxon, with corporate offices in Houston, TX is an "evergreen" agreement and, as such, remains in force on this date.

The purpose and intent of the agreement was, and continues to be, to provide Exxon (now Exxon/Mobil) with emergency oil spill response resources and response capabilities, as required under the Oil Pollution Act of 1990, and according to the terms and conditions of the July 1993 agreement.

Any questions on this matter should be directed to this writer at (781) 849-1800, ext. 1268.

Sincerely,

Hawk H. Hickman

Hawk H. Hickman
OPA-90 Program Manager

cc: Bryan Diehl-CHESI/Braintree

"People and Technology Protecting and Restoring America's Environment"

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EXXON PROPRIETARY

Evergreen Contract

No expiration date

EXXON COMPANY, U.S.A.
POST OFFICE BOX 4552 • HOUSTON, TEXAS 77210-4552

MATERIALS & SERVICES DEPARTMENT
DOWNSTREAM PURCHASING

FRED B. DAVENPORT, JR
MANAGER

Contract No.:
ELIRT Response - ELRT05522ZEEEEE
Non-ELIRT Response - ELRT05522Z99999
(See Article 3.C. for details)

Charge No.: Various

CONTRACT FOR WORK AND SERVICES

This Agreement (hereinafter referred to as "Contract") is entered into this **21st** day of **June, 1993** by and between Exxon Company, U.S.A. (a division of Exxon Corporation), whose address for purposes hereof is P. O. Box 4552, Houston, Texas 77210-4552, for its benefit and the benefit of all the divisions and affiliates of Exxon Corporation (each such division and affiliate rendered service hereunder being hereinafter referred to as "Exxon"), and **Clean Harbors Environmental Services, Inc.**, whose address for purposes hereof is: 1200 Crown Colony Drive, Quincy, MA 02269-9137, (hereinafter referred to as "Contractor"):

WITNESSETH: That in consideration of the covenants and agreements set out herein and the payments provided for herein, Exxon and Contractor agree as follows:

1. DESCRIPTION OF SERVICES

A. Scope

Contractor agrees to provide all necessary supervision, personnel, crews, tools, equipment (furnished and maintained at Contractor's expense), materials (except as hereinafter provided), and support facilities when and as requested by Exxon to properly perform the following described services (hereinafter referred to as "Services" or "Work"):

- Perform Spill Cleanup Work in accordance with OPA 90 requirements and Other Emergency Type Work as requested and authorized by Exxon

B. Specifications and Assignments

1) Services performed under this Contract shall be in accordance with the provisions of the following Specifications and Exhibits listed below which are attached hereto and made a part of this Contract and/or specific Releases as may be made pursuant to Article 1.B.(2):

Designation	Title	Date
Exhibit A	Labor Rate Schedule	6/1/93
Exhibit B	Equipment Rate Schedule	6/1/93

A DIVISION OF EXXON CORPORATION

Exxon or Exxon's Authorized Representative arising under, growing out of, or by reason of Services with respect to such alleged violation or violation of Law whether brought by employees of Contractor or its subcontractors, by third parties, or by any governmental authority.

28. ATTORNEY'S FEES

Should it become necessary for either party to engage in legal proceedings for the purposes of resisting, adjusting and compromising any claims or demands arising out of the subject matter of this agreement, or for the purposes of enforcing this agreement or recovering damages sustained by either party due to breach of the agreement by the other party, the prevailing party will be entitled to reimbursement from the other party for costs, attorneys' fees and any other reasonable expenses incurred in connection with such legal proceedings.

29. HEADINGS

The Article headings of this Contract are for the convenience of the parties only and are not a part of this Contract and do not in any way limit or amplify the terms and provisions of this Contract.

30. ENTIRE AGREEMENT

The Contract constitutes the entire agreement between the parties hereto and supersedes all prior negotiations, representations, or agreements related to this Contract, either written or oral, including Exxon's invitation for proposals and Contractor's proposals, except to the extent they are expressly incorporated herein. No changes, alterations, or modifications to this agreement shall be effective unless in writing and signed by the parties hereto.

In the event there is a conflict between any of the provisions hereof and any of the proposals, general conditions, specifications, or any documents, agreements, or papers of any kind which have been incorporated herein by other provisions hereof, it is understood and agreed that the provisions hereof shall be controlling.

By the signature of duly authorized representatives below, the parties hereto have executed this Contract in duplicate originals as of the day and year first above written.

CLEAN HARBORS ENVIRONMENTAL SERVICES, INC.	EXXON COMPANY, U.S.A. (a division of Exxon Corporation)
By ______________________ (Name and Title)	By: ______________________
Benjamin J. Santacroce Vice President	

cc: Linda Mobley - CCB2763

wm/05522

Clean Channel Association

SERVICES AGREEMENT

THIS SERVICES AGREEMENT ("Agreement") is made as of the 3rd day of June, 19 92 by and between the undersigned Member (the "Member") and Clean Channel Association, Inc., a Texas nonprofit, non-stock Corporation (the "Corporation" or "CCA"), (collectively referred to as "the parties")

RECITALS

A. The Corporation or its Members own, maintain and operate certain Vessels and Equipment for the purpose of the Cleanup of Liquid Spills in the Coverage area;

B. The Member is a Member of the Corporation (individually a "Member" and sometimes collectively referred to as the "Members") and as a Member of the Corporation is entitled and obligated to enter into this agreement;

C. The Member desires to contract with the Corporation to provide standby availability of, and the actual provision of, Cleanup for Liquid Spills on the terms and conditions set forth in the Bylaws and herein;

D. CCA has established a level of "Membership Equipment" for each class of Members that defines what each Member will be required to commit in the event of a CCA Response.

AGREEMENTS

In consideration of the mutual promises and covenants set forth in this agreement, the parties hereto hereby agree as follows:

ARTICLE I

Definitions

As used in this agreement, the following terms shall have the following respective meanings. Any term not otherwise capitalized and defined herein shall have the meaning assigned to it by the Bylaws of the Corporation, as such Bylaws may be amended from time to time.

SA: 12/3/91 1

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10.12 Counterparts. This agreement may be executed in any number of counterparts, each of which when so executed shall be deemed to be an original, and such counterparts together shall constitute and be one and the same instrument.

IN WITNESS WHEREOF, the parties have executed this agreement as of the date first above written.

CLEAN CHANNEL ASSOCIATION, INC.

By: Edward K Roe
President

Name of the Member:

EXXON PIPELINE COMPANY

By: Darrell G Warner
Name: D. G. Warner
Title: President
Address: P. O. Box 2220, Suite 756, Houston

SA: 12/3/91

13

Section 14 Response Planning & Strategies

In This Section

PHMSA Sequence Number 606

Worst Case Discharge

CFR §194.105

Volume

[redacted]

Location of Worst Case Discharge

System

[redacted]

County/State

[redacted]

Type of Oil

Gasoline

Weather Conditions

The worst-case discharge calculation considers the following adverse conditions:

- Wednesday evening proceeding the Thanksgiving holiday.
- 5 mph wind from the southwest.
- Cold with light rain.

Selection Criteria

BASIC ASSUMPTIONS

- [redacted] located at the facility experienced a failure such that 100% of the tank [redacted] the

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[redacted]e.

- [redacted]) based on control credits allowed by PHMSA. The associated calculations are presented below:

Calculation

[redacted]

[redacted]

Control Features/Factors	Credit Applicability (Y/N)	Reduction Value	Reduction Amount In Barrels	Adjusted Tank Volume (bbls)
Initial Volume of Tank (bbls)			[redacted]	[redacted]
Secondary containment > 100% of maximum capacity of largest tank within secondary containment, and secondary containment meets NFPA Code 30.	Y	50%	[redacted]	[redacted]
Tank built/repaired to API STD 620/650/653	Y	10%	[redacted]	[redacted]
Overfill protection standards, API RP 2350	Y	5%	[redacted]	[redacted]
Testing/cathodic protection meets API STD 650/651/653	Y	5%	[redacted]	[redacted]
Tertiary containment/drainage/treatment system meets NFPA Code 30.	N	5%	[redacted]	[redacted]

[redacted]

Historical Releases

The largest historical discharge for the zone was 844 bbl of gasoline in May 2007.

Date	Quantity Spilled (BBL)	Spill to Soil Water Both	Spill from Tank or Pipeline	Incident Summary
8/21/2011	20	Soil	Tank	Jet Fuel A spill from tank 2238 caused by a failed gasket on a tank door
2/2/2011	5.6	Soil	Pipeline	Diesel spill caused by motor operated valve failing to close allowing the pipeline sump to overfill
7/15/2009	6.5	Soil	Pipeline	Gasoline spill cause by directional drill striking the pipeline at the SIMS Bayou crossing
9/21/2007	3	Soil	Pipeline	Crude oil spill caused by human error allowing a valve packing bleeder valve to be left in the open position after maintenance
5/7/2007	844	Both	Pipeline	Gasoline spill caused by a repair crew, using a backhoe to excavate an 8 inch valve, dislodging a 2 inch stub line that was welded to the mainline near Highway 6 and I-290.
2/6/2007	3	Soil	Tank	Diesel oil spill caused by valve failure during a tank to tank transfer of 4 KBBL at the Pasadena Station tank farm
11/2/2002	30	Soil	Pipeline	Crude oil spill due to external corrosion at Corsicana Station
12/1/2001	5	Soil	Pipeline	Gasoline spill cause by equipment failure at Satsuma Station
8/8/2001	30	Soil	Pipeline	Clean product spill caused by seal failure on pump 2 at Satsuma Pump Station
6/10/2001	69	Soil	Pipeline	Av-Gas spill caused by equipment failure on sump at Aldine Station
1/1/2000	41	Soil	Pipeline	Crude oil spill cause by internal corrosion at Baytown Crude Receiving

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Mitigation Tactics for Worst Case Discharge & Other Areas

CFR §194.107(d)(1)(v)

Sensitive area locations and protection measures are included in Section 15.

Primary Worst Case Discharge Scenario

Time of Spill:	1815
Date of Spill:	Day before Thanksgiving
Spill Source:	Pasadena Tank #2171
Quantity Spilled:	[redacted]
Quantity Escaping Property:	
Product Type:	
Spill Cause:	Catastrophic failure of tank

The largest breakout, [redacted] located at EMPCo's Pasadena Station, has a catastrophic failure of the tank shell while the tank is filled to capacity. The Station Operator hears what sounds like an explosion (far parts of tank farm could not be seen from inside building). After visual investigation, the operator detects a severe breach (rupture) of the tank. Approximately [redacted] of gasoline are spilled, of which an estimated [redacted] is contained within the tank firewall and the station's weired drainage/secondary containment levees. An estimated [redacted] has overflowed the weired drainage system and escaped the property. [redacted] has collected in low spots and is contained on adjacent properties. Another [redacted] has entered a flood control ditch, and is moving toward the Houston Ship Channel (HSC). The ditch travels 2.07 miles before it enters the ship channel. The weather is cold with a light rain and slight winds (5 mph) from the Southwest. Weather predictions call for continued rain and dropping temperatures overnight and into the next day. No thunderstorms are anticipated. The incident occurs on the Wednesday evening preceding the Thanksgiving holiday, therefore, traffic is heavy and employees have been dismissed from work for the day.

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Scenario:

1815 The Station Operator hears a noise in the tank farm. He investigates and discovers that [redacted] a rupture in the shell of the tank. He immediately pushes the ESD button and shuts everything down per shutdown procedures. After shut down, he contacts the Operations Control Center (OCC). [redacted]

1818 The OCC Controller notifies the Pasadena Field Supervisor (FS) and apprises him of the spill. The FS contacts the Area Supervisor, the Pasadena Fire and Police Department and informs them of the spill, thereby activating the Bayport/Mid-Tex Response Zone Emergency Response Plan.

1827 The Station Operator has secured the control room, and has taken a position by the entrance gate to the station. All access to the site will be restricted until a safety assessment has been made. No motor vehicle traffic will be allowed inside the station property until the safety assessment is complete.

1828 The FS arrives on site and assumes the role of Assessment/Control Director.

1830 Advance units from the Pasadena Fire and Police Departments begin to arrive at the Station gate. The Assessment/Control Director briefs them on the situation. The Field Supervisor calls the Baytown ExxonMobil Emergency Response Network (BEERN) at (281) 834-5303 for foam and fire fighting capability.

1840 The Area Supervisor, now enroute to the site, contacts the Crude/Refined Product Area Manager by mobile telephone. Due to the anticipated severity of the spill, the Area Manager immediately activates the EMPRT (regional and/or Headquarters support) and then contacts the Operations Manager about details.

1843 The spilled product from Pasadena tank [redacted] reached the Houston Ship Channel via the drainage ditch located east of the Pasadena Terminal. Product travel time calculations are presented on the following page.

