Managing Challenges with Pipeline Seam Welds

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DSAW Pipe

Lap Welded Pipe

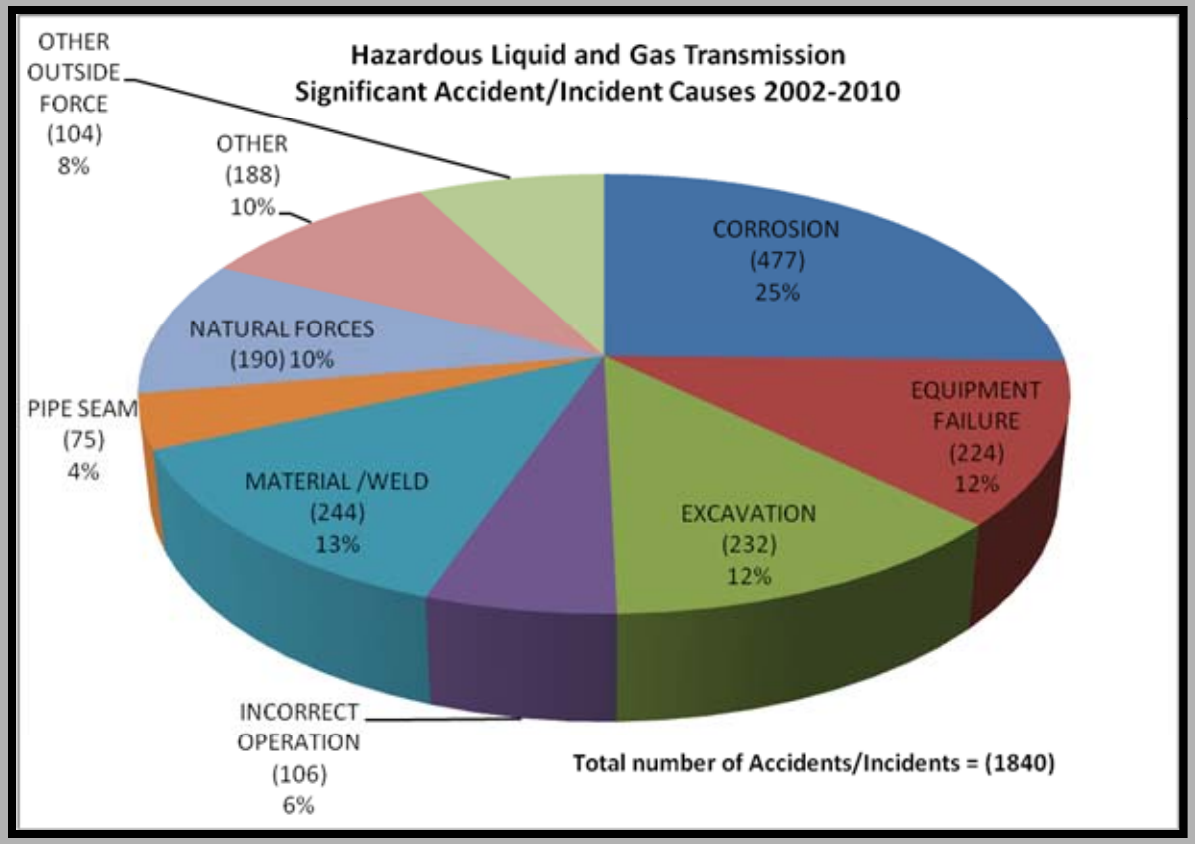
Spiral Weld – SAW Pipe

ERW Pipe

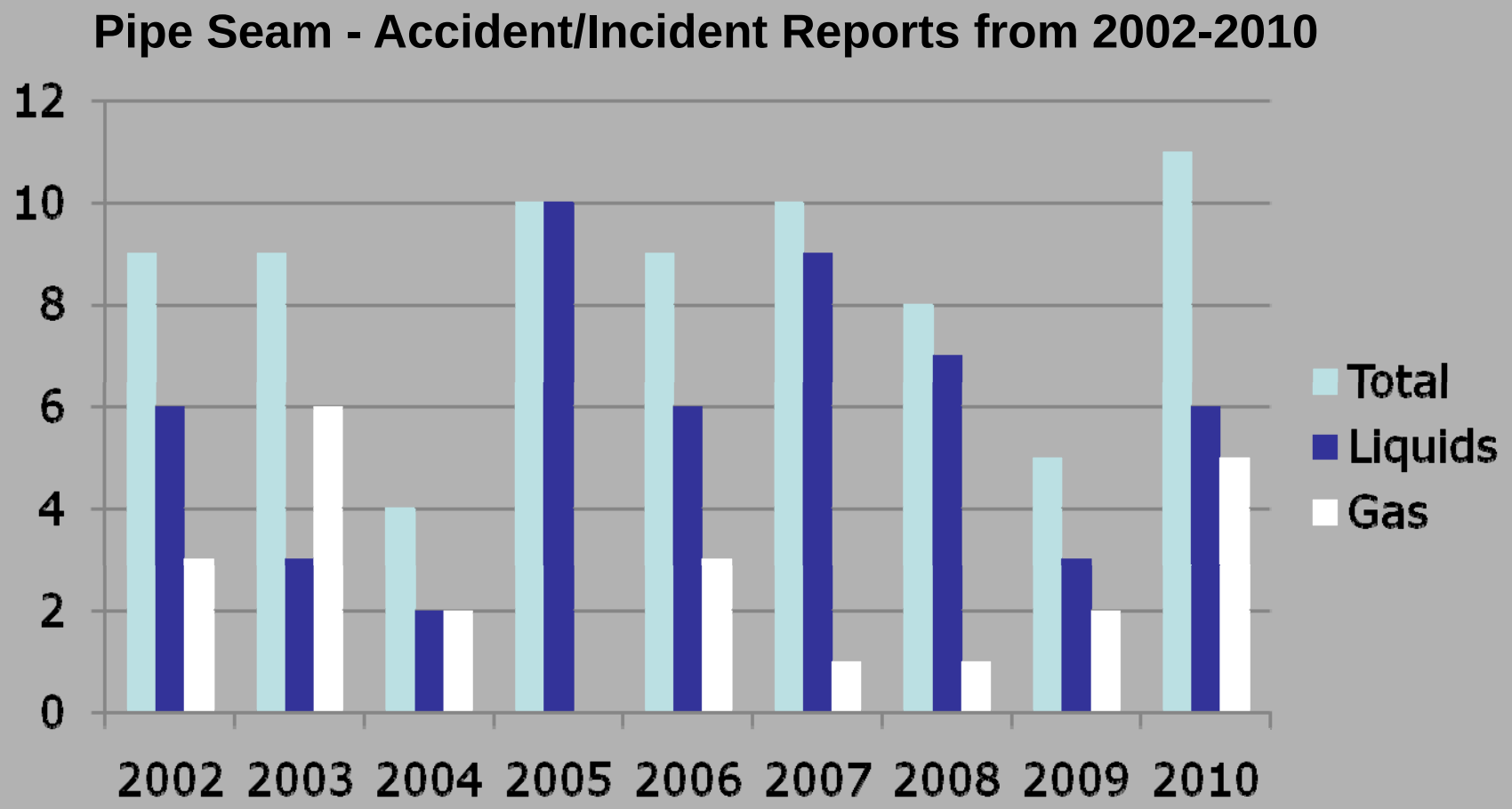
What are the Issues?

- **Seam weld integrity issues are:**
  - **not always being identified by operator's integrity management and risk assessment approaches**
