Risk Analysis & Data Integration

LGA Pipeline Safety Seminar
New Orleans, LA

Wednesday July 22, 2015
4:15 – 5:00 PM
Chris McLaren

US DOT PHMSA

Recent Investigations Illustrate Weaknesses in Managing Risk

- More effective Risk Analysis and Data Integration might have prevented or mitigated many recent high consequence accidents
- Weaknesses identified include inadequate:
  - Knowledge of pipeline risk characteristics including recordkeeping
  - Processes to analyze interactive threats
  - Evaluation of actions to reduce or mitigate consequences
  - Process to select Preventive Measures & Mitigative Measures
  - Lack of objective, systematic approaches based on data

Our Current World: Threat and Result

Santa Barbara, CA – 05/2015

Fallansbee, WV 01/2015

Yellowstone River 01/2015

New Pipe

Sissonville, WV – 12/2012

Inspections Identify Weaknesses in Risk Analysis and Data Integration

- The current challenge is for industry to implement:
  - More rigorous quantitative risk analyses including handling uncertainties and gaps in data
  - A more investigative approach to risk analysis
  - Use Risk and Information Analyses to find problems, not just display what you already know
  - Robust approach for Preventive & Mitigative Measures
  - Technically sound risk-based criteria for decisions
  - Pipe replacement utilized when appropriate

Comments from NASA Director

- We have learned the hard way what can happen when an engineering organization does not have a strong, independent voice.
- That independence cannot be sacrificed to schedules and budgets, just as programmatic concerns cannot be overlooked in the development of the technical approach for a given program or project.
- Do your engineering/operational professionals have an independent voice?

Integrity Management

- Successful IM Implementation
  - Investigative
  - Data-driven
  - Analytical
  - Interacting threats
  - Integrity-related decision making
  - Prevention
  - Mitigation
- **Risk evaluation approaches need to reflect and account for these attributes**

Risk Approach

- **Risk evaluation approaches need to be "investigative-oriented"**
  - Approach must tell us what can be done to reduce risk vs. simply knowing which parts of the pipeline represent the highest relative risk?
  - Generating risk numbers is not the end goal
  - Structured method to evaluate and reduce operational risk is the goal
  - Past "index" models are generally not sufficient past establishing a baseline assessment plan

Risk Approaches

- PHMSA is interested in engineering and technical modeling considerations including:
  - Quantitative and semi-quantitative risk approaches.
  - Interacting integrity threats.
  - Applicability to evaluating preventive and mitigative measures.
  - Availability of data to support identified risk modeling approach.
  - Approaches to pipeline facility risk.
  - Investigative performance of the example potential approach.
  - Adaptation of model approaches from non-pipeline systems.
  - Cost.

As summarized in notice for Risk Modeling Workshop 09/09-10/2015

Risk Modeling Methodology Workshop

- To support integrity management requirements, a risk analysis modeling approach must be able to adequately characterize all pipeline integrity threats and consequences concurrently, and the impact of measures to reduce risk must be evaluated.
- This workshop will focus on advancing risk modeling approaches by looking at risk modelling methodologies for pipeline and non-pipeline systems, and practical ways that operators can adopt and/or adapt them to the analyses of their systems.

Risk Workshop Background

- While index models and other basic approaches to risk modeling have been implemented by industry for purposes such as risk-ranking pipeline segments to prioritize initial integrity management-required baseline assessments, the ability of many of these approaches to do more investigative oriented analyses in order to identify specific ways to reduce risk is limited.
- PHMSA believes that improving risk models is important for further reducing the risk of pipelines to the public health and safety. In particular, PHMSA is interested in specific ways to advance pipeline risk models, and in practical ways that operators can adopt and/or adapt risk models to the analyses of their systems.

