DEPARTMENT OF TRANSPORTATION

Research and Special Programs Administration

49 CFR Part 195

[Docket No. PS-133; Notice 1]

RIN 2137-AC 39

Emergency Flow Restricting Devices/ Leak Detection Systems

AGENCY: Research and Special Programs Administration (RSPA), DOT.

ACTION: Advance notice of proposed rulemaking.

SUMMARY: In 1991, the Department issued a report on emergency flow restricting devices (EFRDs) that proposed seeking public input on the placement of EFRDs at certain locations on hazardous liquid pipelines. The Pipeline Safety Act of 1992 mandated that the Department issue regulations prescribing the circumstances under which operators must use EFRDs and other equipment used to detect and locate pipeline ruptures on hazardous liquid pipelines. The regulations are to be issued following a survey and assessment of the effectiveness of such equipment. This advance notice of proposed rulemaking (ANPRM) poses a series of questions in order to solicit public input for the survey process.

DATES: Interested persons are invited to submit written comments in duplicate by April 19, 1994. Late-filed comments will be considered to the extent practicable. Interested persons should submit as part of their written comments all the material that is considered relevant to any statement of fact or argument made.

ADDRESSES: Send comments in duplicate to the Dockets Unit, Room 8421, Research and Special Programs Administration, U.S. Department of Transportation, 400 Seventh Street SW., Washington, DC 20590. Identify the docket and notice numbers stated in the heading of this advance notice. All comments and materials cited in this document will be available in the docket for inspection and copying in room 8421 between 8 a.m. and 4 p.m. each working day. Visitors are admitted to DOT headquarters building through the southwest quadrant at Seventh and E Streets. Commenters may request copies of the questions in a format which can be filled out and returned to the RSPA. Requests should be made to Lloyd W. Ulrich, Office of Pipeline Safety, room 2335, 400 Seventh Street SW., Washington, DC 20590, telephone (202) 366-4556 or FAX (202) 366-4566.

FOR FURTHER INFORMATION CONTACT: Lloyd W. Ulrich, (202) 366-4556, regarding the subject matter of this advance notice, or Dockets Unit, (202) 366-5046, for copies of this advance notice or other material in the docket.

SUPPLEMENTARY INFORMATION:

Background

The RSPA has been concerned for some time with the issue of more rapid leak detection on hazardous liquid pipelines, and the optimum placement of EFRDs to limit commodity release after the location of the release in the hazardous liquid pipeline has been identified.

Section 203 of the Hazardous Liquid Pipeline Safety Act (codified at 49 U.S.C. app. § 2002(n)) as amended by the Pipeline Safety Act of 1992 (the 1992 Act) (Pub. L. 102-508) mandated the Secretary, within two years of enactment, to conduct a survey and assess the effectiveness of emergency flow restricting devices (EFRDs) and other procedures, systems, and equipment used to detect and locate hazardous liquid pipeline ruptures and minimize product releases from hazardous liquid pipeline facilities. The 1992 amendments further mandated that the Secretary issue regulations within two years of completion of the survey and assessment. These regulations would prescribe the circumstances under which operators of hazardous liquid pipelines would use EFRDs and other procedures, systems, and equipment to detect and locate pipeline ruptures and minimize product release from pipeline facilities. The Secretary has delegated this authority to the Research and Special Programs Administration (RSPA) (See 49 CFR 1.53).

Also, the Department's March 1991 report titled "Emergency Flow Restricting Devices Study" contained proposals that we seek public input on the placement of EFRDs in urban areas, at water crossings, at other critical areas affected by commodity release, and areas in close proximity to the public outside of urban areas.

This ANPRM solicits public input for the survey process mandated by the 1992 Act as well as the proposals from the Department's 1991 EFRD study. The ANPRM requests information and data by posing a series of questions. This approach is utilized rather than conducting a traditional research survey of a selected number of respondents in order to obtain a broader base of data and to accelerate the regulatory process.

Notice on Highly Volatile Liquids—1978

In 1978, the RSPA issued an NPRM (43 FR 39402; September 5, 1978) proposing requirements intended to limit spillage from hazardous liquid pipelines carrying highly volatile liquids (HVL)[1] in inhabited areas by requiring installation of remotely controlled valves (RCVs)[2] or automatically controlled valves (ACVs).[3] This proposal was later withdrawn (46 FR 2130; January 8, 1981) because hazardous liquid pipeline industry studies demonstrated that placement of closely spaced valves over the full length of an HVL pipeline was not a reasonable method of reducing the effects of an accident.

Mounds View Accident

A July 8, 1986, accident on a gasoline pipeline focused interest on EFRDs. The accident, caused by a ruptured pipe seam on a gasoline pipeline in Mounds View, Minnesota, resulted in two deaths, one injury, and property damage well in excess of $1,000,000. The accident was exacerbated by backflow or draining from the pipeline after the manually operated valves on either side of the ruptured section were closed. The spill ignited approximately 20 minutes after the rupture. It took the pipeline operator over 1 hour and 40 minutes from the time of the rupture to isolate the ruptured section. Since this accident, the pipeline company installed a computerized leak-detection system and RCVs on either side of Mounds View (a distance of about 5.7 miles).

Advance Notice on Certain Safety Proposals—1987

In 1987, as a result of the same accident, the RSPA again addressed RCVs and ACVs in an ANPRM (52 FR 4361; February 11, 1987). This ANPRM invited public comment on the merit of certain safety proposals advanced by Congress, the Minnesota Commission on Pipeline Safety, and the National Transportation Safety Board. One safety

[1] The term "HVL" is defined in 49 CFR 195.2 as a hazardous liquid which will form a vapor cloud when released to the atmosphere and which has a vapor pressure exceeding 276 kPa (40 psia) at 37.8°C (100°F). The commodities included in the term "HVL" are LPG, anhydrous ammonia, and certain natural gas liquids.

[2] An RCV is any valve which is operated from a location remote from where the valve is installed. The location is usually at the pipeline control or dispatching center. The linkage between the pipeline control center and the RCV may be by fiber optics, microwave, telephone lines, or satellite.

[3] An ACV is any valve which automatically closes in response to a rate of pressure drop or flow rate in the pipeline which exceeds a preset level.

proposal was to convert shutoff valves required by the pipeline safety regulations on existing pipelines to RCVs or ACVs, and require similar valves on new pipeline construction.