Time Calculation for Spilled Product to Reach the Houston Ship Channel

$$\text{Time} = \frac{\text{Distance}}{\text{Velocity}}$$

Distance = 2.07 miles
Velocity = 6.62 feet per second

$$\text{Time} = \frac{2.07 \text{ miles}}{6.62 \text{ feet per second}}$$

$$\text{Time} = \frac{10{,}929 \text{ feet}}{6.62 \text{ feet per second}}$$

Time = 1,650.90 seconds

$$\text{Time} = \frac{1{,}650.90 \text{ seconds}}{60 \text{ seconds}}$$

Time = 27.5 minutes for the spilled product to reach the Houston Ship Channel via the drainage ditch located east of Pasadena Station.

CHEZY-MANNING'S EQUATION

Calculation of the navigable water velocity should be done with the following formula:

Velocity = 1.5/n x r2/3 x s1/2

Velocity = 1.5/.03 x $(10 \times .667)^{2/3}$ x 15 $/2.07^{1/2}$

Velocity = 50 x 3.54 x 0.37

Velocity = 6.62 feet per second

1844 The Area Supervisor, enroute to the spill, contacts the Containment/Cleanup Director by mobile telephone, and requests that appropriate company and contact personnel be dispatched to the spill site.

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The Area Supervisor contacts the Safety Officer and one of the Area Safety & Health Responders (at home), who immediately travels to the site. The Area Supervisor then contacts the Field Supervisor and requests that he dispatch two additional Safety & Health Responders to the spill site (Note: Bayport/Mid-Tex Area has several Safety & Health Responders available).

The Operations Manager contacts the SHE Manager and requests that all regulatory agency notifications be initiated as soon as possible, even though details are sketchy at this time. He also requests that the U.S. Coast Guard be notified that boat/vessel traffic may need to be restricted since product may have reached the Ship Channel.

1845 The SHE Manager contacts the Assessment/Control Director to get the current information so that he can notify the proper regulatory agencies. The Leak Investigation Supervisor contacts the Southern Pacific Railroad Authority (888-877-7267) by mobile telephone, and requests that they shutdown all railroad activity in the spill area (since product has escaped the station property and is located near the railroad tracks, a spark from a passing rail car could create a source of ignition).

The Assessment/Control Director begins contacting industrial plants and facilities by mobile telephone nearest the spill location, and notifies them of the situation. He requests that they report any strong smells or sightings of product near their facilities. He also advises them to take appropriate action to protect water intakes or other sensitive resources.

The Safety, health and Environment Department (SHE) initiates the regulatory agency notification and documentation process (begin notification within one hour of event with the information known at that time).

1846 The Containment/Cleanup Director, using a mobile telephone, begins notifying appropriate company personnel to dispatch the FORT, CART, and two boom deployment boats to the spill site. The FORT, CART and boats will be located outside the station property fence line (near the Highway 225 service road) as the Command and Control Center for on-site containment and cleanup activity until the Safety and Health Responders have declared the station safe to enter the area.

The Containment/Cleanup Director then begins contacting contractors with spill containment and cleanup personnel and equipment, such as boom, boats, vacuum trucks, and excavating equipment (contractors include Garner Environmental Services, B&G Vacuum, and Benson Pipeline Maintenance).

Amoco Corporation (formally Albermarle Corporation) will give EMPCo access through the main gate to their property where the flood control ditch drains into the Houston Ship Channel.

Four vacuum trucks and other recovery equipment will be dispatched to the station initially. The Containment/Cleanup Director has called for all available vacuum trucks.

1850 The Operations Manager contacts the EMPCo President and notifies him of the situation, and that the ELIRT resources may need to be deployed once the situation has been assessed further.

The Assessment/Control Director and the Pasadena Fire Department discuss the possibility that foam may be required to reduce the chance of ignition and fire (Clean Channel Association foam will be used to supplement EMPCo's foam trailer which is permanently located in Pasadena Station). The fire department will also assist with any necessary evacuations.

1855 The Area Supervisor arrives on the scene and is apprised of the emergency situation. He assumes the role of Qualified Individual at this time.

1900 The Operations Manager contacts the Information Officer, who immediately travels to the spill site to handle media questions, and begin preparations for a press conference, if needed. The Operations Manager assigns a Logistics Section Chief, who goes immediately to Field Operations Headquarters to coordinate logistical, materials and equipment support activities. The Logistics Section Chief helps the Containment/Cleanup Director locate and dispatch response equipment and personnel to the site.

The Assessment/Control Director consults with the Pasadena Police Department regarding traffic and evacuations. The police will be coordinating traffic activity and any necessary evacuations, as well as securing the area.

The flood control ditch discharges into the Houston Ship Channel adjacent to Amoco's property. Amoco has given permission for EMPCo to access their property that is located at the Houston Ship Channel shoreline and parallel to the drainage ditch. After it is determined to be safe, EMPCo will use this site to set up the CART. Amoco Corporation's 24 hour main number is 713-740-1382.

Our contact for Amoco Corporation is the operations supervisor @ 713-740-1389.

The CART will be located where the flood control ditch feeds into the Houston Ship Channel. The ditch contains water and spilled product. Boom will be deployed across the ditch to prevent additional product from entering the ship channel.

1910 The Crude/Refined Products (C/RP) Area Manager arrives at the leak site and is fully briefed on the situation by the Area Supervisor. The C/RP Area Manager will assist the Area Supervisor.

The Containment/Cleanup Director arrives at Pasadena Station, and is briefed by the C/RP Area Manager.

The C/RP Area Manager contacts the CLEAN CHANNEL ASSOCIATION. The contact name for CCA is Phil Glenn (office 713-534-6195). The C/RP Area Manager will advise CCA of EMPCo's resource needs.

The Operations Section Chief (Area Supervisor) contacts HL&P, *(713-228-7400 press one for a touch-tone phone, press 4 for trouble).* He advises them of the situation and that it is their decision whether to shut down the power lines and substation located north of the site. The substation feeds power to industrial customers along the ship channel.

1915 Additional Pasadena Police units arrive at the scene and begin blocking the entrance to the Highway 225 service road. Since the wind is currently from the southwest to the northeast, there is no immediate threat to residential areas South of Highway 225. However, as a precaution in the event the wind direction shifts, local residents south of Highway 225 will be evacuated and arrangements made for them to stay in a nearby hotel, if needed.

The Safety Officer is given responsibility for development, communication and implementation of a site safety and health plan. Safety and health of employees, contractors and the public is given priority in all response activities. All EMPCo and contract employees will be thoroughly briefed on the plan before they are allowed to enter the site.

1916 The Safety and Health Responder(s) arrive and begin conducting air monitoring to identify hazard areas and determine personal protective equipment requirements.

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Due to the wind direction, vapor concentrations along the Highway 225 service road are virtually non-existent, and the area is safe to conduct command and control operations.

The SHE requests the U.S. Coast Guard dispatch personnel to the spill location via boat to warn all ship channel traffic in the area to take extra precautions when traveling in the area.

1918 EMPCo boats and CART arrive at Pasadena station. Personnel are briefed about future deployment of diversion boom in the Ship Channel.

EMPCo's FORT arrives at the station, and sets up along the Highway 225 service road. The FORT will serve as an On-Site Incident Command Center.

Garner Environmental Services (281-930-1200 or 800-442-7637), primary response contractor with boom deployment equipment, arrives at Pasadena Station. Other contract personnel and emergency response equipment, additional vacuum truck, etc. also begin arriving at the station. In addition to using vacuum trucks, transfer pumps will be set up to pump product contained at the station into adjacent available tankage.

EMPCo Safety and Health Responder(s) and Pasadena Fire Department HazMat personnel have entered the spill area, with appropriate personal protective equipment and breathing apparatus, to assess the situation inside the station. They are monitoring for flammable and other potentially hazardous vapors in the air.

1919 The inspection by the Safety and Health Responders and Pasadena Fire Department personnel reveals that the majority of the gasoline is contained at the north end of the station, inside several tank firewalls, and inside the station's drainage system. The identified hazard areas, in which breathing protection is required, are marked off with appropriate warning signs.

EMPCo Safety and Health Responders and the Safety Officer brief all company and contract personnel on the Site Safety and Health Plan, including the identification of hazards and appropriate personal protective equipment. Material Safety Data Sheets for motor gasoline are reviewed with all response personnel.

1920 Local Industry units begin arriving with foam trucks and trailers and take a position along the Highway 225 service road.

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An Emergency Medical Service crew arrives and set up an emergency treatment area along the service road in the event of injuries. Local medical services facilities are also notified, advised of the situation, and put on standby alert.

Pasadena Police contact the local Federal Aviation Authorities, and request that all air traffic in the area be restricted and re-routed around the area. Congested air traffic in the area could be dangerous.

The Operations Section Chief, Containment/Cleanup Director, Fire Chief, Police Chief, and Lead Safety and Health Responder all meet and assess the current situation with the C/RP Area Manager.

1925 The FORT is now operational, and is the central command, control, and communication center for the response. Communications capabilities consist of two-way radios, telephone, LAN and a facsimile machine inside the FORT.

The Operations Manager arrives on the scene and is fully apprised of the situation by the C/RP Area Manager. The Operations Manager assumes the role of Incident Commander at this time. The C/RP Area Manager assumes the role of Deputy Incident Commander. The Operations Manager contacts the EMPCo President from the FORT. The President and the Operations Managers decide full activation of the HSC ELIRT at this time is not necessary. However some ELIRT resources, such as a Fire Fighting equipped boat, boom, etc., will be used during the spill recovery and cleanup activities in the Houston Ship Channel.

The SHE Manager arrives on site and confers with the Operations Manager.

The Area Supervisor contacts OCC to determine the amount of available tankage at Pasadena so that product recovered during spill cleanup operations can be transferred. I (b) (3), (b) (7)(F) [redacted] in one tank that was being emptied at the time of the accident. There will be sufficient tankage to store recovered product.

The USCG arrives via boat at the location where the flood control ditch and the Ship Channel meet. Spilled product is observed on the channel water. The USCG stops all boat traffic on the Houston Ship Channel until further notice.

1930 Based on surveys, optimal initial boom deployment locations are determined to be: (1 at several points in the flood control ditch off of Amoco's Private Road which parallels the ditch approximately one mile north of Pasadena Station (primary), and 2) near the flood control ditch inlet to the Ship Channel (secondary). Also, upstream and downstream of ditch/channel confluence (downstream first).

1935 Due to the wind direction, the south side of the station to a point within 50-100 yards south of tank #2171, is safe for fire department vehicle traffic. This will allow foaming and product recovery equipment to access the station control building inside the station property.

1936 EMPCo and contract personnel begin to construct an earth dam with flume pipe across the flood control ditch at the entrance from the flood control ditch to the Houston Ship Channel. This will allow water to flow through the pipes yet containing the spilled product in the flood control ditch.

No sensitive fish or wildlife habitats or other sensitive areas are known to exist along the flood control ditch which traverses an industrial area. Sensitive tidal flats and wetlands do exist along the Ship Channel. Boom is deployed to protect these areas. Also, trained and licensed wildlife rehabilitators are notified.

Diversion boom is also deployed in the Houston Ship Channel to allow dissipation of the gasoline spill. The ExxonMobil HSC ELIRT fire fighting boat applies water spray to the gasoline spill on the surface of the ship channel until the gasoline has dissipated.

1940 Electrical power will be disabled if necessary and where possible at the leak site to minimize potential ignition sources.

1945 The Information Officer arrives on site and is briefed on the situation. The Information Officer then briefs the media, who have begun to arrive on site.

1950 EMPCo boats and CART arrive at the Ship Channel, and begin preparations to deploy boom where it is deemed safe and necessary.

2005 EMPCo and contract boats are deployed from the Phillips docks (received prior approval from Phillips). Phillips 24-hour number is Security 713-475-3624. Phillips' main number is 713-475-3666. The Phillips boat docks are approximately one mile upstream from where the drainage ditch connects to the Houston Ship Channel. ExxonMobil Supervisors will direct the deployment of boats and equipment. Amoco owns land at the junction of the flood control ditch and the Houston Ship Channel (there are no boat launch sites available on

Amoco's property). While always maintaining a safe distance, ExxonMobil Management monitors the gasoline spill in the ship channel from Amoco's property.

2015 EMPCo personnel, the Pasadena Fire Department and local industry, equipped with proper PPE, begin foaming the gasoline spill area(s) to abate potential fire hazards. EMPCo has made prior agreements for foam concentrate from various sources. The Clean Channel Association (CCA) has access to 6,000 gallons of foam concentrate stored in a tanker at a local chemical plant, CCA can activate CIMA which has access to many sources of foam concentrate and personnel to apply foam, National Foam (713-472-1504) has a response organization that stores 4,840 gallons of foam concentrate contained in 55 gallon drums and the ExxonMobil Baytown Refinery has 12,500 gallons of foam concentrate for emergencies. All equipment and personnel are positioned upwind of the spill. Tanks 2171, 2172 and 2173 have a common firewall. Foaming the interior of the common firewall will be necessary to cover the gasoline and prevent gasoline vapors from escaping. The gasoline located in the firewall and adjacent ditches will have a layer of foam applied to prevent gasoline vapors from escaping.