Risk Methods

- **Risk evaluation methods must be sufficiently analytical to be predictive**
  - Threats on a particular line segment increasing or decreasing?
  - Consequence potential increasing?
  - Interactive threat potential becoming a major issue?
- Industry and PHMSA are in general agreement that risk models need to evolve in such a way as to be more investigative in nature

As summarized and discussed in past public forums and workshops on pipeline safety (*e.g.*, 2014 *Government/Industry Pipeline R&D Forum*)

Sufficiently analytical to be predictive

- Results reflect year-to-year changes in risk levels?
  - Operational, Environmental, Assessments
- Does the overall risk profile adequately match operational experience?
- Approaches may need to vary between respective types of threats (time dependent/independent)
- More complex does not necessarily mean better
  - Interactive threats may need more sophisticated modeling than threats evaluated individually

Connection to Decision Making

- **Risk evaluation results must have a connection to real-life decision making**
  - Point of risk evaluations is not to do a risk evaluation
  - Risk insights must be integrated into routine integrity-related decision making
  - Operators should be able to easily demonstrate how risk evaluation results influence work practices

Preventive & Mitigative Measures

- **Decision making includes identification/evaluation of Preventive Measures & Mitigative Measures**
  - Risk evaluations are a primary way to evaluate potential P&M measures including pipe replacement
  - If risk methodology is unable to reflect any change in results for meaningful candidate P&M measures, the methodology is inadequate
  - Consequence aspect of risk must not be ignored, and risk method should still be able to evaluate relative effectiveness of candidate mitigative improvements

Pipeline Facilities

- **Pipeline risk is not limited to the right of way**
  - Facilities are also part of the pipeline system and need to be part of understanding and managing risk
  - Risk approach likely to be different than for line pipe
  - As for line pipe, emphasis should be on methods that can identify and evaluate potential reductions in risk to the public

Data

- **Data availability and validation**
  - Missing/inaccurate data results in unreliable risk evaluations/conclusions
  - Efforts such as DIMP and IVP indicate that gaps in basic pipeline data still exist
  - Keeping data up to date is an on-going challenge
  - Should be able to take risk model data into the field and not find discrepancies

Data Integration

- **Data Integration has been noted in NTSB investigations as deficient**
  - **"It is not clear that overall integration of knowledge and data is occurring on a consistent basis."**
  - **"According to API 1160, "The integration of information is a key component for managing system integrity." API 1160 further notes that it is important to integrate all available information from various sources in the decision-making process."**

Data Integration

- **Data Acquisition Forms must be improved to provide the information operator needs for their specific assets**
- **“A key ingredient in continual assessment is data integration, which is the process of assembling and evaluating all relevant information regarding the integrity of a pipeline or segment.”**
- **“The desired safety benefit of data integration is the improved analysis of overall risk.”**

Data Integration

- Hazardous Liquid IM Rule requires an analytical process that integrates all available information about pipeline integrity and the consequences of a failure - §195.452(g) *What is an information analysis?*
- Gas IM Rule requires an operator must identify and evaluate all potential threats to the covered segment. The operator must collect and integrate data from the entire pipeline that could be relevant to the covered segment and conduct a risk assessment in accordance with ASME/ANSI B31.8S - §192.911(c)

Data for Integration is Everywhere

ASME B.318S, Table 1

Category - Attribute Data

- Pipe wall thickness
- Diameter
- Seam type and joint factor
- Manufacturer
- Manufacturing date
- Material Properties
- Equipment Properties

Category–Construction Data

- Year of installation
- Bending method
- Joining method, process and inspection results
- Depth of cover
- Crossings/casings
- Pressure test
- Field coating methods
- Soil, backfill
- Inspection reports
- Cathodic protection installed
- Coating Type

Operational Data for Integration

Category–Operational Data

- Gas quality
- Flow rate
- Normal maximum and minimum operating pressures
- Leak/failure history
- Coating condition
- CP system performance
- Pipe wall temperature
- OD/ID corrosion monitoring
- Pressure fluctuations
- Regulator/relief performance
- Encroachments
- Repairs
- Vandalism
- External forces

