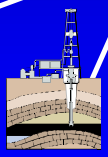
Enhanced Safety and Environmental Protection for Gas Transmission and Hazardous Liquid Pipelines in High Consequence Areas

Terry Boss

Interstate Natural Gas Association of America

INGAA

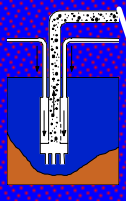
Marketers



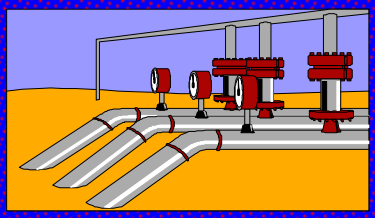
2,500
as Wells

oducers
Majors
ndependents

Gathering



Storage

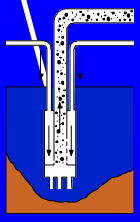


29 Major
Interstate
Pipelines

Commercial

Residential

Industria
Utilities

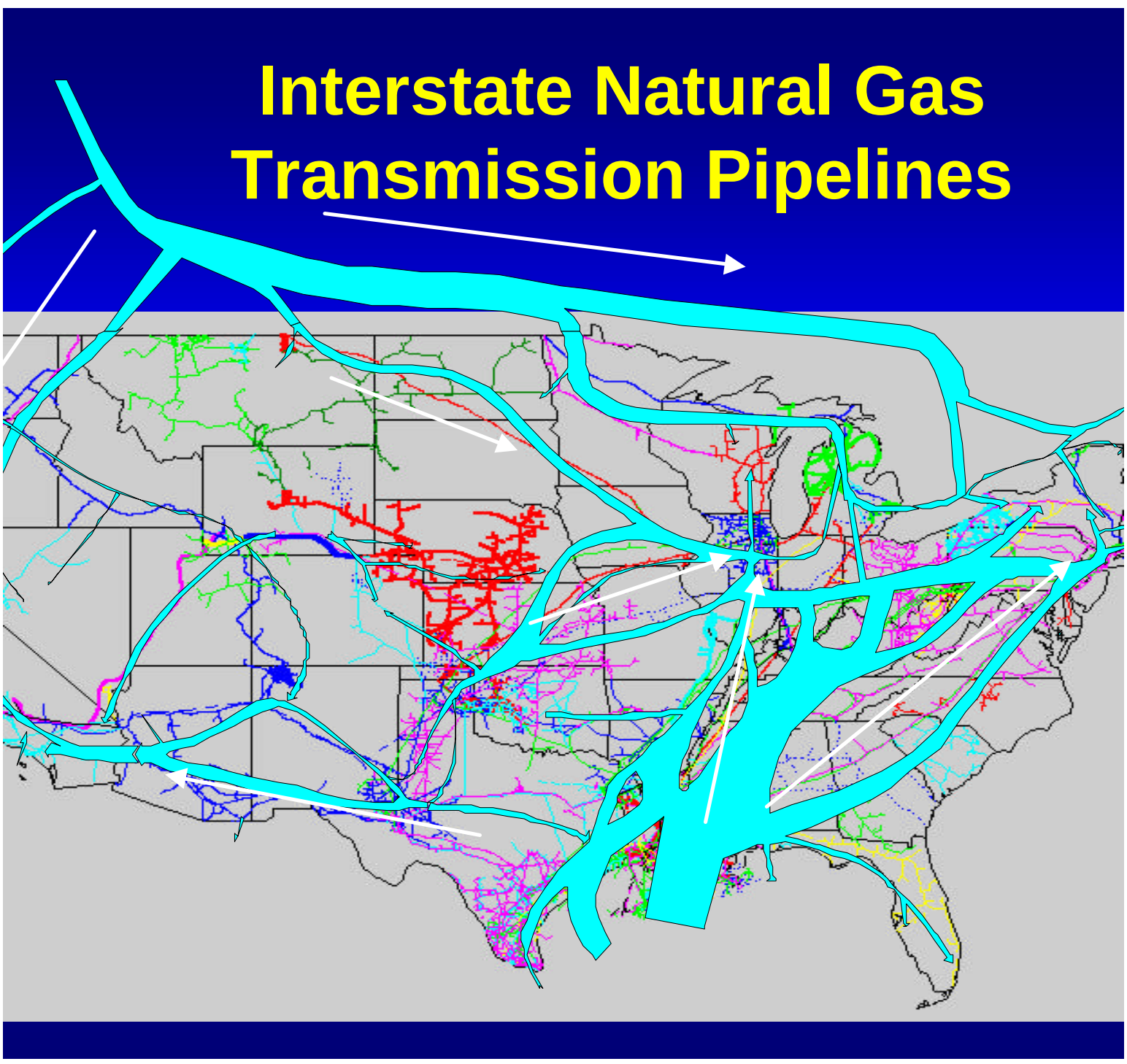


Storage

1200
Distributor

t Regulated	Regulated by some States	Regulated by DOT	Regulated by State

Interstate Natural Gas Transmission Pipelines



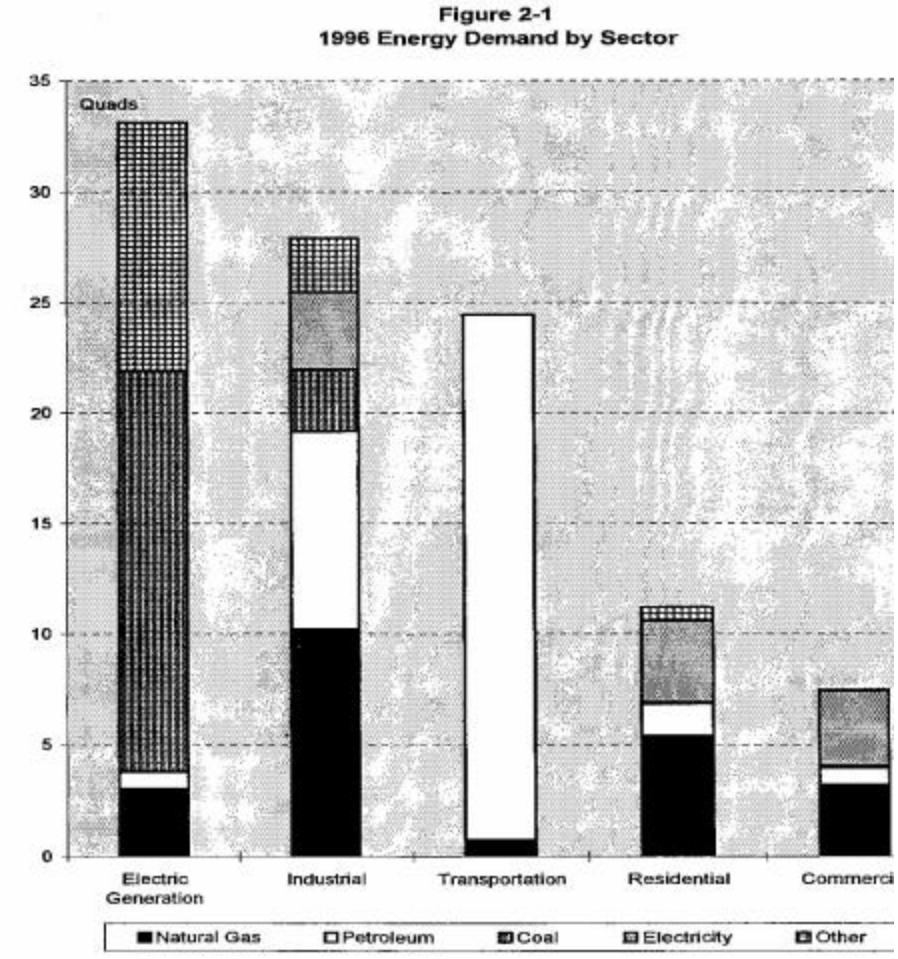
Summary

- Natural gas demand forecasted to grow 50% to 30 tcf
- NGAA members don’t rest on their excellent safety record
- Pipelines and their regulators have a risk communication problem with the public
- Most of the questions in the meeting notice are answered in present gas pipeline safety regulations
- Additional safety improvements are not expected to occur wit proposed integrity plan review
- Current initiatives to share additional information have not ye realized their potential
- One thing learned from these initiatives is there is no “silver bullet”
- Additional regulations must pass risk assessment/cost benefit tests to avoid diffusing resources