Both gas and hazardous liquid pipeline operators indicated that neither RCVs nor ACVs were installed as shutoff valves as standard practice. They indicated that RCVs and ACVs had little effect to mitigate the extent of the spill because often, especially in populated areas on gas pipelines, ignition occurred before either type of valve could shut down a pipeline.

The specific concern of false closure of ACVs was identified in these comments. There was substantial agreement by both gas and hazardous liquid pipeline operators that ACVs should not be used as EFRDs because of their unreliability. This unreliability was due to the inability of ACV sensors to distinguish between a leak and normal operating fluctuations. Pipeline operators indicated numerous documented cases of unintended closures of ACVs. A false closure of an ACV on a hazardous liquid pipeline can cause an immediate pressure buildup or surge which may result in a pipeline rupture.

On September 23, 1987, the ANPRM was discussed at the joint meeting of the RSPA's Technical Pipeline Safety Standards Committee and the Technical Hazardous Liquid Pipeline Safety Standards Committee. (Both technical committees were established by the Secretary of Transportation to advise the Department on the technical feasibility, reasonableness, and practicability of all proposed gas and hazardous liquid pipeline safety standards and all amendments to existing standards.) The committees recommended that the Department study the selective use of RCVs and ACVs.

Emergency Flow Restricting Devices Study—1991

Section 305 of the Pipeline Safety Reauthorization Act of 1988 (Public Law 100–561), enacted on October 31, 1988, directed a study of the safety, cost, feasibility, and effectiveness of requiring gas and hazardous liquid pipeline operators to install EFRDs in existing and future pipeline systems in varying circumstances and locations.

In March 1991, in response to this Congressional mandate, the Department issued the study titled "Emergency Flow Restricting Devices Study." One of the conclusions in the study was that RCVs and check valves[4] are the only feasible EFRDs. Another conclusion was that requiring the retrofitting of all existing manually operated valves to RCVs on hazardous liquid pipelines in urban locations, as well as new valves in urban areas appeared to be cost effective. Still another conclusion in the study was that for an RCV to be effective, a modern supervisory control and data acquisition (SCADA) system with a well-designed leak detection subsystem was necessary to reduce spills from hazardous liquid pipelines. The study found that there was no significant benefit from installing EFRDs on gas transmission pipelines.

SCADA systems utilize computer technology to analyze data (e.g., pressure, temperature, and delivery flow rates) that are continuously gathered from remote locations on the pipeline. Computer analysis of this data is used to assist in day-to-day operating decisions on the pipeline and to provide input for real-time models of the pipeline operation which can identify and locate leaks.

SCADA-based leak detection subsystems are composed of hardware and software programs that employ a real-time modelling procedure to compare the current operational conditions of a segment of pipe to an "ideal" operating state. This ideal state is sometimes recalibrated during operations to accommodate variations in conditions (e.g., temperature or pressure fluctuations in the pipe that occur due to changes in the materials in transport or external environmental conditions). An "alarm" is sent to a central operator when the software model detects a condition that is "substantially" different from the idealized state. What makes the condition "substantially" different, thereby triggering the alarm, is determined by the model designer and the conditions imposed on the model, as well as by the amount of data available on the "ideal" state and its normal operational variability.

An RCV can operate without a SCADA system installed. However, for an RCV to be used effectively in reducing a spill, the dispatcher must be able to determine that a pipeline failure has occurred, identify the location of the failure, and then quickly initiate closure of the valve. Accomplishing these actions in a timely manner requires the installation of a SCADA system including a well-designed leak detection subsystem. The extensive pollution which resulted from a 1988 pipeline failure in Maries County, Missouri, to be discussed later in this ANPRM, might have been avoided if a leak detection subsystem had been installed with the SCADA system allowing operator personnel to detect the leak.

It is clear from the RSPA's analysis of information and data obtained in conducting the March 1991 EFRD study, that spillage from a pipeline failure can be significantly reduced by RCVs only where a modern SCADA system is equipped with a well-designed leak detection subsystem. The type and sophistication of the control system, installed as part of an existing SCADA system, depends on the age of the control system.

The March 1991 EFRD study contained a number of proposals to address the issue of EFRDs. One of the proposals was that the Department conduct a research study on whether SCADA systems, including well-designed leak detection subsystems, should be required on hazardous liquid pipelines in order to enhance the safe operation of the pipelines. Enhanced safety requirements would include provision for more rapid response following accidents, including valve spacing criteria and initiating the closure of RCVs. This study is presently being conducted by the Volpe National Transportation System Center (VNTSC) and is discussed later in this ANPRM.

Another proposal from this study was for the RSPA to issue a notice of proposed rulemaking proposing to require, on hazardous liquid pipelines with SCADA systems installed, that existing manually operated main line block valves[5] in urban areas be retrofitted to make them RCVs and install RCVs when new valves are installed in urban areas. This ANPRM seeks data on valves located in urban areas.

Other proposals in the study suggested public input on whether the hazardous liquid pipeline safety regulations in 49 CFR part 195 should be revised to require valve spacing criteria for EFRDs at the following locations: (1) Where the valves could most effectively reduce the likelihood of the escaping liquid entering the water at water crossings that are more than 100-feet wide, and on either side of a reservoir holding water for human consumption; (2) At other critical areas affected by commodity release; and (3) At specific locations outside of urban

[4] Check valves are valves that permit fluid to flow freely in one direction and contain a mechanism to automatically prevent flow in the other direction.

[5] A valve which provides a positive shut off of commodity flow both upstream and downstream of the valve is generally known as a "block valve" because it blocks the flow in the pipeline.

areas on hazardous liquid pipelines in proximity to the public.

Some of the questions posed in this ANPRM are designed to provide data on which the RSPA will decide on a further course of action concerning the proposed placement of EFRDs in these locations.

Past Data Collection

To broaden the data base for the March 1991 EFRD study, the RSPA solicited information from the public, including gas and hazardous liquid pipeline operators and equipment manufacturers, through a **Federal Register** notice (54 FR 20945; May 15, 1989). A series of 15 questions addressed a number of EFRD/leak detection-related issues including SCADA technology, establishing a maximum allowable spill value, and criteria for valve spacing. The 72 responses to the notice are contained in Docket PS–104; Notice 1 and are available for review in the Docket Unit, room 8421.

