

**GAO**

**United States General Accounting Office**  
**Report to Congressional Requesters**

**March 1989**

# **PIPELINE SAFETY**

## **New Risk Assessment Program Could Help Evaluate Inspection Cycle**



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United States  
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Resources, Community, and  
Economic Development Division

B-214352.2

March 7, 1989

The Honorable Frank R. Lautenberg  
Chairman, Subcommittee on Transportation  
and Related Agencies  
Committee on Appropriations  
United States Senate

The Honorable William Lehman  
Chairman, Subcommittee on Transportation  
and Related Agencies  
Committee on Appropriations  
House of Representatives

In response to your request and subsequent agreements with your offices, we examined the process the Office of Pipeline Safety (OPS), within the Department of Transportation's Research and Special Programs Administration (RSPA), used to develop the inspection cycle for the natural gas and hazardous liquid pipeline safety program. We focused our review on determining (1) whether the pipeline inspection cycle is based on a sound assessment of risk and (2) whether the Pipeline Inspection Priority Program will enable the agency to identify pipelines with the greatest potential safety risk.

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## Results in Brief

We found that OPS did not analyze pipeline safety risk to determine whether 2.5 years was the most appropriate inspection interval. Rather, OPS established the 2.5-year cycle on the basis of the number of days OPS expects its inspectors to spend performing pipeline unit<sup>1</sup> inspections, the number of pipeline units, and the number of inspectors.

The Pipeline Inspection Priority Program provides OPS its first opportunity to integrate pipeline data collected from its inspectors and pipeline companies. When fully operational, the program will assist RSPA's regional offices in identifying pipeline unit inspection priorities on the basis of potential safety risk. However, we found that the regions are having difficulty operating the program because OPS has not provided its inspectors adequate computer training. In addition, OPS has not instructed the regions on how to assign unit inspection priorities.

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<sup>1</sup> A pipeline inspection unit is all or part of a pipeline facility under the control of a pipeline company's administrative office. The office is responsible for ensuring uniform design, construction, operation, and maintenance procedures.

Furthermore, although OPS established the inspection cycle before developing the pipeline priority program, we believe that OPS can use the program's indicators of potential safety hazards for companies and units to evaluate whether the 2.5-year cycle is appropriate for all pipeline units. Additionally, OPS could use the data to determine whether the number and location of pipeline inspectors are appropriate to handle any regional concentrations of high-risk pipelines that the program may identify.

## Background

The Natural Gas Pipeline Safety Act of 1968, as amended, and the Hazardous Liquid Pipeline Safety Act of 1979, as amended, provide the Department of Transportation authority to establish and enforce safety standards for both interstate and intrastate pipelines used to transport natural gas and hazardous liquids. (See app. I for a diagram of a natural gas pipeline system.) Transportation delegates its pipeline safety responsibilities to RSPA, which has designated OPS and RSPA's five regional offices to implement the national program of pipeline regulation, enforcement, training, and research; to administer the pipeline safety grant programs to states; and to collect the user fees that fund the program. (See app. II.)

## Resources, Not Risk, Determined Inspection Cycle

OPS determined in 1987 that each of the 1,204 pipeline inspection units associated with approximately 500 natural gas and hazardous liquid pipeline companies under federal jurisdiction should be inspected, on average, every 2.5 years. OPS based its 2.5-year inspection cycle on the number of days OPS expects its inspectors to spend performing unit inspections, the number of pipeline units under federal jurisdiction, and the number of OPS pipeline inspectors. (See app. III.) While OPS officials believed that 2.5 years was reasonable since historical data showed a low level of reported pipeline failures and a decreasing number of fatalities and injuries, they did not take into account the variations in safety conditions that may exist among individual pipeline units. Moreover, we found that regional chiefs believe the 2.5-year cycle may be too ambitious because of the time required to perform other important compliance activities, such as follow-up and construction inspections.

## OPS Encountering Difficulties Achieving the 2.5-Year Cycle

In 1988, in hearings before the House Appropriations Committee, RSPA's Administrator estimated that OPS would inspect 380 units that year. The Administrator noted that this was 100 units fewer than the 480 needed to achieve the 2.5-year cycle. However, the official said that RSPA was

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hiring additional inspectors, which would help OPS meet the 480-unit inspection target.<sup>2</sup> (Once the inspectors were hired, OPS had a total of 15 field inspectors.)

OPS officials recently estimated that its inspectors performed a total of 344 comprehensive unit inspections in 1988. This number is 136 (or 28%) less than RSPA's target of 480 inspections per year. The regional chiefs gave a variety of reasons why their regions did not accomplish the number of inspections anticipated. These reasons included the time spent performing accident investigations, training new inspectors, and entering company and unit inspection histories into the pipeline priority program. While all regional chiefs, with one exception, project that they will inspect units in their respective regions within a 2.5- to 3-year cycle, the majority believe that this target will be achieved only at the expense of other important compliance activities.<sup>3</sup>

OPS requires its inspectors to schedule 110 days of the 220-workday year for activities away from the office. This time includes 80 days for unit inspections and 30 days for other types of activities, such as follow-up and construction inspections, accident investigations, inspection training, and pipeline industry seminars. The other 110 days are used to respond to public inquiries and document inspections, accidents, and violations, including those requiring legal action.