Inspection Data for Integration

Category–Inspection Data

- Pressure tests
- In-line inspections
- Geometry tool inspections
- Bell hole inspections
- CP inspection (CIS)
- Coating condition inspections (DCVG)
- Audits and reviews
- Pipe inspection reports

Also consider (PHMSA):

- SCC Indications
- HCAs (aerial photography)
- Pipe exposures for any reason
- Geotechnical locations being monitored
- anomaly evaluations from pipe excavations
- Other data pertinent to operator's unique operating environment

Threat Identification

- **Data Integration is key for adequate Threat Identification**
  - Consider and Evaluate Existing and Potential Threats
  - Justify Elimination of Threats from Consideration
    - Time Dependent and Time Independent Threats
  - "Near misses" identified in Data
  - Known threats identified in Industry literature, PHMSA Advisory Bulletins, etc.,
  - Understand how threats interact with each other
  - Interactive Threats (interaction of multiple threats) are potential threats.

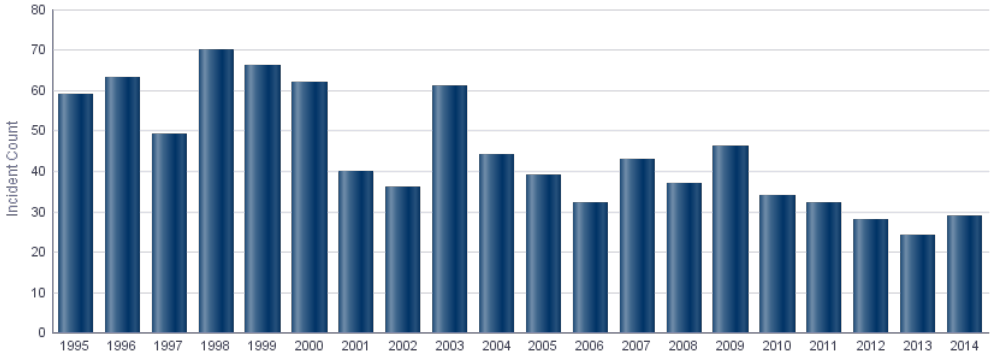
Next Steps

- **Issue Rulemaking: GT IM & HL IM**
- **Promote Requirements of API RP 1173**
- **Responses to NTSB Gas IM Safety Study**
  - **Develop and implement a plan for all segments of the pipeline industry to improve data integration for integrity management through the use of geographic information systems. (P-15-22)**
- **August 27, HL IVP Public Meeting, TBD**
- **Risk Modeling Methodology Workshop**
  - In Washington DC area September 9 and 10, 2015
  - Theme: Moving beyond index models