Natural Gas Is needed in increasing quantities

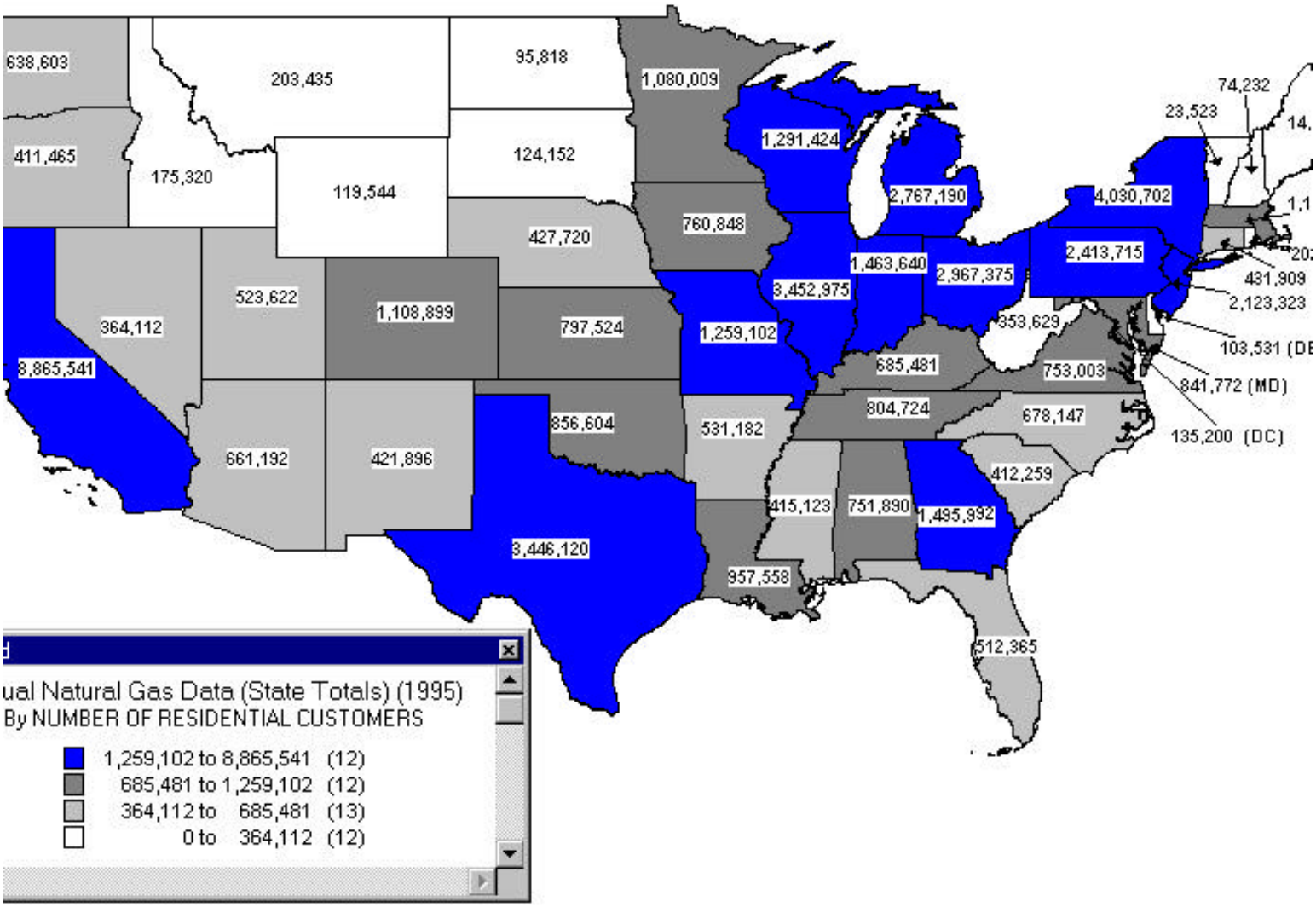
Natural gas is very important for the U.S. in the global economy

- Domestic
- Clean
- Cost Effective
- Versatile

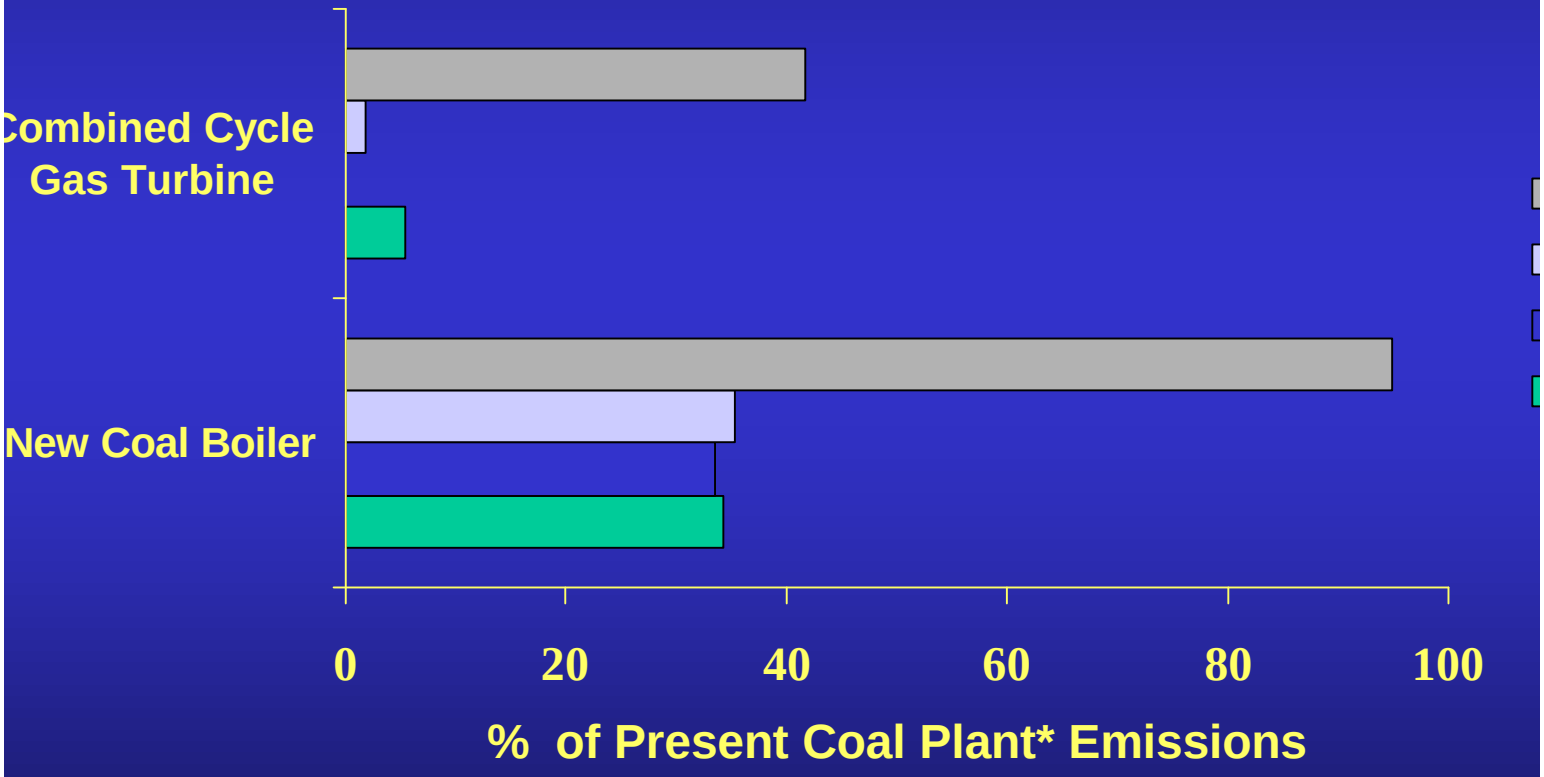


Other includes solar, wood, hydropower, and nuclear.