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## 2.5-Year Cycle May Be Too Ambitious

The consensus among the regional chiefs is that achieving the 2.5-year cycle will require spending less time on follow-up and/or construction inspections, pipeline inspection training, and industry seminars. Follow-up inspections determine whether the violations cited in the course of unit inspections and accident investigations are corrected. Construction inspections allow inspectors their only opportunity to view a pipeline before it is buried. According to the regional chiefs, attendance at pipeline industry seminars is valuable because inspectors can acquaint themselves with company operations and clarify federal pipeline safety regulations for company representatives.

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<sup>2</sup>RSPA decreased its pipeline unit count from 1,204 to 1,100 in part because Louisiana assumed jurisdiction for approximately 100 intrastate pipelines. However, it did not reduce its annual inspection target of 480. RSPA officials believe the number of pipeline units will remain near 1,100.

<sup>3</sup>The southwest region is the exception. OPS will allow this region to inspect its onshore pipelines on a 2.5-year cycle and its offshore pipelines on a 5-year cycle.

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OPS' Operations and Enforcement Manual provides inspectors guidance on what constitutes a comprehensive unit inspection. However, the manual leaves to the discretion of each inspector which and how many pipeline records and facilities should be reviewed to determine whether a unit is in compliance with federal regulations. OPS expects each of its field inspectors to conduct about 32 inspections per year, averaging 2.5 days per inspection, to achieve the 2.5-year inspection cycle. Generally, however, regional chiefs believe that an inspector needs between 2.5 and 7.5 days, including travel, to complete an inspection as detailed by OPS' guidance. According to the majority of regional inspectors, their decisions regarding the number of pipeline records and facilities to be examined are driven by OPS' guidance that unit inspections be completed in about 2.5 days, including travel, assuming no potential safety hazard exists. One regional chief noted that the 2.5-day inspection time frame could result in violations not being discovered. Another said that the inspectors may restrict inspections of pipeline facilities to those located near the office where a company's records are kept in order to meet the 2.5-day time frame.

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### **Lack of Guidance May Affect Potential to Identify High-Risk Pipelines**

The Pipeline Inspection Priority Program, which was initiated in January 1986, is OPS' first attempt to integrate all the various types of pipeline data that the office collects from its inspectors and pipeline companies. When fully implemented, the computerized pipeline priority program will assist the regions in establishing pipeline unit inspection priorities by identifying the relative risk of pipeline companies and units. (See app. IV.) The regions are responsible for entering the data from pipeline safety inspections into the pipeline priority program, which will then generate the unit inspection priorities and pipeline safety rankings. We found that the regions are encountering problems operating the program because OPS has not provided regional offices sufficient computer training. In addition, OPS has not provided the regions guidance on how to assign unit inspection priorities, which characterize the potential safety risk associated with the pipeline units.

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### **Insufficient Computer Training Provided**

The pipeline priority program is being implemented in two stages. In the first stage, an OPS contractor entered the data on the pipeline safety conditions obtained from companies' reports. The program generated company safety rankings, which were made available to the regions in

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September 1987. For the second stage, regions are responsible for entering into the program inspection results and pipelines' compliance histories. Together the data from the two stages form the baseline that will be used to establish unit inspection priorities.

Regional chiefs and inspectors do not believe that OPS headquarters has provided them sufficient training on how to access the computer system. During our visits to the regional offices between October and November 1988, we found that not all of the inspectors could access the pipeline priority program or use the program software to retrieve and/or delete recently entered unit information. We also learned that while OPS has left it up to the regions to validate the accuracy of the information entered in the second stage of the program, no region had procedures in place to validate the data entered. According to the field personnel responsible for entering the information, they verified the data themselves as they entered it. In addition, at the time of our review, there was no resource person in OPS' Washington, D.C., headquarters to respond to the regions' technical difficulties. OPS has since determined that a resource person is needed. In December 1988, a consultant was designated and a computer user committee was established to address the problems regions are encountering with the computer system.

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### Regions Lack Guidance on Unit Inspection Priority Codes

OPS headquarters also has not provided the regions guidance on how to assign a unit inspection priority code, which is one of the safety factors that the pipeline priority program uses to establish a unit's safety ranking. The inspectors assign a low, normal, high, or urgent code to a pipeline unit on the basis of the inspector's assessment of the unit's most recent inspection results.