The notice included a series of questions about leak detection subsystems which are part of operators' SCADA systems. The responses to the questions indicated SCADA systems are becoming more sophisticated and leak detection subsystems are becoming more common on hazardous liquid pipelines. The sensitivity of leak detection subsystems on hazardous liquid pipelines was reported to range from 0.5 percent of flow to 5 percent of flow over a 1- to 2-hour period. Once a leak is suspected, the time for the dispatcher to respond by closing valves ranges from a few minutes for an RCV to an average of about 2 hours for manually operated valves.

Commenters to the notice were also asked to discuss the advantages and disadvantages of establishing a valve spacing requirement based on a maximum spill criterion. Two advantages cited by commenters to support establishing a maximum spill criterion on a hazardous liquid pipeline were: (1) Reduction in the exposure to the public of the possible hazard created by a spill and (2) improved contingency plans since the plans could be based on a spill of a set volume. However, commenters cited more disadvantages than advantages.

Most hazardous liquid pipeline operators opposed setting a maximum spill criterion. They indicated a maximum acceptable spill would vary widely along the length of any pipeline depending on spill location. Establishing one criterion for all pipelines would not account for the variables at each spill location. Commenters indicated that more important than establishing an arbitrary spill limit is the need to consider the line profile, drainage gradient, length, and diameter of the hazardous liquid pipeline, susceptibility to outside force damage, population density, and potential hazards to public safety and the environment. Commenters indicated a spill limit would require more valves, particularly on large diameter hazardous liquid pipelines. This would increase the opportunity for inadvertent valve closure, leakage from the valve itself, and vandalism. One commenter stated that protection of the public and environment is related more to exposure of the hazardous liquid pipeline to the public and response time in detecting and responding to a failure, than to setting a limit on the volume of product released. This commenter stated: "The most effective means for mitigating potential pipeline failure hazards is prompt leak identification, rapid pipeline shutdown, and immediate dispatch of response crews to the failure site."

Commenters were asked if the spacing of RCVs and ACVs is determined by a maximum spill from the hazardous liquid pipeline, what should that maximum spill value be? None of the commenters provided a maximum spill value. Hazardous liquid pipeline operators reiterated that the information provided in the responses to the valve spacing question should be used in the context of spill mitigation rather than to establish a single maximum spill criterion. One commenter stated that, in addition to pipe diameter, terrain, and the pipeline's route near or in urban areas, the RSPA should consider the probability of failure, magnitude of the leak, and consequences of the leak in establishing a maximum spill criterion.

December 24, 1988, Failure in Maries County, Missouri

The legislative history for the 1992 Act cites a December 24, 1988, failure in Maries County, Missouri to demonstrate the need of adequate leak detection equipment. The failure resulted in a crude oil spill of approximately 20,554 barrels (863,268 gallons). The cause was the abrupt change in pressure and fluid flow from the switching of flowing, low density crude oil from one pipeline into another containing a substantially heavier oil.

Crude oil released entered a tributary of the Gasconade River, the Gasconade River, the Missouri River, and eventually the Mississippi River near St. Louis, Missouri. In order to control the contamination from the large volume of crude oil released, it was necessary to shut down several water companies along these rivers and a brewery in St. Louis.

Failure of pipeline personnel at the dispatching station to recognize that a rupture had occurred and to shut down the pipeline greatly increased the volume of crude oil spilled.

The Gasconade River and its tributary, into which the crude oil spill first entered, were bracketed by manually operated block valves. The RSPA estimates that the installation of a check valve would have prevented drainage from the 5 mile of pipe on either side of the river, thereby substantially reducing the size of the spill. Also, the installation of a leak detection subsystem on the SCADA system would probably have substantially reduced the size of the spill.

Report From the National Institute of Standards and Technology

The legislative history of the 1992 Act also cites a July 1989 report from the National Institute of Standards and Technology (NIST), U.S. Department of Commerce (Report Number NISTIR 89–4136) which resulted from an investigation of the Maries County, Missouri pipeline failure. In the report, titled "An Assessment of the Performance of Older ERW Pipelines", NIST found that the installation of EFRDs could significantly reduce the damage from pipeline failures and recommended that they be installed in "critical risk locations."

Current SCADA Study by the VNTSC

In May 1992, the RSPA commenced a research study with the VNTSC to analyze SCADA systems and computer-generated leak detection systems. The purpose of the research study is to determine the feasibility and costs of requiring pipeline operators to install a SCADA system including a leak detection subsystem, and determine what impediments exist or what system improvements are needed to minimize the time it takes SCADA systems to detect and locate leaks, and make recommendations to resolve these difficulties. As mentioned previously, this new initiative is based on findings from the Department's March 1991 EFRD study concerning RCVs. These valves maximize the value of SCADA-based leak detection systems by helping to mitigate damages from detected leaks.

The first phase of this study included a literature search on the subject, on-site interviews with seven pipeline operators, interviews with five equipment vendors, and development of a mathematical model describing optimal valve spacing for given annual pipeline failure rates per mile and costs, and a method to evaluate alternative leak detection system performance characteristics to reduce pipeline spill volumes.

Every pipeline operator surveyed by the contractor used some sort of SCADA system. Most operators had at least one computerized leak detection system, either one purchased from a vendor, custom designed by the operator, or a combination of the two systems. All operators interviewed believed that the condition of high false alarm rates was a major drawback to the installation and operation of leak detection systems. The problem occurs due to the required trade-off between the threshold volume sensitivity of the leak detection system and the resulting false alarm rate when this sensitivity is too high. All the operators interviewed emphasized that the most critical link in leak detection was the interface between the system itself and the pipeline dispatcher, and that there was no substitute for a highly competent pipeline dispatcher.

The VNTSC is drafting a report on the first phase of the study. Once the report is completed, a copy will be placed in the docket to this rulemaking.

Regulatory Analysis and Notices

A. Impact Assessment

This ANPRM is not considered a significant regulatory action under section 3(f) of Executive Order 12866 and was not reviewed by the Office of Management and Budget. The ANPRM is not considered significant under the Regulatory Policies and Procedures of the Department of Transportation (44 FR 11034).

B. Regulatory Flexibility Act

This ANPRM would not have a significant economic impact on a substantial number of small entities (i.e., small businesses, governmental jurisdictions, and non-for-profit organizations) under the criteria of the Regulatory Flexibility Act. This ANPRM would apply to operators of hazardous liquid pipelines, all of whom are large businesses. Therefore, I certify that this ANPRM will not, if promulgated, have a significant economic impact on a substantial number of small entities. This certification is subject to modification as a result of a review of comments received in response to this ANPRM.

