Comment Letter No. 18

September 13, 2012

Mr. Bill Dean
Assistant Director of Development and Engineering Services
City of Tracy
333 Civic Center Plaza
Tracy CA 95376

RE: Ellis DEIR

Dear Mr. Dean

I write to you again regarding the Ellis project. I am completely appalled at the lack of consideration for the health and safety of potential residents. It's as if Surland Company chose the most adverse and unsuitable parcel in the City of Tracy for this project. After the first attempt and the complete rejection of the Final EIR by Superior Court, Surland Company persists in its pursuit of the project in complete disregard of the findings of the court and the concerns of the public. They have been aided in this by City employees that should be serving the public not the developer and by the Tracy City Council who in spite of the obvious and numerous deficiencies of the project site continue their rubber stamp approval of unsafe conditions for potential residents. Shame on those that continue to insist that a large subdivision over these three pipelines is feasible and safe. One does not need anything other than common sense to understand it is a disaster waiting to happen and a travesty by those involved to knowingly put so many lives in danger. 18.1

I reject the conclusions and mitigations of the DEIR relative to the pipelines. I want to again resubmit supporting documents for the DEIR of my disapproval of every aspect of Surland Company's plan to build their project in such close proximity to the pipelines. I am submitting as follows:

1) A Model for Sizing High Consequence Areas Associated with Natural Gas Pipelines
2) Building Safe Communities: Pipeline Risk and its Application to Local Development Decisions
3) Final Report of Recommended Practices PIPA
4) Landowner's Guide to Pipelines

Please ensure that the Tracy Planning Commission, City Council and your FEIR Consultant have copies of these documents and please ensure that these documents are included in the FEIR for public display and access.

In closing I want to ask this simple question. If the project had come first and thousands of residents now occupied the homes would it be acceptable to them for PG&E and Chevron (or any other hazardous materials company) to be given permission to build these pipelines through their subdivision?

Please let me know if you have any questions.

Sincerely,

Carole Dominguez

Carole Dominguez
1580 Hearthsong Dr
Manteca CA 95337
Ph 209-834-6299

GRI-00/0189

A MODEL FOR SIZING HIGH CONSEQUENCE AREAS ASSOCIATED WITH NATURAL GAS PIPELINES

TOPICAL REPORT

Prepared by:

Mark J. Stephens

C-FER Technologies
200 Karl Clark Road
Edmonton, Alberta T6N 1H2
CANADA

C-FER Report 99068

Prepared for:

GAS RESEARCH INSTITUTE
Contract No. 8174

GRI Project Manager

Keith Leewis,
Pipeline Business Unit

October 2000

REPORT DOCUMENTATION PAGE	Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information including suggestions for reducing this burden to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, D.C. 20503.

1. AGENCY USE ONLY	**2. REPORT DATE** October, 2000	**3. REPORT TYPE AND DATES COVERED** Topical Report

4. TITLE AND SUBTITLE A Model for Sizing High Consequence Areas Associated with Natural Gas Pipelines	**5. FUNDING NUMBERS** GRI Contract 8174
6. AUTHOR(S) Mark J. Stephens	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) C-FER Technologies 200 Karl Clark Road Edmonton, Alberta T6N 1H2 CANADA	**8. PERFORMING ORGANIZATION REPORT NUMBER** C-FER J068
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) GRI 8600 West Bryn Mawr Ave. Chicago, IL 60631-3562	**10. SPONSORING/MONITORING AGENCY REPORT NUMBER** GRI-00/0189
11. SUPPLEMENTARY NOTES	
12a. DISTRIBUTION/AVAILABILITY STATEMENT	**12b. DISTRIBUTION CODE**

13. ABSTRACT (*Maximum 200 words*)

This report developed a simple and defendable approach to sizing the ground area potentially affected by a worst-case ignited rupture of a high-pressure natural gas pipeline. Based on this model, a simple equation has been developed that relates the diameter and operating pressure of a pipeline to the size of the area likely to experience high consequences in the event of an ignited rupture failure. Pipeline incident reports, located in the public domain, were reviewed and provide the basis for evaluating the validity of the proposed affected area equation. The correlation suggests that the simple equation provides a credible estimate of affected area.

14. SUBJECT TERMS	**15. NUMBER OF PAGES**
	16. PRICE CODE $125

17. SECURITY CLASSIFICATION OF REPORT	**18. SECURITY CLASSIFICATION OF THIS PAGE**	**19. SECURITY CLASSIFICATION OF ABSTRACT**	**20. LIMITATION OF ABSTRACT**
Unclassified	Unclassified	Unclassified	

NSN 7540-01-280-5500 Standard Form 298 (Rev.2-89)

ii

RESEARCH SUMMARY

Title	A Model for Sizing High Consequence Areas Associated with Natural Gas Pipelines
Contractor(s)	C-FER Technologies
GRI-Contract Number	8174
Principal Investigator(s)	Mark J. Stephens
Report Type	Topical Report
Objective State	To develop a simple and defendable approach to sizing the ground area potentially affected by the failure of a high-pressure natural gas pipeline.
Technical Perspective	The rupture of a high-pressure natural gas pipeline can lead to outcomes that can pose a significant threat to people and property in the immediate vicinity of the failure location. The dominant hazard is thermal radiation from a sustained fire and an estimate of the ground area affected by a credible worst-case event can be obtained from a model that characterizes the heat intensity associated with rupture failure of the pipe where the escaping gas is assumed to feed a fire that ignites very soon after line failure.
Technical Approach	An equation has been developed that relates the diameter and operating pressure of a pipeline to the size of the affected area in the event of a credible worst-case failure event. The model upon which the hazard area equation is based consists of three parts: 1) a fire model that relates the rate of gas release to the heat intensity of the fire; 2) an effective release rate model that provides a representative steady-state approximation to the actual transient release rate; and 3) a heat intensity threshold that establishes the sustained heat intensity level above which the effects on people and property are consistent with the adopted definition of a High Consequence Area (HCA).
Results	For methane with an HCA threshold heat intensity of 5,000 Btu/hr ft^2, the hazard area equation is given by: $r = 0.685\sqrt{p d^2}$ where r is the hazard area radius (ft), d is the line diameter (in), and p is the maximum operating pressure (psi).
Project Implications	Natural gas transmission line operators will provide periodic assurances that their pipelines are safe. The Federal code 49CFR192 mandates increased wall thickness thereby reducing the corrosion and mechanical damage risks as the population density increases. The definition of High Consequence Areas is expected to require additional protection for people with limited mobility such as day care centers, old age homes, and prisons. This report suggests the definition for the HCA area of increased protection be set by two parameters, the pipe diameter and it's operating pressure.

iii

TABLE OF CONTENTS

Legal Notice i
Report Documentation ii
Research Summary iii
Table of Contents v

1. INTRODUCTION **1**

1.1 Scope and Objective 1
1.2 Technical Background 1
1.3 Report Organization 2

2. HAZARD MODEL **3**

2.1 Overview 3
2.2 Fire Model 3
2.3 Effective Release Rate Model 5
2.4 Heat Intensity Threshold 7
2.5 Hazard Area Equation 10

3. MODEL VALIDATION **12**

4. REFERENCES **15**

1. INTRODUCTION

1.1 Scope and Objective

This report summarizes the findings of a study conducted by C-FER Technologies (C-FER), under contract to the Gas Research Institute (GRI), to develop a simple and defendable approach to sizing the ground area potentially affected by the failure of a high-pressure natural gas pipeline. This work was carried out at the request of the Integrity Management and Systems Operations Technical Advisory Group (IM&SO TAG), a committee of GRI.

1.2 Technical Background

The failure of a high-pressure natural gas pipeline can lead to various outcomes, some of which can pose a significant threat to people and property in the immediate vicinity of the failure location. For a given pipeline, the type of hazard that develops, and the damage or injury potential associated with the hazard, will depend on the mode of line failure (*i.e.*, leak vs. rupture), the nature of gas discharge (*i.e.*, vertical vs. inclined jet, obstructed vs. unobstructed jet) and the time to ignition (*i.e.*, immediate vs. delayed). The various possible outcomes are summarized in Figure 1.1.

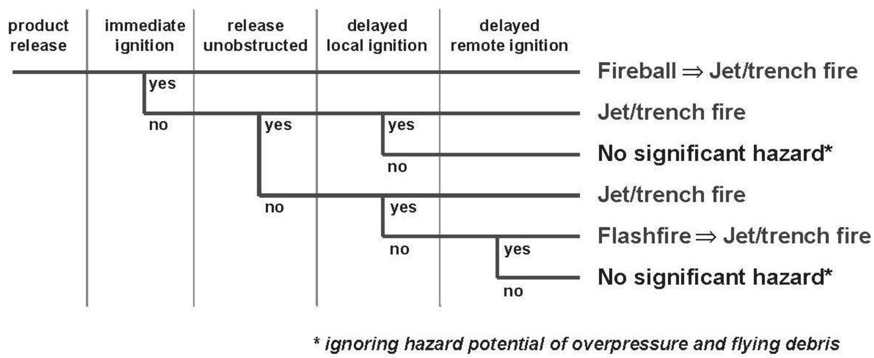


Figure 1.1 Event tree for high pressure gas pipeline failure (adapted from Bilo and Kinsman 1997).

For gas pipelines, the possibility of a significant flash fire resulting from delayed remote ignition is extremely low due to the buoyant nature of the vapor, which generally precludes the formation of a persistent flammable vapor cloud at ground level. The dominant hazard is, therefore, thermal radiation from a sustained jet or trench fire, which may be preceded by a short-lived fireball.

In the event of line rupture, a mushroom-shaped gas cloud will form and then grow in size and rise due to discharge momentum and buoyancy. This cloud will, however, disperse rapidly and a quasi-steady gas jet or plume will establish itself. If ignition occurs before the initial cloud

1

disperses, the flammable vapor will burn as a rising and expanding fireball before it decays into a sustained jet or trench fire. If ignition is slightly delayed, only a jet or trench fire will develop. Note that the added effect on people and property of an initial transient fireball can be accounted for by overestimating the intensity of the sustained jet or trench fire that remains following the dissipation of the fireball.

A trench fire is essentially a jet fire in which the discharging gas jet impinges upon an opposing jet and/or the side of the crater formed in the ground. Impingement dissipates some of the momentum in the escaping gas and redirects the jet upward, thereby producing a fire with a horizontal profile that is generally wider, shorter and more vertical in orientation, than would be the case for a randomly directed and unobstructed jet. The total ground area affected can, therefore, be greater for a trench fire than an unobstructed jet fire because more of the heat-radiating flame surface will typically be concentrated near the ground surface.

An estimate of the ground area affected by a credible worst-case failure event can, therefore, be obtained from a model that characterizes the heat intensity associated with rupture failure of the pipe, where the escaping gas is assumed to feed a sustained trench fire that ignites very soon after line failure.

Because the size of the fire will depend on the rate at which fuel is fed to the fire, it follows that the fire intensity and the corresponding size of the affected area will depend on the effective rate of gas release. The release rate can be shown to depend on the pressure differential and the hole size. For guillotine-type failures, where the effective hole size is equal to the line diameter, the governing parameters are, therefore, the line diameter and the pressure at the time of failure. Given the wide range of actual pipeline sizes and operating pressures, a meaningful fire hazard model should explicitly acknowledge the impact of these parameters on the area affected.

1.3 Report Organization

The hazard model developed to relate the area potentially affected by a failure to the diameter and pressure of the pipeline is described in Section 2.0. Validation of the proposed hazard area model, based on historical data from high-pressure gas pipeline failure incidents in the United States and Canada, is presented in Section 3.0.

2. HAZARD MODEL

2.1 Overview

An equation has been developed that relates the diameter and operating pressure of a pipeline to the size of the area likely to experience high consequences in the event of a credible worst-case failure event. The hazardous event considered is a guillotine-type line rupture resulting in double-ended gas release feeding a trench fire that is assumed to ignite soon after failure.

The hazard model upon which the hazard area equation is based consists of three parts: 1) a fire model that relates the rate of gas release to the heat intensity of the fire as a function of distance from the fire source; 2) an effective release rate model that provides a representative steady-state approximation to the actual transient release rate; and 3) a heat intensity threshold that establishes the sustained heat intensity level above which the effects on people and property are consistent with the definition of a high consequence area. Note that in the context of this study, an HCA is defined as the area within which the extent of property damage and the chance of serious or fatal injury would be expected to be significant in the event of a rupture failure.

The basis for each model, and any underlying assumptions, are described in Sections 2.2 through 2.4. The hazard area equation obtained by combining the model components is described in Section 2.5.