We found no consistent definition used among inspectors or across the regions in assigning a unit's priority code. Inspectors generally had their own criteria for determining the code. For example, in one region every inspected unit was assigned a "normal" priority regardless of the inspection results. Since our review, headquarters officials have indicated that guidelines for assigning priority codes need to be developed. They discovered this problem while reviewing a draft of the data generated by the pipeline priority program, where they found that two regions had entered a normal priority code for all their inspection units.

## OPS Does Not Currently Plan to Use Risk Data to Evaluate Its Inspection Cycle

The January 1989 report of the Department of Transportation's Safety Review Task Force, Research and Special Programs Administration's Pipeline Safety Program, stated that the pipeline priority program would enable OPS staff to identify the safety risk associated with individual pipelines and assist in deciding when a pipeline unit should be inspected. The task force recommended that RSPA expedite the implementation of the program because the data were critical to an effective enforcement program.

According to OPS, the Pipeline Inspection Priority Program will be fully operational by December 1990 if the majority of the units are inspected by that time. OPS believes that once the program is complete, the information the program generates can be used by headquarters to monitor which regions are achieving the 2.5-year cycle, identify trends in companies' violations of pipeline safety standards, and determine whether enforcement actions have been consistent.

We see another application of the pipeline priority program data. In our 1987 management review of the Department of Transportation,<sup>4</sup> we noted that by monitoring the work its safety inspectors do and the results they achieve, Transportation could obtain more timely data to identify safety problems and direct its inspector resources at high-risk conditions. We see a similar application for the Pipeline Inspection Priority Program. Once the program is complete, OPS will have information on the relative safety risk associated with the pipelines under federal jurisdiction. OPS could use the risk information to evaluate whether the 2.5-year cycle is appropriate for all units. Further, since the pipeline priority program identifies both the number and location of pipeline units with the highest potential for risk, the data could be valuable in evaluating whether OPS' overall staffing level is appropriate. In addition, when assigning inspectors to regions, OPS could take into account any concentration of high-risk pipeline units that may be identified by the program.

When we discussed these issues with agency officials, they said they had not planned to use the program's risk indicators to evaluate either the inspection cycle or staffing levels. However, they said that using the program for these types of evaluations is an option that could be considered in the future. The Assistant Director of the Operations and Enforcement Division, who is responsible for implementing the program,

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<sup>4</sup>Department of Transportation: Enhancing Policy and Program Effectiveness Through Improved Management (GAO/RCED-87-3, Apr. 13, 1987).

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told us that OPS' current focus is on completing the program's development and implementation as planned.

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## Conclusions

OPS' inspection cycle provides for each pipeline unit to be inspected every 2.5 years. When the cycle was developed, OPS did not consider that units with a high relative safety risk need to be inspected more frequently than units with a low relative safety risk. Additionally, OPS' inspection targets—such as how many inspections each inspector should perform per year—and inspection resources—such as the number and location of inspectors—do not consider that the number of high-risk pipeline units may vary among regions.

The Pipeline Inspection Priority Program was developed to identify pipeline inspection priorities on the basis of weighted safety factors. However, the reliability of the data cannot be ensured because OPS has not provided its inspectors sufficient training on how to enter and validate the pipeline data and use the priority program. Nor has OPS provided any guidance to regions on how to characterize the potential safety risk of pipeline units.

Furthermore, OPS is currently not planning to use the data from the program to evaluate its inspection cycle or staffing level. We believe OPS could use the data to rank the pipelines under its jurisdiction on the basis of risk and determine whether the 2.5-year cycle is appropriate for all units, given identified variances in risk. Additionally, OPS could use the data to evaluate whether it has a suitable number of field inspectors to inspect pipelines identified as having a high potential for safety hazards and whether the location of its inspectors appropriately reflects regional concentrations of high-risk pipelines.

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## Recommendations to the Secretary of Transportation

To ensure that OPS' Pipeline Inspection Priority Program identifies and prioritizes pipeline inspections on the basis of a sound assessment of risk, we recommend that the Secretary of Transportation direct the Administrator of RSPA to (1) provide training to field staff on how to access and validate the pipeline priority program data and (2) issue guidance to regions on how to characterize the pipeline units' safety risks.

Additionally, once the pipeline priority program becomes operational, the Secretary should direct RSPA's Administrator to use the information on the number and regional location of high-risk pipelines to determine



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whether its pipeline inspection cycle and current inspector staffing level are appropriate.

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In addressing the issues discussed in this report, we reviewed pipeline safety program legislation, pipeline safety regulations, unit inspection reports prepared by field inspectors, guidance to regional offices, and pipeline priority program documentation. We also interviewed Office of Pipeline Safety personnel in Washington, D.C., the five regional chiefs, and 15 pipeline inspectors in RSPA's regional offices in Washington, D.C.; Atlanta, Ga.; Lakewood, Co.; Kansas City, Mo.; and Houston, Tx.

We conducted our review between March 1988 and December 1988 in accordance with generally accepted auditing standards.