Number of Residential Natural Gas Customers in the U. S., 1995

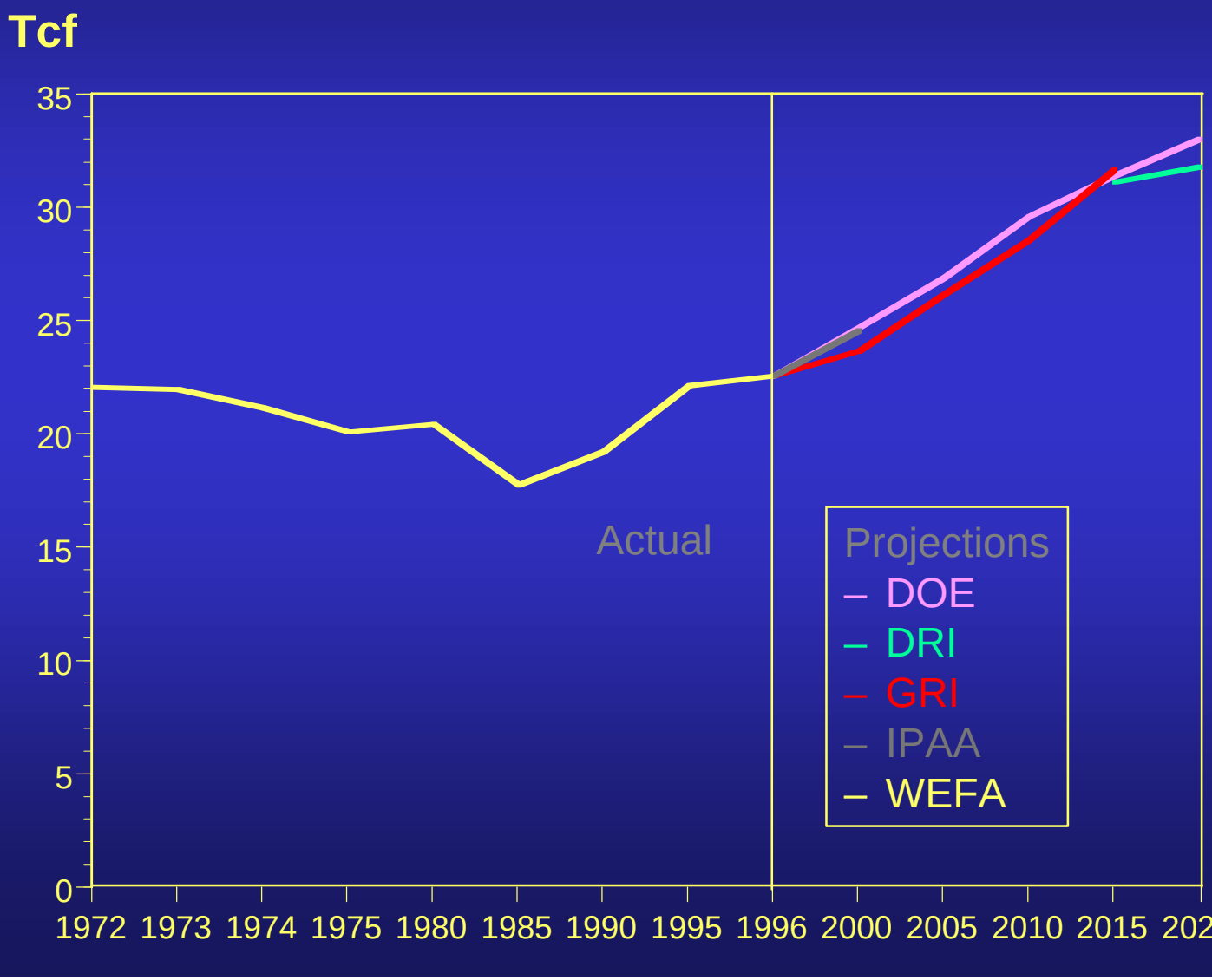


Natural Gas Results in Significantly Improved Emissions from Electric Generation



*300 MW Powerplant

Projections of Natural Gas Demand Through 2020



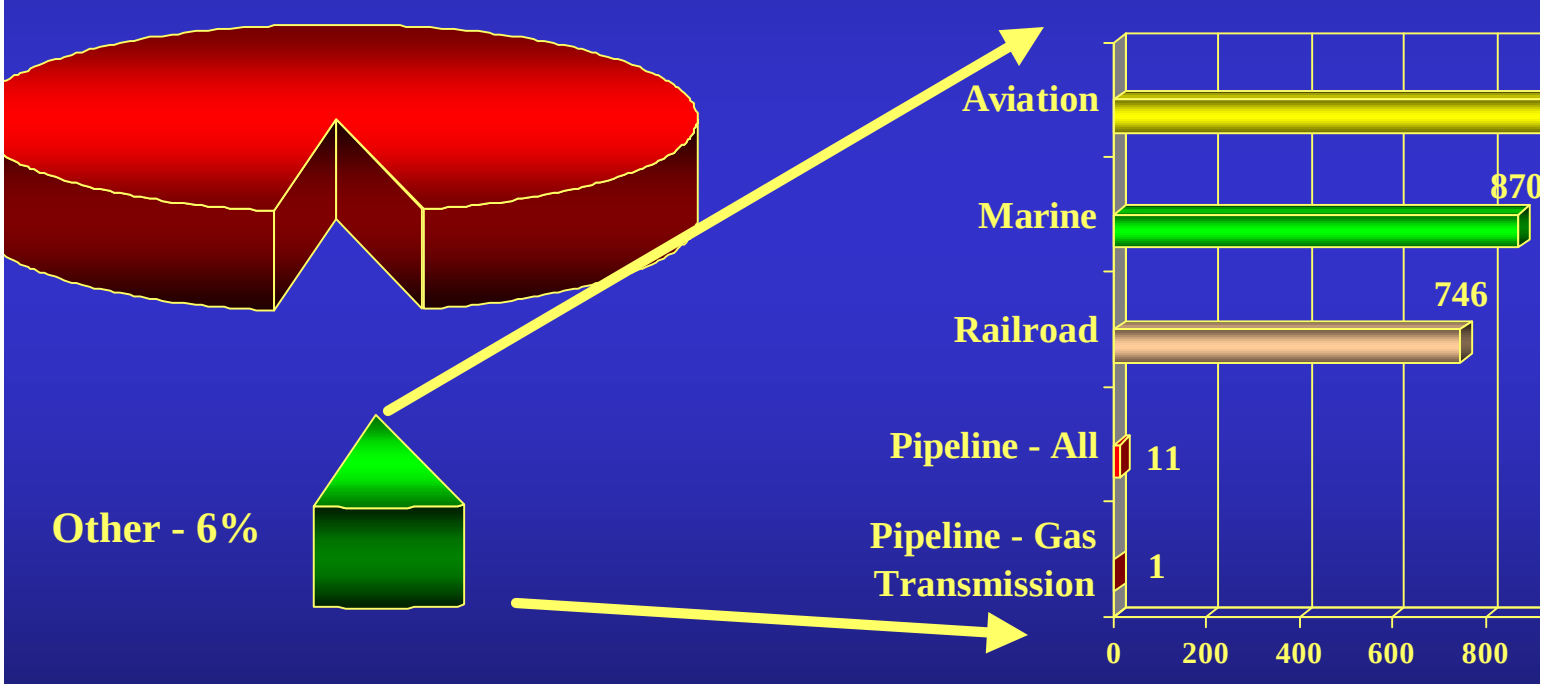
INGAA members don’t rest on their excellent safety record

INGAA has a Board Level Pipeline Safety Task Group

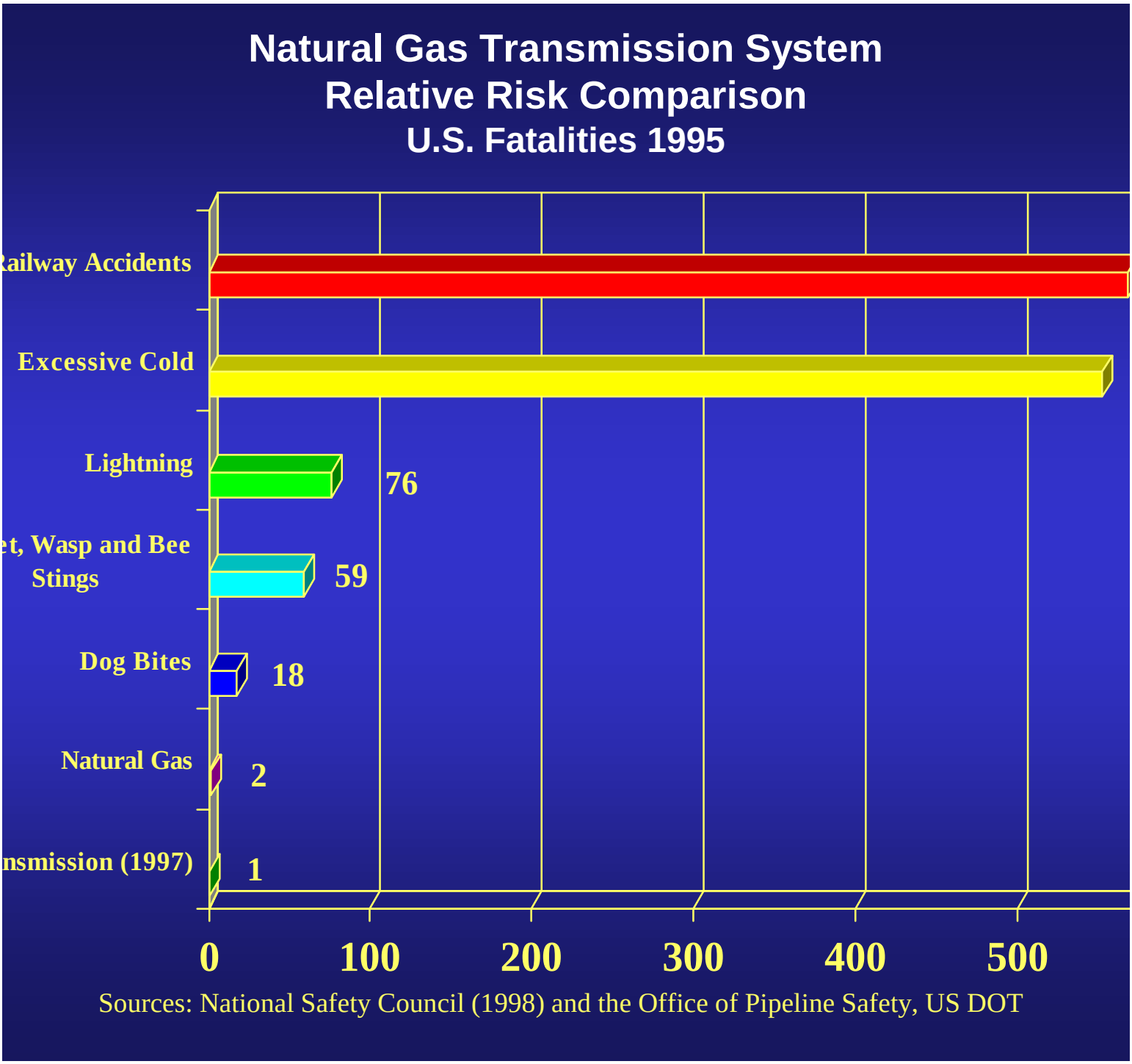
Consequences of a Natural Gas Transmission Pipeline Failure

- Fatalities and Injuries
  - Contractors
  - Employees
  - Public
- Property Damage
  - Gas Lost
  - Company Facilities
  - Private Property
  - Public Property