C. Federalism Assessment

The ANPRM has been analyzed in accordance with the principles and criteria in Executive Order 12612 ("Federalism"), and does not have sufficient federalism impacts to warrant the preparation of a federalism assessment.

D. Paperwork Reduction Act

There are no new information collection requirements in this ANPRM.

Questions

The RSPA is issuing this ANPRM to solicit data from the public through a series of questions as the means of conducting the survey mandated in the 1992 Act. The response from the public to these questions will aid in developing proposals on what circumstances and criteria operators must install EFRDs and other equipment to limit product release from hazardous liquid pipelines. The failures discussed above suggest that releases can be reduced when EFRDs and well-designed leak detection systems are installed on hazardous liquid pipelines.

Assessing the data received from the questions in the ANPRM should accelerate the rulemaking process required by the 1992 Act. The data gathered by this ANPRM, the findings from earlier reports on the subject of EFRDs, including the Department's March 1991 EFRD study, and the work accomplished so far in the SCADA contract with the VNTSC could form the basis for any notice of proposed rulemaking concerning the proposed placement of EFRDs and criteria for leak detection systems.

The RSPA is considering a systems approach to reducing spills from hazardous liquid pipelines. The system involved includes equipment, personnel, software and procedures to accomplish three tasks: (1) Detect that a failure and resultant spill has occurred; (2) Identify the location of the spill; and (3) Shut the pipeline down in order to reduce the amount of the spill. The first two tasks involve computerized leak detection systems, while the third task involves the installation of EFRDs.

Many of the following questions are directed to the operators of hazardous liquid pipelines. They relate to pipeline system operational data in addition to the physical location of pipeline facilities in relation to geographical and topographical features which can only be obtained from pipeline operators. However, the RSPA solicits comments to questions which do not involve data on a particular hazardous liquid pipeline from other members of the public including State agencies, trade associations, and environmental organizations, both private and public. The RSPA believes that State pipeline safety agencies can contribute significantly to this rulemaking because of the States' unique experience with regulating intrastate hazardous liquid pipelines and as the Department's agent on interstate hazardous liquid pipelines. Questions 18 and 19 are directed to the nonregulated public. These commenters are requested also to suggest additional questions, including clarification questions, which may emerge from reviewing this ANPRM.

To aid in analysis of the responses, commenters are requested to respond using the same numbering system which is used in this ANPRM.

SCADA-based Leak Detection System Sensitivity and Reliability

The RSPA needs data on which to base decisions on what should be proposed for SCADA-based leak detection systems. The RSPA is starting from the premise that most if not all hazardous liquid pipeline operators have installed a SCADA system which is used for the everyday efficient operation of the pipeline. The SCADA study by the VNTSC has, so far, found this to be true. (Commenters are requested to indicate if this premise is true.) The RSPA must decide whether to propose: (1) A specific type of leak detection system; (2) whether to propose requiring certain criteria which would embody the attributes of all of the presently recognized computerized leak detection systems; (3) a combination of (1) and (2); or (4) some other leak detection system requirement which at present is unknown to the RSPA but which may emerge from comments to this ANPRM.

The questions are intended to obtain responses which relate to operational data that a hazardous liquid operator has concerning the SCADA-based leak detection system installed on its pipeline system including the sensitivity and reliability of that system.

Questions 1 through 6 primarily relate to the experience on a segment of the operator's hazardous liquid pipeline system which is covered by a SCADA-based leak detection system. If the operator has segments of its hazardous liquid pipeline system covered by more than one SCADA-based leak detection system, please submit responses to the series of questions 1 through 6 for each segment of the covered pipeline system. For instance, a SCADA-based leak detection system may be installed on a 400 mile segment of an interstate pipeline in Texas and another SCADA-based leak detection system on a 200 mile segment in Virginia. The RSPA requests a separate set of responses for each segment, not aggregate responses for all of the SCADA-based leak detection systems for all parts of the operator's pipeline system.

Several topics will be addressed in the set of questions below. These are: (1) The method(s) of leak detection in use on the segment described in the data submission; (2) leak detection alarms which occur at the hazardous liquid pipeline systems operating center; (3) the leak detection and SCADA system availability; and (4) the actual performance of leak detection systems in identifying and locating leaks on an operational hazardous liquid pipeline.

If the operator does not presently have this data, we encourage the operator to gather the data for at least one month and then submit it to the RSPA. System alarms history should be provided to the RSPA as a log and may be submitted either as a computer printout or on a diskette using standard ASCII format as long as the segment identifying information is clearly noted on the data. Experimental (or simulation-based) data may be provided as well as operational data which only reflect actual operational experience.

The leak detection performance data should be provided as a log and may be submitted either as a computer printout or on a diskette using standard ASCII format. Historical performance data gathered during developmental phases such as system installation and modification also should be submitted.

It would be helpful if commenters group data for each different data collection time period or pipeline segment, so that all data (questions 1–6) relates to only one specific segment and time period. For the purposes of these questions, a pipeline segment is defined as that part of the pipeline between two points where the product can be contained, such as between two pressure pump stations, between a pressure pump station and a terminal, between a pressure pump station and a valve, or between two valves.

Question 1: Provide the following general information about the segment of hazardous liquid pipeline to which the series of questions 1–6 relate:

1.1 Pipeline segment length description covered in this data submission:
  1.1.1 Starting point (mile post or survey station no.)_______
  1.1.2 Ending point (mile post or survey station no.)_______
  1.1.3 Length of segment (miles)_______
1.2 Pipeline nominal diameter (in.)_______
1.3 Number of pumping stations on segment? _______
1.4 Number of injection points on segment?_______
1.5 Number of delivery points on segment?_______
1.6 Commodity(s) transported during this data history_______
1.7 Nominal flow rate (bbls/day) _______
1.8 Beginning date covered by this data history (MM/DD/YY)_______
1.9 Ending date of this data history (MM/DD/YY) _______

Question 2: Classify the leak detection system(s) installed on this pipeline segment (check each that applies and answer questions 4 through 6 for each system checked).

2.1 Mass balance_______
2.2 Pressure wave _______
2.3 External hydrocarbon sensor_______
2.4 Other (specify) _______

Question 3: For each leak detection system checked in Question 2, check whether the system was supplied by an independent vendor or was the system developed within your company.