We discussed the draft report's content with the Director of the Office of Pipeline Safety and cognizant program officials to ensure its accuracy. However, as requested by your offices, we did not obtain official agency comments on a draft of this report.

As arranged with your offices, unless you publicly announce its contents earlier, we plan no further distribution of this report until 7 days from the date of this letter. At that time we will send copies to the Secretary of Transportation; the Administrator, RSPA; and other interested parties and will make copies available to others upon request.

Our work was performed under the direction of Kenneth M. Mead, Director, Transportation Issues. Major contributors are listed in appendix V.



J. Dexter Peach  
Assistant Comptroller General



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# Contents

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Letter		1
Appendix I Natural Gas Pipeline System		12
Appendix II RSPA's Five Regional Offices		13
Appendix III Pipeline Unit Inspection Cycle		14
Appendix IV The Pipeline Inspection Priority Program		17
Appendix V Major Contributors to This Report	Resources, Community, and Economic Development Division, Washington, D.C.	20 20
Figure	Figure III.1 Method OPS Used to Develop Pipeline Inspection Cycle	16

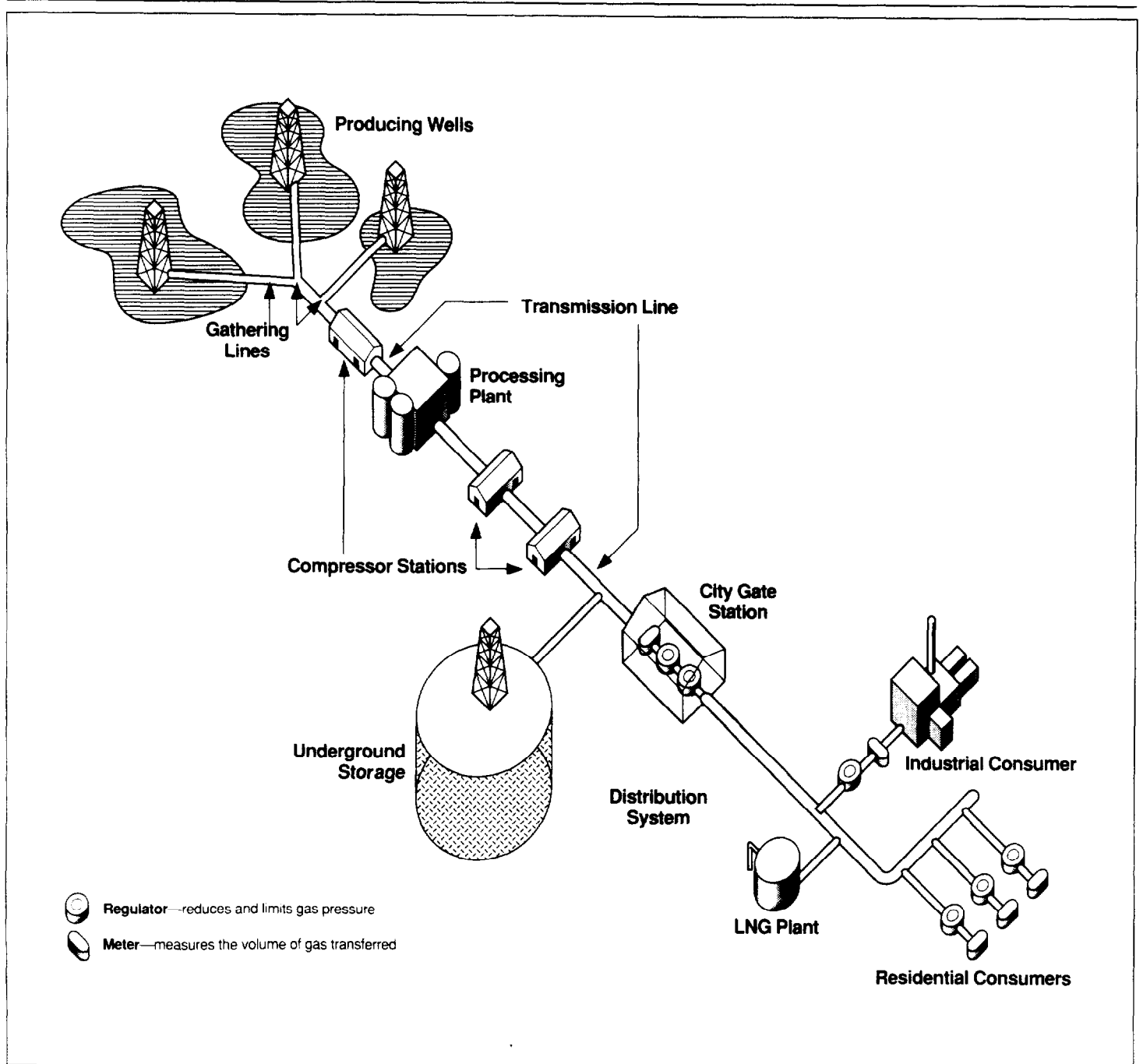
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## Abbreviations