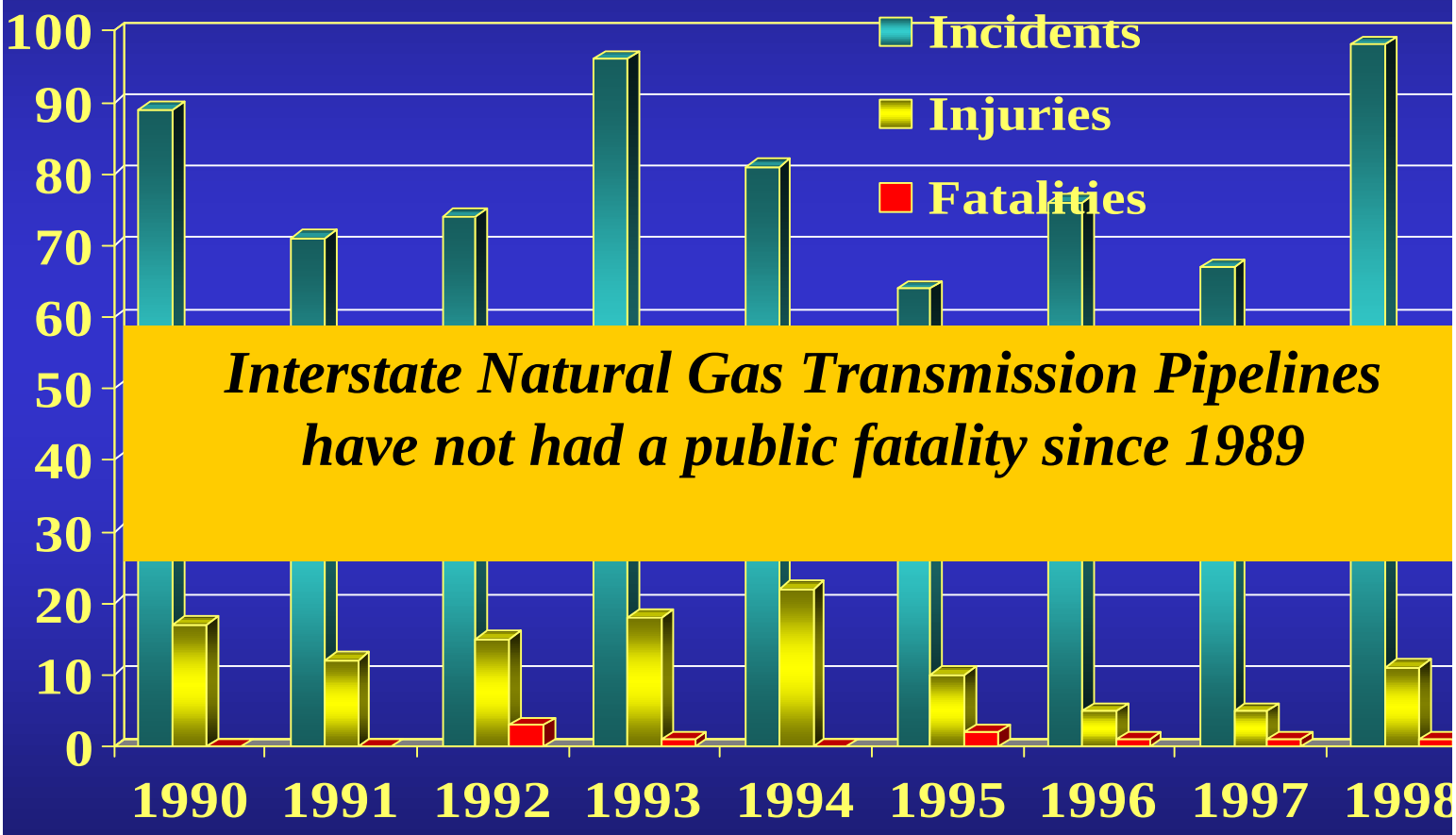
Transportation-Related Fatalities 1997



Sources: National Transportation Safety Board and the Office of Pipeline Safety, US DOT

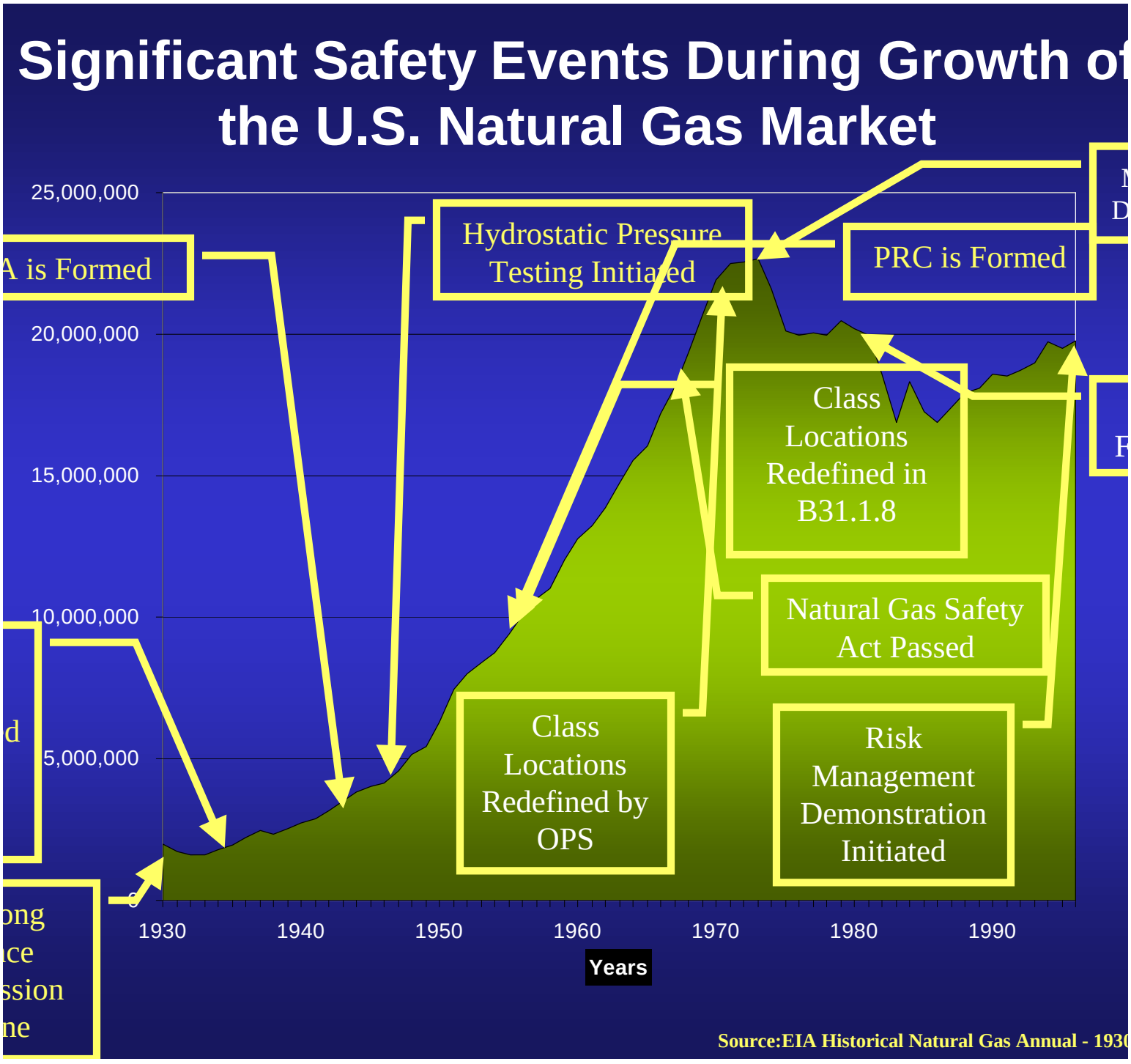

Natural Gas Transmission System
Relative Risk Comparison
U.S. Fatalities 1995
ailway Accidents
Excessive Cold
Lightning
76
t, Wasp and Bee Stings
59
Dog Bites
18
Natural Gas
2
nsmission (1997)
1
0
100
200
300
400
500
Sources: National Safety Council (1998) and the Office of Pipeline Safety, US DOT

Natural Gas Transmission Reportable Incident Summary 1990 - 1998



Interstate Natural Gas Transmission Pipelines have not had a public fatality since 1989

Source: Office of Pipeline Safety, US DOT


Significant Safety Events During Growth of the U.S. Natural Gas Market
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
1930
1940
1950
1960
1970
1980
1990
Years
A is Formed
Hydrostatic Pressure Testing Initiated
PRC is Formed
Class Locations Redefined in B31.1.8
Natural Gas Safety Act Passed
Class Locations Redefined by OPS
Risk Management Demonstration Initiated
Source:EIA Historical Natural Gas Annual - 193

How Do Pipelines Manage Risk?