Review of Incident/Accident Statistics for 2014

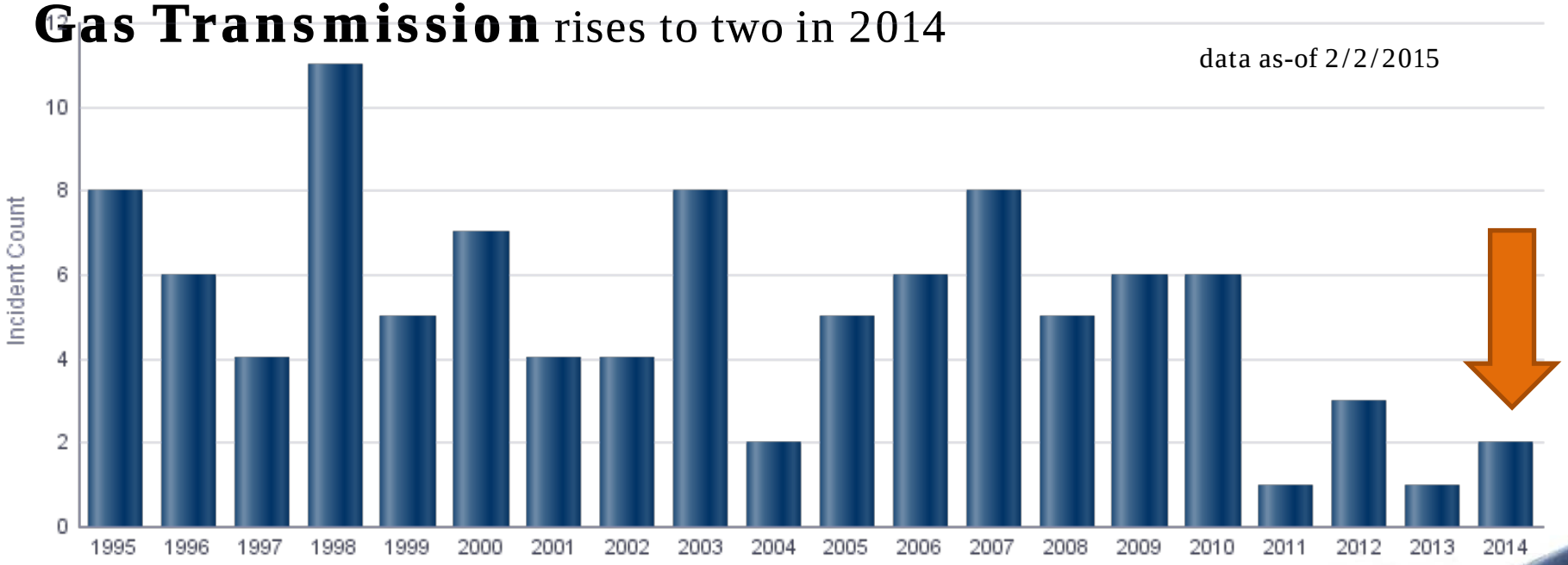
Serious Incidents

All System Types rises slightly in 2014