The available foam concentrate is 23,340 gallons. EMPCo will need 20,973 gallons of foam concentrate to cover the ditches on EMPCo property and within the firewalls of Tanks 2171, 2172 and 2173, based on the following calculation:

Foam Concentrate Requirement Inside The Firewall Calculation

1. Determine square footage of area to be foamed.
2. Multiply square footage times factor of .16.
3. Multiply the number in step 2 times 3 %.
4. Multiply the number in step 3 times the number of minutes of foam required. This will give you the amount of concentrate required for the length of time designated.
5. Divide the gallons of concentrate required by 3 % to determine the amount of water required for the foam concentrate and time foam should remain on the spilled product.

Example: Foaming inside the common firewalls of 2171, 2172 and 2173

1. Length of firewalls - 960 feet

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2. Width of firewalls - 280 feet

3. Square footage - 268,800

4. Subtract square footage of tanks 2171, 2172 and 2173.
268,800 minus 50,894 square feet = 217,906 square feet

5. 217,906 x .16 = 34,865

6. 34,865 x 3 % = 1,046 gallons of concentrate for one minute

7. 1,046 x 20 minutes = **20,920 gallons of concentrate for 20 minutes**

8. Ditches will require **53 gallons of concentrate for 20 minutes**

9. Water required to distribute the foam concentrate (the fire water pond contains one million gallons of water when full)

   Water = 20,973 gallons foam concentrate divided by 3 %

   Water = 699,100 gallons of water

2016 The water will be pumped from the fire water containment area by available Pasadena Fire Department or CCA acquired fire fighting equipment from ExxonMobil Pipeline Company's fire water pond. If additional water is required, the fire fighting trucks can connect to a city fire hydrant located at the service road south of Pasadena Station. The water pressure should be 150 pounds for optimum foaming results.

2018 An EMPCo six inch and rental 12 inch diesel pumping units will evacuate gasoline out of the fire wall and into the transfer system. *(Diesel/pump rental units and piping are available 24 hours a day from GenPower Pump and Equipment 281-476-9268, Rain For Rent 713-937-6799 and Garner Environmental 713-920-1300).* The diesel pump suction hoses are placed inside the fire wall so product can be pumped to tanks after the discharge hoses are properly connected. The transfer system has valves that can accept two six inch discharge and a 12 inch discharge hose from the pumps. After it is declared safe, the discharge hoses of the diesel pump units are attached and pumping begins into the appropriate tanks. EMPCo tanks 2171, 2172 and 2173 have a common fire wall. It will take approximately one day to recover the main quantities of spilled product, foam and water from the fire wall interior and ditches.

2019 Vacuum trucks will be utilized around the drainage ditches inside and outside our property line, along the flood control (b) (3), (b) (7)(F) [redacted] The ExxonMobil Pipeline Company GATX delivery pump will be lined up so product can be pumped from the slop tank (30,000 barrel capacity) into the transfer system or an available barge. Recovery efforts will continue until all spilled gasoline has been recovered.

The fire department(s) will remain on standby to provide fire fighting response in the event of a fire.

2025 Regulatory agency personnel begin to arrive. They are briefed on the situation by the Operations Manager. They take no exception to the proposed response plans, but plan to closely monitor all site activities throughout product recovery operations.

EPILOGUE

Product contained by boom within 1 mile upstream and down stream of confluence of flood control ditch and Houston Ship Channel. Product recovery and cleanup continue for several weeks. All recovered gasoline is returned to tankage at Pasadena Station. Solid wastes are accumulated in lined steel roll-off boxes for temporary storage pending processing at permitted industrial waste management facilities. Sorbent materials are cleaned up to the extent possible by extracting sorbed liquids with mechanical wringers and recovering the liquids back into station tankage.

The USCG opens the Houston Ship Channel to boat traffic after it is determined all danger has passed from the gasoline spill. It is estimated that boat traffic can resume in 12 hours from the initial spill release.

The Logistics Section Chief oversees acquisition of necessary equipment and handling all contracts, invoices, etc., associated with this work.

Recovery and cleanup activities will continue until EMPCo and regulatory agency personnel agree clean up has been satisfactorily completed.

Selected Trajectories and Climatological Conditions

The trajectories described below were chosen based on the proximity of EMPCo facilities to waterways within the Bayport/Mid-Tex Response Zone. Several pipelines and facilities are within relatively close proximity to the Houston Ship Channel, which is the basis for selecting the channel as a trajectory location. Pipelines also cross a number of streams/rivers and, subsequently, a discussion of typical spill trajectories along these types of waterways. The general hydrological and meteorological conditions that could affect spill trajectories in the Bayport/Mid-Tex area are also discussed in this section.

The methodology used to calculate these trajectories is described in Volume I, Section 5.2.7. Although a new trajectory should be calculated for each spill based on real time conditions, the trajectories described herein can be used for guidance in making these predictions. Generally, the necessary wind and current parameters used in the calculations can be obtained on-site at the time of the incident.

Houston Ship Channel

The Houston Ship Channel (HSC) extends from Galveston Harbor, across Galveston Bay, and through parts of the San Jacinto River and Buffalo Bayou to the Turning Basin in Houston, a distance of some 44 miles. Industrial facilities and docking facilities are located along the HSC's length, with heavy industry generally focused in its upper and lower reaches.

The "inland", (i.e., relatively confined) portion of the HSC essentially refers to that part of the channel above Morgans Point to the Turning Basin in Houston. U.S. Army Corps of Engineers project depth in the HSC is nominally 40 feet at low tide, and the channel width is 400 feet. Bank-to-bank distance is significantly greater than the channel width in most areas. Also, a number of bayous and small bays branch off from the channel at several locations.

The diurnal tide range reported at Morgans Point (Mean Low Lower Water to Mean Higher High Water [MLLW to MHHW]) is 1.0 feet (NOAA Chart #11328, HSC: Atkinson Island to Alexander Island, Texas, September 22, 1990.) At the Turning Basin in Houston, the tide range is probably less. No data are given in the NOAA Tidal Current Tables for the confined portions of the HSC. From theoretical calculations, supported by limited conversation with tugboat operators, the currents associated with periodic, astronomical tides are expected to be 0.3 to 0.5 feet/sec (roughly 0.2 to 0.3 knots); they should be less near the turning basin in Houston.

Strong winter northerly winds can generate "blowout" (e.g., abnormally low) tides substantially lower than MLLW. During the blowout tides, the extreme low water observed at Morgans Point is 3.5 feet below MLLW. Under such low tide conditions, the ebb tidal current could reach 1 knot or more. On abatement of the northerly winds, however, a similar flood tidal current can be expected.

The other important source of currents in the HSC is storm runoff contributed by the various bayous tributary to the channel. In the natural, non-artificially deepened river, these currents could amount to 2 to 3 ft/sec or more. In the oversize dredged channel, a typical storm runoff flow velocity of 1.7 ft/sec (1 knot) is estimated. Storms of different intensity, of course, will generate different flow velocities.

An important feature of these storm runoff currents is that they always flow towards Galveston Bay, and may persist for some time. Thus, in contrast to the reversing tidal currents, storm runoffs have the capacity to transport spilled oil or other such materials into Galveston Bay. Once in Galveston Bay, wind can subsequently drive the spill slick into environmentally sensitive areas.

Stream and River Crossings

A spill may occur at a pipeline river crossing such that oil flows into the river over some period of time.

Once in the river, the dominant means of transport (of the spilled oil) is coparallel (e.g. downstream) river currents. The speed of the currents can be variable: depending on the antecedent rainfall in the watershed and on groundwater levels, and from place to place, depending on local variations in stream width and depth.

As the river approaches the bay, some tidal influence may be felt. Tidal influences would appear as a periodic reversing current superimposed on the river flow. While it may affect the instantaneous velocity and position of the slick as a reversing component of the flow, such periodic reversing current has no long-term net effect on the spill trajectory. Also, the waterway channel may become wider and deeper, especially if dredged for navigation, slowing the river current.

If marshes are present along the banks, spilled oil may migrate into them; some fraction of this oil may be released later into the river.

As the river enters the bay, (which may not be a "well-defined" location), the river current (except at extreme discharges, at some locations) drops off to a point where the wind comes to dominate.

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Generally, there are three significant wind conditions along the Texas coast: afternoon/evening onshore winds; generally light and variable winds at other times; and winter northerly (offshore) winds.

Afternoon onshore winds would tend to confine slicks to the vicinity of the river mouths or the inshore end of a bay, depending on the local geometry. Onshore winds may also tend to drive the slick into any marshes along the shore, where part of all of the slick may be trapped.

The light and variable winds will tend to move the slick toward whatever direction they are blowing. In light winds, however, the motion will be slow.

The winter northerly winds are typically the strongest winds encountered on the Texas coast. They blow out of the north to northwest, at speeds of up to 30 knots, with a duration of up to 12 hours (or longer at lower speeds). These winds tend to move the slick to the south to southeast, toward the barrier islands. A 30-knot wind blowing for 12 hours will move a slick approximately 11 miles downwind. Often, these winds also cause extremely low "blowout" tides, which may add an ebb tide current to be considered.

General Meteorological and Hydrological Conditions

Many EMPCo Bayport/Mid-Tex Area pipeline sections are located adjacent to the Houston Ship Channel.

The Houston Ship Channel is located on the west side of Upper Galveston Bay, just north of Red Bluff Point. The inshore portion of the channel is approximately 1.6 nautical miles long. Possibly excepting local storm water runoff, there are no known fresh water inflows to the channel, and the periodic tide range is generally less than 1.0 feet.

Significant wind conditions include:

- Onshore wind at about 12 knots, blowing from approximately 150°, afternoons and early evening, spring, summer and fall.
- "Northerlies," from north-northwest to west-northwest, at speeds near 30 knots, for durations of 6 to 12 hours, typically every few days, in winter.
- Otherwise, the winds are typically light and highly variable in direction.

Tidal currents are estimated to peak at about 0.03 knots at the entrance; i.e., they are negligible. The afternoon onshore wind blows approximately perpendicular to the general trend of the shoreline, or from about 150°. As the channel lies in an east-west direction, the component of the wind parallel to the channel is about 6 knots, producing a surface current of 0.18 knots. Blowing for 8 hours, this moves a slick approximately 1.44 nautical miles to the west. Thus, spills that occur during this wind regime will tend to be blown to the west (inshore) end of the channel, where they can be collected.

The northerly wind blows from a range of directions, generally from north to north-west, typically around 30 knots, for 6 to 12 hours. For the Houston Ship Channel, winds from the northwest would tend to move oil the fastest, at about 0.6 knots, to the east. As the inland portion of the channel is only about 1.6 nautical miles long, a spill near the inner end of the channel (that is not trapped in the turning basin) will move into Upper Galveston Bay in 2 to 3 hours.

Once in Galveston Bay, the slick will move downwind at 3 percent of the wind speed until it encounters land. If the wind abates and swings to the northeast, the slick is most likely to land on the beach between Red Bluff and Eagle Point.

Additional Scenarios

As specified in the Texas guidance documents, the discharge scenarios are defined by a combination of potential spill volumes and wind/weather information. Spill volumes for each scenario are:

Scenario	Gallons
Small Operational Spill	100-1000
Medium Subcatastrophic	5,000-50,000
Large Subcatastrophic	50,000-350,000
Catastrophic	Worst Case Possible

The following scenarios illustrate hypothetical spill responses for planning purposes to show what might happen if a spill were to occur in certain conditions. Details have been added for purposes of illustration. The times that response activities occur in these scenarios have been hypothesized based on deployment time of the respective equipment. These times are not guarantees of what will occur, and they do not limit the discretion of persons in charge of an actual spill response to select any sequence and to take whatever time they deem necessary to maximize the effectiveness of the response, consistent with safety considerations. Similarly, the illustrated recovery rates are included to demonstrate response strategies and equipment availability, but are not guarantees of what will occur in an actual spill.

For all of these reasons, these scenarios, though useful for planning purposes, are not predictions or guarantees of performance. Actual response operations will be tailored to meet actual circumstances.

Scenario #1 - Small Operational Spill

Time of Spill: 1001 CDT

Date: 12 May

Spill Source: Pipeline manifold

Quantity Spilled: Approximately 250 gallons (6 bbl)

Product: Crude oil

Spill Cause: Leaking valve

During regular maintenance along a pipeline, a valve in a pipeline to a breakout tank begins leaking. While attempting to make a repair, the valve is further damaged, and crude begins to leak from the valve more severely.

The weather is sunny and moderately warm, with light breezes. Routine facility operations are proceeding. The short-range weather forecast is the same, with showers and/or thunderstorms predicted later in the week.

1001 Maintenance Tech Leader discovers the valve leak and contacts the EMPCo Area Supervisor. The Area Supervisor instructs Tech Leader to attempt immediate repairs.