3.1 For the system in Question 2.1?
  3.1.1 Vendor (name) _______
  3.1.2 Internal company developed_______
3.2 For the system in Question 2.2?
  3.2.1 Vendor (name) _______
  3.2.2 Internal company developed _______
3.3 For the system in Question 2.3?
  3.3.1 Vendor (name) _______
  3.3.2 Internal company developed _______
3.4 For the system in Question 2.4?
  3.4.1 Vendor (name)_______
  3.4.2 Internal company developed _______

Question 4: For the alarm history, leak detection system availability history, and performance data of the leak detection system submitted, include answers to the following:

4.1 For the time period reported, at what threshold volume was the leak detection system set to alarm (including any error bandwidth that is incorporated into that amount) (bbls.)?_______
4.2 At that volume how long should detection take (mins.)? _______
4.3 What was the average detection time for that volume (mins.)?_______
4.4 For each alarm during the time period reported in your response to Question 4, include the following data:
  4.4.1 Alarm Initiated (MM/DD/YR & hours & minutes in military time[6])_______
  4.4.2 Alarm Cleared (MM/DD/YR & hours & minutes in military time)_______
  4.4.3 The length of time it took to identify the cause of the alarm (if not equal to the difference between the initiation and cleared time)(mins.)?_______
4.5 For each alarm, was the alarm attributed to one of these causes (Y/N)?
  4.5.1 A leak _______ (If "yes", go to 4.6)
  4.5.2 An operational change _______
  4.5.3 Data errors (associated with telemetry fluctuations) _______
  4.5.4 Component failure (hardware or telecommunications) _______
  4.5.5 Human error (e.g., failure to adjust the leak detection software system to commodity-specific parameters) _______
  4.5.6 Other (specify) _______
  4.5.7 Undetermined _______
4.6 If a leak was detected—
  4.6.1 What was the cause of the leak (check)?
  4.6.1.1 Corrosion? _______
  4.6.1.2 Failed pipe or pipe seam? _______
  4.6.1.3 Outside force damage by other than natural forces? _______
  4.6.1.4 Outside force damage by natural forces? _______
  4.6.1.5 Malfunction of control or relief equipment? _______
  4.6.1.6 Operator error? _______
  4.6.1.7 Other (specify) _______
  4.6.2 Was the leak on pipe originally installed on the pipeline segment (Y/N)? _______
  4.6.3 What year was the pipe originally installed (year)? _______
  4.6.4 If the answer to 4.6.2 was "no", what year was the pipe replaced or modified (year)? _______
  4.6.5 What action did you take?
  4.6.5.1 Shut pipeline down (Y/N) _______
  4.6.5.2 Shut down leak detection system (Y/N) _______
  4.6.5.3 Left pipeline and leak detection systems running, conducted visual inspection (Y/N) _______
  4.6.5.4 Other (specify) _______

Question 5: For leak detection system availability (SCADA-based or non-SCADA-based), include answers to the following:

5.1 For each instance of leak detection system unavailability reported during the time period, include the following data:
  5.1.1 Was this a complete shutdown of the SCADA/leak detection

[6] "Military time" is using a 24 hour clock. For instance, 4:00 pm = 1600 hours or 5:15 pm = 1715 hours.

system (Y/N)? _______ (If "no", go to question 5.3)

5.2 If "yes", answer the following (check all that apply):

5.2.1 Date and time the system stopped running (MM/DD/YR & hours & minutes in military time) _______

5.2.2 Date and time the system resumed (MM/DD/YR & hours & minutes in military time) _______

5.2.3 Was the shutdown attributed to one of these causes (Y/N)?

5.2.3.1 Dispatcher decision? _______

5.2.3.2 Input failure (telemetry/ telecomm error)? _______

5.2.3.3 Software failure of the SCADA system? _______

5.2.3.4 Software failure of the leak detection system? _______

5.2.3.5 Software failure of both? _______

5.2.3.6 Hardware failure of the SCADA system? _______

5.2.3.7 Hardware failure of the leak detection system? _______

5.2.3.8 Hardware failure of both? _______

5.2.3.9 Undetermined _______

5.3 If the leak detection system itself did not completely shut down, did it issue an alarm (Y/N)? _______

5.4 If an alarm was issued, was the problem attributed to any of the following (Y/N)?

5.4.1 Dispatcher decision? _______

5.4.2 Input failure (telemetry/ telecomm error)? _______

5.4.3 Software failure of the SCADA system? _______

5.4.4 Software failure of the leak detection system? _______

5.4.5 Software failure of both? _______

5.4.6 Hardware failure of the SCADA system? _______

5.4.7 Hardware failure of the leak detection system? _______

5.4.8 Hardware failure of both? _______

5.4.9 Undetermined _______

Question 6: Answer the following on leak detection system performance:

6.1 What was the circumstance(s) under which data was collected for this segment and time period?

6.1.1 System development (Y/N) _______

6.1.2 Leak detection system pre-operational demonstrations on a segment of operational pipeline (define segment length) (Y/N) _______

6.1.3 Existing system modification/ testing (Y/N) _______

6.1.4 Actual system operation (Y/N) _______

6.1.5 Other (specify) _______

6.2 For *each* leak detected by the system during the time period, include the following data:

6.2.1 The specific detection threshold volume (include any error bandwidth that is incorporated in that amount)(bbls.) _______

6.2.2 Pipeline length between leak detection measuring devices in the pipeline segment on which leak occurred (miles) _______

6.2.3 Commodity transported at the time of the alarm _______

6.2.4 Flow rate at the time of the alarm (bbls/hr) _______

6.2.5 Estimated (or actual) leak volume (bbls.) _______

6.2.6 Estimated (or actual if known) size of hole or rupture (in.) _______

6.2.7 Estimated[7] (or actual) date and time leak occurred (MM/DD/YR & hours & minutes in military time) _______

6.2.8 Date and Time leak detected (MM/DD/YR & hours & minutes in military time) _______

6.2.9 Date and Time leak located (MM/DD/YR & hours & minutes in military time) _______

6.2.10 Location of leak as indicated by leak detection system (mile post or survey station no.) _______

6.2.10.1 Was a leak detection/ SCADA system alarm issued (Y/N)? _______

6.2.10.2 If "yes", the date and time alarm issued (MM/DD/YR & hours & minutes in military time) _______

6.2.10.3 If "yes", the date and time alarm cleared (MM/DD/YR & hours & minutes in military time) _______

6.2.10.4 Dispatcher response (check all that apply):

6.2.10.4.1 Pipeline shutdown _______

6.2.10.4.2 Leak detection system shutdown only _______

6.2.10.4.3 Contacted pipeline personnel to check for operational or system explanations for alarm (other than a leak) _______