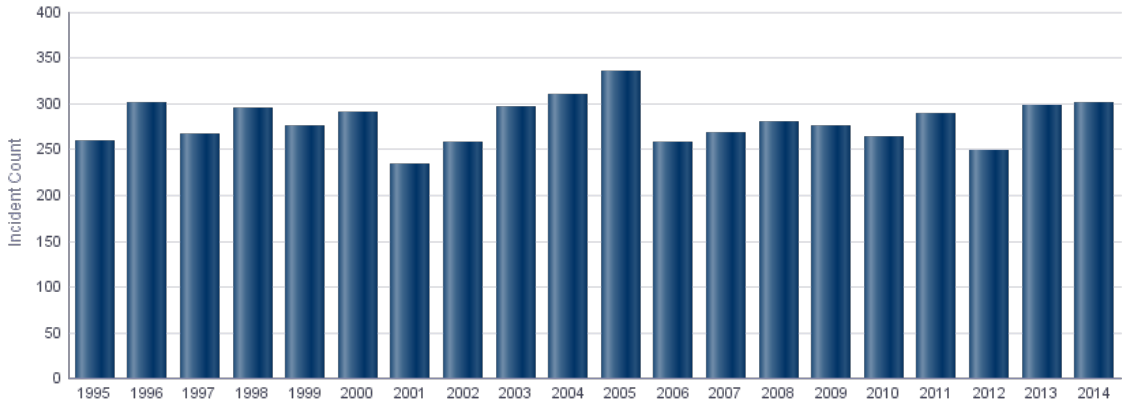
Gas Transmission rises to two in 2014

data as-of 2/2/2015

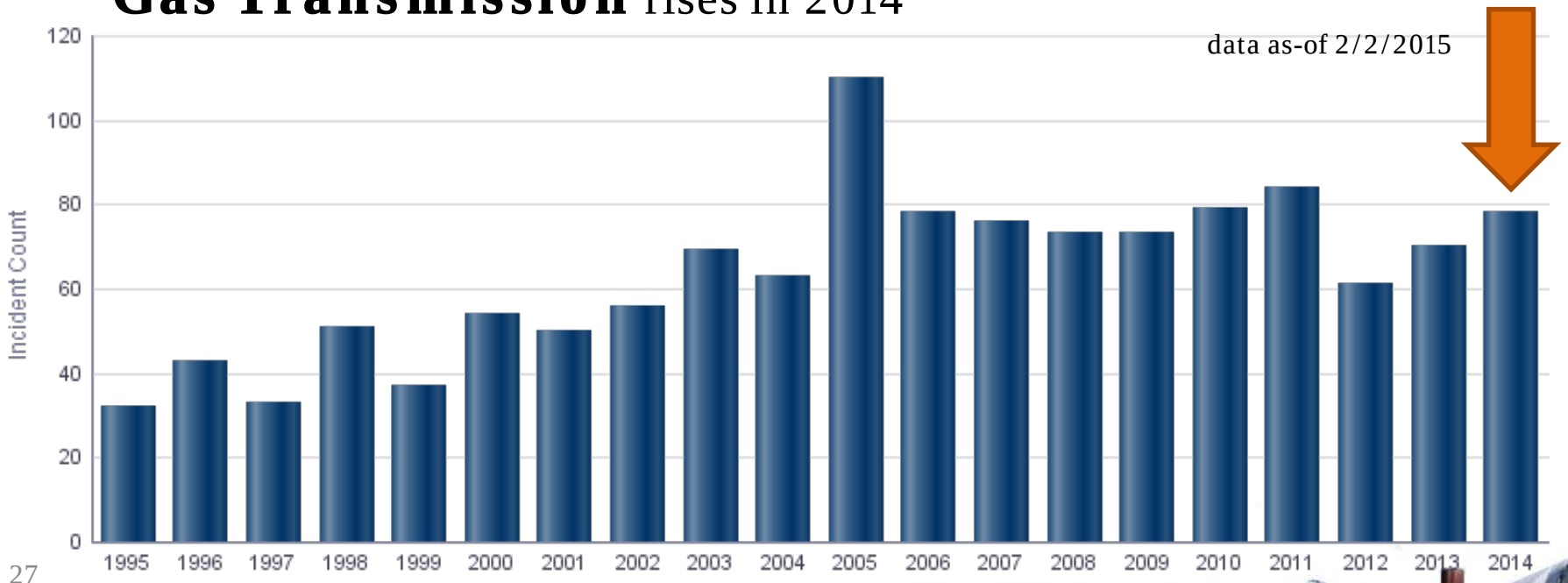


Significant Incidents

All System Types flat in 2014