GAO	General Accounting Office
OPS	Office of Pipeline Safety
RSPA	Research and Special Programs Administration

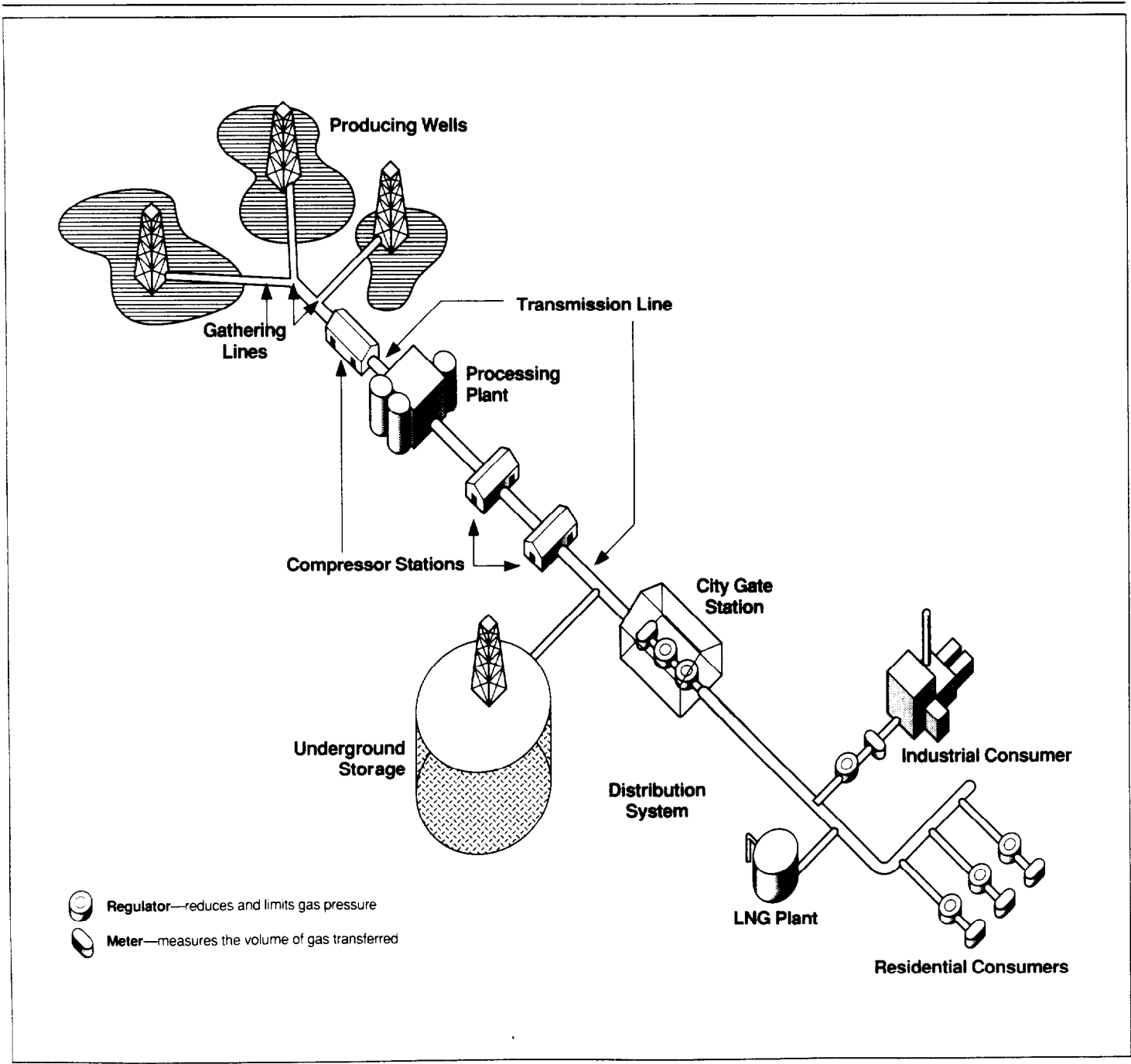


# Natural Gas Pipeline System



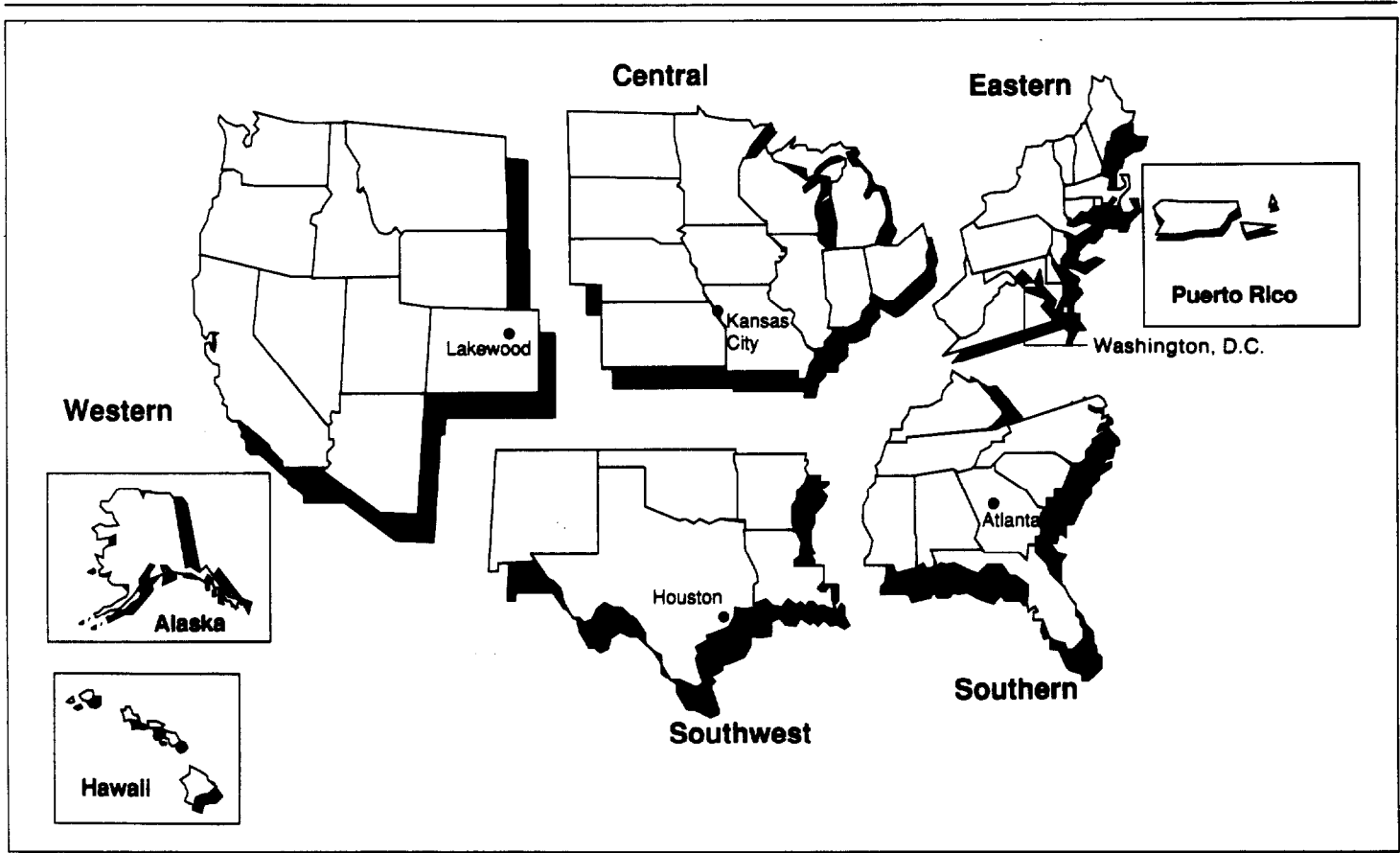
Source: Department of Transportation

# Natural Gas Pipeline System



Source: Department of Transportation

# RSPA's Five Regional Offices



Source: Department of Transportation

# Pipeline Unit Inspection Cycle

OPS established its 2.5-year inspection cycle on the basis of the number of pipeline units under federal jurisdiction, the number of days OPS expects its inspectors to spend performing unit inspections, and the number of OPS pipeline inspectors.

OPS projected that the inspection cycle would begin in July 1987, with 20 inspectors—5 regional chiefs and 15 field inspectors—by the end of fiscal year 1987. The regional chiefs are primarily responsible for inspecting state pipeline safety programs, managing the regional office, supervising the field inspectors' activities, and assisting in accident investigations and enforcement activities. Field inspectors' duties include performing and documenting unit inspections, preparing recommendations to the regional chief for proposed corrective actions and/or civil penalties for violators, following up on enforcement actions to determine whether corrective action is being taken, and participating in accident investigations, pipeline industry meetings, and inspection training.

According to the Department of Transportation's June 1987 Safety Inspector Staffing Studies (Vol. 8: Pipeline Safety, Research and Special Programs Administration), the pipeline safety program's work load is defined by the 500 inter- and intrastate pipeline companies subject to federal inspection. To ensure that all segments of a company's pipeline are inspected, OPS subdivided these companies into approximately 1,200 inspection units on the basis of how the companies organized their pipeline operations. According to agency officials, a 2.5-year inspection cycle ensures that all of a company's pipeline units will be inspected on a periodic basis.