1003 Tech Leader tries to repair the valve and notes that the leak appears to be worsening. The Tech Leader assumes the role of Incident Commander (IC) and instructs one of the associates to place sorbents under the growing spill.

1005 After a few minutes effort, the Tech Leader notifies EMPCo's Area Supervisor that the leak cannot be controlled immediately and requests permission to shut down the section of pipeline to the valve.

1006 The Area Supervisor contacts the Area Manager. After a short discussion, they agree to shutdown the adjacent pipeline section(s), and authorize the Tech Leader to do so.

1007 During the time from the leak discovery to emergency shutdown, approximately 3-5 barrels of crude oil spilled from the valve into secondary containment around the tank.

1010 The Area Supervisor assigns a Containment/Cleanup Director, for spill cleanup support, an Assessment/Control Director and the Lead Safety Health Responder

(SHR) dispatches them to the site. The Containment/Cleanup Director is advised by radio of the spill and steps taken by the Tech Leader.

1020 The Assessment/Control Director arrives at the site and inspects the general area and the berms around the storage tank for signs of additional leakage and notes that all storm drain valves are closed. No additional sources are identified. Only the soils immediately proximal to the leaking valve appear to have been impacted by the incident.

1027 The Assessment/Control Director advises the Area Supervisor of the spill event and spill mitigation actions taken. The Tech Leader and maintenance personnel return to the leak site to assist in securing the source of the spill after SHR monitors the air quality of the work area.

1029 Designated on-shift response personnel are mobilized by the Containment/Cleanup Director to assist with cleanup operations.

1040 The Area Supervisor instructs the Safety, Health and Environment Department (SHE) to notify the appropriate government agencies of the spill.

1051 Containment/Cleanup Director arrives onsite and immediately confers with the cleanup personnel, the Assessment/Control Director, and the Lead SHR.

1125 EMPCo spill response personnel, begins the recovery operation. Small puddles of pooled crude are pumped into portable storage tanks by a local vacuum truck service and sorbents are applied to small patches of oil. Impacted soils are excavated by shovels onto plastic sheeting. It is not practical to recover crude (for return to inventory) from the soils. As recovery progresses, the excavated soils will be transferred to lined drums.

1232 A local Railroad Commission Inspector arrives onsite. No waterways were affected so no other agency personnel responded.

1255 The recovered crude and excavated soils are temporarily stored for transport to an ExxonMobil approved disposal facility. Estimated time to excavate oily soils is estimated at 2 - 4 hours.

1425 Residual crude at the spill site is sorbed up with sorbent material. Used sorbents and other oily cleanup materials are stored in 55-gallon storage drums for transport to an ExxonMobil approved disposal facility.

1630 It is estimated that cleanup and proper collection and disposal can be completed within 48 hours after the spill.

Where practical, the recovered crude is returned to inventory while oily waste are sent to an ExxonMobil approved disposal facility. The Area Supervisor designates personnel to replace equipment and materials that have been expended during the cleanup.

EPILOGUE Within 30 days of completion of the cleanup, the SHE Manager submits a RRC Form H-8 to the RRC District 3 office. Disposal of spill wastes have been completed, and spill response materials have been restocked.

Scenario #2 - Medium Sub-Catastrophic Spill

Time of Spill: 1035

Date: 3 August

Spill Source: 16" Pipeline

Quantity: 13,000 gal. (310 bbl)

Product: Various types of Crude Oil

Spill Cause: Backhoe punches hole in pipeline

During installation of sewer lines for a shopping center under construction, a backhoe operator accidentally punches a 1" by 2" hole near the top of a 16" pipeline transporting crude oil. At a pressure of approximately 50 psi, the resulting discharge is approximately 300 gpm, arching upwards some distance, clear of the trench.

1035 Backhoe operator proceeds to his construction office and notifies construction superintendent of the leak. The Construction Superintendent calls ExxonMobil Production Company, from a call out list on his office wall. ExxonMobil instructs him to notify ExxonMobil Pipeline Company (EMPCo) and gives him the number.

1045 Superintendent notifies EMPCo of spill. EMPCo's Operations Control Center (OCC) activates emergency shut down procedure for pipeline and notifies the EMPCo Area Supervisor. Area Supervisor dispatches a Technician to close nearby manual block valves, and then activates the local EMPRT initial responders.

1047 The Area Supervisor notifies the Crude/Refined Products Area Manager of the spill.

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1100 Area Supervisor dispatches the Leak Assessment/Control Director and the Lead Safety/Health Responder (SHR) to the spill site.

1130 The Assessment/Control Director arrives at spill site just as the discharge from the break in pipeline is reduced to a trickle. The spilled crude has spread onto the ground mostly outside of the graded area of the shopping center.

Approaching from the observed upwind direction, the Assessment/Control Director evaluates the spill and then contacts EMPCo Area Supervisor. The Assessment/Control Director and Area Supervisor agree the spill could be several hundred barrels and it has reached water.

Area Supervisor informs Safety, Health and Environment Department (SHE) Manager of spill. The SHE verbally reports a crude spill of approximately 200-250 bbl to NRC, RRC and GLO, Area Supervisor dispatches the Containment/Cleanup Director to the spill site and calls Garner Environmental Services (GES) to assist with the cleanup.

1132 Some of the crude has saturated into the soils, and some has flowed into a drainage channel with slow moving water.

1150 Two GES vacuum trucks and a backhoe arrive. The Lead SHR monitors spill area for toxic vapors with a Draeger tube, and determines that upwind concentrations are low enough to work without respirators. Downwind near the drainage ditch, however, respirators with organic vapor cartridges are required.

1155 The Containment/Cleanup Director arrives on the scene and notes oil flowing sluggishly from the hole in the pipeline into the ditch.

1159 EMPCo's Containment/Cleanup Director requests GES' backhoe operator to place a small dam across the ditch.

1207 One vacuum truck begins to suck oil out of the ditch, and EMPCo personnel fit a temporary pipeline patch on in the hole at the direction of the Casualty/Repair Director who recently arrived on scene.

1210 GES crews, wearing personal protective equipment, install booms in the drainage approximately 1000 feet below the point where the spill entered.

1215 GLO, RRC and USCG personnel arrive, inspect the scene, and confer with the Containment/Control Director and the Lead SHR. They agree that steps taken have effectively contained the spill, except for minor leakage around a downstream boom.

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1230 Three sorbent boom sections are installed at intervals 200, 300 and 400 feet downstream of the containment boom.

1245 The Area Supervisor arrives and confers with the Containment/Cleanup Director and on-scene regulatory response personnel. They agree on the following clean up plan:

1. Contaminated soil will be removed from the ditch around the pipeline, and transferred to drums.
2. Oil in the drainage ditch will be collected and stored in a Frac tank supplied by GES.
3. Contaminated soil in the open field may have to be excavated and disposed, but EMPCo and agency personnel will look into onsite treatment.
4. Materials collected and drummed will be transported later to an ExxonMobil approved disposal facility or will be recycled.

1250 The Containment/Cleanup Director observes break in the pipeline, and has the backhoe operator remove and stockpile contaminated soil from the excavation near the pipeline. Excavated soil is placed on plywood borrowed from the construction company.

The Containment/Cleanup Director requests GES to mobilize skimmer within the containment boom where oil has collected.

1320 EMPCo's Assessment/Control Director and GES foreman estimate that there are about 10,000 gallons of oil contained in low areas adjacent to the spill site. After calculating the total outage, the Assessment/Control Director estimates that approximately 3000 gallons of oil have discharged to the water.

1342 The Assessment/Control Director and the Area Supervisor stake off the impacted area. Containment/Control Director arranges for the excavation, and temporary storage of approximately 120 cubic yards of contaminated soil. Excavation of oiled soils is planned for several days.

1400 ACME FS AOOASK-39T skimmer arrives and is deployed within the containment boom. Although this skimmer has a pumping capacity of 275 gpm, the skimmer is valved down to about 60 gpm of fluid to reduce the water intake for this situation. The effective oil recovery rate is found to be about 20 gpm of oil initially.

1600 Skimming continues until little oil is visible on the water. visible on the water.

1800 The amount of oil on water in the drainage ditch is reduced to where the skimmer and vacuum trucks are no longer efficient. Sorbent pads are applied to the water to trap remaining oil.

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1830 Some oil is found on the banks of the ditch. As no rain is forecast, it is decided to leave the booms in place overnight and remove this oil the next day.

EPILOGUE Cleanup and recovery efforts continue for three days until the EMPCo, USCG, GLO, and RRC agree that no further cleanup is necessary. The SHE Manager arranges for disposal of crude contaminated soils, and files written reports with regulatory agencies.

Scenario #3 - Large Sub-Catastrophic Spill

Time of Spill: 1205

Date: August (a Sunday during summer)

Spill Source: Pipeline manifold failure

Quantity Spilled: Approximately 105,000 gal. (2,500 bbls)

Product Type: Crude Oil

Spill Cause: Third party damage to a pipeline

The weather is hot, partly sunny, with increasing onshore breezes. It is a summer Sunday, and scheduled maintenance work on a local water line is proceeding. A third party backhoe operator is digging a ditch for a water line near EMPCo's property. He digs into a pipeline that runs to a 55,000-bbl breakout tank. Gravity flow from the tank discharges oil at approximately 1,700 gpm. Oil fills the excavated ditch and flows into an adjacent dry drainage ditch. The drainage ditch and a creek confluence approximately 0.5 miles away.

1205 Backhoe operator damages pipeline. Oil fills the ditch quickly, then spills into a nearby dry drainage ditch.

1206 The backhoe operator notes the emergency telephone number listed on the pipeline marker and proceeds to a local convenience store.

1212 The backhoe operator calls the emergency telephone number which puts him in contact with the Operations Control Center (OCC). The OCC controller notes the location, cause of the spill and activates emergency shutdown procedure.

1218 The OCC controller contacts the Area Supervisor at home.

1230 The Area Supervisor contacts the Lead Safety and Health Responder (SHR) and Assessment/Control Director and dispatches them to the site. Area Supervisor then contacts the Crude/Refined Products (C/RP) Area Manager with details of incident then instructs the SHE to notify the NRC, GLO and RRC.

1250 The Lead SHR and Assessment/Control Director gather up their equipment and drive to the spill sites. SHRs begins immediate testing for explosive gases, total hydrocarbons and benzene.

1257 SHR clears entry into the area. Assessment/Control Director enters the tank farm and secures manual valves. The Assessment/Control Director evaluates the situation and estimates loss at approximately 1500 bbls.

1300 The Assessment/Control Director contacts Area Supervisor and advises him of situation. After discussion, they conclude loss is closer to 2500 bbls. SHRs continues to monitor the work environment.

1310 Area Supervisor contacts C/RP Area and Operations Managers. They arrange to meet at the Area Supervisor's office.

1325 Area Supervisor, Area Manager, and Operations Manager meet and evaluate facts known about the spill. Based on their experience and the potential size of the spill, a decision is made to activate the expanded EMPRT (regional and/or Headquarters support).

1345 Operations Manager assumes role of Incident Commander of the EMPRT and instructs Area Supervisor to dispatch Containment/Cleanup Director and Pipeline Casualty/Repair Director to the site. C/RP Area Manager then assumes the role of Incident Manager and contacts Garner Environmental Services (GES) for spill response assistance.

1400 GES immediately mobilizes for emergency response.

1405 The Information Officer has been instructed by the Incident Commander to contact the local community organizations.

1430 Approximately 2.0 hours have elapsed since the pipeline was damaged. The Containment/Cleanup Director and GES Supervisor meet at site and determine the spill has reached the creek and booms should be deployed at a bridge approximately 2 miles downstream.

1445 EMPRT personnel have arrived onsite with a CART and begin installing boom at the bridge.

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1500 GES arrives with boats, two 275 BPH ACME model FS-400 skimmers, vacuum trucks and booms. The Incident Commander instructs GES on "priority" emergency response actions.

1520 GES commence skimming operations at the first boom and begin installing secondary booms downstream to catch leakage from first boom.

1600 The booms and both skimmers are operative. Temporary storage tanks have been delivered to the site by GES.

1630 Recovered oil collected by skimmers and vacuum truck is pumped into the temporary tanks. Oil and water are transported to a storage tank at a local EMPCo Slop Tank. Oil and water will be shipped via pipeline to the ExxonMobil Refinery for reclamation.

1810 Crude recovery operations continue into the early morning hours using both ACME skimmers and three vacuum trucks.

2100 GES deploys additional sorbents to collect small amounts of oil that has "escaped" boom containment.

NEXT DAY

1035 Skimming operations have been concluded, sorbent booms have been deployed, EMPRT and GES spill response personnel continue picking up oil with sorbent pads and pompoms. Vacuum trucks continue picking up oil trapped on land. GES has brought in earth moving equipment to begin removing oil-contaminated soils.

Recovered now reclaimable oiled materials and used boom, are stored for later transport to an ExxonMobil approved waste-oil disposal facilities.

EPILOGUE Cleanup of stranded oil continues for five more days until the EMPCo and regulatory agencies have agreed that cleanup has been completed. SHE Manager files written spill reports and other documentation to regulatory agencies.