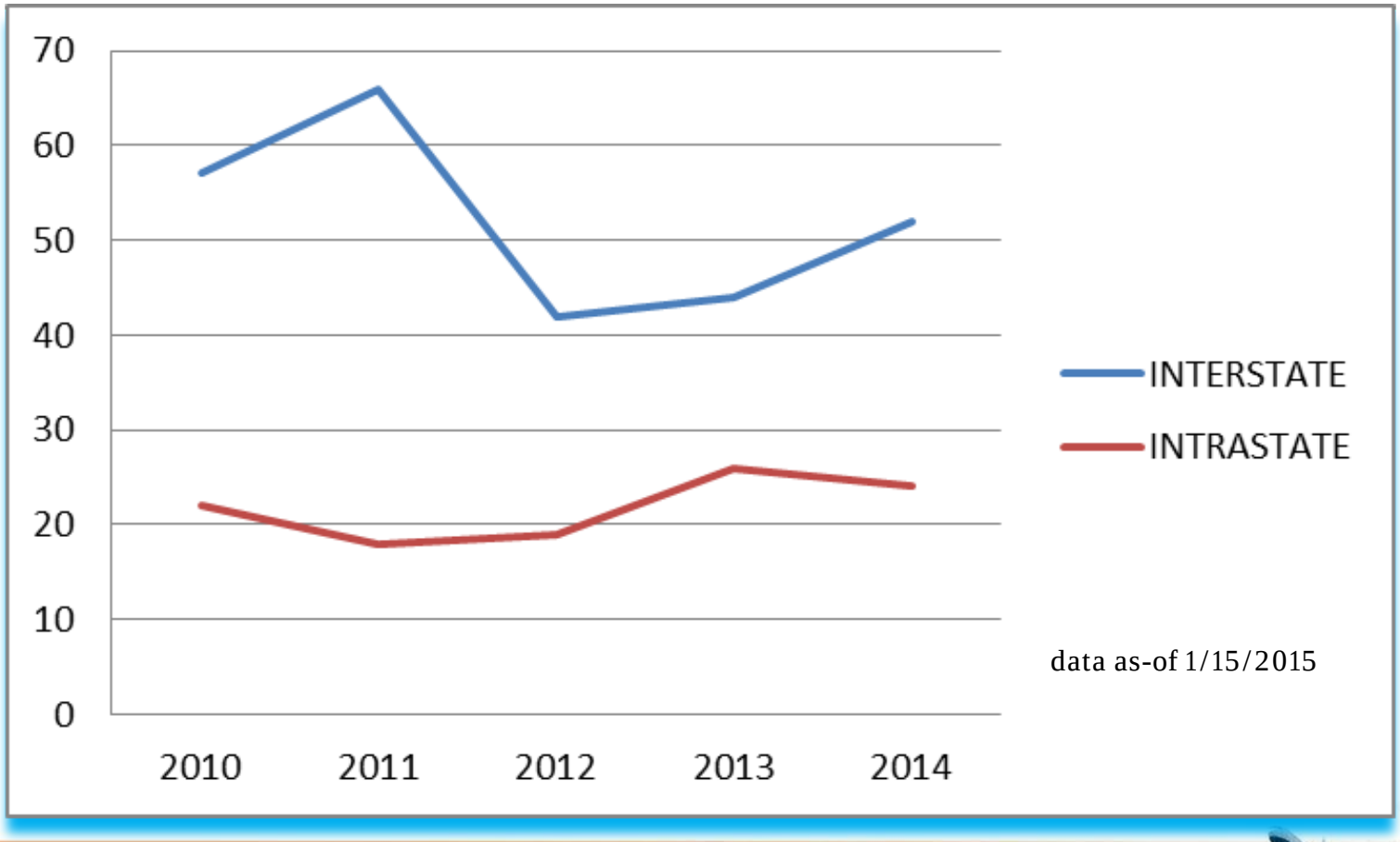


Gas Transmission rises in 2014



Gas Transmission Significant Incidents Inter vs Intra