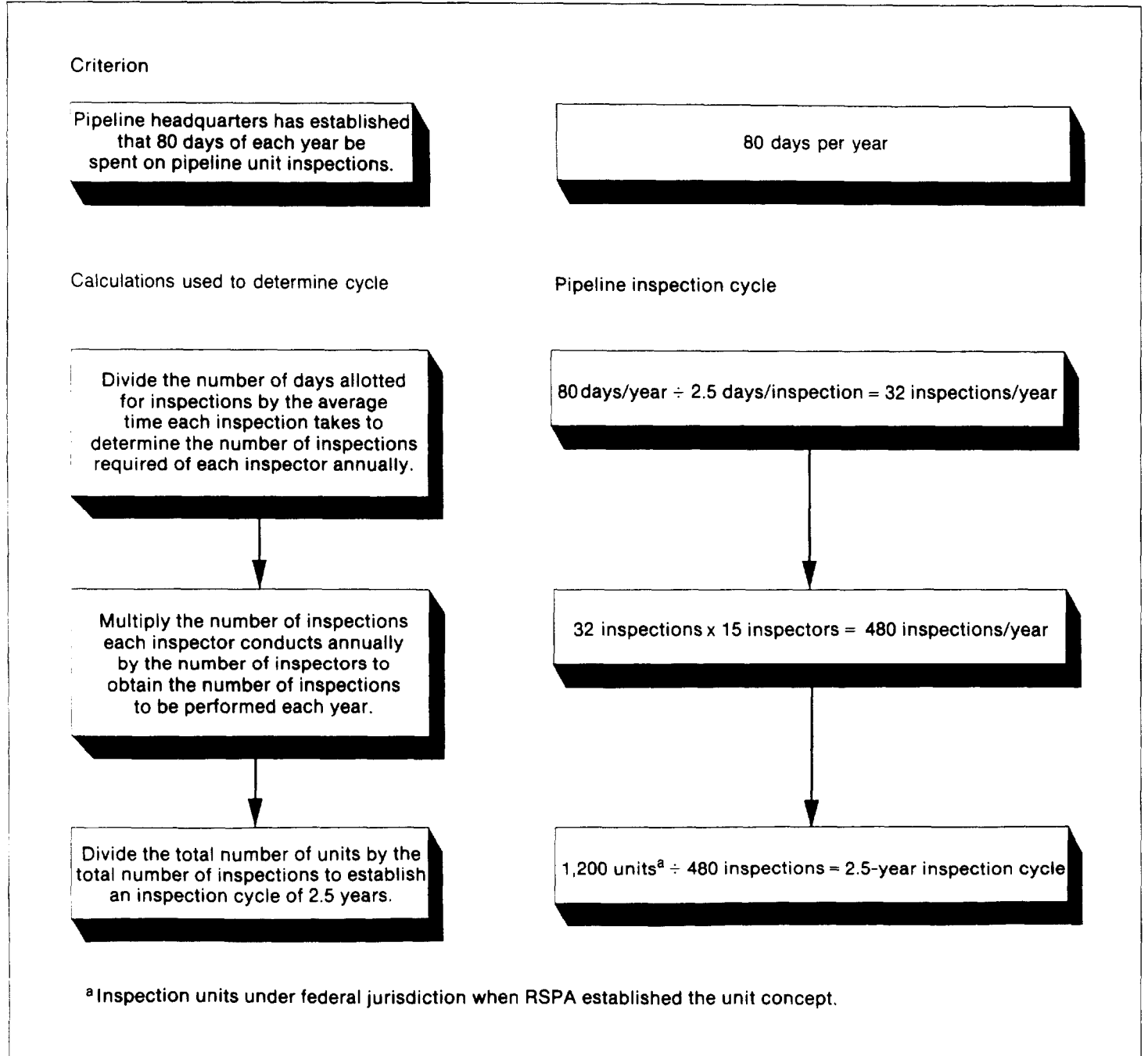
According to OPS officials, to inspect all pipeline units within 2.5 years and accomplish other compliance activities, such as follow-up inspections and accident investigations, pipeline inspectors are expected to travel away from the office 110 days of the 220-workday year. Of the 110 days, 30 are to be spent on activities such as follow-up inspections, accident investigations, pipeline industry meetings, and inspector training. The remaining 80 days away from the office are to be spent performing comprehensive unit inspections. OPS' inspection guidelines state that a comprehensive unit inspection takes, on average, 2.5 days, including travel, to complete. Given a 2.5-year inspection frequency, each field inspector is expected to average 32 inspections per year (80 days/year divided by 2.5 days/inspection). Therefore, the total number of inspections OPS' 15 regional inspectors should perform each year is 480 (15 field inspectors times 32 inspections/inspector). The 2.5-year cycle was



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computed by dividing the 1,200 inspection units that the office was responsible for inspecting when the cycle was established by the 480 inspections the 15 field inspectors are expected to perform each year. Figure III.1 describes the computations that led to the development of the 2.5-year inspection cycle.