- **Pipe that is not fit for service is:**
  - **being left in service (some cases)and not being identified for special or urgent preventive and mitigative actions**
- **Grandfather MAOP/MOP**
  - **No Code pressure test to +125% MAOP/MOP**

Significant Accident / Incident Causes 2002-2010



Pipe Seam Accident Experience

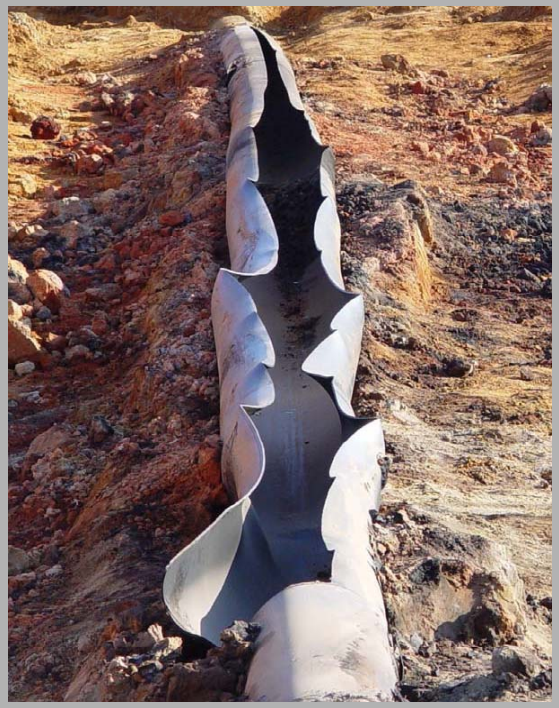


Pipe Seams Failures (2002-2010)