Reduce the probability a failure will occur

Reduce the consequences of a failure

Focus resources on the highest risk areas

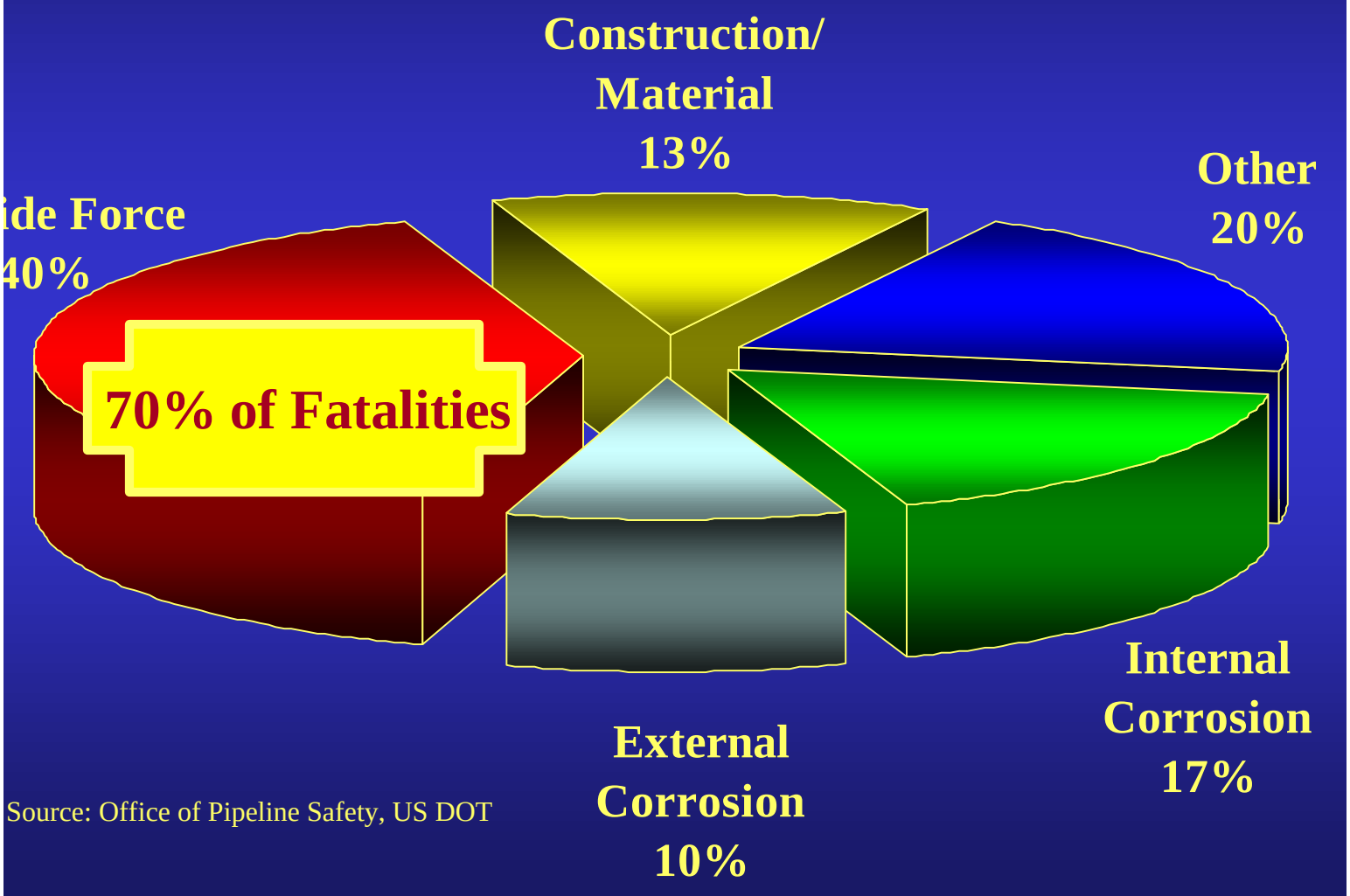
Identify the Risk Components

Probability of an incident occurring

- Outside Force
- Corrosion
- Material failure
- Construction defect
- Equipment Failure
- Human Error

- Consequences of the incident
  - Fatality
  - Injury
  - Property damage
  - Product loss
  - Environmental Degradation

Total Number of Natural Gas Transmission Pipeline Accidents, by Cause 1984- 1997



Source: Office of Pipeline Safety, US DOT

Methods to Lower Probability of Failure as stated in ANSI B31.8 and then adopted for 49 CFR Part 192

- laterials
- ipe Design
- esign of Pipeline Components
- elding of Steel in Pipelines
- eneral Construction Requirements for Transmission ines and Mains
- equirements for Corrosion Control
- est Requirements
- perations
- laintenance

Methods to Reduce Consequences stated in ANSI B31.8 and then adopted for 49 CFR Part 192

- Procedural manual for operations, maintenance, and emergencies
- Damage prevention program
- Emergency plans
- Public education

Additional Improvements in Safety are Due to Individual Company Practices

- Improved Management Processes
- Improved O&M Practices
- Improved Technology
  - Improved Materials
  - Corrosion Monitoring Systems
  - Geographic Information Systems
  - Smart Pigging
  - One Call Systems
  - Hydrostatic Testing Techniques

Pipelines and their regulators have a risk communication problem with the public

rget Problem is Risk Communicati

- Scientists, Engineers, and Risk Managers
  - Risk
    - Frequency of Occurrence
    - Severity of the Consequences
- General Public
  - Risk
    - Frequency of Occurrence
    - Severity of the Consequences
  - Perception

Perception Weighting

Unfamiliar Risks
- New vs. Old ; Industrial vs. Natural

Involuntary Risks
- Choice vs. Mandate

Risks That Are Unfair
- Equity; Intergenerational

Risks That Induce Fear
- Memorability; Chronic vs. Catastrophic; Dread

Relationship Factors
- Trust; Compassion; Value Sharing

Most of the questions in the meeting notice are answered in present gas pipeline safety regulations

efining and Locating High Consequence Are

192.609 Change in Class Location

192.611 Confirmation or revision of MAOP

192.613 Continuing Surveillance

192.619(a)(4) MAOP (determine maximum safe pressure)

192.703 General (Unsafe pipeline must be replaced, repaired, etc.

192.705 Patrolling

eral Pipeline Safety Regulatio

49CFR Part 192

Identifying Affected Pipeline Segments

192.609 Change in Class Location

192.611 Confirmation or revision of MAOP

192.613 Continuing Surveillance

192.619(a)(4) MAOP (determine maximum safe pressure)

192.703 General (Unsafe pipeline must be replaced, repaired, etc.

192.705 Patrolling

eral Pipeline Safety Regulatio

49CFR Part 192

Inspecting and Assessing the Condition of the Affected Segments

192.459 Examination of buried pipeline when exposed

192.477 Internal Corrosion Control: Monitoring

192.619 MAOP (see 192.619(a)(4))

192.703 General (Unsafe pipeline)

eral Pipeline Safety Regulatio

49CFR Part 192

Assessing the Need for Additional Preventive or Mitigative Actions

192.459 Examination of buried pipeline when exposed

192.475 Internal corrosion control: General

192.613 Continuing surveillance

192.617 Investigation of failures

192.703 General (Unsafe pipeline must be replaced, repaired, or removed from service)

eral Pipeline Safety Regulatio

49CFR Part 192

Remediating and Repairing the Affected Segments as Necessary

192.485 Remedial Measures: Transmission Lines

192.711 General Requirements for repair procedures

Rule 192.713 Permanent field repair of imperfections and damage

Rule 192.715 Permanent field repair of welds

Rule 192.717 Permanent field repair of leaks

eral Pipeline Safety Regulatio

49CFR Part 192

Implementing and Monitoring Other Cost-Effective Risk Control Activities

192.1 Scope of part

192.605 Procedural manual for operations, maintenance, and emergencies

192.614 Damage prevention program

192.615 Emergency plans

192.616 Public education

Federal Pipeline Safety Regulations

49CFR Part 192

Documenting Inspections, Assessments, and Actions

192.491 Corrosion Control Records

192.603 General provisions (O&M records requirements)

192.709 Transmission lines: Record keeping

eral Pipeline Safety Regulatio

49CFR Part 192

Reviewing and Ensuring Compliance

- Federal Interstate Pipeline Inspection Process
  - Standard Inspection Protocol
  - Corporate Review
  - Training at TSI
  - Exceptions posted on Internet
- State Intrastate Pipeline Inspection Process
  - Available at State Offices
- State Natural Gas Distribution Inspection Process
  - Available at State Offices
- Federal Safety Related Condition Reports

Standard Federal Inspection

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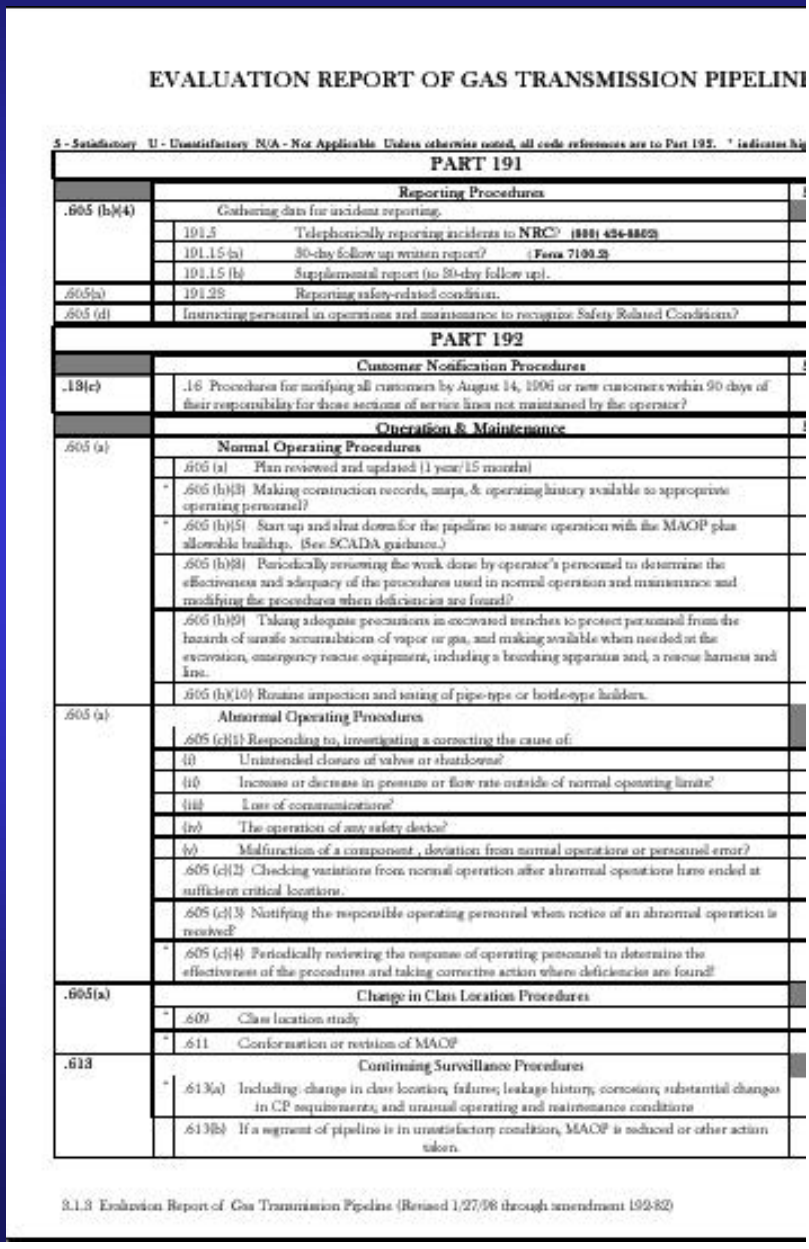
996

ntegrated Corporate
eviews began in
997



EVALUATION REPORT OF GAS TRANSMISSION PIPELINE

5 - Satisfactory U - Unsatisfactory N/A - Not Applicable Unless otherwise noted, all code references are to Part 195. * indicates hig