Scenario #4 - Alternate Worst Case Discharge

(b) (3), (b) (7)(F) [redacted]

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CALCULATIONS

To calculate a WCD for this pipeline location, the following formula was used:

[redacted] (b) (3), (b) (7)(F)

[redacted] (b) (3), (b) (7)(F)

1315 This line segment is in a shared Right of Way with several other oil companies. A backhoe operator is digging out a pipeline for another company and even though the DOE is clearly located and marked the backhoe operator, thinking he has hit a tree root hits and breaks the 40" line. Oil fills the ditch quickly, then follows the natural lay of the land to Chocolate Bayou. The ditch is less than 250 yards from Chocolate Bayou.

1316 The backhoe operator notes the emergency telephone number listed on the pipeline marker and the backhoe operator calls the emergency telephone number which puts him in contact with the Operations Control Center (OCC)..

1320 The OCC controller, had noticed a line pressure and flow problem on the DOE line, and after notifying the Controller Supervisor, he activates emergency shutdown procedure. He also records the information given by the backhoe operator.

1322 The OCC controller contacts the Area Supervisor at home.

1330 The Area Supervisor contacts the Lead Safety and Health Responder (SHR) and Assessment/Control Director (Field Supervisor) and dispatches them to the site. Area Supervisor then contacts the Crude/Refined Products (C/RP) Area Manager with details of incident then instructs the Safety, Health and Environment Department (SHE) to notify the DOE, NRC, GLO and RRC.

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1325 The Lead SHR and Assessment/Control Director gather up their equipment and drive to the spill sites. It is approximately a 35 minute drive to the spill site. The Safety and Health Responders (SHR) begin immediate testing for explosive gases, total hydrocarbons and benzene.

1400 SHR clears entry into the area. Assessment/Control Director enters the tank farm and secures manual valves. The Assessment/Control Director evaluates the situation and estimates loss at approximately 40,000 bbls.

1410 The Assessment/Control Director contacts Area Supervisor and advises him of situation. After discussion, they conclude loss is closer to 50,000 bbls. based on OCC meter shortage numbers. SHRs continues to monitor the work environment.

1415 Area Supervisor contacts C/RP Area and Operations Managers. They arrange to meet at the Area Supervisor's office.

1430 Area Supervisor, Area Manager, and Operations Manager meet and evaluate facts known about the spill. Based on their experience and the potential size of the spill, a decision is made to activate the expanded EMPRT(regional and/or Headquarters support).

1445 Operations Manager assumes role of Incident Commander of the EMPRT and instructs Area Supervisor to dispatch Containment/Cleanup Director and Pipeline Casualty/Repair Director to the site. C/RP Area Manager then assumes the role of Incident Manager and contacts Garner Environmental Services (GES) for spill response assistance.

1530 GES immediately mobilizes for emergency response from their Freeport and Houston Offices.

1600 The Information Officer has been instructed by the Incident Commander to contact the local community organizations.

1615 Approximately 3.0 hours have elapsed since the pipeline was damaged. The Containment/Cleanup Director and GES Supervisor meet at site and determine the spill has reached Chocolate Bayou and is heading towards Chocolate Bay and West Bay and booms should be deployed in both bays to keep oil from hitting the Gulf of Mexico.

1630 EMPRT personnel have arrived onsite with a CART and begin installing boom at the bridge.

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1700 GES arrives with boats, two 275 BPH ACME model FS-400 skimmers, vacuum trucks and booms. The Incident Commander instructs GES on "priority" emergency response actions.

1715 GES commence skimming operations at the first boom and begin installing secondary booms downstream to catch leakage from first boom.

1800 The booms and both skimmers are operative. Temporary storage tanks have been delivered to the site by GES.

1830 Recovered oil collected by skimmers and vacuum truck is pumped into the temporary tanks. Oil and water are transported to frac tanks at the bridge where FM 2004 crosses Chocolate Bayou. Oil and Water will be separated and brought by vacuum truck back to the ExxonMobil refinery for reclamation.

1930 Crude recovery operations continue into the early morning hours using both ACME skimmers and three vacuum trucks.

NEXT SEVERAL DAYS

Skimming operations have been continuing, sorbent booms have been deployed, EMPRT and GES spill response personnel continue picking up oil with sorbent pads and pompoms. Vacuum trucks continue picking up oil trapped on land. GES has brought in earth moving equipment to begin removing oil contaminated soils.
Recovered now reclaimable oiled materials and used boom are stored for later transport to an ExxonMobil approved waste-oil disposal facilities.

Epilogue

Cleanup of stranded oil continues for ten more days until the EMPCo and regulatory agencies have agreed that cleanup has been completed. SHE Department files written spill reports and other documentation to regulatory agencies.

PHMSA Sequence Number 606

Section 15 Highly Sensitive Areas

CFR §194.105; 194.107(c)

In This Section

Sensitive Area Locations and Protection Measures

General Protection Measures and Strategies

The protection of social, economic, and environmentally sensitive areas is of primary importance in the response to an oil spill incident. The primary sensitivity of concern should be the potential impact to the safety and health of the people in the vicinity of the incident. Protection of incident sensitivities is generally accomplished by preventing spilled liquids from impacting the sensitive areas through:

- Mitigation strategies and tactics which reduce the amount of a hazardous substance released and removes the potentially affected people from the hazard or protects them from the safety and health exposure risk
- Implementation of upstream or upgradient spill containment and/or recovery operations
- Deployment of exclusion booms or construction of exclusion barriers between approaching oil and the area of concern
- Diversion of oil away from or around the area of concern

In most cases the initial protection activities for land spills will involve the construction of earthen berms or dams or the excavation of shallow trenches between the spill and the sensitive area to either contain the oil or prevent it from contacting the area. For spills on water, protection activities will generally involve similar actions but will use containment or sorbent booms for the containment, diversion or exclusion of the oil. Dams or sorbent barriers constructed upstream across relatively narrow and shallow waterways with low flows are also common methods of protecting sensitive areas.

Recovery of both land and water spills prior to their contacting sensitive areas is another form of protection and is often facilitated, at least in the initial stages using vacuum trucks, portable pumps, or sorbents. Skimmers are the most efficient means of oil recovery but are not always available during the initial response effort.

Descriptions of water and land containment, exclusion, diversion, and other protection techniques are summarized in Table 15-1. It is important to note that many of the protection techniques in Table 15-1, and particularly those for terrestrial spills, are actually containment techniques but are also a form of protection when implemented upgradient or upstream of a sensitive area. More detailed discussions of sensitive area protection/containment strategies are provided in Volume 1. Detailed descriptions of the protection/containment techniques and deployment/implementation configurations are provided in the *Exxon Oil Spill Response Field Manual.*

Where multiple sensitive areas are hreatened, consideration should be given to prioritizing the areas based on their relative sensitivity to oil spills, the potential degree of impact, the feasibility of implementing protection measures prior to oil contact, and the probable effectiveness of those measures. A simplistic prioritization method is provided in Volume 1.

General Environmental Sensitivities

Overview

Sensitive areas that are important for economic, cultural, or human use reasons and which may also be potentially impacted by a spill or release in the Mid-Tex Response Zone include:

- High density populated areas (schools, churches, institutions, etc.)
- Public drinking water intake points
- Park and Recreational areas
- Marinas and boat launches
- Historical/archeological sites

Environmentally sensitive habitats which may be potentially impacted by an oil spill from EMPCo facilities within the Mid-Tex Response Zone include:

- Rare, threatened, and endangered species habitats
- Bird habitats
- Fish and shellfish grounds
- Wildlife management areas
- Sensitive coastal areas such as:
  - seagrass flats

- marshes and wetlands
- riparian zones
- tidal flats, etc.

Description of Environmentally Sensitive Areas

The Texas Natural Resources Conservation Commission (TNRCC) has defined the following environmentally sensitive areas. They are ranked according to sensitivity from high (H), to moderate (M), to low (L). Habitats are not independent of one another and should not be considered in isolation.

Salt Marshes and Wetlands (H)

Salt marshes and associated wetlands are the temperate equivalent of mangrove forests. These are highly productive ecosystems that are important to offshore fisheries, migrating waterfowl, and a diverse resident fauna. They are based upon various species of salt marsh grasses. These grasses, particularly the seaward species, trap sediments and stabilize the marsh from erosion. Salt marshes develop in sheltered coastal areas where there is minimal wave action and a high sediment load in the water column. Marshes usually range from areas that are completely submerged to areas that are almost continually exposed. The gently sloped marsh surface usually is dissected by complex drainage channels that are free of vegetation. The distribution of plants and animals in salt marshes is associated with the tide level. The plants are salt tolerant and most can withstand rapidly changing salinities.

The vegetation composition in any particular wetland is dependent upon the ambient salinity level and elevation in relation to the inundation water level. Wetlands may be classified as freshwater, brackish, or saltwater. No beach exists for such environments, only distinctive edges between open water and vegetated areas.

Emergent plant communities which exist in dense stands in marshes and wetlands are tolerant of constantly saturated sediment conditions. Zonation is the result of a number of factors including saturation, duration of exposure and submergence, and sediment salinity. The primary producer community within a wetlands habitat also includes numerous varieties of attached, floating, and planktonic algae which help to sustain an abundant and diverse assemblage of invertebrates and fishes. Because of this high productivity and attractiveness to a wide variety of juvenile organisms, marshes and wetlands are referred to as a nursery grounds for adjacent estuaries.

Small to moderate amounts of floating oil will accumulate along the outer fringe of vegetation, but significant tide-height variation acts to drive the oil inward into the marsh. Presence of bayous and tidal channels provides pathways for oil movement into the marsh interior. Oil coatings on living and dead vegetation may adversely affect the value of the marsh habitat as a nursery ground for estuarine species. Effect on plants per se will depend upon a number of factors including oil type, amount of oil, whether the roots are oiled, and season of the year in which oiling occurs.

Marshes have high priority for protection because they are very sensitive to oil pollution and because most cleanup techniques can also severely impact marshes. Due to the composition of soft sediments and annual species, marshes are particularly susceptible to physical disturbance.

Fresh Water Marshes and Wetlands (H)

Fresh water marshes are shoreline types found in the coastal interior. Fresh water marshes include floating aquatic mats, vascular submerged vegetation, needle and broad leafed deciduous scrubs and shrubs, and broad leafed evergreen scrubs and shrubs. The sediments are highly organic and muddy. Fresh marshes are characterized by high biodiversity and rich wetland habitat. This shoreline type; is found within the river valleys that dissect the chenier plain as well as between the individual ridges. On the delta plain, fresh water marshes occur in the upper reaches of individual delta complexes as well as along distributary courses.

The environmental sensitivity of fresh water marshes is high because of the presence of wetland habitat. Alligators, birds, and mammals extensively use fresh marshes for feeding and breeding purposes. Small amounts of oil can contaminate the outer marsh fringe only; natural removal by wave action can occur within months. Oil spills can coat and cover the sediment and vegetation.

The sediment penetration potential is low due to the high water table and water content of the sediments. A major environmental concern about fresh water marshes is that the cleanup can be more damaging than the oil itself, if left alone. Transitability of fresh marsh is poor due to the soft sediment. Land access is typically poor.

Swamps (H)

Swamps are shoreline types that are comprised of scrubs, shrubs, evergreen trees, and hardwood forested wetlands. This shoreline type is essentially a flooded forest. This shoreline type is common in the river valleys of the chenier plain, and the interior areas of the delta plain. The sediments within the interior swamps tend to be silty clay and contain a large amount of organic debris.

The environmental sensitivity is high for swamps because of the presence of wetland habitat. Even small amounts of oil can spread through the swamp. Oil spills can coat and cover sediment and vegetation.

The sediment penetration potential is low, due to the high water and the water contents of the sediments. A major environmental concern is that the cleanup may be more damaging than the oil itself. The access and trafficability of the swamps are poor due to the soft sediment and the presence of dense tree growth.

Tidal Flats (H)

Tidal flats are broad low-tide zones, backed by sandy beaches, salt marshes or mangrove forests. These habitats are characterized by shallow estuarine waters that undergo diurnal water level changes and possess a fringe of emergent vegetation along the shoreline. The sediments are compacted fine sand, mud/sand mixtures or unconsolidated mud and very fine sands. Tidal flats contain biologically rich communities and are commonly shorebird areas.

Tidal flats that are sheltered from tidal currents or wind-induced waves can occur along the inland shoreline of barrier islands or as components of secondary and tertiary bay systems. These flats may be open to adjacent bay waters or semi-enclosed with limited contact with adjacent waters.

Sheltered flats may develop fringes of emergent vegetation comprised of saltwater marsh varieties. These flats contribute to local detrital-based food chains and act as a protective habitat for many juvenile estuarine species. This habitat is valued by juvenile shrimps, crabs, and many commercial finfish, especially during the summer months. Algal communities may be locally important, but blue-green algae mats are not usually dominant.