2.2 Fire Model

A jet flame can be idealized as a series of point source heat emitters spread along the length of the flame (see Figure 2.1). Each point source can be is assumed to radiate an equal fraction of the total heat with the heat flux I_i at a given location resulting from point source *i* being given by (Technica 1988):

$$I_i = \frac{\eta X_g Q_{eff} H_c}{4 n_p \pi x_i^2} \qquad [2.1]$$

where H_c = heat of combustion (constant for given product) ≅ 50,000 kJ/kg for methane;
η = combustion efficiency factor = 0.35;
X_g = emissivity factor = 0.2;
n_p = number of point sources;
Q_{eff} = effective gas release rate; and
x_i = radial distance from heat source *i* to the location of interest.

The total heat flux reaching a given point is obtained by summing the radiation received from each point source emitter.

3

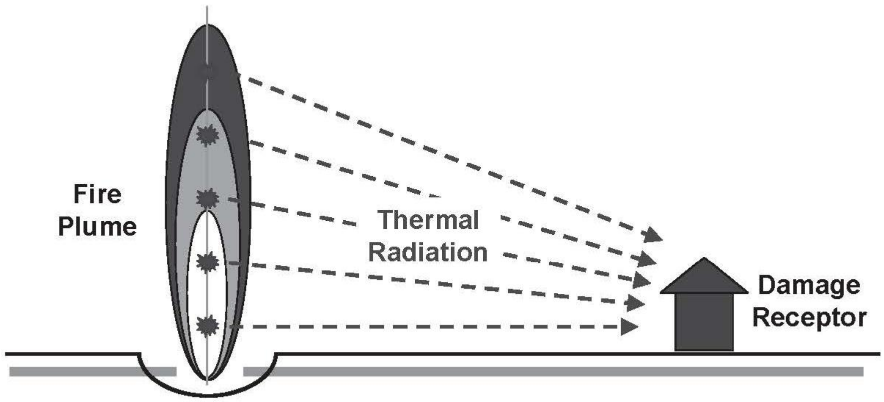


Figure 2.1 Conceptual fire hazard model.

A simplifying assumption, that generally yields a conservative estimate of the total heat flux received by ground level damage receptors, involves collapsing the set of heat emitters into a single point source emitter located at ground level (see Figure 2.2).

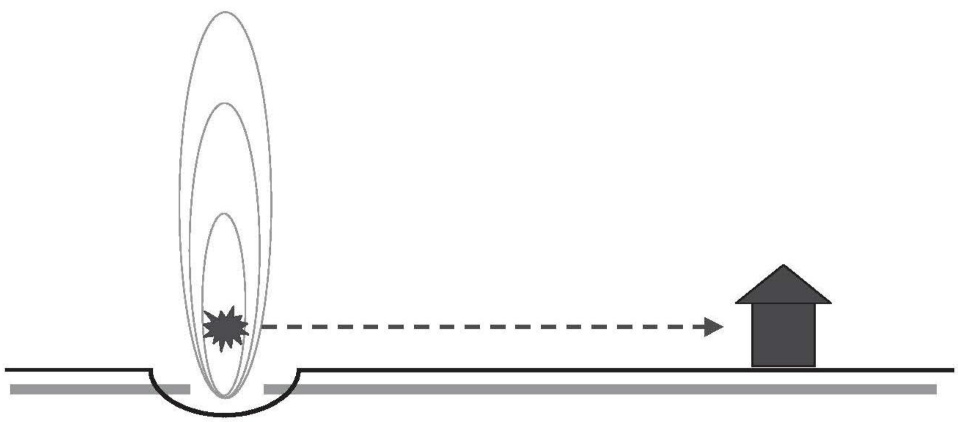


Figure 2.2 Simplified fire hazard model.

The resulting equation for the total heat flux I at a horizontal distance of r from the fire center is given by:

$$I = \frac{\eta X_g Q_{eff} H_c}{4\pi r^2} \qquad [2.2]$$

4

This simplification is, in some respects, more consistent with the geometry of a trench fire which, due to the jet momentum dissipation (see Section 1.2), concentrates more of the heat-radiating flame surface near ground level. Note, however, that while a ground-level point source model represents a conservative approximation to a vertically-oriented jet flame or trench fire, this conservatism is partially offset by the fact that the model does not explicitly account for the possibility of laterally-oriented jets and/or the effects of wind on the actual position of the fire center relative to the center of the pipeline.

Note, also, that for a single point source emitter located at ground level directly above the pipeline, the locus of points receiving a heat flux of I defines a circular area of radius r centered on the pipeline. Thermal radiation hazard zones of increasing impact severity are, therefore, described by concentric circles centered on the pipeline having radii that correspond to progressively higher heat fluxes.

The adopted heat flux versus distance relationship given by Equation [2.2] represents an extension of the widely recognized flare radiation model given in API RP 521 (API 1990). It can be shown to be less conservative than the API flare model (*i.e.*, it gives lower heat intensity estimates at a given distance) but this should not be considered surprising since the API model is widely recognized to be conservative (Lees 1996).

The adopted model is also preferred over some of the more generic, multi-purpose models available for industrial fire hazard analysis because it acknowledges factors, ignored by other models, that play a significant role in mitigating the intensity of real-world jet fire events. In particular, it accounts for the incomplete combustion of the escaping gas stream (through the combustion efficiency factor η), and it acknowledges (through the emissivity factor X_g) that a significant portion of the radiant heat energy will be absorbed by the atmosphere before it can reach targets at any significant distance from the flame surface.

2.3 Effective Release Rate Model

The rate of gas release from a full-bore line rupture varies with time. Within seconds of failure, the rate of release will have dropped to a fraction of the peak initial value and over time the release rate will decay even further. This tendency for rapid release rate decay is illustrated in Figure 2.3, which shows how the rate would be expected to vary with time for two representative line diameter and operating pressure combinations. The relative release rate estimates shown in the figure were calculated using a non-dimensional rate decay model presented in a study by the Netherlands Organization of Applied Scientific Research, Division of Technology for Society (TNO 1982) which is based on realistic gas flow and decompression characteristics and which acknowledges both the compressibility of the gas and the effects of pipe wall friction.

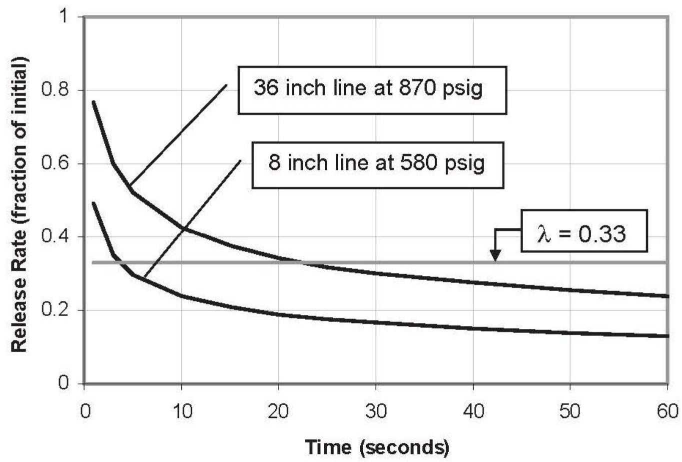


Figure 2.3 Release rate decay.

The peak initial release rate from the single end of a full-bore line rupture can be estimated using the widely recognized gas discharge equation given by the Crane Co. (1981) for sonic or choked flow through an orifice:

$$Q_{in} = C_d \frac{\pi d^2}{4} p \frac{\varphi}{a_0} \qquad [2.3a]$$

where φ = flow factor = $\gamma \left(\frac{2}{\gamma + 1} \right)^{\frac{\gamma+1}{2(\gamma-1)}}$; [2.3b]

a_0 = sonic velocity of gas = $\sqrt{\frac{\gamma R T}{m}}$; [2.3c]

C_d = discharge coefficient ≅ 0.62;

γ = specific heat ratio of gas ≅ 1.306 for methane;

R = gas constant = 8,310 J/(kg mol)/K;

T = gas temperature ≅ 288 K or 15 C;

m = gas molecular weight ≅ 16 kg/mol for methane;

d = effective hole diameter ≅ line diameter; and

p = pressure differential ≅ line pressure.

Given that the release rate is highly variable, it follows that the size and intensity of the associated fire will also vary with time and the peak intensity of the fire will depend on exactly

6

when ignition occurs. The hazard model developed herein accounts for the above by approximating the transient jet or trench fire as a steady state fire that is fed by an *effective* release rate. The effective release rate is a fractional multiple of the peak initial release rate that can be used to obtain estimates of sustained heat flux that are comparable to those obtained from a more realistic transient fire model that assumes a slight delay in ignition time.

For a guillotine-type failure of a pipeline resulting in double-ended release, the effective release rate that is assumed to feed a steady-state fire is given by:

$$Q_{eff} = 2\lambda Q_{in} = 2\lambda C_d \frac{\pi d^2}{4} p \frac{\varphi}{a_0} \qquad [2.4]$$

where λ is the release rate decay factor and the factor of 2 acknowledges that gas will be escaping from both failed ends of the pipeline.

In general, the most appropriate value for the release rate decay factor will depend on the size of pipeline being considered, the pressure in the line at the time of failure, the assumed time to ignition, and the time period required to do damage to property or cause harm to people. Given that even immediate ignition will require several seconds for the establishment of the assumed radiation conditions and given further that a fatal dose of thermal radiation can be received from a pipeline fire in well under 1 minute (see Section 2.4), it follows from Figure 2.3 that a rate decay factor in the range of 0.2 to 0.5 will likely yield a representative steady state approximation to the release rate for typical pipelines.

In a study of the risks from hazardous pipelines in the United Kingdom conducted by A. D. Little Ltd. (Hill and Catmur 1995), the authors report using a release rate decay factor of 0.25. A slightly more conservative value for λ of 0.33 has been adopted herein to ensure that the sustained fire intensity associated with nearly immediate ignition of fires associated with large diameter pipelines will not be underestimated (see Figure 2.3). Given that anecdotal information on natural gas pipeline failures suggests that the time to ignition may typically be in the range of 1 to 2 minutes (as in the Edison, New Jersey incident of 1994), the adopted release rate decay factor will likely yield an effective release rate estimate that overestimates the actual rate for the full duration of a typical gas pipeline rupture fire.

2.4 Heat Intensity Threshold

For people, the degree of harm caused by thermal radiation is usually estimated using a model that relates the chance of burn injury or fatality to the thermal load received where the thermal load L_p is given by an equation of the form (Lees 1996):

$$L_p = t\, I^n \qquad [2.5]$$

where t is the exposure duration, I is the heat flux and n is an index.

Various recognized thermal load vs. effect models based on Equation [2.5] are summarized in Table 2.1 together with calculated estimates of the exposure times required to reach various

7

conditions of injury and mortality for persons exposed to specified heat intensity levels. If it is assumed that within a 30 second time period an exposed person would remain in their original position for between 1 and 5 seconds (to evaluate the situation) and then run at 5 mph (2.5 m/s) in the direction of shelter, it is estimated that within this period of time they would travel a distance of about 200 ft (60 m). On the further assumption that, under typical conditions, a person can reasonably be expected to find a sheltered location within 200 ft of their initial position, a 30 second exposure time is considered credible and is, therefore, adopted as the reference exposure time for people outdoors at the time of failure.

Radiation Intensity or Heat Flux (Btu/hr ft^2)	Radiation Intensity or Heat Flux (kW/m^2)	Time to Burn Threshold (Eisenberg et al. 1975) $t*I^{1.15} = 195$	Time to Blister Threshold - lower[1] (Hymes 1983)[2] $t*I^{1.33} = 210$	Time to Blister Threshold - upper[1] (Hymes 1983)[2] $t*I^{1.33} = 700$	Time to 1% Mortality (Hymes 1983)[2] $t*I^{1.33} = 1060$	Time to 50% Mortality (Hymes 1983)[2] $t*I^{1.33} = 2300$	Time to 100% Mortality[3] (Bilo & Kinsman 1997) $t*I^{1.33} = 3500$
1600	5.05	30.3	24.4	81.3	123.1	267.1	406.4
2000	6.31	23.5	18.1	60.4	91.5	198.5	302.1
3000	9.46	14.7	10.6	35.2	53.4	115.8	176.2
4000	12.62	10.6	7.2	24.0	36.4	79.0	120.2
5000	15.77	8.2	5.4	17.9	27.0	58.7	89.3
8000	25.24	4.8	2.9	9.6	14.5	31.4	47.8
10000	31.55	3.7	2.1	7.1	10.8	23.3	35.5
12000	37.85	3.0	1.7	5.6	8.4	18.3	27.9

Note:
1) Hymes gives a thermal load range (210 to 700) rather than a single value for blister formation
2) the thermal load values given by Hymes are based on a revised interpretation of the results obtained by Eisenberg et al.
3) Bilo and Kinsman assume that 100% mortality corresponds to a lower bound estimate of the thermal load associated with the spontaneous ignition of clothing

Table 2.1 Effects of thermal radiation on people.