Figure III.1 Method OPS Used to Develop Pipeline Inspection Cycle



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# The Pipeline Inspection Priority Program

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OPS developed the Pipeline Inspection Priority Program to assist regional offices in identifying pipelines with potential safety hazards. OPS is implementing the pipeline priority program in two stages, Phase I and Phase II. Phase I data were provided to the regions in September 1987, while Phase II data are expected to be complete by December 1990.

Phase I company data provide an indication of the types of safety problems individual companies have—for example, the number of accidents. Using this information, the inspector can target specific deficiencies when inspecting other units of the same company. Phase II unit data will consist primarily of data taken from unit inspection reports. These data are designed to assess the risks associated with each unit. The data also alert the inspector to whether the unit is under a compliance order to correct a particular deficiency.

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## Phase I

Phase I of the program consists of the information reported by companies in their annual gas transmission and distribution reports, their gas distribution and hazardous liquid incident reports, and the reports OPS requires to assess user fees. Identified safety factors taken from these reports are weighted according to risk and summed to establish a company's overall ranking or safety profile. Safety factors include information such as the number of deaths and injuries in the last 3 years not caused by a third party, the ratio of miles of bare steel pipe to miles of total steel pipe, and the number of leaks repaired per mile of pipeline.

OPS headquarters and the regional chiefs developed pipeline safety ratios by identifying relationships between certain pipeline safety factors. They assigned these factors weighted numerical values, which the pipeline priority program then uses to generate company and unit rankings. Regional inspectors can use these rankings to assist in determining their pipeline unit inspection priorities.

The following are the ratios in Phase I:

- bare unprotected onshore pipeline to bare steel onshore pipeline
- bare steel onshore pipeline to total steel onshore pipeline
- onshore leaks repaired to onshore miles of pipe
- known leaks scheduled for repair to total miles of pipe
- corrosion incidents to miles of steel pipe
- construction-defects incidents to miles of onshore pipe
- coated unprotected pipeline to coated pipeline
- bare unprotected pipeline to bare steel pipeline

- bare steel pipeline to total steel pipeline
- leaks repaired on pipeline to miles of pipeline
- leaks repaired on services to number of services
- known leaks to miles of pipeline
- corrosion leak services to steel, iron, and copper services
- number of corrosion leaks to steel, iron, and copper pipeline
- number of liquid incidents reported to miles of liquid pipe
- number of distribution incident reports in last 3 years to miles of pipeline
- corrosion incidents to total incidents
- construction-defects incidents to total incidents

The following are nonratio data also found in Phase I:

Transmission system data:

- coated unprotected onshore pipe
- miles of iron pipe
- miles of "other" pipe
- number of transmission incidents reports in the last 3 years
- number of deaths or injuries not caused by third-party damage in the last 3 years
- corrosion incidents without cathodic protection

Liquid system data:

- number of corrosion incidents
- number of incorrect operation incidents
- number of failed pipe incidents
- number of failed weld incidents
- number of outside force incidents
- failure of longitudinal weld incidents
- total barrels spilled
- total deaths and injuries not caused by outside force
- corrosion incidents of noncathodically protected pipe

Distribution system data:

- type of plastic pipe present
- cast iron pipeline present
- unaccounted-for gas
- number of deaths or injuries not caused by third-party damage in last 3 years

- corrosion incidents without cathodic protection
- 

## Phase II

Phase II of the program augments the company safety profiles under Phase I with safety profiles of individual pipeline units. Phase II unit data include information such as the date of the last inspection, the number of civil penalties, and an inspector's assessment of a unit's inspection priority based on the unit's most recent inspection. Using both the Phase I and Phase II data, the pipeline priority program establishes a pipeline unit's safety ranking. The following are the safety factors that will be in Phase II:

- period of time since last comprehensive inspection of the unit
- period of time since last comprehensive inspection of any other unit of the company in region
- number of warning letters issued to unit in last 3 years
- number of warning letters issued to other units in last 3 years
- number of regulations cited in warning letters to unit in last 3 years
- number of regulations cited in warning letters to other units in last 3 years
- number of compliance cases opened against unit in last 3 years
- number of compliance cases opened against other units in last 3 years
- inspector's assessment of inspection priority based on unit's last inspection

According to OPS officials, as of January 17, 1989, the pipeline priority program needed to be further developed to allow analysis of the following data elements:

- number of compliance orders issued against unit in last 3 years
- number of compliance orders issued against other units in last 3 years
- number of civil penalties assessed against unit in last 3 years
- number of civil penalties assessed against other units in last 3 years
- number of Hazardous Facilities orders issued against unit in last 3 years
- number of Hazardous Facility orders issued against other units in last 3 years
- number of regulations cited in Final Orders for unit in last 3 years
- number of regulations cited in Final Orders for other units in last 3 years

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