6.2.10.4.4 Dispatched personnel to approximate leak location _______

6.2.10.4.5 Other (specify) _______

6.2.11 Actual location of leak as determined by field observation (mile post or survey station no.) _______

Placement of EFRDs at water crossings, locations affected by commodity release, and rural areas where the public is in proximity The request for information notice, documented in the Department's March 1991 EFRD study, asked "Where should RCVs and ACVs be placed and why?" The response provided a number of specific locations, e.g., locations where possible ground movement might occur, and densely populated locations, such as near a school or hospital, near an office building or factory, or near a shopping center. River crossings were also specified by some commenters. Although conventional wisdom would seem to suggest installing RCVs at these locations, the RSPA presently has no data which supports requiring the installation of EFRDs at these locations. The number of these locations is unknown, but one of the following questions will solicit data on the number of such areas which might be affected by a pipeline release.

Likewise, the number of failures which have resulted in water pollution is unknown because the Department does not require the occurrence of pollution to be identified on the hazardous liquid pipeline accident report. However, the RSPA knows from research for developing the interim final rule for onshore oil pipeline response plans (58 FR 244, January 5, 1993) under the Oil Pollution Act of 1990, Public Law No. 101–380, 104 Stat. 484, (OPA 90) that of the approximately 2,700 oil pipeline spills reported each year to the Environmental Protection Agency (EPA), about half affect water. The accident effects which would be reduced by the installation of EFRDs are related more to pollution than safety. Once the hazardous liquid mixes with water, the likelihood of a fire or explosion is reduced considerably. Two of the following questions address the issue of water pollution as a result of pipeline failures.

The accidents which occurred in Mounds View, Minnesota and Maries County, Missouri demonstrate that an assessment by the RSPA should be conducted concerning the installation of EFRDs at specific locations along hazardous liquid pipelines where the pipelines are in proximity to the public in rural areas, bodies of water (particularly bodies of water containing drinking water intakes), and other critical locations affected by commodity release. This position is supported by the NIST report (discussed above) which recommended installation of EFRDs in critical risk locations to significantly limit the extent of damage if a failure occurs. Critical risk locations are defined in the NIST report as

[7] Data provided from simulations should include the simulated leak start and end times, however, actual leak start times are not expected from operational data since there is a lag between the actual leak start and when it is detected.

locations where the risk to public safety, property, and the environment is great.

The RSPA is also asking questions to gather data regarding locations where valves are presently required by the regulations to protect bodies of water (49 CFR 195.260 (e) and (f)). The regulations in 49 CFR 195.260 currently require valves to be placed at locations along a hazardous liquid pipeline that will minimize damage or pollution from accidental discharges[8] (Section 195.260 (c)), on either side of a water crossing that is more than 100-feet wide (Section 195.260(e)), and on either side of a reservoir holding water for human consumption (Section 195.260(f)). The American Petroleum Institute has indicated that most of these main line block valves are manually operated. The current regulations do not require that they be EFRDs. The financial impact on the regulated industry, if the RSPA were to require the installation of RCVs, is unknown so cost data will be obtained through responses to questions set forth below.

These questions apply only to hazardous liquid pipelines with leak detection systems since the March 1991 EFRD study concluded RCVs are only effective where leak detection systems are installed. In addition, the questions address valve spacing, particularly whether EFRDs should be installed at other critical locations. Such critical locations would be identified during the rulemaking process after a review of data on water pollution from hazardous liquid pipeline spills collected by agencies, such as the EPA, and as a result of the RSPA implementation of OPA 90. Placement of a check valve on one side of a location and an RCV on the other side could reduce the number of valves that would require remote control capability.

The location of valves would be proposed, as a result of this assessment, only to effectively reduce the amount of liquid entering a body of water depending on the terrain, and would not necessarily be immediately located on either side of the water crossing. For instance, valves placed immediately on either side of a water crossing would be effective in reducing pollution only if the failure was in the water crossing, a rare occurrence according to anecdotal evidence. Valves would only be effective in locations where the hazardous liquid pipeline operator has a SCADA-based leak detection system so that each RCV can be closed soon after a failure is detected.

[8] DOT does not know on what factors hazardous liquid pipeline operators base their judgment on where and how far apart to place such valves.

Past Leak History

Question 7: For the period 1983 through 1992 (10 years), how many failures have occurred on your pipeline system resulting in product release entering a body of water?[9]_______

Question 8: Provide the following information for each failure in Question 7:

8.1 Date of the failure (MM/YY)_______
8.2 What was the cause of the release (check)?
8.2.1 Corrosion?_______
8.2.2 Failed pipe or pipe seam?_______
8.2.3 Outside force damage by other than natural forces?_______
8.2.4 Outside force damage by natural forces?_______
8.2.5 Malfunction of control or relief equipment?_______
8.2.6 Operator error?_______
8.2.7 Other (specify)_______
8.3 Answer the following concerning the commodity—
8.3.1 At the time of the release what was the total volume of commodity between valves immediately upstream and downstream of the release location (bbls.)?_______
8.3.2 How much commodity was released (bbls.)?_______
8.4 How far away from the point of release were the valves referred to in 8.3.1 (miles)?_______
8.4.1 Upstream from the release?_______Type of valve (check)?
8.4.1.1 manual_______
8.4.1.2 Check valve_______
8.4.1.3 RCV_______
8.4.1.4 ACV_______
8.4.2 Downstream from the release?_______Type of valve (check)?
8.4.2.1 manual_______
8.4.2.2 Check valve_______
8.4.2.3 RCV_______
8.4.2.4 ACV_______
8.5 Were these valves installed to comply with 49 CFR 195.260 (e) or (f)[10] (Y/N)?_______
8.6 Were these valves EFRDs (RCVs or check valves)(Y/N)?_______
8.7 Was there a leak detection system or systems operating on the pipeline which experienced the release (Y/N)?_______(specify each type):
8.7.1 Pressure wave front monitoring?_______
8.7.2 Volume monitoring?_______
8.7.3 Other (specify)?_______
8.8 Indicate for each activity the time to shut down the pipeline
8.8.1 Detection time (mins.)?_______
8.8.2 Shutdown time including shutdown of pumping stations and isolation of the pipeline section (mins)?_______
8.8.3 Time to drain the pipeline section (mins.)?_______
8.8.4 Total time to shut down pipeline from the time release was detected to completion of drainage from the section involved (mins.)?_______
8.9 If the pipeline section did not contain EFRDs, would the installation of EFRDs have reduced the shutdown time and/or amount of the release (Y/N)?_______
8.9.1 If "yes", by how much for each (estimate)?
8.9.1.1 The total shutdown time of 8.8.4 (mins.)?_______
8.9.1.2 Amount of the release (bbls.)?_______
8.9.2 If "no", why not?_______
8.10 What was the total estimated cost of the release including—
8.10.1 Cost of repair or replacement of pipeline facility? $_______
8.10.2 Cost of product lost? $_______
8.10.3 Cost attributed to loss of use of the pipeline? $_______
8.10.4 Cost of damage to property other than the pipeline? $_______
8.10.5 Cost of bodily harm and/or loss of life (For analytical purposes, loss of life is valued at $2,500,000 and significant bodily harm reported per Section 195.50(e) is valued at $450,000)? $_______
8.10.6 Cost of environmental clean-up (whether or not paid by the operator)? $_______
8.10.7 Estimated cost of damage to the environment, i.e., natural resource damage, assessed by a court or State agency (exclusive of clean-up cost)? $_______
8.10.8 Cost of litigation? $_______
8.10.9 Other costs? (specify) $_______
8.10.10 Total cost? $_______
8.11 How far from the release did the commodity enter a body of water (miles)?_______
8.12 Were there other areas of risk, other than a body of water, affected by the release (Y/N):
8.12.1 Urban area?_______ If yes, distance from release (miles)_______
8.12.2 Rural area in proximity to population?_______ If yes, distance