PART 191

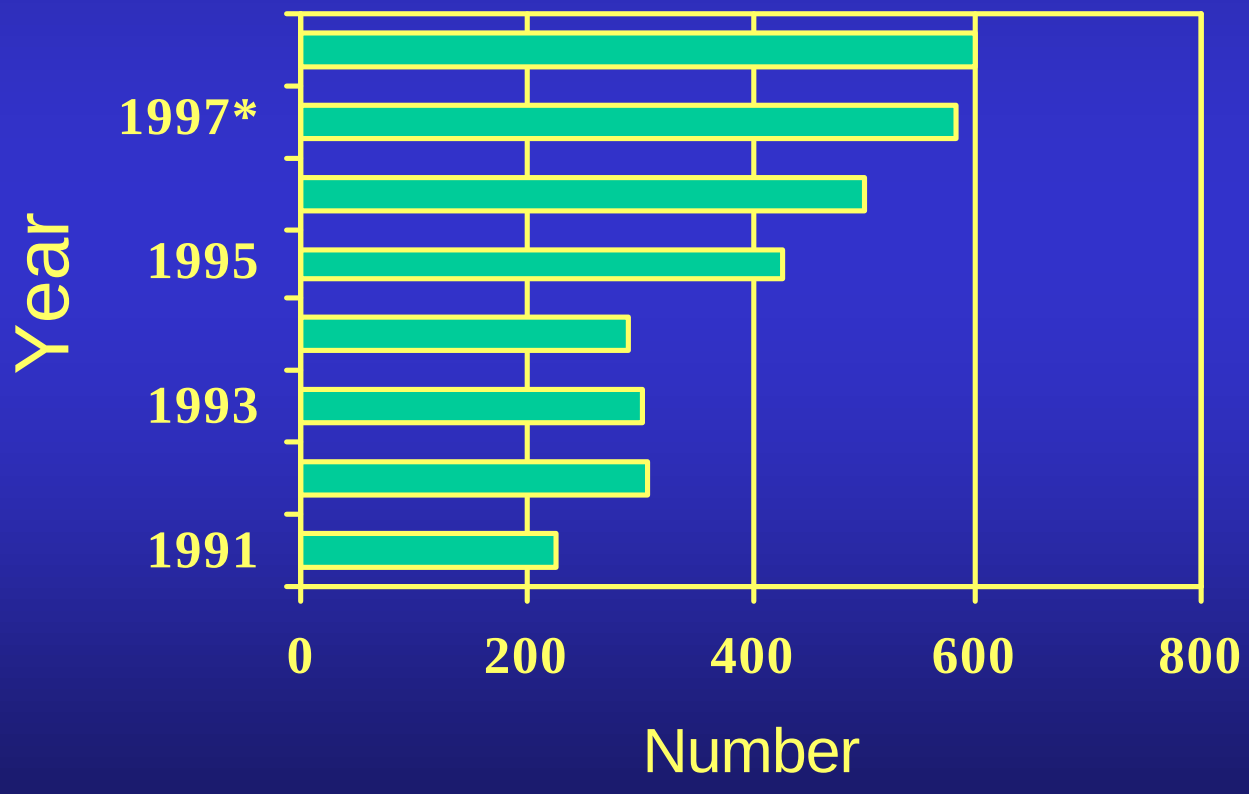
	Reporting Procedures	
.605 (b)(4)	Gathering data for incident reporting.	
	191.5 Telephonically reporting incidents to NRC? (800) 424-8802	
	191.15 (a) 30-day follow up written report? (Form 7100.2)	
	191.15 (b) Supplemental report (to 30-day follow up).	
.605(a)	191.23 Reporting safety-related condition.	
.605 (d)	Instructing personnel in operations and maintenance to recognize Safety Related Conditions?	

PART 192

	Customer Notification Procedures	
.13(c)	.16 Procedures for notifying all customers by August 14, 1996 or new customers within 90 days of their responsibility for those sections of service lines not maintained by the operator?	
	Operation & Maintenance	
.605 (a)	**Normal Operating Procedures**	
	.605 (a) Plan reviewed and updated (1 year/15 months)	
*	.605 (b)(3) Making construction records, maps, & operating history available to appropriate operating personnel?	
*	.605 (b)(5) Start up and shut down for the pipeline to assure operation with the MAOP plus allowable buildup. (See SCADA guidance.)	
	.605 (b)(8) Periodically reviewing the work done by operator's personnel to determine the effectiveness and adequacy of the procedures used in normal operation and maintenance and modifying the procedures when deficiencies are found?	
	.605 (b)(9) Taking adequate precautions in excavated trenches to protect personnel from the hazards of unsafe accumulations of vapor or gas, and making available when needed at the excavation, emergency rescue equipment, including a breathing apparatus and, a rescue harness and line.	
	.605 (b)(10) Routine inspection and testing of pipe-type or bottle-type holders.	
.605 (a)	**Abnormal Operating Procedures**	
	.605 (c)(1) Responding to, investigating & correcting the cause of:	
	(i) Unintended closure of valves or shutdowns?	
	(ii) Increase or decrease in pressure or flow rate outside of normal operating limits?	
	(iii) Loss of communications?	
	(iv) The operation of any safety device?	
	(v) Malfunction of a component , deviation from normal operations or personnel error?	
	.605 (c)(2) Checking variations from normal operation after abnormal operations have ended at sufficient critical locations.	
	.605 (c)(3) Notifying the responsible operating personnel when notice of an abnormal operation is received?	
*	.605 (c)(4) Periodically reviewing the response of operating personnel to determine the effectiveness of the procedures and taking corrective action where deficiencies are found?	
.605(a)	**Change in Class Location Procedures**	
*	.609 Class location study	
*	.611 Conformation or revision of MAOP	
.613	**Continuing Surveillance Procedures**	
*	.613(a) Including change in class location, failures, leakage history, corrosion, substantial changes in CP requirements, and unusual operating and maintenance conditions	
	.613(b) If a segment of pipeline is in unsatisfactory condition, MAOP is reduced or other action taken.	

3.1.3 Evaluation Report of Gas Transmission Pipeline (Revised 1/27/98 through amendment 192-82)

Interstate Inspections Have Increased Through Out the Years



Source: Office of Pipeline Safety, US

Additional safety improvements are not expected to occur with proposed integrity plan review

1998 Accident Statistics of Pipelines

Type of System	Mileage	Number of Incidents	Number of Fatalities
Natural Gas Transmission	326,389	98	1
Natural Gas Distribution	1,100,000	154	16
Hazardous Liquids	157,204	134	1

Present Population Density Definition

5 Class locations.

This section classifies pipeline locations for purpos
part. The following criteria apply to classification
ler this section.

A "class location unit" is an onshore area that exten
yards (200 meters) on either side of the centerline
continuous 1-mile (1.6 kilometers) length of pipeli

Each separate dwelling unit in a multiple dwelling u
lding is counted as a separate building intended for
nan occupancy.

Let's Assume that a Definition of High Consequence Area is…

) A **Class 3 location** is:

(i) Any class location unit that has 46 or more buildings intended for human occupancy; or

(ii) An area where the pipeline lies within 100 yards (91 meters) of either a building or a small, well-defined outside area (such as a playground, recreation area, outdoor theater, or other place of public assembly) that is occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12-month period. (The days and weeks need not be consecutive.)

) A **Class 4 location** is any class location unit where buildings with four or more stories aboveground are prevalent.