Oil spill movement into these shallow habitats can have substantial adverse effects, especially if emergent vegetation is oiled, depending on the type of oil, penetration into subshale, and season of spill. Revegetation of fringe marsh areas may take several seasons. Oil incorporation into sediments may be detrimental to the juvenile organisms that occupy the shallow waters over these flats and larger species that feed upon the affected species.

Because tidal flats contain diverse biological communities and the soft sediments are highly susceptible to physical disturbance, they have a moderate priority for protection. Sheltered tidal flats have a high priority.

Riparian Zones (M)

Shorelines of navigable coastal rivers and streams often are vegetated with plant types characteristic of floodplain forests and wetlands. Saltwater may be present during low-flow regime, but freshwater is usually in contact with the shoreline vegetation. Downstream riverflow is generally continuous, but water levels in the watercourse may vary in response to diurnal tide variation. Along dredge channels, original vegetation may have been disturbed and shoreline may appear barren.

Riparian shorelines contain numerous emergent plants and trees that typify Texas coastal watercourses; each community trophic level contains transitional mixtures of freshwater and estuarine species. Estuarine invader species, particularly crabs and many finfish species, utilize this habitat during periods of low river flow.

Downstream flow is the primary mechanism for oil movement. Patchy accumulations among riparian vegetation and debris deposits are likely. Floating oil will accumulate in backwater areas with poop flushing. Due to the nature of the vegetation and the natural cleansing of the system via downstream flow, Riparian zones are of moderate sensitivity.

Exposed Tidal Flats (M)

Exposed tidal flats oftentimes occur adjacent to primary bays and lagoons where observable diurnal tidal variation is significant or where wind-induced seiches may change local water level. These flats usually lie adjacent to large openwater areas where water exchange is unrestricted across a wide front. Flats vary greatly in surface area, but are alternately flooded and dewatered dependent upon the prevailing tidal regime. Although the true shoreline lies at the high-tide mark, the observed location of the shoreline varies.

Biota inhabiting these tidal flats are often based on blue-green algae mats that grow atop the muds. Species diversity and bio-mass unit area are relatively low for tidal flats biota, due to periodic drying and exposure to temperature extremes. Composition of algal mat communities are often distinct from those in adjacent estuarine waters.

Since the location of the actual waterline varies with prevailing tidal or wind-induced water movement, intruding oil may be deposited in sands across the flats or at the high water level. Due to a relatively low biological diversity, and oil deposition followed by dewatering, exposed tidal flats are a moderate priority for protection.

Dredged Soil Deposits (M)

Soil deposits may occur as islands, submerged banks, or man-made land. These shoreline environments are formed by removal of bottom sediments to create deeper areas more suited to navigation and subsequent deposition of this material into selected shore areas or bay bottoms.

Biota that inhabit the waters adjacent to dredge soil deposits are affected by the predominant composition of the sediment. Observed community structure is often a function of time since the material was physically displaced. Presence of aquatic plants and algae are very limited during the earlier stages of soil aging when fine- sediment resuspension is most active, but invertebrates may thrive on the organic detritus available.

Spilled oil affects soil deposits in a manner similar to partially-exposed bay margins. Oil may accumulate along the upper tideline when wave action is present, but may remain in the adjacent shallows if low levels of flushing exist. Turbid conditions facilitates the oiling of some shallow-water sediments. As in the exposed tidal flats, dredged soil deposits have a moderate priority for protection.

Partially Exposed Bay Margins (M)

Bay and lagoon shorelines are characterized by relatively narrow intertidal beach-faces, usually surrounded by shallow bay bottoms.

Resident biota along the beachface may be varied in diversity, with crustaceans and mollusks being the predominant invertebrates. Emergent or submersed macro-phyte communities are usually absent. Blue-green algal mat communities may cover the sediment surface in more protected locations. Post-larval and juvenile fishes frequent shallow nearshore habitats.

Oil will accumulate along the narrow beachface due to wave action, but much can remain a floating mass on nearshore waters. Oil may adversely affect the intertidal biological community if extensive shallows are present and wave action causes mixing of oil with suspended sediments; however, these ecosystems are of a moderate priority for protection.

Sand-Shell Substrate (L)

On a sand-shell substrate, the beachface is usually narrower and steeper than fine-grained beaches due to active transport of lighter sediment materials caused by wave action. Such beaches may occur along both gulf shorelines and bay shorelines. Shell fragments of various sizes accumulate as wave energy removes finer-grained material.

Biota associated with such beaches exhibit low diversity and standing crop biomass. In more sheltered waters, increased populations of invertebrates in the lower intertidal zone may occur.

Like other higher-energy beaches, oil accumulates along the upper beachface washlines. Penetration of deposited oil into the substrate is possible depending upon the depth of porous shell material. This type of beachface is a low priority for protection.

Seawalls, Jetties, Bulkheads, and Revetments (L)

Man-made structures, such as seawalls, jetties, bulkheads, and revetments, are in place along shoreline zones to deflect and absorb wave and current energy, thereby preventing erosion or the acceleration of nearshore sediment transport along the shoreline zone. These structures may be constructed of treated pilings and heavy lumber, performed or chunk concrete, or rocks of various sizes and composition. Development of such structures often entails dredging of adjacent shallow areas for navigation enhancement.

The biological community structure can vary considerably among such structures. Attached algae are the major primary producers that occur on these solid substrates. Invertebrate communities may be diverse and high in standing crop biomass; distinct zonation of dominant invertebrates is often present within the intertidal zone, especially along the gulf shoreline and major passes where tide heights are greatest.

Oil accumulates along the shoreline due to wind and wave action. Amounts and persistence of oil depend on the type of material (i.e., rock, concrete wall, etc.) and wave-energy level. Heavy accumulation of oil is likely among the rocks of revetment structures and thin oil is likely on vertical faces. The protection priority for these man-made structures is low.

Erosional Scarps (L)

Steep scarps form in headlands due to wave erosion. They occur primarily in clay soil horizons with vegetated cover where slope failure is abrupt following wave-induced erosion of supporting strata. They occur most frequently on shoreline areas downwind of prevailing wind patterns, but wind-induced wave erosional effects may change seasonally. Beaches at the base of the scarp are narrow or absent.

Emergent or submerged vegetation is absent and benthic fauna is of minor importance. The utilization of habitat by important estuarine species is slight, therefore warranting a low priority for protection.

Sensitive Area Locations and Protection Measures

Five sites along EMPCo pipeline sections within the Mid-Tex Area have been selected by EMPCo for detailed study of protection planning and are based on the potential for significant impacts in the event of a release or spill. These sites include major river/stream crossings by pipelines and contiguous breakout tank farms. The site locations are shown in the associated Environmental Sensitivity Maps at the end of this section and were identified from the TCEQ's series of spill response maps for the Gulf Coast of Texas.

Types and/or names of sensitive ecological resources, the applicable protection options, and supplemental response information (i.e., general coastal sensitivities, access/staging areas, boat launches, etc.) are included on the accompanying environmental sensitivity map information tables (Tables 15-2 through 15-6). A legend for the response maps is attached to the last sensitivity map for each zone.

During an actual spill event, these response maps and tables will help to guide the response team in identifying the key sensitive area locations and selecting the most appropriate protection methods. The protection options listed in the information tables are those that are generally applicable to protecting the particular type of sensitivity in that type of environment.

The protection options listed in Tables 15-2 through 15-6 use an alphabetical designation which corresponds to those designations listed in Table 15-1.

It should be noted that many of the sensitive sites are outside of the GLO's Coastal Facility Designation (12-hour line). However, in the interest of providing a complete survey of the potential spill sites along the pipeline, they have been included on the environmental sensitivity maps.

Other environmentally sensitive areas that could be impacted by a spill from the sections of pipelines regulated under 49 CFR 194.103 have been identified within the Mid-Tex Response Zone. Locations of these areas are shown on Figures 15-1, 15-2 and 15-3 in Section 15 and include public drinking water intakes which are located within a 5 mile radius of the pipelines and other environmentally sensitive areas (including the waters of lakes, ponds, rivers, and bayous) within 1 mile downstream of the pipeline. .

Additional information regarding the recommended protection, containment, and recovery techniques for oil spills including the worst case discharge described in Section 14 is provided in Volume 1 *ExxonMobil Oil Spill Response Field Manual.*

Key Sensitive Area

The protection and general response actions that would likely be taken in the event of a spill are described below for a key sensitive area within the Mid-Tex Response Zone. It is not the intent of this section to provide response actions for all sensitive areas but to include that which may experience the greatest overall impact from a pipeline spill.

The recommended protection and containment techniques for the key sensitive areas are assigned letter designations, shown in parentheses, which correspond to the letter designations for the various techniques listed in Table 15-1. Additional information on these techniques as well as the recovery techniques mentioned below is provided in Volume 1.

New Marlin Reservoir Area No. 60

- **General/Access -** The pipeline crosses intermittent streams in close proximity to the New Marlin Reservoir (Figure 1-3). A spill could reach the reservoir if it occurs during a storm event. The reservoir is the drinking source for the town of Marlin. Access is generally limited to traveling along the pipeline ROW from north of FM 147.

- **Protection/Containment -** Containment booming **(H)** or diversion booming **(G)** near the spill's point of entry to the lake are generally the most applicable techniques. Boats would be required to deploy booms and the Marlin water district should be notified to shut down the water intake.

- **Recovery -** Recovery on the lake is best accomplished using skimmers and/or vacuum trucks and sorbents for final cleanup. A large spill may require on-site interim storage.

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TABLE 15-1 Summary of Protection Techniques

Technique[1]	Description	Primary Logistical Requirements	Use Limitations[2]	Potential Environmental Effects
Spills on Land				
A. Containment/ Diversion Berms	Construct earthen berms ahead of advancing surface spill to contain spill or divert it to a containment area.	Equipment * 1 backhoe, bulldozer, front-end loader, or set of hand tools Personnel 4-8 workers	• Steep slopes • Porous substrate	• Disturbance to surface soils and vegetation • Increased oil penetration
B. Storm Drain Blocking	Block drain opening with sediments, plastic sheet, boards, etc. and secure to prevent oil from entering drain.	Equipment * misc. Hand tools 1 board, plastic sheet, mat, etc. Personnel 1-2 workers	• May be advantageous for oil to enter drain • Heavy precipitation	• Increased oil penetration • Oil can spread to other areas
C. Blocking Dams	Construct dam in drainage course/stream bed to block and contain flowing oil. Cover with plastic sheeting. If water is flowing, install inclined pipes during dam construction to pass water underneath.	Equipment * 1 backhoe, bulldozer, front-end loader, or set of hand tools 1 plastic sheeting roll Personnel 4-6 workers	• Upstream storage capacity • Flowing water	• Increased oil penetration
D. Culvert Blocking	Block culvert opening with plywood, sediments, sandbags, etc. to prevent oil from entering culvert	Equipment * misc. Hand tools misc. Plywood, sandbags, etc. Personnel 3-4 workers	• Upstream storage capacity • Flowing water	• Increased oil penetration
E. Interception Trench	Excavate ahead of advancing surface/ near-surface spill to contain oil. Cover bottom and downgradient side with plastic.	Equipment * 1 backhoe, or set of hand tools misc. Plastic sheeting Personnel 3-6 workers	• Slope • Depth to near-surface flow	• Increased oil penetration • Disturbance to surface soils and vegetation
Spills on Water				
G. Diversion Booming	Boom is deployed from the shoreline at an angle towards the approaching slick and anchored or held in place with a work boat. Oil is diverted towards the shoreline for recovery.	Equipment * 1 boat 3 anchor systems (min.) 100 ft boom (min.) Personnel 3 workers plus boat crew	• Currents >2-3 kts • Waves >1-2 feet • Water depth >50 feet (anchoring) • Sensitive shorelines	• Minor substrate disturbance at anchor points • Heavy oiling at shoreline anchor point

TABLE 15-1 (Cont'd) Summary of Protection Techniques

Technique[1]	Description	Primary Logistical Requirements	Use Limitations[2]	Potential Environmental Effects
Spills on Water (Cont'd)				
H. Narrow Channel Containment Booming	Boom is deployed across entire river channel at an angle to contain floating oil passing through channel.	Equipment * 1 boat, vehicle, or winch 1-2 booms (1.2 x channel width each) 2-10 anchor systems Personnel 2-3 workers	• Currents >2-3 kts • Water depths >50 feet (anchoring) • Sensitive shorelines	• Minor substrate disturbance at anchor points • Heavy shoreline oiling at downstream anchor point
I. Sorbent Barriers	A barrier is constructed by installing two parallel lines of stakes across a channel, fastening wire mesh to the stakes, and filling the space between with sorbents.	Equipment * (per 100 feet of barrier) misc. Hand tools 1 boat 20 fence posts 200 feet wire mesh 200 ft^2 sorbents misc. Fasteners, support lines, additional stakes, etc. Personnel 2-3 workers	• Water depths >5-10 feet • Currents >0.5 kts • Soft substrate	• Minor substrate disturbance at post and shoreline anchor points • High substrate disturbance if boat is not used
L. Exclusion Booming	Boom is deployed across or around sensitive areas and anchored in place. Approaching oil is excluded from area.	Equipment * (per 500 feet of boom) 1 boat 6 anchor systems 750 ft boom (min.) Personnel 3 workers plus boat crew	• Currents >1-2 kts • Waves >1-2 feet • Water depth >50 feet (anchoring)	• Minor substrate disturbance at anchor points
M. Deflection Booming	Boom is deployed from the shoreline away from the approaching slick and anchored or held in place with a work boat. Oil is deflected away from shoreline.	Equipment * 1 boat 5 anchor systems boom (200 feet) Personnel 3 workers plus boat crew	• Currents >2-3 kts • Waves >1-2 feet • Water depth >50 feet (anchoring) • Onshore winds	• Minor substrate disturbance at anchor points • Oil is not contained and may contact other shorelines