Interstate Miles approximately twice Intrastate Miles



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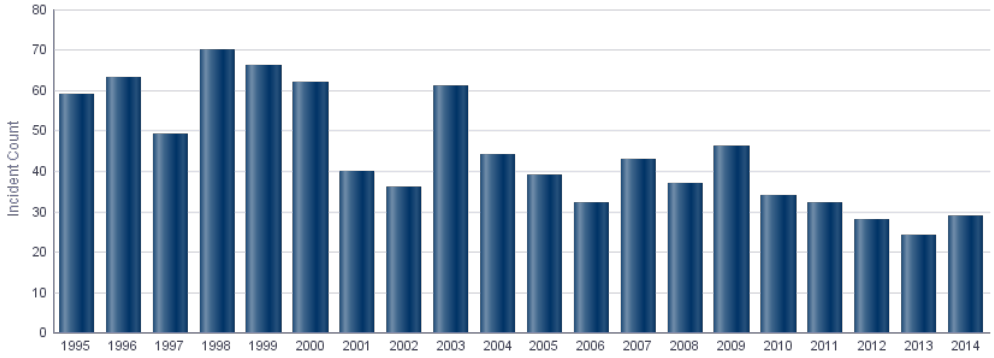
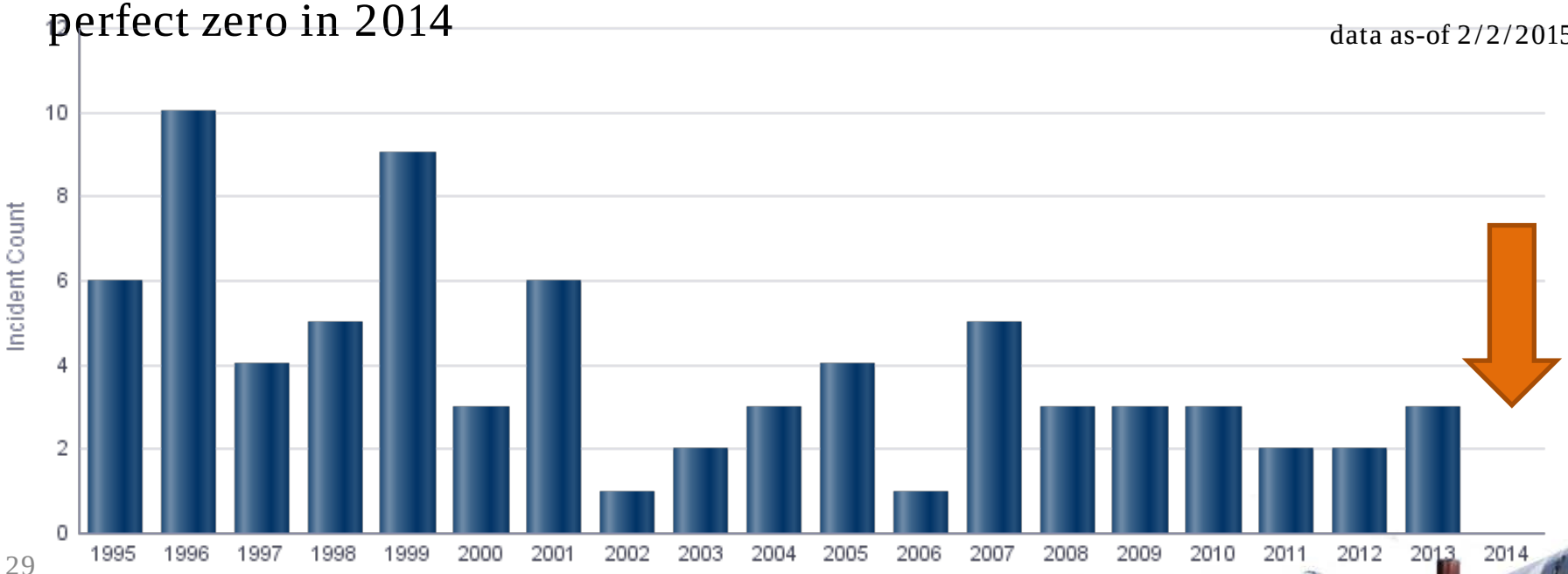