Use Existing Performance Measures: Reportable Incidents

- Fatality
  - Public, Contractor, Employee
- Injury
  - Public, Contractor, Employee
- Property Damage > $50k
  - Public, Company, Gas Lost
- Other
  - Public Awareness, Unique Event

Failures in the Assumed High Consequence Areas (1993-1998)

- Incidents reported
  - Incorrectly classified(M&R & Compressor)
- Incidents left
  - Third party damage incidents
- Remaining incidents would not be found by pigging or hydrostatic pressure testing

Source: OPS Inc

nsequences in Assumed High Consequence Areas

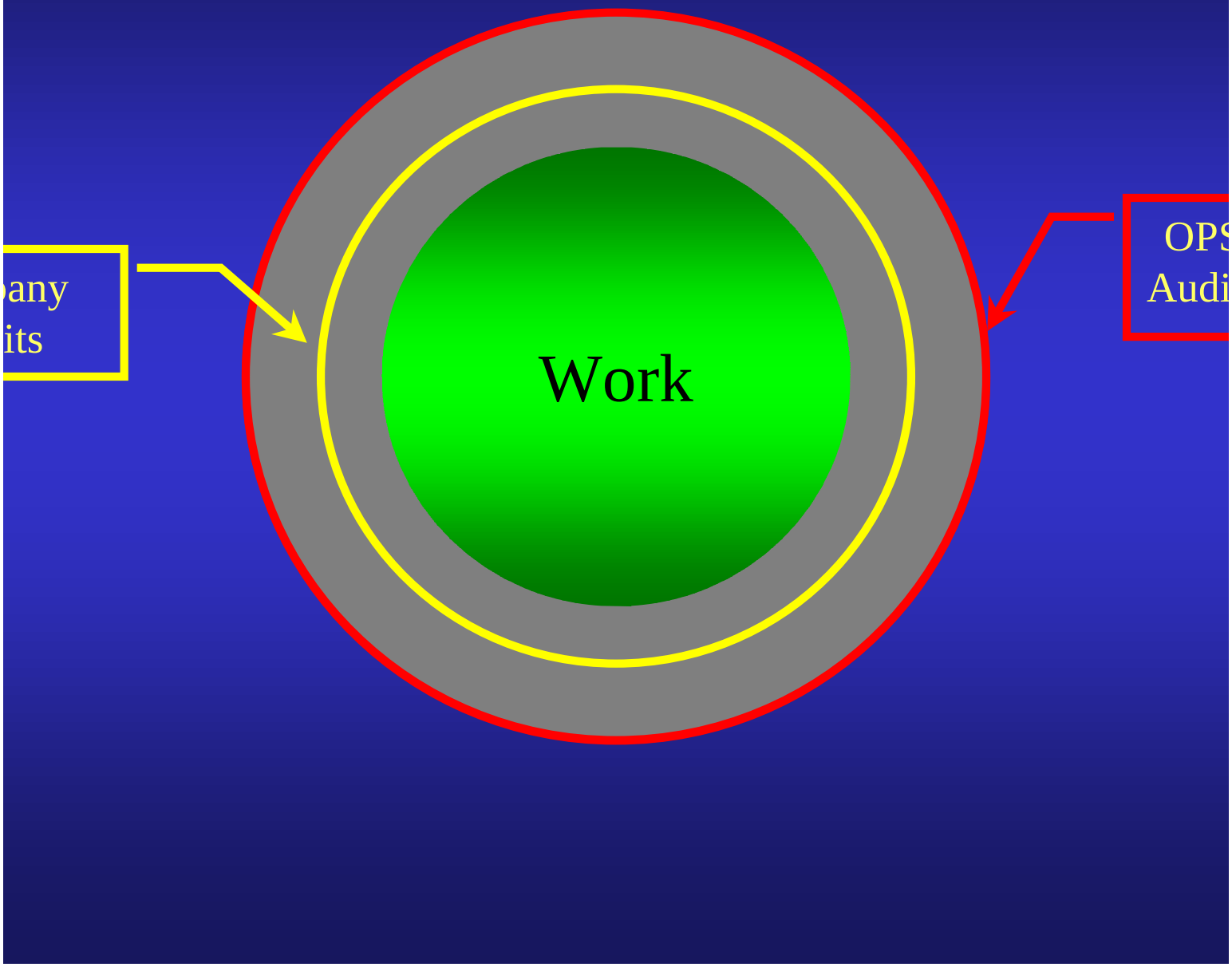
No public fatalities on Interstate Natural Gas Transmission Pipelines in assumed high consequence areas since 1989

- Difference is contractors and employees

Public property damage is a fraction of reported value.

- For example, one INGAA company reported $1,283,000 in property damages reported resulted in only $38,000 of actual damage to public property
- Difference is company repair cost and gas lost

Quality Control and Integrity Assurance



Current initiatives to share additional information have not yet realized their potential

NGAA Members are partners in the following OPS initiatives.

- Damage Prevention
- Risk Management Demonstration
- High Impact Inspections
- Safety Data Initiative
- Joint Research Initiative
- Operator Qualification
- System Integrity Inspection
- National Mapping Initiative

Damage Prevention

Public Education Campaign

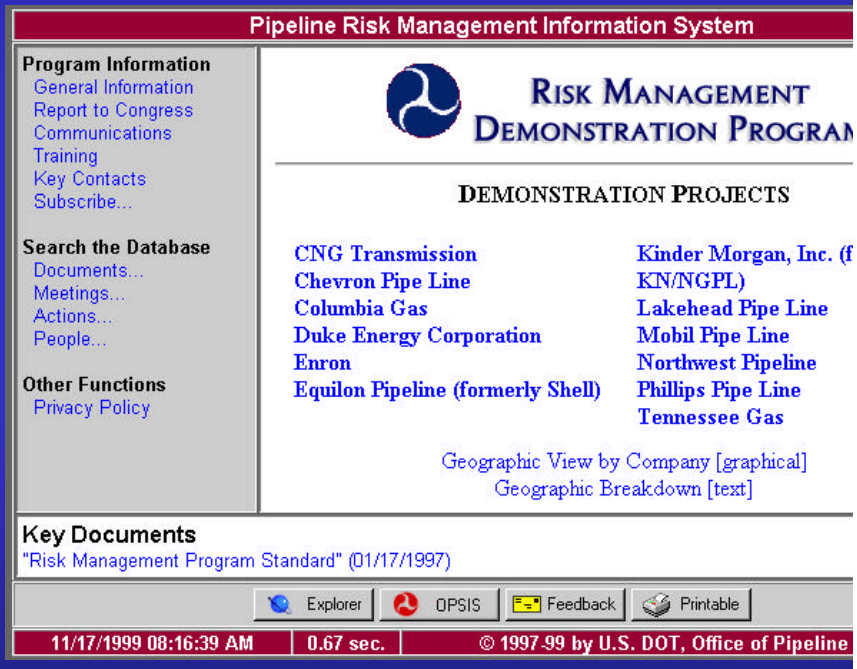
- Pilot Test Successful
- Training and Integration Proceeding

Common Ground

- Report Published
- Path Forward is progressing

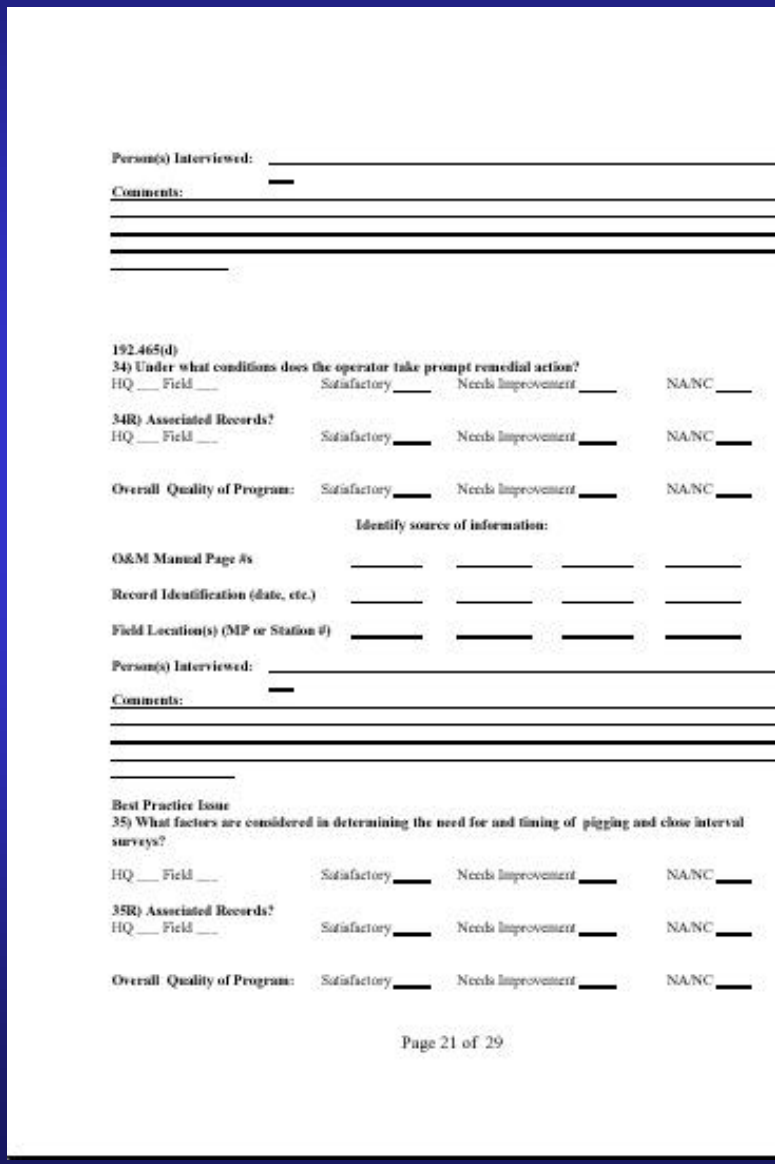
Risk Management Demonstration Status

- nterstate Pipelines
- nvestigating structured nd formalized risk anagement programs
- dentify specific risks
- llocate resources to most ffective activities
- Natural Gas Pipeline rojects Applied
- Natural Gas Pipeline ipeline Accepted



High Impact Inspections

ntegrity Questions
– System Wide
– Pigging
Best Practice Issues
– Operator Fatigue
– Y2K
– Process Flow
Interstate gas
ransmission pipelines
ompanies inspected



Person(s) Interviewed: _____

Comments: _____

192.465(d)
34) Under what conditions does the operator take prompt remedial action?
HQ ___ Field ___ Satisfactory ___ Needs Improvement ___ NA/NC ___

34R) Associated Records?
HQ ___ Field ___ Satisfactory ___ Needs Improvement ___ NA/NC ___

Overall Quality of Program: Satisfactory ___ Needs Improvement ___ NA/NC ___

Identify source of information:

O&M Manual Page #s _____ _____ _____ _____

Record Identification (date, etc.) _____ _____ _____ _____

Field Location(s) (MP or Station #) _____ _____ _____ _____

Person(s) Interviewed: _____

Comments: _____

Best Practice Issue
35) What factors are considered in determining the need for and timing of pigging and close interval surveys?