The exposure time estimates closest to this reference time are highlighted in Table 2.1 for each different thermal load effect. Note that the onset of burn injury within the reference exposure time is associated with a heat flux in the range of 1,600 to 2,000 Btu/hr ft^2 (5 to 6.3 kW/m^2), depending on the burn injury criterion. The chance of fatal injury within the reference exposure time becomes significant at a heat flux of about 5,000 Btu/hr ft^2 (15.8 kW/m^2), if the significance threshold is taken to be a 1% chance of mortality (*i.e.,* 1 in 100 people directly exposed to this thermal load would not be expected to survive).

For property, as represented by a wooden structure, the time to both piloted ignition (*i.e.,* with a flame source present) and spontaneous ignition (*i.e.,* without a flame source present) can also be estimated as a function of the thermal load received. For buildings, the thermal load L_b is given by an equation of the form (Lees 1996):

$$L_b = (I - I_x)t^n \quad [2.6]$$

where I_x is the heat flux threshold below which ignition will not occur.

Models based on Equation [2.6], developed from widely cited tests as re-interpreted by the UK Health and Safety Executive (Bilo and Kinsman 1997), are summarized in Table 2.2 together with calculated estimates of the exposure times required for both piloted and spontaneous ignition at selected heat intensity levels.

8

Radiation Intensity or Heat Flux ($Btu/hr\ ft^2$)	Radiation Intensity or Heat Flux (kW/m^2)	Time to Piloted Ignition[1] (Bilo & Kinsman 1997) $(I-14.7)*t^{0.667}=118.6$	Time to Spontaneous Ign.[1] (Bilo & Kinsman 1997) $(I-25.6)*t^{0.8}=167.6$
4000	12.62	no ignition	no ignition
5000	15.77	1162.3	no ignition
8000	25.24	37.8	no ignition
10000	31.55	18.7	65.0
12000	37.85	11.6	26.3
Note: 1) based on experiments on American whitewood			

Table 2.2 Effects of thermal radiation on wooden structures.

From Table 2.2 it can be seen that 5,000 Btu/hr ft^2 (15.8 kW/m^2), corresponds to piloted ignition after about 20 minutes (1,200 seconds) of sustained exposure. The table further shows that spontaneous ignition is not possible at this heat intensity level. It is therefore assumed that this heat intensity represents a reasonable estimate of the heat flux below which wooden structures would not be destroyed, and below which wooden structures should afford indefinite protection to occupants.

Note that the model employed for estimating the effects of thermal radiation on property explicitly considers the duration of exposure required to cause ignition. Some earlier wood ignition models, which appear to be the basis for the often cited 4,000 Btu/hr ft^2 (12.6 kW/m^2) threshold for piloted wood ignition, are in fact associated with an almost indefinite time to ignition and are, therefore, considered to be overly conservative given the transient (decaying) nature of real pipeline rupture fires.

In light of the above, if a high consequence area is defined as the area within which both the extent of property damage and the chance of serious or fatal injury would be expected to be significant, it follows that this area can reasonably be defined by a heat intensity contour corresponding to a threshold value below which:

- property, as represented by a typical wooden structure, would not be expected to ignite and burn;
- people located indoors at the time of failure would likely be afforded indefinite protection; and
- people located outdoors at the time of failure would be exposed to a finite but low chance of fatality.

The information presented on thermal load effects suggests that below 5,000 Btu/hr ft^2, a wooden structure would not be expected to burn and it, thereby, affords indefinite protection to sheltered persons. Also, this heat intensity level corresponds to approximately a 1 percent chance of fatality for persons exposed for a credible period of time before reaching shelter. A heat flux of 5,000 Btu/hr ft^2 has, therefore, been adopted as the threshold heat intensity for the purpose of sizing a high consequence area.

2.5 Hazard Area Equation

Substituting the expression developed for the effective release rate (Equation [2.4]) into the heat intensity versus distance formula (Equation [2.2]), replacing all constants and rearranging gives the following expression for the radial distance to locations where the heat flux is equal to the threshold value:

$$r = \sqrt{\frac{2348\, p\, d^2}{I_{th}}} \quad \text{(ft)} \qquad [2.7]$$

where I_{th} = threshold heat intensity (Btu/hr/ft^2);
p = line pressure (psi); and
d = line diameter (in).

For a threshold heat intensity of 5,000 Btu/hr ft^2, the above expression reduces to:

$$r = 0.685\sqrt{p\, d^2} \qquad [2.8]$$

Equation [2.8] can, therefore, be used to estimate the radius of a circular area surrounding the assumed point of line failure within which the impact on people and property would be expected to be consistent with the adopted definition of a high consequence area.

Hazard area radii, as calculated using Equation [2.8] are plotted in Figure 2.4 as a function of line diameter and operating pressure. The figure shows that, for pipelines operating at pressure levels in the range of 600 to 1,200 psi, the calculated hazard area radius ranges from under 100 ft for small diameter lines to over 1,100 ft for large diameter lines.

Note that the concept of relating the potential hazard area to the line diameter and operating pressure is not new. An approach similar to that described herein has been an integral part of the high pressure gas transmission pipeline code in the United Kingdom since 1977 (Knowles *et al.* 1978 and IGE 1993). The standard as developed in the United Kingdom incorporates the concept of a Building Proximity Distance (BPD), multiples of which serve to define development exclusion zones and establish the pipeline corridor width for the purpose of determining Location Class. The BPD is calculated directly from the line diameter and the maximum operating pressure.

10

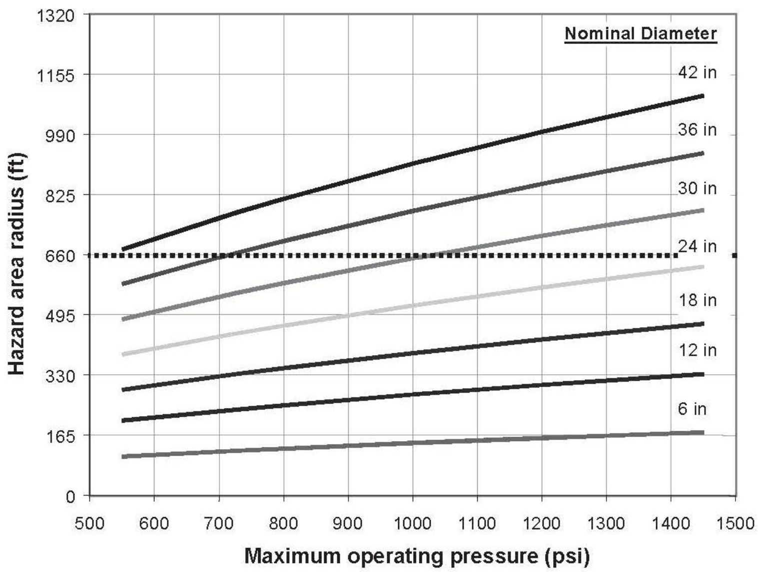


Figure 2.4 Proposed hazard area radius as a function of line diameter and pressure.

11

3. MODEL VALIDATION

Pipeline incident reports, located in the public domain, were reviewed to provide a basis for evaluating the validity the proposed hazard area model given by Equation [2.8]. The data sources reviewed included reports on pipeline incidents in the United States prepared by the National Transportation Safety Board (NTSB) going back to 1970, and similar reports on incidents in Canada prepared by the Transportation Safety Board (TSB) going back to 1994. Note that the information extracted from these reports required some interpretation due to differences in the way the information was reported. The processed data together with hazard area estimates obtained using Equation [2.8] are summarized in Figure 3.1. A summary of the information that forms the basis for Figure 3.1 is given in Table 3.1.

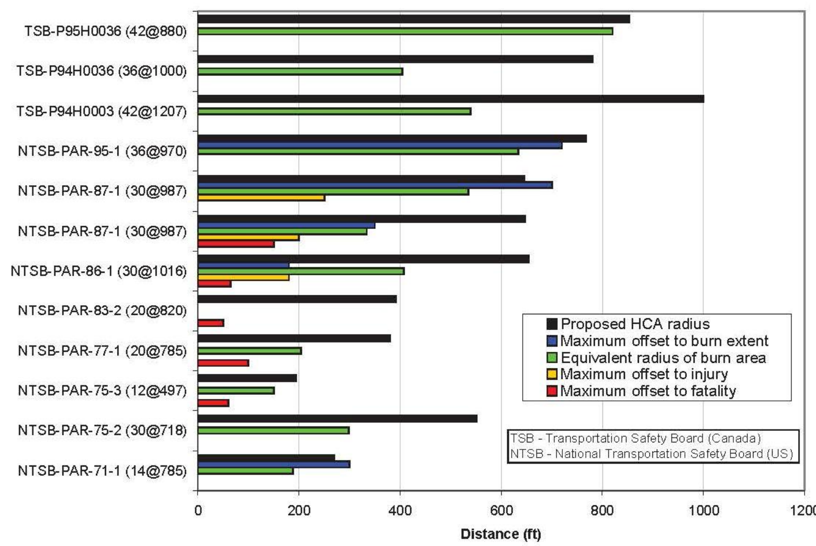


Figure 3.1 Comparison between actual incident outcomes and the proposed hazard area model.

In interpreting the incident outcomes summarized in Figure 3.1 note the following:

- the *equivalent radius of burn area* is the radius of a circle having an area equal to the reported area of burnt ground;
- the *maximum offset to burn extent* is the maximum reported of inferred lateral extent of burnt ground measured perpendicular to a line tracing the alignment of the pipeline prior to failure; and
- the *maximum offset to injury/fatality* is the maximum reported or inferred distance to an injury/fatality again measured perpendicular to a line tracing the alignment of the pipeline prior to failure.

12

Figure 3.1 shows that in every case the hazard area calculated using the proposed equation is greater than the actual reported area of burnt ground. In addition, with the sole exception of one of the incidents reported in NTSB-PAR-87-1, the radius obtained from the hazard area equation conservatively approximates the maximum lateral extent of the burn zone. Finally, in all cases the calculated hazard zone radius significantly exceeds the maximum reported offset distance to injury or fatality.

Note, however, that whereas the interpretation of reported burn areas and burn distances is obvious, caution should be exercised in interpreting maximum offset distances to injury and fatality. Given that most of the incidents occurred in sparsely populated areas, the reported injury and fatality offsets are more indicative of where people happened to be at the time of failure rather than being representative of the maximum possible distances to injury or fatality for the incident in question.

Acknowledging the uncertainty associated with interpreting reported offsets to injury and fatality, the balance of information still overwhelmingly indicates that the proposed hazard area radius equation provides a reasonable, if somewhat conservative, estimate of the zone of high consequence.

It is thought that one of the main reasons for the apparent conservatism in the proposed hazard area model is that it is based on an effective sustained release rate that is consistent with the assumption of almost immediate ignition. The actual time to ignition for many of the reported incidents is probably longer (see incident notes in Table 3.1) making the effective release rate approximation conservative.