Seam Type	Gas	Hazardous Liquid	TOTAL	% of Total
DSAW	9	5	14	18
Flash Welded	1	5	6	8
HF ERW	2	14	16	22
LF ERW	5	21	26	35
Lap Weld	1	2	3	4
SAW	1	3	4	5
Other	4	2	6	8
Total	23	52	75	100

Pipe Seam - Failures

Pipe – ERW Seam



Submerged Arc Welded (SAW)

Electric Resistance Welded Pipe (ERW)

Past Accident History

- **Late 80s concern with LF-ERW**
  - **PHMSA Technical Report 89-1, August 1989**
    - **172 LF-ERW Failures in HL P/L 1968-1988**
    - **103 ERW Seam Failures in Gas P/L 1970 – 1988**
  - **PHMSA Alert Notices ALN 88-01 & 89-01**
- **Late 90s concern with managing integrity**
  - **IMP rules including risk analysis**
  - **Special requirements for LF-ERW & Lap Welded pipe**
- **Present**
  - **Pipe seam integrity**

Integrity Management

- **Rule intent for operators to systematically research, understand, minimize, and mitigate pipeline risks**
- **Specifically for the seam threat, IM rule requires operators to:**
  - **Obtain or acquire data (Manufacturing, excavation and repair, leaks and failures, ILI and other assessments, etc.)**
  - **Analyze and integrate data to understand risk of seam failure**
  - **Take preventive and mitigative measures**

Integrity Management Presumption of Seam Stability

- **Recent events cast doubt about underlying presumption of seam stability**
- **Long term pipe seam stability assurance practices for pipe seams (that have not been pressure tested to 125% MAOP/MOP) may not be sufficient:**
  - **Records**
  - **Operational controls**
  - **Establishment of MAOP (for grandfathered pipe)**
  - **Excavation monitoring**
  - **External strain monitoring**
  - **Integrity Assessment**
  - **Interactive Threats – corrosion, SCC, selective seam corrosion, etc.**
  - **Criteria for Preventive and Mitigative Measures**

Integrity Management Presumption of Seam Stability

- **Seams that are marginally stable can become unstable from:**
  - **Threats not currently detectable by assessment technology (necessary for evaluating interacting threats)**
  - **Operational practices currently allowed by regulations**
  - **Maintenance practices currently allowed by regulations**
  - **Third party activity currently not monitored or recognized to be deleterious**

Integrity Management

Rule requires Operators to look at all integrity information – such as original pipe mill inspection reports:

Our records indicate that on the 30" O.D. x .406" wall pipe a total of 24,952 X-rays were taken, of which 7,442 or 29.8% showed a defect of some nature in the weld. On the 30" O.D. x .500" wall pipe, our records indicate that a total of 6,595 X-rays were taken, of which 2,259 or 34.2% were found to contain some type of defect.

A tabulation of these defects as disclosed by the X-raying is as follows:

X-Ray Defects	30" O.D. x .406"W.	30" O.D. x .500"W.
Cracks in weld	2,293	611
Gas pockets	4,254	1,369
Slag inclusion	311	131
Porosity	34	13
Lack of fusion	163	83
Off-seam welds	57	9
Undercut welds	130	30
Arc pits	200	13
Total	7,442	2,259

All of the above listed defects were eliminated by cutting back from the end of the pipe, thus eliminating the defective area.

- **Original inspection records can give insight into possible future pipe seam issues**

IM Inspection Results

- **PHMSA inspection results to date:**
  - **indicate operators have not achieved the expected level of performance in understanding pipeline risk and managing pipeline integrity**
- **Recent incidents validate PHMSA observations**
- **Advisory Bulletin ADB-11-01**
  - **NTSB and PHMSA have discovered indications that operator oversight of IM programs has been lacking and thereby failed to detect flaws and deficiencies in their programs**

Process to Analyze Seam Integrity

- **Present and Future Seam Integrity issues:**
  - **Process to analyze seam integrity needs improvement**
  - **Better analysis of interacting threats that could destabilize a marginally stable seam**
  - **Process to obtain and integrate data relevant to seam integrity needs improvement**
  - **Actions when data is lacking or suspect**

IM Seam Assessments

- **IM Seam assessments must be:**
  - **Multi-disciplinary, deterministic engineering analysis of pipe seams to determine if they are safe and fit for continued service until the end of some desired period of operation**
- **PHMSA believes that a robust seam assessment program must be an integral aspect of all IM Programs**
- **IM Programs in many cases have failed to identify problematic pipe seams and take appropriate mitigative measures**

Thank You