[9] "Body of water" includes, but is not limited to, creeks, streams, rivers, tributaries to rivers, lakes, reservoirs, and waters which are used for recreation.

[10] 49 CFR 195.260 (e) requires valves to be installed on each side of a water crossing that is more than 100 feet wide from high-water mark to high-water mark. 49 CFR 195.260 (f) requires valves to be installed on each side of a reservoir holding water for human consumption.

from release (miles)_______
8.12.3 Other (specify)_______
Distance from release (miles)_______
8.13 Were there one or more public water intakes affected by the release (Y/N)?_______
8.13.1 If the answer to question 8.13 was "yes", how many?_______
8.13.2 For each response to 8.13.1, approximately how far was the public water intake downstream from where the release entered the body of water (miles)?_______
8.13.3 Did high river flow due to flooding affect the release reaching the water intake(s)(Y/N)?_______

Valves Installed Per 49 CFR 195.260 (e) & (f)

As stated previously, 49 CFR 195.260 (e) and (f) require valves to be placed on hazardous liquid pipelines in order to protect water.[11] The March 1991 EFRD study proposed that the RSPA obtain public comment on whether the valves at these locations should be EFRDs. The next series of questions are posed to obtain data to make that decision.

For this series of questions, operators are requested to provide data *only* on hazardous liquid pipelines which have leak detection systems installed, since the study concluded RCVs are effective only on hazardous liquid pipelines with leak detection systems.

Question 9: How many locations have valves installed to comply with 49 CFR 195.260 (e) and (f)?_______
9.1 How many locations have two block valves installed?_______
9.2 How many locations have one block valve and one check valve installed?_______
9.3 How many locations have two block valves and one check valve installed?_______
9.4 Are any of the block valves RCVs (Y/N)?_______
9.4.1 If "yes", how many locations reported in 9.1 are RCVs?_______
9.4.2 If "yes", how many locations reported in 9.2 are RCVs?_______
9.5 How many block valves which are not RCVs are installed to comply with 49 CFR 195.260 (e) and (f)?_______

Question 10: Estimated cost data to convert the block valves reported in 9.4 to RCVs is requested. Report data to questions 10.1–10.3 for *each* valve size (diameter) in your pipeline system:
10.1 What valve diameter does this series of questions pertain (in.)?_______
10.2 How many block valves are installed of this diameter?_______
10.3 What is the total estimated cost to convert all of these valves to RCVs? _______
10.3.1 Installation cost (material & labor) $_______
10.3.2 Communication system cost $_______
10.3.3 Other installation costs (specify) $_______
10.3.4 Total installation cost $_______
10.3.5 Annual operating cost $_______
10.3.6 Annual maintenance cost $_______
10.3.7 Other annual costs (specify) $_______
10.3.8 Total annual costs $_______

Question 11: Estimated cost data for installing new RCVs on your pipeline system is requested. Report data to questions 11.1–11.6 for *each* valve size (diameter) in your pipeline system:
11.1 What valve diameter does this series of questions pertain (in.)?_______
11.2 Cost of a manually operated block valve $_______
11.3 Cost of an equivalent RCV $_______
11.4 Communication cost $_______
11.5 Other installation costs (specify) $_______
11.6 Total installation costs $_______

Question 12: What factors should the RSPA use in determining when a manually operated valve should be converted to a RCV in order to reduce the effects to bodies of water in case of a release?_______

Locations Affected by Commodity Release

Question 13: Would a release from your pipeline affect the following locations (answer "yes" or "no" and provide rationale for your answer)?
13.1 Wetlands as defined in 40 CFR 230.3? [12]_______
13.2 Critical habitat for endangered/threatened species?_______
13.3 National/State parks?_______
13.4 Marine sanctuaries?_______
13.5 Federal wilderness areas?_______
13.6 Coastal Zone Management Act designated areas?_______
13.7 National monuments?_______
13.8 National seashore/lakeshore recreational areas?_______
13.9 National preserves?_______
13.10 National wildlife refuges?_______
13.11 National conservation areas? _______
13.12 Hatcheries? _______
13.13 Waterfowl management areas? _______
13.14 Public drinking water intakes? _______
13.15 Other areas (specify)? _______

Rural Areas[13] *Affected*

Question 14: How many of the following areas would be affected by a release from your pipeline (answer 14.1–14.8 with the number of areas)?
14.1 Areas where it would take more than two hours to reach and close a block valve once the location of a release is identified? _______
14.2 Areas of possible ground movement including areas of: known seismic risk, slope instability, landslide, and mine subsidence? _______
14.3 Schools? _______
14.4 Hospitals? _______
14.5 Closely spaced individual dwellings (defined as areas similar to class 2 locations as defined in 49 CFR 192.5(c)[14])? _______
14.6 Office buildings? _______
14.7 Factories or plants, such as power plants? _______

Valves in Urban Areas

The March 1991 EFRD study concluded that it was feasible from a benefit to cost standpoint to retrofit existing manually operated block valves on hazardous liquid pipelines located in urban areas to RCVs and to install RCVs when installing new valves in urban areas. An urban area is one which is not a rural area[15]. A proposal to require RCVs in urban areas would apply to hazardous liquid pipelines which have installed leak detection systems, as the Department found in the March 1991 study that RCVs are effective only where leak detection systems are installed.