Date	Report	Location	Incident	Damage	Maximum Burn Distance	Diameter (in)	Pressure (psi)
1969	NTSB-PAR-71-1	near Houston, Texas	Rupture at 3:40 p.m. on September 9th, explosive ignition 8 to 10 minutes after failure.	Burned area 370 ft long by 300 ft wide (all to one side). Houses destroyed by blast to 250 ft, heat damage to 300 ft, 106 homes damaged, 9 injuries, and 0 fatalities.	300 ft	14	789
1974	NTSB-PAR-75-2	near Bealeton, Virginia		Burned area 700 ft by 400 ft.		30	718
1974	NTSB-PAR-75-3	near Farmington, New Mexico	Rupture at 3:45 a.m. on March 15th, ignition soon after failure.	Earth charred within a 300 ft diameter circle, 3 fatal injuries (within 60 ft offset)		12.75	497
1976	NTSB-PAR-77-1	Cartwright, Louisiana	Rupture at 1:05 p.m. on August 9th, ignited within seconds	Burn area 3 acres (implies a 200 ft radius circle), 6 fatalities (within about 100 ft offset) and 1 injury.		20	770
1982	NTSB-PAR-83-2	Hudson, Iowa		5 fatalities (within 150 ft, less than 50 ft offset).		20	820
1984	NTSB-PAR-86-1	near Jackson, Louisiana	Rupture at 1:00 p.m. on November 25th, ignition soon after failure.	Burned area 1450 ft long by 360 ft wide (furthest fire extent 950 ft), 5 fatalities (within 65 ft, 0 ft offset), and 23 injuries (within 800 ft,180 ft offset).	Offset 180 ft. Distance 950 ft.	30	1016
1985	NTSB-PAR-87-1	near Beaumont, Kentucky	Rupture at 9:10 p.m. on April 27th, ignition soon after failure.	Burned area 500 ft wide by 700 ft long. 2 houses, 3 house trailers and numerous other structures and equipment destroyed. 5 fatalities due to smoke inhalation in house 318 ft from rupture (150 ft offset), 3 people burned running from house 320 ft from rupture (200 ft offset) one hospitalized with 2nd degree burns.	Offset 350 ft. Distance 500 ft.	30	990
1986	NTSB-PAR-87-1	near Lancaster Kentucky	Rupture at 2:05 a.m. on February 21st, ignition soon after failure.	Burned area 900 ft by 1000 ft. 2 houses, 1 house trailer and numerous other structures and equipment destroyed. 3 people burned running from house 280 ft from rupture (requiring hospitalization), 5 others received minor burn injuries running from dwellings between 200 and 525 ft from rupture (250 ft offset).	Offset 700 ft. Distance 800 ft.	30	987
1994	NTSB-PAR-95-1	Edison, New Jersey	Rupture at night on March 23rd, ignition within 1 to 2 minutes after failure.	Burned area 1400 ft long by 900 ft wide. Fire damage to dwelling units up to 900 ft from rupture, dwelling units at 500 ft and beyond caught fire between 7 to 10 minutes after failure, no fatalities but 58 injuries.	Offset 720 ft. Distance 960 ft.	36	970
1994	TSB Report No. P94H0003	Maple Creek, Saskatchewan	Rupture at 7:40 p.m. on February 14th, ignition soon after failure.	Fire burn area 21.0 acres (8.5 hectares).		42	1207
1994	TSB Report No. P94H0036	Latchford, Ontario	Rupture at 7:13 a.m. on July 23rd, ignition soon after failure.	Fire burn area 11.8 acres (4.77 hectares), heat-affected area 18.6 acres (7.52 hectares).		36	1000
1995	TSB Report No. P95H0036	Rapid City, Manitoba	Rupture of 42 inch line at 5:42 a.m. on July 29th, ignition soon after failure leading to rupture and fire on adjacent 36 inch line at 6:34 a.m.	Fire burn area 48.5 acres (19.6 hectares), heat-affected area 198 acres (80 hectares).		42	880

Table 3.1 Summary of relevant North American pipeline failure incident reports.

14

4. REFERENCES

API 1990. Guide for Pressure-Relieving and Depressuring Systems. American Petroleum Institute, Recommended Practice 521, Third Edition, November.

Bilo, M. and Kinsman, P.R. 1997. Thermal Radiation Criteria Used in Pipeline Risk Assessment. Pipes & Pipelines International, November-December, pp. 17-25.

Crane Co. 1981. Flow of Fluids through Valves, Fittings and Pipe, Metric Edition - SI Units. Technical Paper No. 410M, Crane, NY, USA.

Eisenberg, N.A., Lynch, C.J. and Breeding, R.J. 1975. Vulnerability Model: A Simulation System for Assessing Damage Resulting from Marine Spills. Environmental Control, Report CG-D-136-75, Rockville, MD, USA.

Hill, R.T. and Catmur, J.R. 1995. Risks from Hazardous Pipelines in the United Kingdom. Health and Safety Executive Contract Research Report No. 82/1994.

Hymes, I. 1983. The Physiological and Pathological Effects of Thermal Radiation. Systems Reliability Directorate, Report SRD, R275, Culcheth, Warrington, UK.

IGE 1993. Steel Pipelines for High Pressure Gas Transmission. Recommendations on Transmission and Distribution Practice IGE/TD/1 Edition 3 (Communication 1530), The Institution of Gas Engineers, London, UK.

Knowles, A.E., Tweedle, F. and van per Post, J.L. 1978. The Background and Implications of IGE/TD/1 Edition 2. Gas Engineering and Management, July, p. 247.

Lees, F.P. 1996. Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control. Second Edition, Vol. 2, Butterworth-Heinemann, A division of Reed Educational and Professional Publishing Ltd., Oxford, UK.

Technica 1988. Techniques for Assessing Industrial Hazards: A Manual. World Bank Technical Paper Number 55, The International Bank for Reconstruction and Development, The World Bank, Washington, DC, USA.

TNO 1982. Safety Study on the Transportation of Natural Gas and LPG by Underground Pipeline in the Netherlands. Netherlands Organization for Applied Scientific Research, Ref. No. 82-04180, File No. 8727-50960, translation of a report by the Division of Technology for Society, commissioned by The Minister of Public Health and Environmental Hygiene, The Netherlands.

U.S. Department of Transportation

Pipeline and Hazardous Materials Safety Administration

Building Safe Communities: Pipeline Risk and its Application to Local Development Decisions

Office of Pipeline Safety

October, 2010

Table of Contents

I. Purpose ... 3

II. Background ... 3

III. Pipeline Risks and Risk Mitigation ... 7

Pipeline Risks ... 7

Risk Mitigation ... 9

IV. Historical Safety Performance of Onshore Gas Transmission & Hazardous Liquid Pipelines ... 10

Hazardous Liquid Pipelines ... 11

Gas Transmission Pipelines ... 13

Incident Causes ... 15

V. Relative Risk of Transmission Pipelines ... 20

VI. Summary and Conclusions ... 28

Appendix: Pipeline Integrity Management Programs ... 30

Table of Figures

Figure 1: U. S. Network of Hazardous Liquid and Natural Gas Transmission Pipelines ... 4

Figure 2: Hazardous Liquid Pipeline Mileage by Decade of Installation ... 5

Figure 3: Onshore Natural Gas Transmission Pipeline Mileage by Decade of Installation ... 5

Figure 4: Trends in Hazardous Liquid Onshore Incidents: 1990-2009 ... 11

Figure 5: Trends in Fatalities and Injuries in Hazardous Liquid Onshore Incidents: 1990-2009 ... 12

Figure 6: Trends in Natural Gas Transmission Onshore Incidents: 1990-2009 ... 14

Figure 7: Trends in Fatalities and Injuries in Natural Gas Onshore Transmission Incidents: 1990-2009 ... 15

Figure 8: Causes of Significant Onshore Hazardous Liquid Pipeline Incidents ... 16

Figure 9: Causes of Gas Transmission Pipeline Significant Onshore Incidents ... 16

Figure 10: Causes of Significant Onshore Hazardous Liquid Pipeline Incidents ... 17

Figure 11: Causes of Gas Transmission Pipeline Significant Onshore Incidents ... 18

Figure 12: Causes of Onshore Hazardous Liquid Pipeline Serious Incidents 2005-2009 ... 19

Figure 13: Causes of Onshore Gas Transmission Pipeline Serious Incidents 2005-2009 ... 19

Building Safe Communities:

Pipeline Risk and its Application to Local Development Decisions

I. Purpose

Developing and applying recommended practices for land use and development in areas near pipelines is one means of addressing pipeline risks to communities. The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA), Office of Pipeline Safety (OPS), is sponsoring the Pipelines and Informed Planning Alliance (PIPA) to develop these recommended practices. A balanced view of the risks involved with pipelines and their relation to land use planning and development decisions by local governments, landowners, and property developers is important for effective application of the recommended practices.

The purpose of this report is to assist local governments and developers in better understanding pipeline risks and to provide a context for the use of recommended practices for development near hazardous liquid and gas transmission pipelines. This report aims to provide a context for local governments and developers to better understand pipeline risks through discussion of the following areas:

- Risks that transmission pipelines pose to the community and mitigation of those risks;
- Transmission pipeline historical safety performance;
- Comparison between pipeline historical risk and historical risk from the release of hazardous materials from other modes of transportation;
- Specific regulations covering pipeline operations that could affect populated areas, drinking water sources, and ecologically sensitive areas.

II. Background

A vast network of hazardous liquid and gas transmission pipelines[1] traverses the United States (see Figure 1 below). Approximately 294,000 miles of onshore gas transmission pipelines and 164,000 miles of onshore hazardous liquid pipelines move natural gas, crude oil, and petroleum products throughout the U.S. every day[2]. These pipelines transport commodities from producers, refiners, and processors to industrial and commercial end users, as well as to terminals and distribution companies. Transmission pipelines transport a high volume of commodities over long distances, with approximately two-thirds of

[1] Hazardous liquid and gas transmission pipelines will be collectively referred to as "transmission pipelines" throughout this study. Transmission pipelines, which are the subject of this report and the PIPA Final Report, are distinct from "gathering" and "distribution" pipelines. Gathering pipelines transport gas or liquids from production facilities to transmission pipelines. Distribution pipelines are used to supply natural gas to the consumer and are located downstream of a natural gas transmission pipelines. See 49CFR192.3 for definitions of gas "transmission," "gathering," and "distribution" pipelines. See 49CFR195.2 for the definition of a hazardous liquid "gathering" pipeline.

[2] This is average mileage from annual reports for hazardous liquid and gas transmission onshore pipelines during 2004-2008. Mileage data may be found here on the OPS website.

3

the ton-miles of the nation's oil and petroleum products transported by pipelines[3] and nearly all natural gas used in the U.S. transported by transmission pipelines.

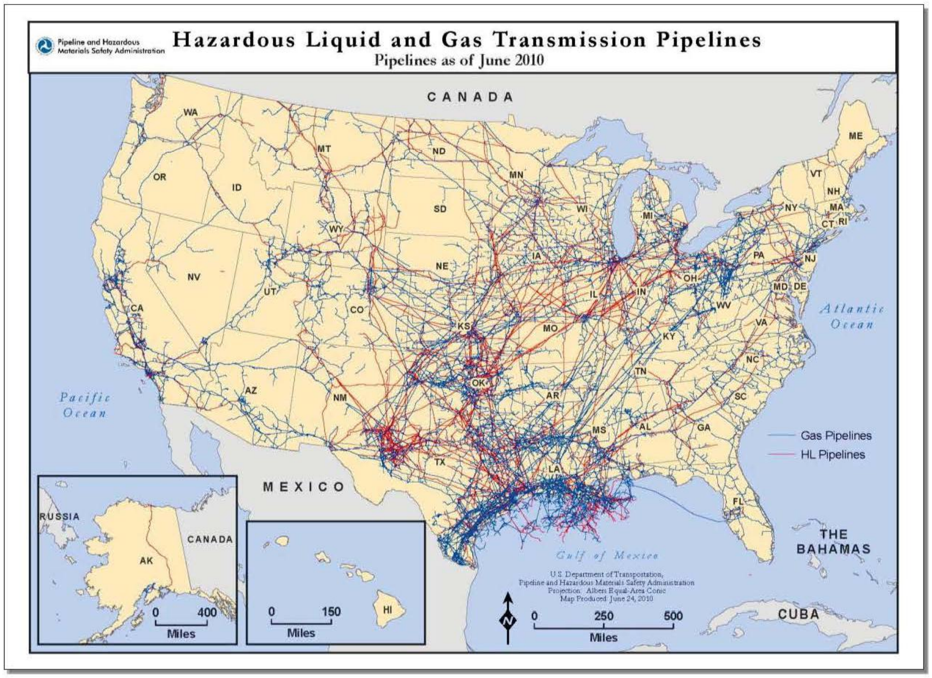


Figure 1: U. S. Network of Hazardous Liquid and Natural Gas Transmission Pipelines[4]

Across the U.S., transmission pipelines are often located in rights-of-way adjacent to and across land used for other purposes, such as residences, businesses, farms and industrial facilities. In these locations, people may spend extended periods of time in close proximity to pipelines. Many of these transmission pipelines have been in place for decades and often pre-date the surrounding development. Many portions of existing transmission pipelines were originally constructed in sparsely populated areas, but subsequent population growth over time transformed some of these areas into more populated and developed areas, with increasing development of housing subdivisions, schools, shopping centers, industrial/business parks, etc. Simultaneously, economic growth over time has generated demand for construction of more pipelines to meet growing needs for energy.

[3] http://aopl.org/aboutPipelines/. Operators of hazardous liquid pipelines reported transporting 3.9 trillion barrel-miles of crude oil, refined products, and highly volatile liquids in 2009 annual reports to PHMSA.
[4] Source: National Pipeline Mapping System (NPMS) maintained by OPS.