Hazardous Liquid and Carbon Dioxide

perfect zero in 2014

data as-of 2/2/2015



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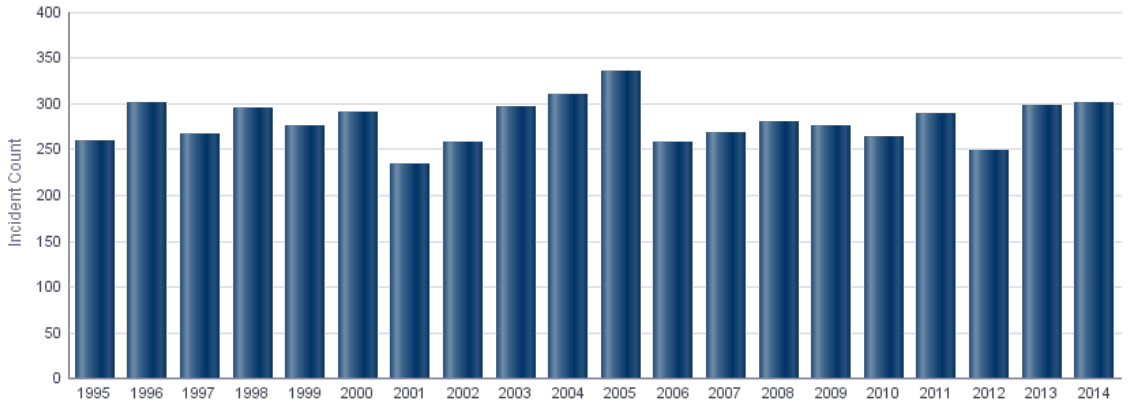
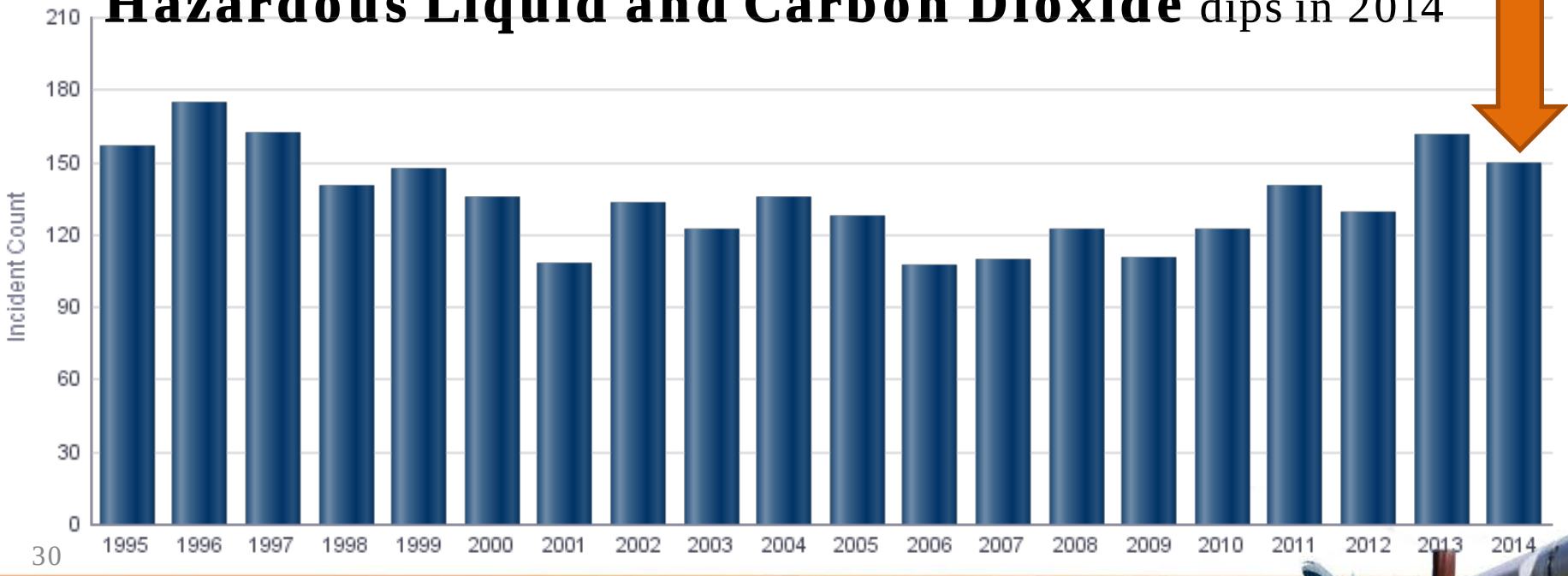


Hazardous Liquid and Carbon Dioxide dips in 2014



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Know what's below.
Call before you dig.

Thank You for Your Participation