HQ ___ Field ___ Satisfactory ___ Needs Improvement ___ NA/NC ___

35R) Associated Records?
HQ ___ Field ___ Satisfactory ___ Needs Improvement ___ NA/NC ___

Overall Quality of Program: Satisfactory ___ Needs Improvement ___ NA/NC ___

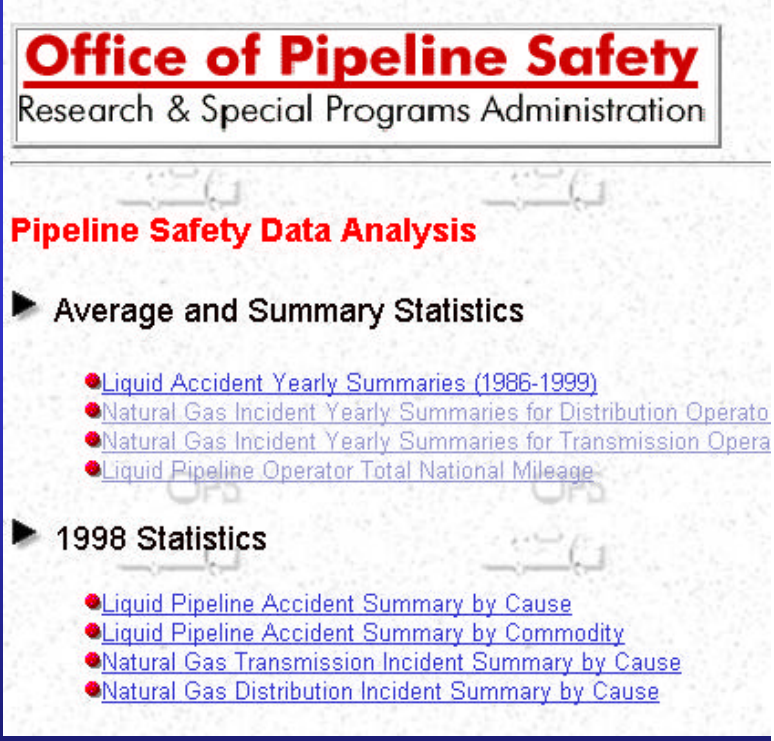
Page 21 of 29

Pipeline Safety Data Analysis

Augment present OPS incident data

Based on PRCI data analysis (1984-1997)

Eliminates “other” category



Joint Research Initiative

- Memorandum of Understanding
- Focus to develop pig to detect and characterize mechanical damage
- Complements present GRI and PRCI research @ $12M/yr


Report No. DTRS56-96-C-0010
Task 1 and 2 Final Report

Click here for

In-Line Inspection Technologies for Mechanical Damage ar
in Pipelines - Final Report on Tasks 1 and 2

prepared by
T. A. Bubenik, J. B. Nestleroth, and R. J. Davis, Battelle
A. Crouch, Southwest Research Institute
S. Udpa and M. A. K. Afzal, Iowa State University
for
U. S. Department of Transportation, Office of Pipeline Safety
Lloyd Ulrich, Contracting Officer's Technical Representative
December 1998

DEPARTMENT OF TRANSPORTATION
UNITED STATES OF AMERICA

System Integrity Inspection (SII)

- nternal Audit
  rogram Review
- ntegrity Program
  eview
- nformation and
  ocumentation
- haring with OPS
- Interstate Pipeline
  pplied

RSPA Proposes Pipeline Systems Integrity Pilot Program; Decem
WASHINGTON, Dec. 21 /PRNewswire:

-- The U.S. Department of Transportation's Research and Special Programs Adm
(RSPA) today proposed a new public-private partnership pilot program to improve
safety. The System Integrity Inspection program (SII) will enhance current inspec
practices by focusing on a broad range of pipeline integrity issues instead of con
inspections only from a regulatory and compliance perspective.

"This proposal highlights the federal government's commitment to improving pipe
said RSPA Administrator Kelley S. Coyner. "By teaming-up with pipeline operato
creating a smarter approach to assuring the public that pipeline systems in their
communities are operating as safely as possible."

RSPA's review of current national pipeline inspection programs concluded that th
approach to developing a federal government-private partnership for effectively imp
way operators address potential risks posed by pipelines provides greater levels
environmental protection and pipeline service reliability.

Five interstate pipeline operators with good performance records will be consider
approved for participation in the SII program. RSPA invites eligible pipeline opera
submit letters of application for the pilot program.

OPS Launches System Integrity Inspection Pilot: Decem

The Office of Pipeline Safety (OPS) has issued a request for pipeline operators t
in the System Integrity Inspection (SII) Pilot Program. The SII Pilot Program is d
enhance the inspection practices currently in use by focusing on a broad set of p
integrity issues instead of conducting inspections only from a regulatory complia
perspective. OPS invites eligible pipeline operators to submit a Letter of Applicat
expressing interest in SII Pilot Program participation. Letters will be accepted un
12, 1999.

National Pipeline Mapping Initiative

- Interstate pipelines
- Standardized mapping format
- Integrates with government mapping data
  - Federal
  - State
  - Local
- National Repository opened July

One thing learned from these initiatives is there is no “silver bullet”

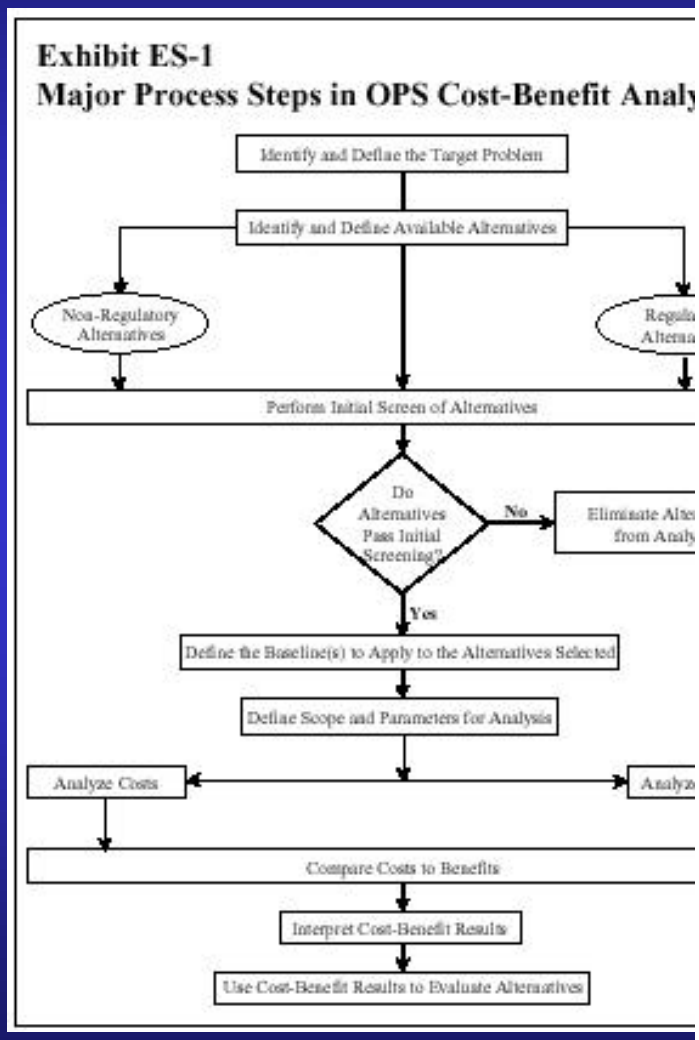
xample Technology: Smart Piggin

- Commercially Available Defect Characterization
  - Dents
  - General Corrosion
  - Not Seams,SCC, Gouges, Material Defects
- Snapshot of present conditions
  - Linear deterioration vs. random events
  - Subject to interpretation and reinterpretation
- Limited Flexibility
  - 25 of 53 segments need to be modified (994 miles)
- Macro Solution for Micro Problem
  - 492 Miles of Class 3&4; 2,915 miles must be pigged
  - One Metro area installation cost is $60–80 Million

Additional regulations must pass risk assessment / cost benefit tests to avoid diffusing resources

Risk Assessment / Cost Benefit

- Identify the Target Problem
  - Public Safety
  - Environment
  - Public
- Identify Alternatives
  - Regulatory
  - Voluntary
- Analyze Costs
- Analyze Benefits
- Make Recommendations



Conclusions

tural gas is needed in increasing quantity

GAA member companies don’t rest on their excellent safety ord

elines have a risk communications problem with the public

st of the questions in the meeting notice are answered in pre pipeline safety regulations

ditional safety improvements are not expected to occur with posed integrity plan review

rrent initiatives to share additional information have not yet lized their potential

e thing learned from these initiatives is there is no “silver bu

ditional regulations must pass risk assessment/cost benefit te oid diffusing resources

Recommendations

- DPS and state pipeline safety agencies should
  ommunicate to the public their present
  nspection process as well as the new initiative
- The present joint initiatives should be
  ompleted, documented and successes
  ntegrated into the regulatory structure
- A joint public safety education effort should b
  stablished