4

According to infrastructure information collected by OPS, at least 55% of currently operating hazardous liquid pipelines was installed before 1970 and at least 71% was installed before 1980. Figure 2 below shows the breakdown of hazardous liquid pipeline mileage by decade of installation.

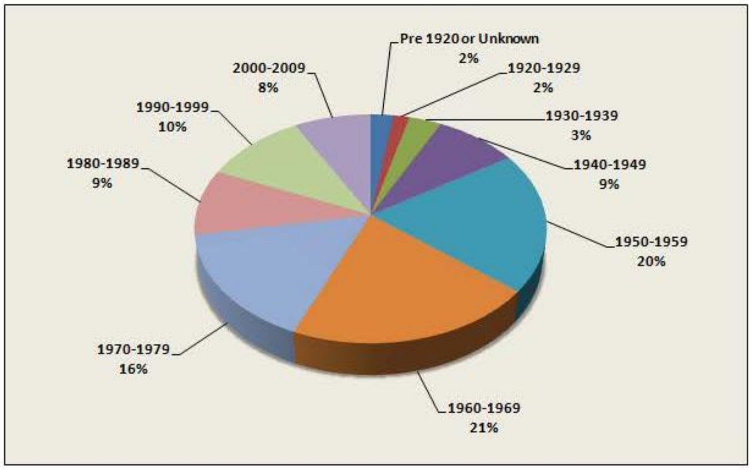


Figure 2: Hazardous Liquid Pipeline Mileage by Decade of Installation[5]

This breakdown is similar for onshore natural gas transmission pipelines. As shown on Figure 3 below, at least 59% of onshore gas transmission pipeline mileage was installed before 1970 and at least 69% was installed before 1980.

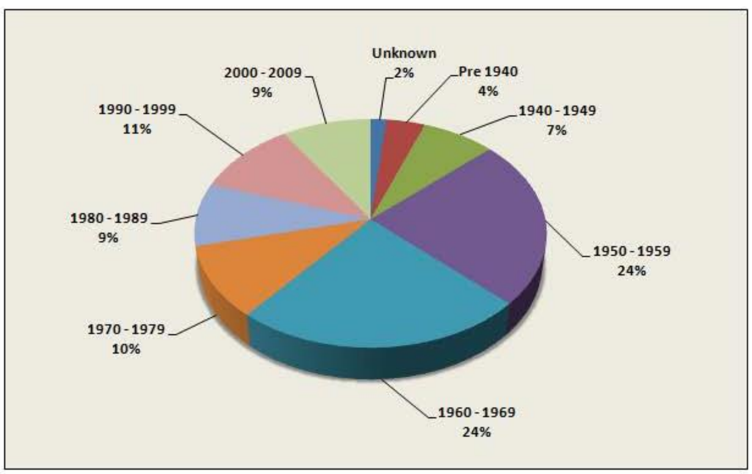


Figure 3: Onshore Natural Gas Transmission Pipeline Mileage by Decade of Installation

[5] Includes both onshore and offshore pipelines. Data on decade of installation is not recorded separately for onshore and offshore hazardous liquid pipelines.

5

As additional homes, businesses, and schools are constructed and other development occurs, more people will be living, working, and shopping in the vicinity of transmission pipelines. Similarly, with increasing demand for energy, it is likely that new transmission pipelines will be constructed in areas of existing development. Because of these expected trends, local governments are increasingly required to make decisions concerning land use planning and development in the vicinity of transmission pipelines.

The federal government, along with its state partner agencies, regulates the safe construction, testing, operation, and maintenance of the nation's transmission pipelines. In addition, federal pipeline safety regulations include targeted regulations for inspecting and managing the integrity of pipeline segments that have the potential to impact populated and developed areas[6].

Permitting and routing of interstate natural gas pipelines are approved by the Federal Energy Regulatory Commission (FERC). State agencies (e.g. Public Utility Commissions) approve the permitting and routing of intrastate natural gas pipelines and hazardous liquid transmission pipelines

Local governments (and in some cases state governments), rather than the federal government, are the most common regulators of land use and property development, including land use and development near pipelines. Some local governments have enacted or are developing ordinances to regulate land use and development near transmission pipelines. Examples include St. Peters, Missouri; Edison Township, New Jersey; Austin, Texas; Olathe, Kansas; Redmond and Whatcom County, Washington; and Brookings County, South Dakota. In 2004, a study[7] was conducted to examine how local governments, property owners, and developers should approach such development. The study concluded that recommended practices should be developed for decision-makers to apply when addressing proposed land use and property development near transmission pipelines.

Recommended practices for land use and development in areas near transmission pipelines is one means of addressing pipeline risks to communities. The Pipelines and Informed Planning Alliance (PIPA) was initiated to develop such recommended practices. PIPA is a collaboration of pipeline safety stakeholders, including representatives of: local, state and federal governments; the pipeline industry; property development organizations; home builder associations; fire marshals; and pipeline safety advocacy organizations. PIPA's work to develop recommended practices raised the question of how risks posed by transmission pipelines – to residential, commercial, and other development in populated areas – should be considered in land use planning and decision making.

Each community faces a variety of risks from many causes, including, motor vehicle accidents, household accidents, natural hazards, and industrial accidents. Control and mitigation of these risks involves a combination of measures employed by the sources of the risks, regulatory bodies, community groups and individual efforts. For example, motor vehicle risks are reduced by measures taken by the motor vehicle manufacturer, road designer and builder, local government (through the placement of road signs and traffic signals and enforcement of road safety laws), and by individual initiatives (through safe driving habits and seat belt use, etc).

[6] See the appendix to this report for more detail on these regulations, called "Pipeline Integrity Management" regulations.
[7] Special Report 281, *Transmission Pipelines and Land Use*, Transportation Research Board of the National Academies. 2004.

III. Pipeline Risks and Risk Mitigation

Pipeline Risks

Risks to the public from hazardous liquid and gas transmission pipelines result from the potential unintentional release of products transported through the pipelines. Releases of products carried by pipelines can impact surrounding populations, property, and the environment, and may result in injuries or fatalities as well as property and environmental damage.

These consequences may result from fires or explosions caused by ignition of the released product, as well as possible toxicity and asphyxiation effects. Some releases can cause environmental damage, impact wildlife, or contaminate drinking water supplies. Releases can also have significant economic effects, such as business interruptions, damaged infrastructure, or loss of supplies of fuel such as natural gas, gasoline, and home heating oil.

The potential consequences of transmission pipeline releases vary according to the commodity that is released as well as characteristics of the surrounding area. Gas transmission pipelines transport natural gas almost exclusively[8]. Natural gas releases pose a primarily acute hazard. If an ignition source exists, a release of gas can result in an immediate fire or explosion near the point of the release. This hazard is reduced over a relatively short period after the release ends as the gas disperses. If the vapors accumulate inside a building, then the hazard may remain longer[9]. There is also a possibility that the size or movement of the vapor cloud could result in consequences away from the initial point of the release, but because natural gas is lighter than air, this situation is not common. Structures and topographic features in the vicinity of a release can serve as barriers and mitigate the consequences of the release for other nearby areas.

Hazardous liquid pipelines transport a greater variety of products (including petroleum, petroleum products, natural gas liquids, anhydrous ammonia, and carbon dioxide), so the risks of hazardous liquid pipeline releases vary according to the commodity involved. Releases of some commodities transported in hazardous liquid pipelines, such as propane, pose primarily an acute hazard of fire or explosion, similar to natural gas. These commodities have a high vapor pressure and are in liquid form while transported under pressure in a pipeline. However, if they are released from the pipeline, they will convert to gas as the pressure is reduced. Some of these commodities have densities greater than air, so they have a stronger propensity to remain near the ground than natural gas, which disperses more readily. The behavior of these commodities when released presents some different challenges for mitigation, compared to other hazardous liquids or natural gas.

Releases of other hazardous liquids, such as gasoline and crude oil, have both acute and more long-term potential consequences, as the released product can spread over land and water, flowing into valleys, ravines, and waterways. This can result in harmful consequences to people and to the environment, including human injuries or fatalities from fire or explosion, as well as potential ecological damage and contamination of drinking water supplies occurring some distance from the point of initial release.

---

[8] A very small percentage of gas transmission pipelines transport other commodities such as hydrogen and chlorine, as well as other gases that are the result of oil refinery operations.
[9] Muhlbauer, W. Kent, *Pipeline Risk Management Manual*, 1992.

7

Assessing the potential consequences of releases from specific pipelines in specific locations should be based on a pipeline- and location-specific evaluation of the following four elements:

1. *Which commodity or commodities might be released?* A list of commodities potentially transported in a specific pipeline may be obtained from the pipeline operator.
2. *How much of the transported commodity might be released?* The answer to this differs at different locations along a pipeline and can be derived from pipeline flow rates, spill detection time, pipeline shutdown time, drain down volume, and other technical factors. These factors may be discussed with the pipeline operator.
3. *Where might the released substance go?* The answer to this is derived by considering the released commodity, release volume, and potential flow paths over land and water, as well as potential air dispersion. Overland flow can be affected by factors such as gas or liquid properties, topography at and near the spill location, soil type, nearby drainage systems, and flow barriers. Similarly, flow in water can be affected by the water flow rate and direction and properties of the spilled fluids. Air dispersion can be affected by the properties of released vapors and wind direction and speed.
4. *What locations might be impacted?* This question is answered by considering how potential impacts, including thermal impacts from fire, blast overpressure from explosion, toxic and asphyxiation effects, and environmental contamination, could affect locations where the released commodity travels. Planned evacuation routes should be considered when performing these assessments.

Various commercially available models have been developed and are available to communities to help predict the impacts of pipeline releases on nearby areas. These models support analysis of such elements as spill volumes, release paths along land or water, air dispersion patterns, and spill impacts on human health, property, and the environment.

Transmission pipeline releases result from a variety of causes, including internal and external corrosion, excavation damage, mechanical failure, operator error, and natural force damage. Pipelines with different characteristics and operating environments have different susceptibilities to these failure causes. This results in different failure probabilities from different causes at different points along the pipeline.

In addition to the lengths of pipe that make up transmission pipeline segments on a right-of-way (sometimes referred to as "line pipe"), transmission pipeline systems include ancillary facilities, such as pump stations and tank facilities (for liquid pipelines) and compressor and regulator/metering stations (for gas pipelines). These facilities are often adjacent or beyond the right-of-way and on operator-owned property, frequently protected by security fencing.

Most communities in the vicinity of transmission pipelines are near rights-of-way with line pipe and not near ancillary facilities. However, some communities may be near these facilities. The predominant failure causes and failure modes are different for these ancillary pipeline facilities than the predominant failure causes and failure modes for line pipe. Consequently, local governments should be aware of what

8

parts of a transmission pipeline system are in the vicinity of their communities in order to better understand which pipeline risk factors should be addressed in their communities.

Risk Mitigation

Transmission pipeline operators seek to reduce the risk of releases by taking measures to minimize the probability and consequences of such releases. These measures include proper pipeline route selection, design, construction, operation, and maintenance, as well as the use of automated monitoring and control systems, public awareness programs, and excavation damage prevention programs.

Transmission pipeline operators also conduct emergency response drills and exercises – both on their own and in cooperation with local emergency responders – to ensure that emergency preparedness and response planning is adequate should a pipeline incident occur. Also, gas transmission pipeline operators are required by regulation to reduce the operating pressure of their pipelines and make other adjustments to operations and maintenance based on criteria related to increasing populations near their pipelines. These requirements could come into effect if additional residences or places of public assembly (schools, hospitals, nursing homes, parks, etc.) are constructed near a gas transmission pipeline.

Federal pipeline safety regulations govern the construction, operation, and maintenance of pipelines. These regulations govern significant risk factors that affect the probability and consequences of releases. PHMSA and its partnering state regulatory agencies inspect transmission pipelines and enforce the regulations to better assure safety and reduce risk. In addition to federal government regulatory requirements, standards and recommended practices developed by standards development organizations provide further guidance on the safe construction, operation, and maintenance of pipelines in important areas[10].

Safety can also be promoted through proper, risk-informed land use planning, design, and construction practices for industrial, commercial and residential developments near transmission pipelines. There are a number of opportunities for stakeholders (including landowners, local governments, emergency responders, developers, and state and federal pipeline regulators) to participate in transmission pipeline safety discussions and support safety initiatives. These activities include following safe excavation practices, including use of the one-call process (e.g., call 811 before digging); monitoring and reporting suspicious activity on transmission pipeline rights-of-way; keeping rights-of-way free from obstructions and encroachments; and following PIPA recommended practices on land use near transmission pipelines. Together, transmission pipeline operators and other stakeholder groups can significantly reduce risks to people, communities, and the environment.