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TABLE 15-1 (Cont'd) Summary of Protection Techniques

Technique[1]	Description	Primary Logistical Requirements	Use Limitations[2]	Potential Environmental Effects
Spills on Water (Cont'd)				
N. Inlet Dams	A dam is constructed across the inlet or channel using local shoreline sediments to prevent oil from entering inlet. Dam can be covered with plastic to minimize erosion.	<u>Equipment *</u> 1 backhoe, bulldozer, front-end loader, or set of hand tools 1 plastic sheeting roll <u>Personnel</u> 2-6 workers	• Water outflow • Inlet depth >5 feet • Excessive inlet width	• Sediment/vegetation disturbance at borrow areas • Inlet substrate disturbance • Increases suspended sediments • Water in inlet can become stagnant
O. Debris/Ice Exclusion	Install fence barrier upstream of containment site to exclude debris/ice	<u>Equipment</u> * (per 100 ft of barrier) misc. Hand tools 1 boat 10 fence posts 100 feet cyclone fence Misc. Fasteners, support lines, etc. <u>Personnel</u> 2-3 workers	• Water depths > 5-10 ft. • Currents > 3-4 kts • Soft substrate	• Minor substrate disturbance at post and anchor points
Releases of LPG/HVL/Gases to the Atmosphere				
P. Controlled burn	Allow the material to consume itself in a safe and controlled manner. If flammable material is not burning may want to consider a **controlled ignition**.	<u>Equipment *</u> Flares/torches <u>Personnel</u> A trained ignitor from a safe distance	• Managing the fire and heat • Damaging force of ignition	• Damages of fire and heat on exposures
Q. Vapor Suppression	Apply water spray/fog over the released liquid to reduce the formation of vapors.	<u>Equipment *</u> Fire truck (water pumper) Foam generator unit Foam tanker or trailer <u>Personnel</u> 1 operational crew per unit	• Limited reductions • Fire/explosive hazard. • Water may cause material to spread	• Temporary flooding • Minor disturbance to surface soils and vegetation
R. Dissipation or dispersion	Apply a medium (air/gas/chemical) to disperse, dissolve, diffuse or in any way dissipate the density of the released material.	<u>Equipment *</u> Fans/blowers/air movers Nitrogen generator trucks <u>Personnel</u> 1 operational crew per unit	• Minimal effectiveness • Fire/explosive hazard.	•

1 - Techniques A through I appeared on Table 5 5-1 in Volume 1 as appropriate techniques for containment and recovery These techniques have been assigned the same letter designation as Table 5 5-1 for consistency
2 - In addition to implementation time and accessibility
*** - Need to establish a safe perimeter and follow safety precautions as appropriate before work begins, i.e., TGSM, JSA, and Hot Work Permit procedures.**

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TABLE 15-2
Pasadena Product Station - Sensitive Area Map 1
(Location - N. of Pasadena Freeway, S. Southern Pacific Railroad off Ethyl Road)

Sensitivity Type	Description	Location	Protection Options
Rare, Threatened, and Endangered Species Habitat	None identified		
Bird Habitats	None identified		
Fish and Shellfish Grounds	None identified		
Wildlife Management Areas	None identified		
Water Intakes	Industrial use Industrial use Industrial use Industrial use Industrial use	Phillips Petroleum Co. Ethyl Corporation Oiltanking of Texas, Inc. Diamond Shamrock Chemical Co. Diamond Shamrock Corporation	G,H,L,M
Recreational Areas	None identified		
Marinas	None identified		
Other	None identified		
Coastal Sensitivities			
High Impact	Marshes and wetlands	In Greens Bayou opens from Houston Ship Channel over two miles N. of facility	G,H,I,L,M,N
Moderate Impact	Exposed tidal flats	Boggy Bayou Basin (approx. 2-1/2 mi. downstream)	G,L,M
Low Impact	Seawall, jetties, bulkheads, & revetments	Along Houston Ship Channel (approx. 2 mi. N. of facility)	G,L,M
Other Response Information			
Access/Staging Areas	Access	Pasadena Freeway to Ethyl Road	
Boat Launches	None identified		

TABLE 15-3
Clear Creek (north) - Sensitive Area Map 2
(Location - Less than one mile southwest of Baytown to Pierce Junction)

Sensitivity Type	Description	Location	Protection Options
Rare, Threatened, and Endangered Species Habitat	None identified		
Bird Habitats	None identified		
Fish and Shellfish Grounds	None identified		
Wildlife Management Areas	None identified		
Water Intakes	None identified		
Recreational Areas	None identified		
Marinas	None identified		
Other	None identified		
Coastal Sensitivities			
High Impact	Marshes and wetlands	Approx. 6 mi. downstream from pipeline	G,H,I,L,M,N
Moderate Impact	Riparian zone	Approx. 3 mi. downstream from pipeline	G,L,M
Low Impact	None identified		
Other Response Information			
Access/Staging Areas	Access	State Highway 2351	
Boat Launches	None identified		

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TABLE 15-4
Houston Ship Channel/Galveston Bay Crossing - Sensitive Area Map 3
(Location - includes Alexander Island and Barnes Island)

Sensitivity Type	Description	Location	Protection Options
Rare, Threatened, and Endangered Species Habitat	None identified		
Bird Habitats	Rookeries Rookeries (inactive) Rookeries (unverified) Colonial waterbird nesting and rookeries	Alexander Island Baytown Tunnel Cedar Bayou Channel Atkinson Island approx. 4 mi. downstream	G,M
Fish and Shellfish Grounds	Shrimp and blue crab resources Drum, Sheepshead, and Southern Flounder resources	Upstream and downstream of facility	G,M
Wildlife Management Areas	None identified		
Water Intakes	Industrial use	Houston Lighting and Power	G,L,M
Recreational Areas	Sylvan Beach Park San Jacinto Battleground	Upper Galveston Bay southwest of Morgans Pt. South of Lynchburg Ferry Crossing	G,L,M
Marinas	None identified		
Other	None identified		

TABLE 15-4 (Cont.)
Houston Ship Channel/Galveston Bay Crossing - Sensitive Area Map 3
(Location - includes Alexander Island and Barnes Island)

Coastal Sensitivities			
High Impact	Marshes and wetlands Sheltered tidal flat	Cedar Bayou S.E. of Baytown Approx. 1 mi. upstream in San Jacinto State Park and downstream approx. 2 mi. in Goose Creek further downstream on portions of Hog Island and Atkinson Island, and off Mesquite Knoll W. of Beach City	G,H,I,L, M,N G,M
Moderate Impact	Dredged soil deposits and partially exposed bay margins Partially exposed bay margin	Fringe of Alexander Island and the E. bank of the ship channel E. of Alexander Island Along W. bank of upper San Jacinto Bay S.W. of Alexander Island	G,M,L G,M,L
Low Impact	Seawalls, jetties, bulkheads, and revetments Erosional scarps	N. and S. of Alexander Island Barnes Island and several other locations downstream	G,M,L G,M,L
Other Response Information			
Access/Staging Areas	Access	State Highway 146	
Boat Launches	Private boat ramp Private boat ramp Private boat ramp	Goose Creek and Highway 146 Will's Fish Camp, near Ash Point south of Baytown Morgan Point ramp on E. Main	

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TABLE 15-5
San Jacinto River Crossing - Sensitive Area Map 4
(Location - Moore Rd.-Baytown Pipeline at I-10/San Jacinto River, approx. 3 mi. west of the Baytown - Mont Belvieu Corridor)

Sensitivity Type	Description	Location	Protection Options
Rare, Threatened, and Endangered Species Habitat	None identified		
Bird Habitats	None identified		
Fish and Shellfish Grounds	Three species of finfish and crustacean		
Wildlife Management Areas	None identified		
Water Intakes	None identified		
Recreational Areas	River Terrace Park San Jacinto State Park	On Old River in Channelview S. of Lynchburg Ferry X-ing of Houston Ship Channel	G,L,M
Marinas	None identified		
Other	Lynchburg Ferry		G,L,M
Coastal Sensitivities			
High Impact	None identified		
Moderate Impact	Partially exposed bay margins Dredged soil deposits Exposed tidal flats	Approx. 6 mi. of coastline at: • The W. most shore at the old river, N. of the Buffalo Bayou confluence • The S.E. half of Burnet at Bay Shoreline • The S.E. portion of shoreline bordering San Jacinto State Park Approx. 6 mi. of coastline including islands and many sand bars Approx. 3 mi. of coastline on the N. shore at Burnet Bay	G,L,M G,L,M G,L,M
Low Impact	Seawalls, jetties, bulkheads, revetments Sand/shell substrate	Approx. 2 mi. of coastline E. of the I-10/San Jacinto River Crossing, N. shore of the old river Approx. 2 mi. of coastline including Goat Islands and various sand bars	G,L,M G,L,M
Other Response Information			
Access/Staging Areas	Access	Interstate 10 and Lynchburg Road	
Boat Launches	Public boat ramp	Southeast side of I-10 at San Jacinto River Bridge	

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TABLE 15-6
Social, Economic, and Environmental Sensitive Areas and Water Resources
Mid-Tex Zone

I.D. No.	TLC No.	Line Section	Resource	Location (mile post)*
52	116	Colorado River - Luling	Colorado River (crossing) 11.5 miles downstream of SAPL river crossing. -approximately 1 hour for LCRA to shut down once notified. # 800-779-5272 ext.: 2538 (24hour) LCRA # 979-758-3017 Eagle Lake: Larry or Randy # 979-234-7336	m.p. 0
53	116	Colorado River - Luling	East Navidad River (crossing)	m.p. 25
54	116	Colorado River - Luling	West Navidad River (crossing)	m.p. 29
(b) (3), (b) (7)(F) [redacted]				
56	116	Colorado River - Luling	Queen City Aquifer Recharge Zone (crossing)	m.p. 65-66
57	116	Colorado River - Luling	Salt Branch Creeks	< 5 miles S m.p. 70-72
58	118	Luling - Austin (inactive)	Plum Creek (crossing)	m.p. 6
59	118	Luling - Austin (inactive)	Onion Creek (crossing)	m.p. 34
60	118	Luling - Austin (inactive)	Colorado River	< 5 miles E & W m.p. 35-38
61	118	Luling - Austin (inactive)	Colorado River (crossing)	m.p. 36
62	118	Luling - Austin (inactive)	Edwards Aquifer Recharge Zone	m.p. 36-40
63	81	Seguin - Johnson (inactive)	Guadalupe River	< 5 miles S m.p. 0
64	81	Seguin - Johnson (inactive)	San Marcos River	< 5 miles E & W m.p. 9-12
65	81	Seguin - Johnson (inactive)	San Marcos River (crossing)	m.p. 11
66	81	Seguin - Johnson (inactive)	Salt Lake	< 1 mile E m.p. 10-11
(b) (3), (b) (7)(F) [redacted]				
68	81	Seguin - Johnson (inactive)	Salt Branch (crossing)	m.p. 13
69	81	Seguin - Johnson (inactive)	Plum Creek (crossing)	m.p. 15
70	81	Seguin - Johnson (inactive)	Plum Creek (crossing)	m.p. 16
71	81-A	Johnson - Bastrop (inactive)	Lakes	< 5 miles E & W m.p. 9-11
72	81-A	Johnson - Bastrop (inactive)	Six Mile Branch (crossing)	m.p. 4
73	81-A	Johnson - Bastrop (inactive)	Plum Creek (crossing)	m.p. 1
74	81-A	Johnson - Bastrop (inactive)	Walnut Creek/Cedar Creek	< 5 miles E & W m.p. 16-24
75	81-A	Johnson - Bastrop (inactive)	Town Creek	< 5 miles E & W m.p. 18-19

PHMSA Sequence Number 606

I.D. No.	TLC No.	Line Section	Resource	Location (mile post)*
76	81-A	Johnson - Bastrop (inactive)	Long Branch Creek (crossing)	< 5 miles E & W m.p. 23
77	81-A	Johnson - Bastrop (inactive)	Cedar Creek (crossing)	m.p. 24
(b) (3), (b) (7)(F) [redacted]				
79	117	Luling - San Antonio	San Marcos River (crossing)	m.p. 5
80	117	Luling - San Antonio	Geranimo Creek (crossing)	