The RSPA wants to establish a data base on manually operated block valves

[11] See footnote 10.

[12] 40 CFR 230.3(t) states: The term *wetlands* means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

[13] As defined in 49 CFR 195.2: "*Rural area* means outside the limits of any incorporated of unincorporated city, town, village, or any other designated residential or commercial area such as a subdivision, a business or shopping center, or community development."

[14] 49 CFR 192.5(c) states: A Class 2 location is any class location unit that has more than 10 but less than 46 buildings intended for human occupancy. (A "class location unit" is defined in the regulations in 49 CFR 192.5(a) as an area that extends 220 yards on either side of the centerline of any continuous 1-mile length of pipeline.)

[15] See footnote #13.

located on hazardous liquid pipelines in urban areas to validate the conclusions made in the March 1991 study.

Hazardous liquid pipeline operators are requested to respond to Questions 15–17 for pipelines in their systems which are located in urban areas and on which a leak detection system is installed:

Question 15: For your pipeline system, report the number of manually operated block valves that are installed in urban areas. Report data to questions 15.1–15.4 for *each* pipeline nominal diameter located in urban areas in your pipeline system.

15.1 What nominal pipeline diameter does this series of questions pertain (in.)? ______

15.2 How many block valves are installed of this nominal diameter? ______

15.3 For the total reported by nominal diameter, how many valves are installed to limit release of the commodity transported? ______

15.4 For each total reported by nominal diameter, how many are installed for pipeline maintenance purposes? ______

Question 16: For the period 1983 through 1992 (10 years), how many failures have occurred on your pipeline system in urban areas? ______

Question 17: Provide the following information for each failure in Question 16:

17.1 Date of the failure (MM/YY)______

17.2 What was the cause of the release (check)?

17.2.1 Corrosion? ______

17.2.2 Failed pipe or pipe seam? ______

17.2.3 Outside force damage by other than natural forces? ______

17.2.4 Outside force damage by natural forces? ______

17.2.5 Malfunction of control or relief equipment? ______

17.2.6 Operator error? ______

17.2.7 Other? (specify) ______

17.3 How much product was released (bbls.)?______

17.4 How far away from the point of release were there block or check valves located on either side of the release (miles)

17.4.1 Upstream from the release?______

17.4.2 Downstream from the release?______

17.5 What was the total estimated cost of the release including—

17.5.1 Cost of repair or replacement of pipeline facility? $______

17.5.2 Cost of product lost? $______

17.5.3 Cost attributed to loss of use of the pipeline? $______

17.5.4 Cost of damage to property other than the pipeline? $______

17.5.5 Cost of bodily harm and/or loss of life (For analytical purposes, loss of life is valued at $2,500,000 and bodily harm reported per Section 195.50(e) is valued at $450,000)? $______

17.5.6 Cost of environmental clean-up (whether or not paid by the operator)? $______

17.5.7 Estimated cost of damage to the environment, i.e., natural resource damage, assessed by a court or State agency (exclusive of clean-up cost)? $______

17.5.8 Cost of litigation? $______

17.5.9 Other costs? (specify) $______

17.5.10 Total cost? $______

Questions for the Nonregulated Public

The preceding 17 questions relate to the gathering of pipeline system operational data which can be answered only by hazardous liquid pipeline operators. However, as stated earlier, the RSPA is also soliciting comments and ideas from the nonregulated public including State agencies, trade associations, and environmental organizations. The following 2 questions are directed to these members of the public.

Question 18: The RSPA is attempting to determine which critical locations should be protected from hazardous liquid pipeline releases by the installation of EFRDs. From the locations listed below, please provide a ranking by probability with a ranking of "1" representing the location which poses the greatest probability of combined safety and environmental risk to the public. (Questions 18.10–18.12 are left blank for the commenter to specify locations of risk not listed in questions 18.1–18.9.)

18.1 Locations where valves are required to be placed by 49 CFR 195.260 (e) and (f) on hazardous liquid pipelines in order to protect water? [16]______

18.2 Locations where it would take more than two hours to reach and close a block valve once the location of a release is identified?______

18.3 Locations of possible ground movement including areas of: known seismic risk, slope instability, landslide, and mine subsidence?______

18.4 Schools?______

18.5 Hospitals?______

18.6 Closely spaced individual dwellings (defined as areas similar to class 2 locations as defined in 49 CFR 192.5(c)?) [17]______

18.7 Shopping malls and similar locations?______

18.8 Office buildings?______

18.9 Factories or plants, such as power plants?______

18.10 Other location (specify)______

18.11 Other location (specify)______

18.12 Other location (specify)______

Question 19: From the locations listed below, please provide a ranking of consequences from a hazardous liquid pipeline release with a ranking of "1" representing the location that would result in the greatest combined public safety and environmental consequences from a release of hazardous liquid from a pipeline. (Questions 19.10–19.12 are left blank for the commenter to rank the benefits for the risk locations specify in questions 18.10–18.12.)

19.1 Locations where valves are required to be placed by 49 CFR 195.260 (e) and (f) on hazardous liquid pipelines in order to protect water? [18]______

19.2 Locations where it would take more than two hours to reach and close a block valve once the location of a release is identified?______

19.3 Locations of possible ground movement including areas of: known seismic risk, slope instability, landslide, and mine subsidence?______

19.4 Schools?______

19.5 Hospitals?______

19.6 Closely spaced individual dwellings (defined as areas similar to class 2 locations as defined in 49 CFR 192.5(c)?) [19]______

19.7 Shopping malls and similar locations?______

19.8 Office buildings?______

19.9 Factories or plants, such as power plants?______

19.10 Other location (specify)______

19.11 Other location (specify)______

19.12 Other location (specify)______

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George W. Tenley, Jr.,

Associate Administrator for Pipeline Safety.

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[16] See footnote #10.

[17] See footnote #14.

[18] See footnote #10.

[19] See footnote #14.