Resources are available to easily identify transmission pipelines within or near a given community. PHMSA maintains the National Pipeline Mapping System (NPMS), a geographic information system (GIS)

[10] One example is Standard B31.8S, *Managing Integrity of Gas Pipelines*, developed by the American Society of Mechanical Engineers. Additionally, the American Petroleum Institute's Recommended Practices, such as RP1162, *Public Awareness Programs for Pipeline Operators*, focus on transmission pipeline operations and maintenance, as well as public outreach to help prevent damage to pipelines.

database that contains the locations and attributes of hazardous liquid and gas transmission pipelines operating in the United States. The NPMS is updated and maintained with mandatory annual submissions of pipeline geospatial data by pipeline operators. One important function of the NPMS is to support queries by members of the public to identify which hazardous liquid and gas transmission pipeline companies operate pipelines in a specific county or zip code. This allows local governments to locate transmission pipelines within or near their communities and to determine areas that could be impacted by releases from these pipelines. PHMSA will provide raw NPMS geospatial data to county and state officials upon request[11].

The NPMS is useful to local governments in understanding the general location of transmission pipelines in their area, and in determining who operates those facilities, but the NPMS data accuracy may not be sufficient for some purposes. More accurate data may have to be obtained directly from the pipeline operator. The target accuracy of NPMS data is currently ±500 feet, although much of the NPMS data is much more accurate than ±500 feet. The NPMS does not include information on the location of distribution pipelines or non-regulated pipelines.

IV. Historical Safety Performance of Onshore Gas Transmission & Hazardous Liquid Pipelines

The historical record of onshore[12] hazardous liquid and gas transmission pipeline incidents provides an overview of the safety performance of these pipelines over time at the national level[13]. Figures 4 through 7 below show trends in the number of pipeline incidents and in the resulting number of fatalities and injuries. Graphs are shown for subsets of total reported incidents known as "significant incidents" [14] and "serious incidents"[15]. The graphs depict data for onshore transmission pipelines over the years 1990-2009 and were chosen in order to depict trends over a 20 year time period. Hazardous liquid and gas transmission pipelines are shown on separate graphs. The separate graphs demonstrate somewhat different trends over time.

[11]NPMS may be accessed at http://www.npms.phmsa.dot.gov/. Information on requesting geospatial data may be found at https://www.npms.phmsa.dot.gov/application.asp?tact=Data&page=subapp.asp?app=data&act=data_req.
[12] Pipeline incident data used throughout this study includes onshore pipelines only, as these are the pipelines of immediate concern to local governments. Incident data from offshore pipelines, which often face different risks and predominant incident causes than onshore pipelines, are not included.
[13] Records on transmission pipeline incidents are maintained by PHMSA and are available here and at http://primis.phmsa.dot.gov/comm/reports/safety/PSI.html.
[14] PHMSA defines significant incidents as those incidents reported by pipeline operators when any of the following conditions are met:

1. fatality or injury requiring in-patient hospitalization
2. $50,000 or more in total costs, measured in 1984 dollars
3. highly volatile liquid releases of 5 barrels or more or other liquid releases of 50 barrels or more
4. liquid releases resulting in an unintentional fire or explosion

[15] PHMSA defines a serious pipeline incident as an event involving a fatality or injury requiring in-patient hospitalization. Note that serious incidents are a subset of significant incidents, including only incidents with consequences to human health and safety (fatalities and injuries only).

Hazardous Liquid Pipelines

The incident history of hazardous liquid pipelines for the past 20 years is shown in Figures 4 and 5 below[16]. Figure 4 shows:

- A general downward trend in the annual number of significant hazardous liquid pipeline incidents;
- On average, about 3% of significant hazardous liquid incidents included death or injury and are classified as "serious" incidents. Fatalities and injuries in these data were experienced by both the general public and by pipeline operator personnel. The breakdown of fatality and injury statistics for these groups is discussed in Section V below.

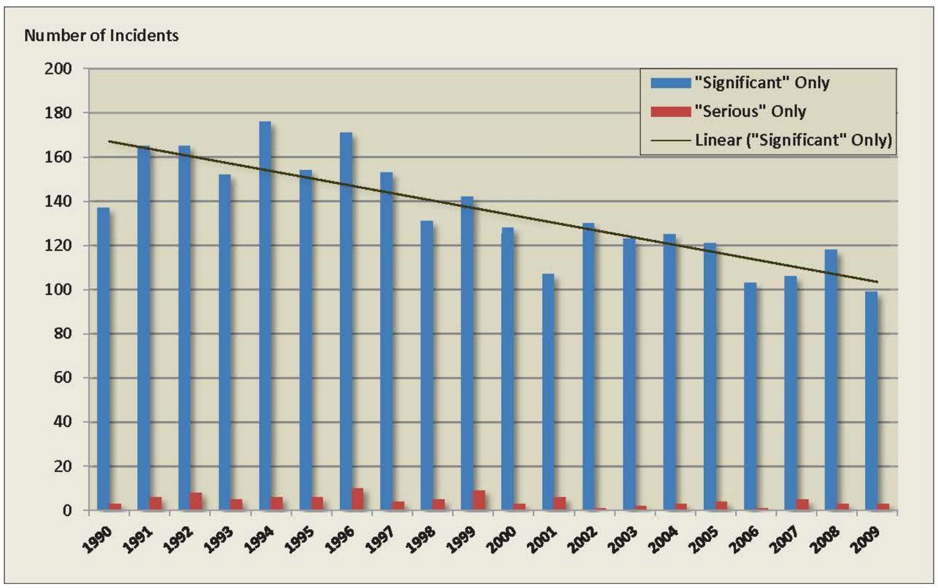


Figure 4: Trends in Hazardous Liquid Onshore Incidents: 1990-2009

[16] Note that the vertical scales of Figures 4 and 5, showing hazardous liquid pipelines incidents, are different from the vertical scales of Figures 6 and 7, showing gas transmission pipeline incidents. More incidents are reported for hazardous liquid pipelines, primarily because the incident reporting criteria for hazardous liquid pipelines require more incidents to be reported.

11

Figure 5 shows that the annual number of fatalities and injuries from hazardous liquid pipeline incidents fluctuated over the time period:

- In six years out of the 20 year period, no fatalities occurred.
- Incidents resulting in multiple injuries or fatalities are not frequent. However, they did occur during this time period. For example, the spike shown in the number of injuries from hazardous liquid pipeline incidents in 1992 was caused by a single incident in Washington County, Texas, with 3 fatalities and 22 injuries[17]. Other incidents with higher numbers of fatalities or injuries include incidents in the following years:
  - 1999 (Whatcom County, Washington, 3 fatalities and 8 injuries);
  - 2004 (Floyd County, Kentucky, 12 injuries);
  - 2004 (Contra Costa County, California, 5 fatalities and 3 injuries);
  - 2007 (Clarke County, Mississippi, 2 fatalities and 7 injuries).

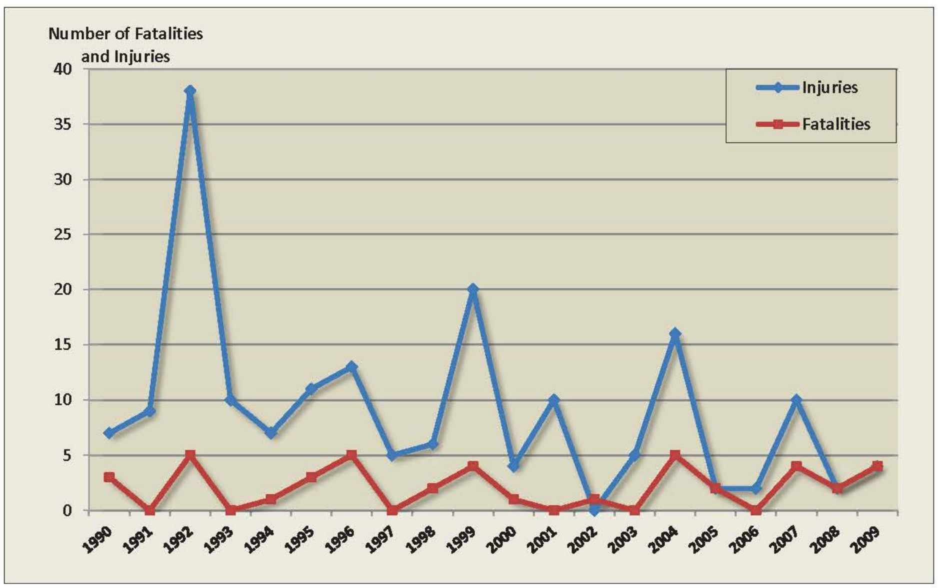


Figure 5: Trends in Fatalities and Injuries in Hazardous Liquid Onshore Incidents: 1990-2009

[17]The number of injuries associated with this event as reported in the accident report from the operator. An NTSB investigation of this event reported a slightly different injury total.

12

Gas Transmission Pipelines

The incident history for gas transmission pipelines for the most recent twenty years is shown in Figures 6 and 7 below[18]. Figure 6 shows:

- An overall increasing trend in the annual number of natural gas transmission pipeline significant incidents over the time period;
- A major reason for this trend is a relatively high number of gas transmission pipeline significant incidents in 2003, 2005, 2006, and 2009:
  - In 2003 and 2006, the higher number of incidents is primarily due to a higher number of incidents caused by materials and weld failures (15 in 2003 and 16 in 2006 due to this cause vs. an average of 8 per year over 1990-2009);
  - In 2005, the relatively high number of incidents reflects the natural force damages to pipelines from the effects of hurricanes Katrina and Rita (11 incidents due to this cause vs. an average of 4 per year over 1990-2009);
  - In 2009, the higher number of incidents is spread among several cause categories, including materials and weld failures and equipment failures.
- On average, about 16% of significant gas transmission incidents included death or injury and are classified as "serious" incidents. Fatalities and injuries in these data were experienced by both the general public and by pipeline operator personnel. The breakdown of fatality and injury statistics for these groups is discussed in Section V below.

[18] Note that the vertical scales of Figures 6 and 7, showing gas transmission pipeline incidents, are different from the vertical scales of Figures 4 and 5, showing hazardous liquid pipelines incidents. More incidents are reported for hazardous liquid pipelines, primarily because the incident reporting criteria for hazardous liquid pipelines require more incidents to be reported.

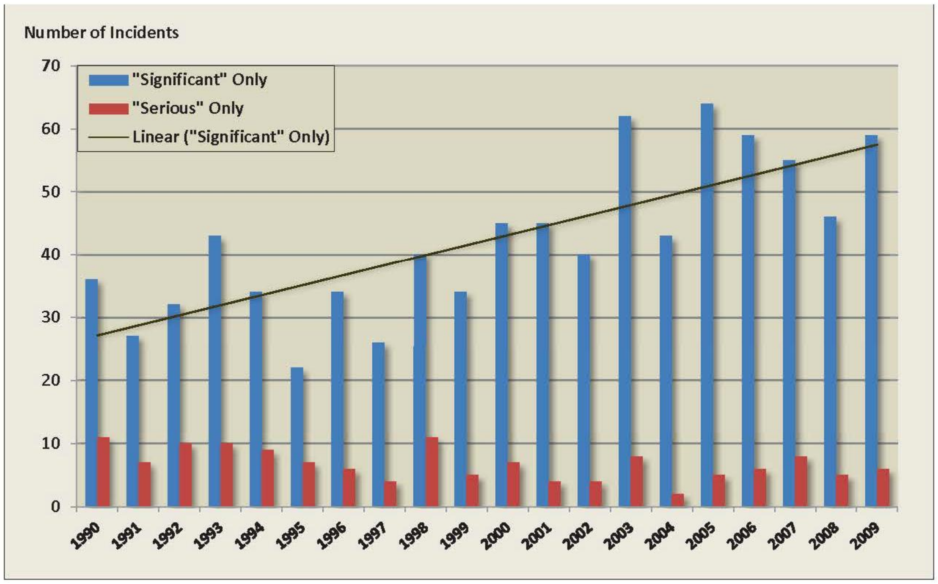


Figure 6: Trends in Natural Gas Transmission Onshore Incidents: 1990-2009

Figure 7 shows that the number of fatalities and injuries has fluctuated over 1990-2009:

- While incidents resulting in multiple fatalities and injuries were not common, they did occur during this time period:
  - A spike in fatalities in 2000 was due to a single incident in a remote area near Carlsbad, New Mexico that claimed 12 lives.
  - A spike in injuries in 2000 is due to two incidents in Louisiana and Mississippi that caused 11 out of the year's 16 injuries.
- No fatalities were experienced in eight out of the 20 years over 1990-2009.