PHMSA Sequence Number 606

TABLE 15-6 (Continued)
Social, Economic, and Environmental Sensitive Areas and Water Resources
Mid-Tex Zone

I.D. No.	TLC No.	Line Section	Resource	Location (mile post)*
81	117	Luling - San Antonio	Guadalupe River (crossing), Lake McQueeney, Lake Dunlap & Lake Placid	< 5 miles N & S m.p. 24 - 26
[redacted]				
84	117	Luling - San Antonio	Cibolo Creek (crossing)	m.p. 38
85	117	Luling - San Antonio	Lakes (SCS 1, 2, 3, 4, 5, 6a)	< 5 miles N & S m.p. 42 - 47
86	117	Luling - San Antonio	Rosillio/Ackerman Creeks (crossing)	m.p. 49
87	117	Luling - San Antonio	Salado Creek (crossing)	m.p. 50
88	117	Luling - San Antonio	Lake	< 5 miles S m.p. 51
12	109	Hwy 59 - Satsuma	Halls Bayou (crossing)	m.p. 2
13	109	Hwy 59 - Satsuma	Halls Bayou	< 1 mile N & S m.p. 1-9
[redacted]				
13	138	Aldine - Intercontinental	Halls Bayou	< 5 miles E & W m.p. 0-2
15	138	Aldine - Intercontinental	Halls Bayou (crossing)	m.p. 1
16	138	Aldine - Intercontinental	Greens Bayou (crossing)	m.p. 5
28	110	Satsuma - Navasota	Cypress Creek (crossing)	m.p. 5
29	110	Satsuma - Navasota	Spring Creek (crossing)	m.p. 21
30	110	Satsuma - Navasota	Spring Creek	<5 miles SW & N m.p. 18-30
31	110	Satsuma - Navasota	Beason Creek (crossing)	m.p. 35
32	110	Satsuma - Navasota	Grassy Creek (crossing)	m.p. 43
33	110	Satsuma - Navasota	Brazos River	< 5 miles SW m.p. 40-43
34	111	Navasota - Hearne	Spring Creek (crossing)	m.p. 3
35	111	Navasota - Hearne	Navasota River (crossing)	m.p. 4
36	111	Navasota - Hearne	Bird Colonies – Anhinga, Cattle Egret, Little Blue Heron, Snowy Egret	< 1 mile N m.p. 11
37	111	Navasota - Hearne	Peach Creek (crossing)	m.p. 14
38	111	Navasota - Hearne	Alum Creek (crossing)	m.p. 17
39	111	Navasota - Hearne	Carter's Creek (crossing)	m.p. 23

PHMSA Sequence Number 606

TABLE 15-6 (Continued)
Social, Economic, and Environmental Sensitive Areas and Water Resources
Mid-Tex Zone

I.D. No.	TLC No.	Line Section	Resource	Location (mile post)*
40	111	Navasota - Hearne	Lakes	< 5 miles S m.p. 10-11
41	111	Navasota - Hearne	Carter Lake	< 5 miles N m.p. 20
42	111	Navasota - Hearne	Bryan Utilities Lake Park	< 5 miles SW m.p. 35-36
[redacted] (b) (3), (b) (7)(F)				
44	111	Navasota - Hearne	Sparta Aquifer Recharge Zone (crossing)	m.p. 45-46
[redacted] (b) (3), (b) (7)(F)				
46	111	Navasota - Hearne	Various Creeks - Spring Creek - Dunn Creek - Campbell Creek (includes crossings)	< 5 miles W & E m.p. 37-43
47	111	Navasota - Hearne	Pin Oak Creek (crossing)	m.p. 46
48	112	Hearne - Waco	Queen City Aquifer Recharge Zone (crossing)	m.p. 0-4
49	112	Hearne - Waco	Little Brazos River/Sandy Creek	< 5 miles W m.p. 0-7
50	112	Hearne - Waco	Pin Oak & Little Pin Oak Creeks	< 5 miles E m.p. 0-4
51	112	Hearne - Waco	Mud Creek (crossing)	m.p. 3
52	112	Hearne - Waco	Sandy Creek (crossing)	m.p. 11
53	112	Hearne - Waco	Walnut Creek (crossing)	m.p. 13
54	112	Hearne - Waco	Little Brazos River	< 5 miles W & E m.p. 13-28
55	112	Hearne - Waco	Flagg Lake	< 1 mile W m.p. 24
56	112	Hearne - Waco	Little Brazos River (crossing)	m.p. 25
57	112	Hearne - Waco	Fish Creek (crossing)	m.p. 28
58	112	Hearne - Waco	Big Creek (crossing)	m.p. 34
59	112	Hearne - Waco	Big Creek/Mussel Run	< 5 miles E & W m.p. 28-35
[redacted] (b) (3), (b) (7)(F)				
61	112	Hearne - Waco	New Marlin Reservoir	< 1 mile W m.p. 37-39
62	112	Hearne - Waco	New Marlin City Lake	< 1 mile W m.p. 38
63	112	Hearne - Waco	Old Marlin City Lake	< 1 mile W m.p. 39

PHMSA Sequence Number 606

TABLE 15-6 (Continued)
Social, Economic, and Environmental Sensitive Areas and Water Resources
Mid-Tex Zone

I.D. No.	TLC No.	Line Section	Resource	Location (mile Post)*
64	112	Hearne - Waco	Lake Creek Lake (crossing)	m.p. 51
(b) (3), (b) (7)(F) [redacted]				
67	112	Hearne - Waco	Midway Park	< 1 mile W m.p. 51
(b) (3), (b) (7)(F) [redacted]				
69	112	Hearne - Waco	Tehuacana Creek	< 1 mile E & W m.p. 55-62
70	112	Hearne - Waco	Tehuacana Creek crossing)	m.p. 56
(b) (3), (b) (7)(F) [redacted]				
73	112	Hearne - Waco	Bird Colonies - Little Blue Heron - Cattle Egret - Great Egret	< 1 mile W m.p. 62
74	112	Hearne - Waco	Lucky Branch (crossing)	m.p. 58
74	113	Waco - Irving	Brazos River & small lakes	< 5 miles W m.p. 0-2
72	113	Waco - Irving	Bird Rookery - Little Blue Heron - Cattle Egret	< 1 mile S m.p. 0
75	113	Waco - Irving	Tehuacana Creek	< 5 miles SE m.p. 0-12
76	113	Waco - Irving	Lake - SCS 10	m.p. 13
77	113	Waco - Irving	Ash Creek	< 5 miles E m.p. 22
78	113	Waco - Irving	Grove Creek Dam	< 1 mile E m.p. 27
79	113	Waco - Irving	White Rock Creek (crossing)	m.p. 31
80	113	Waco - Irving	Richland Creek	m.p. 37
81	113	Waco - Irving	Mill Creek and Lakes SCS 98A & B	< 5 miles E m.p. 39
82	113	Waco - Irving	South Prong Creek (crossing)	m.p. 54
83	113	Waco - Irving	Waxahatchie Creek (crossing)	m.p. 57
84	113	Waco - Irving	Red Oak Creek (crossing)	m.p. 64
85	113	Waco - Irving	Bee Br./Stewart Br./Ten mile Creek	< 5 miles E & W m.p. 66-69
86	113	Waco - Irving	Bee Branch (crossing)	m.p. 66
87	113	Waco - Irving	Stewart Branch (crossing)	m.p. 68

PHMSA Sequence Number 606

TABLE 15-6 (Continued)
Social, Economic, and Environmental Sensitive Areas and Water Resources
Mid-Tex Zone

I.D. No.	TLC No.	Line Section	Resource	Location (mile Post)*
88	113	Waco - Irving	Ten mile Creek (crossing)	m.p. 69
89	113	Waco - Irving	Mountain Creek Lake	< 5 miles E m.p. 66-73
90	113	Waco - Irving	West Fork - Trinity River (crossing)	m.p. 81
91	113	Waco - Irving	West Fork & Trinity River & Bear Creek	< 5 miles E & W m.p. 78-88
92	114	Irving - Love Field	Elm Fork of the Trinity River (crossing)	m.p. 5
(b) (3), (b) (7)(F) [redacted]				
94	114	Irving - Love Field	Elm Fork of the Trinity River	< 5 miles N m.p. 0-6
95	114	Irving - Love Field	West Fork of the Trinity River	< 5 miles S m.p. 0-6
94	160	Irving - DFW Airport	Elm Fork of the Trinity River	< 5 miles NE m.p. 0-6
95	160	Irving - DFW Airport	West Fork of the Trinity River	< 5 miles S m.p. 0-2
96	160	Irving - DFW Airport	Big Bear Creek/Bear Creek	< 5 miles S m.p. 6-13
97	160	Irving - DFW Airport	Woodbine Aquifer Recharge Zone (crossing)	m.p. 6-13
98	160	Irving - DFW Airport	Grapevine Lake, Dam & Rec. Area	< 5 miles N m.p. 9-13

Note: Endangered Wildlife Habitat along the Colorado River for Whooping crane, American Alligator, Houston Toad, and Interior Least Tern.

* Mile posts begin at the origin of the line section as m.p. 0. All mile post distances are approximate.

Bayport MidTex Pipeline Corridor
Sensitive Area Map
Pasadena Product Station

N

The Response Group

(b) (3), (b) (7)(F)

[redacted]

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Bayport MidTex Pipeline Corridor
Sensitive Area Map
Clear Creek North

The Response Group
Emergency Response Pre-Planning & Support

95°8'0"W 95°7'30"W 95°7'0"W 95°6'30"W 95°6'0"W 95°5'30"W 95°5'0"W

(b) (3), (b) (7)(F)

[redacted]

Bayport MidTex Pipeline Corridor
Sensitive Area Map
Houston Ship Channel / Galveston Bay Crossing

The Response Group
Emergency Response Pre-Planning & Support

(b) (3), (b) (7)(F)

[redacted]

Bayport MidTex Pipeline Corridor
Sensitive Area Map
San Jacinto River Crossing

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The Response Group
Emergency Response Pre-Planning & Support

(b) (3), (b) (7)(F)

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Bayport MidTex Pipeline Corridor
Master Legend

ESI Species

- Alligator/Crocodile
- Crab
- Diving Bird
- Diving Bird Endangered
- Dolphin
- Echinoderm
- Fish
- Gastropod
- Gull/Tern
- Gull/Tern_te
- Hardbottom
- Mustelids/Rodents
- Mustelids/Rodents_te
- Other Reptile/Amphibian
- Other Reptile/Amphibian_te
- Oyster/Clam/Mussel
- Palegic Birds
- Passerine Birds
- Raptor
- Raptor_te
- SAV/Kelp
- Shorebird
- Shorebird_te
- Shrimp
- Squid/Octopus
- Turtle
- Turtle_te
- Upland/Wetland Plant
- Wading Bird
- Wading Bird Endangered
- Waterfowl

HCA Data

- Commercial Navigable Waterways
- Ecologically Sensitive Areas
- Drinking Water Areas
- Other Populated Areas
- Highly Populated Areas

Environmental Sensitivity Index

- Exposed Walls and Other Solid Structures
- Salt and Brackish Water Marshes
- Freshwater Marshes
- Freshwater Swamps
- Mangroves and Woody Vegetation
- Scarps and Steep Slopes in Clay
- Wave-cut Clay Platforms
- Fine-Grained Sand Beaches
- Scarps and Steep Slopes in Sand
- Coarse-grained Sand Beaches
- Mixed Sand and Gravel or Shell Beaches
- Gravel or Shell Beaches
- Exposed Riprap Structures
- Exposed Tidal Flats
- Sheltered Solid Manmade Structures
- Sheltered Riprap Structures
- Sheltered Scarps
- Sheltered Rocky/Karst Shores
- Sheltered Tidal Flats

Pipeline Data

- Pipeline - 5 Mile Buffer
- Pipeline - 1 Mile Buffer
- Pipelines

Bayport MidTex Pipeline Corridor
Pipeline Overview Map

The Response Group

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Bayport MidTex Pipeline Corridor
Environmentally Sensitive Areas

The Response Group

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Bayport MidTex Pipeline Corridor
Environmentally Sensitive Areas

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Bayport MidTex Pipeline Corridor
Environmentally Sensitive Areas

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Bayport MidTex Pipeline Corridor
Environmentally Sensitive Areas

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Bayport MidTex Pipeline Corridor
Environmentally Sensitive Areas

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Map 6 of 21

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Bayport MidTex Pipeline Corridor
Environmentally Sensitive Areas

The Response Group

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Bayport MidTex Pipeline Corridor
Environmentally Sensitive Areas

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Environmentally Sensitive Areas

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Bayport MidTex Pipeline Corridor
Environmentally Sensitive Areas

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Bayport MidTex Pipeline Corridor
Environmentally Sensitive Areas

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