14

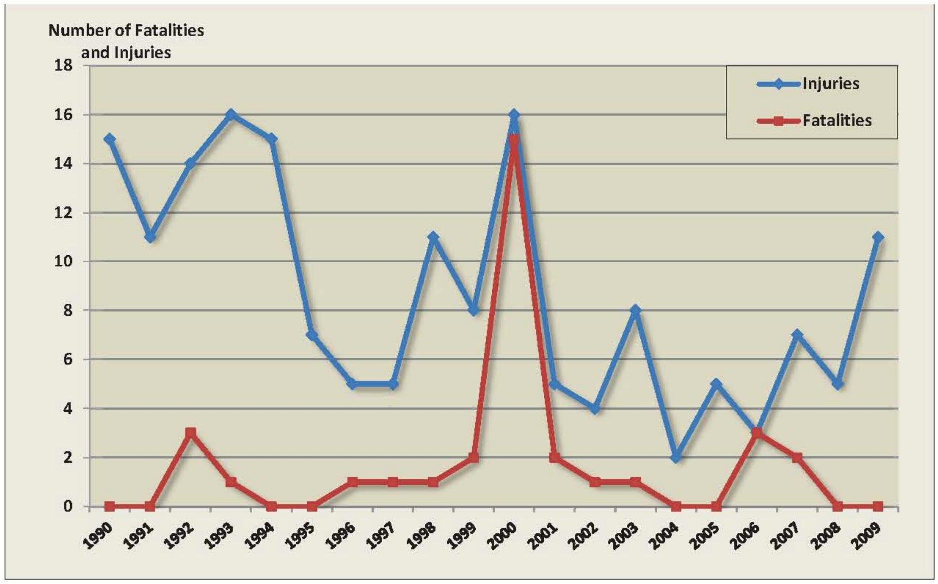


Figure 7: Trends in Fatalities and Injuries in Natural Gas Onshore Transmission Incidents: 1990-2009

Incident Causes

Pipeline incident causes fall into several broad categories based on how PHMSA collects incident data from pipeline operators. Figures 8 through 11 below show the number and percentage of significant onshore transmission pipeline incidents attributable to different cause categories during 2005-2009[19].

Separate graphs are shown for line pipe (i.e., portions of pipelines *not* including ancillary facilities such as tank facilities, pump stations, compressor and regulator/metering stations) and for ancillary facilities (pump stations, compressor stations, tank facilities etc.). Separate graphs are shown to illustrate how different incident causes predominate, depending on the part of the pipeline system involved. Local governments should be aware of the specific parts of a transmission pipeline system within their communities in order to determine which risk factors are most important.

[19] This time period is the most recent five complete years of data available. The period was chosen in order to give a relevant "snapshot" of the relative frequency of different causes. Data on the cause categories used here are not available before 2002.

15

Figures 8 and 9 show the breakdown of incidents by cause for line pipe. For both hazardous liquid and gas transmission pipelines, the predominant failure causes for line pipe are corrosion, material/weld failures, and excavation damage.

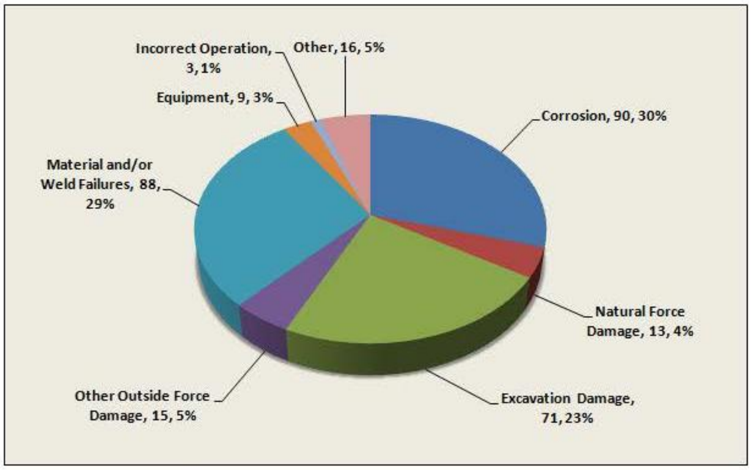


Figure 8: Causes[20] of Significant Onshore Hazardous Liquid Pipeline Incidents (Right-of-Way Line Pipe Only 2005-2009)

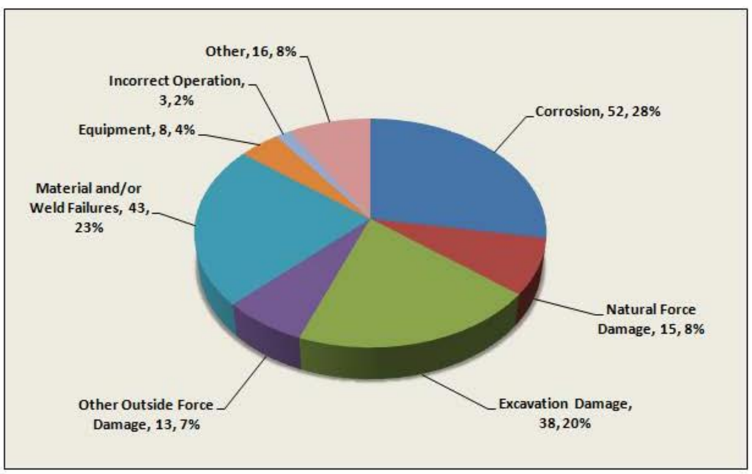


Figure 9: Causes of Gas Transmission Pipeline Significant Onshore Incidents (Right-of-Way Line Pipe Only 2005-2009)

[20] In Figures 8 through 13, which show incident breakdowns by cause, the number of incidents for each cause is given, followed by the percentage of incidents for each cause.

16

Figures 10 and 11 show the breakdown of incidents by cause for ancillary facilities. For hazardous liquid pipeline facilities (pump stations, tank facilities, etc.), the highest-percentage failure causes are equipment failures, incorrect operation, and corrosion (see Figure 10).

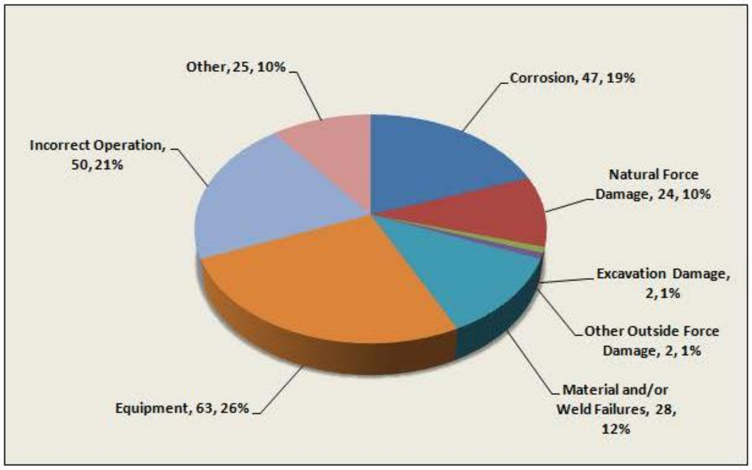


Figure 10: Causes of Significant Onshore Hazardous Liquid Pipeline Incidents Facilities Only (e.g., Pump Stations, Tank Facilities) 2005-2009

17

For gas transmission pipeline facilities (compressor stations, regulator/metering stations), a high percentage of incidents are caused by equipment failures, other outside force damage[21], and natural force damage, but the highest percentage of incidents are classified as being due to "other" causes (see Figure 11). Incidents are assigned to this category if the cause of the incident was unknown or was not tied to one of the other defined failure cause categories. The gas transmission incidents assigned to the "other" cause category included several releases due to equipment malfunctions at compressor stations.

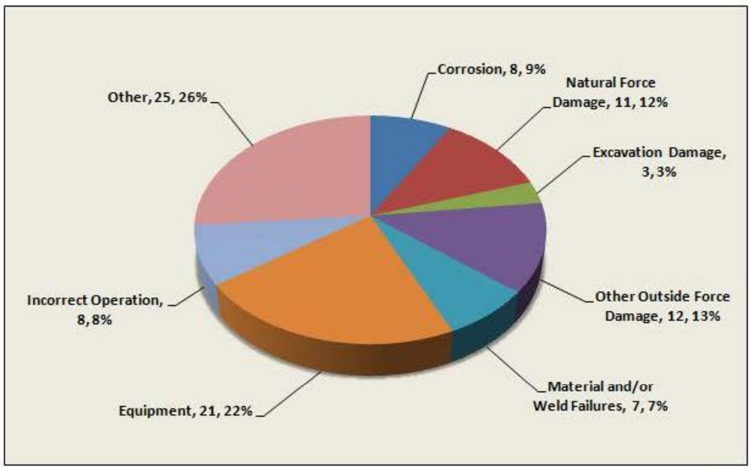


Figure 11: Causes of Gas Transmission Pipeline Significant Onshore Incidents Facilities Only (e.g., Compressor Stations, Regulator/Metering Stations) 2005-2009

[21] An example of this cause category is a non-excavating vehicle striking an aboveground pipeline facility.

18

Figures 12 and 13 below show the cause breakdown for serious incidents (i.e., those which include a fatality or an injury requiring hospitalization), which are a subset of significant incidents. For both hazardous liquid and gas transmission pipelines, excavation damage, incorrect operation, other outside force damage, and "other" causes are the causes of the highest percentage of serious incidents (although the number of incidents in any category is small). Corrosion, material/weld failures, and equipment failures are the cause of a lower percentage of serious incidents than they are for the larger population of significant incidents.

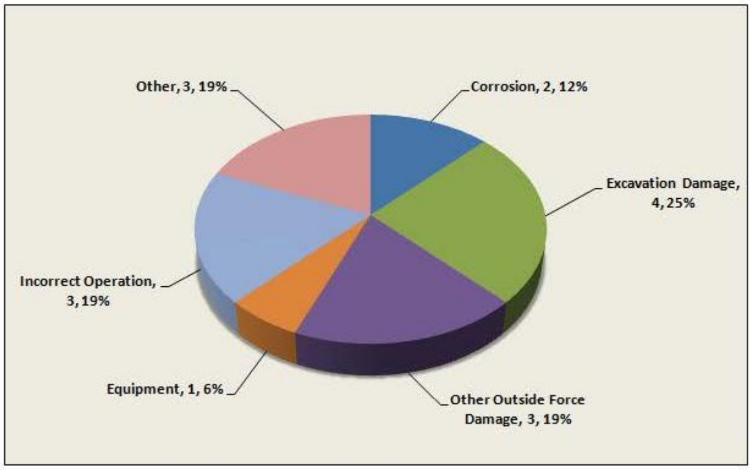


Figure 12: Causes of Onshore Hazardous Liquid Pipeline Serious Incidents 2005-2009

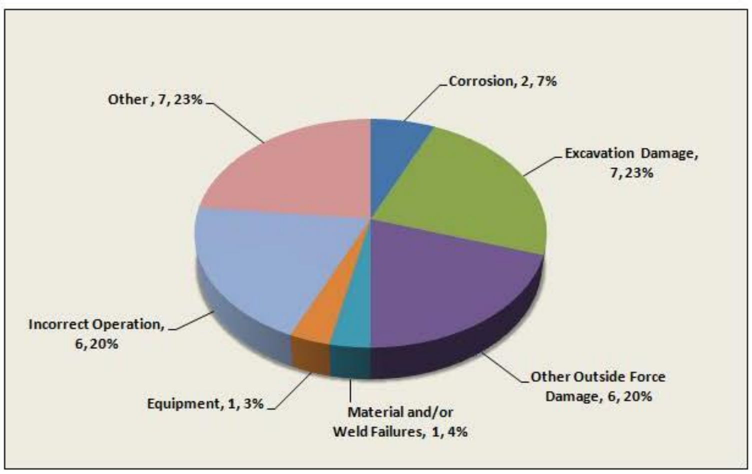


Figure 13: Causes of Onshore Gas Transmission Pipeline Serious Incidents 2005-2009

19

V. Relative Risk of Transmission Pipelines

Stakeholders should be aware of the relative risks of transmission pipelines when considering land use and development decisions near transmission pipelines. Consideration should be given to the characteristics of the specific pipeline involved, the size of the pipeline right-of-way, and the surrounding environment and terrain.

One illustration of transmission pipeline relative risk is a comparison of the incident history of transmission pipelines versus other modes of hazardous materials transportation that may pose risks to communities. This section draws on U.S. Department of Transportation incident data for transportation of hazardous materials by road and railway for comparison with incident data for onshore hazardous liquid and gas transmission pipelines. These comparisons may be useful to local governments for land use planning, because railways and roads, like pipelines, are transportation pathways interspersed within the public domain and present the risk to communities of a potential hazardous materials release.

Presenting the relative frequency of incidents involving release of hazardous materials from different modes and the relative frequency of fatalities and injuries resulting from the release of hazardous materials from different modes provides information on the relative risks of releases from the transportation pathways that a local government may have within its jurisdiction. Tables 1 through 4 below provide incident statistics for the different transportation modes as a framework for this comparison. The road and railway statistics in the tables are based on reported incidents for these modes when hazardous materials were released. The transmission pipeline statistics in the tables are based on significant incidents. The tables also include statistics based on serious[22] incidents for all modes[23].

[22] The definition of "serious" incidents used by PHMSA's Office of Hazardous Materials Safety (OHMS) for hazardous materials releases from road and railway transportation includes additional criteria. Since 2002, PHMSA/OHMS has defined "serious incidents" as incidents that involve either:

- a fatality or major injury caused by the release of a hazardous material,
- the evacuation of 25 or more persons as a result of release of a hazardous material or exposure to fire,
- a release or exposure to fire which results in the closure of a major transportation artery,
- the alteration of an aircraft flight plan or operation,
- the release of radioactive materials from Type B packaging,
- the release of over 11.9 gallons or 88.2 pounds of a severe marine pollutant, or
- the release of a bulk quantity (over 119 gallons or 882 pounds) of a hazardous material.

The number of "serious" incidents presented in the tables of this section for road and railway includes only incidents meeting the first of these criteria (incidents with fatality or injury caused by the release of a hazardous material), and no other incidents meeting the other criteria. For transmission pipelines, all serious incidents are included.

[23] To capture a current snapshot of relative risks for the different modes, comparisons are made based on the most recent five complete years of incident data (2005-2009). Other reasons for using this time period for the data include:

- The current reporting criteria for hazardous materials release data went into effect in 2002.
- The breakdown of fatalities and injuries by public vs. operator employee or contractor was only recorded beginning in 2002.
- Hazardous liquid pipeline operator annual reports of mileage began in 2004.

20

It is recognized that the comparisons presented here do not include a complete picture of the risks of different transportation modes, nor are the statistics that are compared here based on perfectly identical data. Caveats on interpretation of the statistics presented in this section include:

1. Because the scope of PIPA is limited to transmission pipelines, there is no presentation of gas distribution pipeline incident data and no attempt to characterize risk to communities of distribution pipelines[24].
2. The focus of this study is providing information to support planning and land use decisions for areas near transmission pipelines. These pipelines transport hazardous materials and risks to the public result from the accidental release of these materials. Consequently, the comparative incident statistics presented for roads and railways are based strictly on releases of hazardous materials. It is recognized that this is a fraction of the total risk from vehicles transporting hazardous materials[25] and an even smaller fraction of the total risk from all vehicles on roads and railways[26].
3. The specific functions in the transportation system of roads, railways, and pipelines and the types of commodities transported by these modes are not uniform. Hazardous liquid pipelines primarily transport oil and oil products, which, can also be transported by truck and railway. Gas transmission pipelines almost exclusively transport natural gas, which is not transported by road or railway. A variety of other hazardous materials are transported by road and railway, including both bulk and packaged shipments. Release of these materials can have significantly different effects than releases of oil, refined products, or natural gas.
4. Questions were raised in 2009 Congressional hearings[27] about the completeness of reporting of (non-pipeline) hazardous materials incidents. One estimate quoted was that 60-90% of all such incidents were unreported. If these estimates apply equally to serious incidents, then the number of serious road and railway hazardous material incidents presented in this section could be too low by a factor of 10 (some cases were cited of non-pipeline incidents involving fatalities or injuries that went unreported).

---

[24] Gas distribution pipeline incident data may be found here: http://primis.phmsa.dot.gov/comm/reports/safety/SigPSI.html?nocache=3825#_ngdistrib.

[25] For example, see a 2004 study [Craft, *Crashes Involving Trucks Carrying Hazardous Materials*, FMCSA-RI-04-024] of accidents involving trucks with hazardous materials cargo, which estimates that most fatalities from such accidents did not result from release of hazardous materials. Fatalities from these accidents that were not caused by hazardous materials releases are part of the total risk presented by transport of hazardous materials, but are not included in the statistics in this section, because they are not directly relevant to the planning and land use decisions faced by local governments that are the subject of the PIPA recommended practices.

[26] For example, 37,423 total fatalities occurred in 2008 motor vehicle traffic crashes (source: National Traffic Safety Administration (NTSA) Fatality Analysis Reporting System (FARS)). In 2009, 704 total fatalities resulted from accidents involving trains (source: U.S. DOT Federal Railroad Administration, *Railroad Safety Statistics 2009 Preliminary Annual Report*).

[27] Congressional Committee on Transportation and Infrastructure hearings on "Concerns with Hazardous Materials Safety in the U.S.: Is PHMSA performing its mission" (written report submitted by Majority Staff to the Members of the Committee), September 9, 2009.

5. Table 1 presents serious incident counts for roads and railways that include both injuries requiring hospitalization and those *not* requiring hospitalization. The counts given for pipeline serious incidents include only incidents involving fatalities or injuries requiring hospitalization. To make the serious incident data for roads, railways, and pipelines more comparable, Table 1 also gives serious incident counts for roads and railways that include only injuries requiring hospitalization. These counts are shown in the table in parentheses. Both sets of injury counts include only injuries where the hazardous materials release was the cause of the injury.

Tables 1 through 4 present separate statistics for hazardous liquid and gas transmission pipelines. This approach is taken because of the different commodity properties and different risk characteristics for these two classes of transmission pipeline. Natural gas is not typically transported by road or rail, so gas transmission pipelines constitute a distinct transportation mode. The statistics presented for transmission pipelines include incidents involving both line pipe and facilities.

Table 1 shows that the total number of hazardous materials incidents from 2005-2009 for road and railway transportation is greater than the number of transmission pipeline significant incidents[28] (almost 15,000 for road and around 700 for railway versus 109 for hazardous liquid pipelines and 57 for gas transmission pipelines). However, a lower percentage of road and railway incidents result in fatality or injury requiring hospitalization: (less than 1% for both road and railway versus around 3% for hazardous liquid pipelines and 11% for gas transmission pipelines)[29].

[28] Table 1 gives significant incident counts for transmission pipelines for consistency with the historical data presented in the previous section. The magnitude of difference between road and railway incidents and transmission pipeline incidents remains the same even if all transmission pipeline incident reports were considered here.

[29] These percentages are obtained by calculating the proportion of incidents in Table 1 involving fatality or injury *requiring hospitalization*. The relevant figures are 26 out of 14,963 incidents for road, 5 out of 718 for railway, 3 out of 109 for hazardous liquid pipelines, and 6 out of 57 for gas transmission pipelines.

22

Table 1 - Hazardous Materials Transportation Incident Statistics[30] Compared to Onshore Hazardous Liquid and Natural Gas Transmission Incident Pipeline Statistics: 2005-2009

Mode		2005	2006	2007	2008	2009	Total 05-09	Average per Year
Road	All HazMat Incidents	13,460	17,156	16,905	14,787	12,507	74,815	14,963
	HazMat Incidents with Death or Injury[31]	118 (43)[32]	102 (25)	96 (31)	81 (15)	60 (14)	457 (128)	*91* *(26)*
Railway	All HazMat Incidents	745	704	750	751	638	3,588	718
	HazMat Incidents with Death or Injury	23 (4)	21 (7)	28 (4)	29 (7)	19 (5)	120 (27)	*24* *(5)*
Hazardous Liquid Pipeline (Onshore only)	Significant Incidents	121	103	106	118	99	547	109
	Incidents with Death or Injury	4	1	5	3	3	16	*3*
Gas Transmission Pipeline (Onshore only)	Significant Incidents	64	59	55	46	59	283	57
	Incidents with Death or Injury	5	6	8	5	6	30	*6*

Table 2 shows incident rates for each hazardous materials transportation mode, based on the number of serious incidents (i.e., incidents with fatality or injury as a direct result of the release of hazardous materials) per 1,000 miles of road, railway, or pipeline in the U.S. This comparison shows:

- Transmission pipelines have lower rates of serious incidents per mile than other transportation modes, if road and railway serious incident counts include injuries not requiring hospitalization. In this case, rates of serious incidents per mile are slightly lower for pipelines than for roads, while the rate of serious incidents per mile for railways is approximately 10 times greater.
- If only hospitalization injuries are included in the serious incident counts for roads and railways, then transmission pipelines have lower rates of serious incidents per mile than railway transportation, but higher rates (by about a factor of 3) of serious incidents per mile than road transportation. (Injury counts that include hospitalization injuries only for road and railway are shown in Table 2 in parentheses; the figures represent injuries as a direct result of a hazardous materials release).

[30] Source: Hazardous Materials Information System (HMIS) database (data as of 2/22/2010) for road and railway hazardous materials incidents and from PHMSA OPS accident/incident reports for transmission pipeline incidents. Hazardous materials incidents are reported (per 49 CFR 171.15 & 171.16) for unintentional release of a hazardous material during transportation (including loading, unloading and temporary storage related to transportation). Fatalities and injuries reported here are those that are a direct result of a hazardous materials release.

[31] In Table 1, road and railway hazmat incidents with death or injury are hazardous materials releases when injuries or fatalities directly result from the release. Transmission pipeline incidents with death or injury include all incidents when a fatality or injury occurs that is associated with a pipeline release.

[32] Numbers shown in parentheses for roads and railways are for serious incidents involving fatalities and injuries requiring hospitalization only as a direct result of a hazardous material release.

23

- Hazardous liquid pipelines and gas transmission pipelines have nearly equal rates of serious incidents per mile.
- As was noted previously, it is possible that the number of non-pipeline hazardous materials incidents is significantly undercounted, so that the road and railway serious incident rates per mile could be higher than the rates shown in the table and, consequently, higher relative to transmission pipeline serious incident rates per mile.

Table 2: Comparative Statistics for Serious Incident Rates
Onshore Transmission Pipelines vs. Road and Railway (2005-2009 Incidents)

Mode	Average Miles[33]	Average HazMat Serious Incidents per Year	Average HazMat Serious Incidents per 1,000 Miles per Year
Road	4,013,758	91 (26)[34]	0.023 (0.0065)
Railway	95,304	24 (5)	0.25 (0.052)
Hazardous Liquid Pipeline (Onshore)	164,234	3	0.018
Gas Transmission Pipeline (Onshore)	294,562	6	0.020

The rates in Table 2 are averages using nationwide incident data from 2005-2009. The rate of serious incidents per mile in a specific location in any specific community may vary considerably, based on the specific characteristics of the transportation infrastructure at the location (pipeline, roadway, and railway) and characteristics of the surrounding community. The expected rate of incidents involving different hazardous material transportation modes in a specific community will depend on the degree of exposure to each mode, namely, the number of miles of road, railway, and pipeline. The higher the pipeline, road, and railway mileage in a community, the higher is the community's level of exposure to potential incidents. However, the characteristics of the area (e.g., rural versus urban; density, pattern, and type of structures; topography) could decrease or increase the risk to the area surrounding the transportation infrastructure.

In serious transmission pipeline incidents, those killed or injured can be pipeline operator employees or contractors working in the pipeline right-of-way or on pipeline operator property (ancillary facilities) or members of the general public. Thus, the rate of incidents that resulted in death or injury to the general public is less than the rates in Tables 1 and 2 for all incidents resulting in deaths and injuries.

[33] Road mileage consists of miles of public roads and streets in the U.S. Railway mileage consists of miles of track in the U.S. (Source: http://www.bts.gov/publications/national_transportation_statistics/#chapter_1). Mileage data are the average mileages during 2004-2008, as the latest mileage figures for road, railway and transmission pipelines are for 2008 at the time of this report. Mileage for hazardous liquid and gas transmission onshore pipelines may be found at this link.
[34] Numbers shown in parentheses for roads and railway are for serious incidents involving fatalities and injuries *requiring hospitalization* as a direct result of a hazardous material release.

24

For example, of the 17 pipeline-related fatalities during 2005-2009, five (29%) were fatalities among the general public. Because of the relatively small number of incidents that result in fatalities, this percentage would be expected to vary if data from a different time period were considered. Fatalities to members of the public in these data include:

- A natural gas transmission pipeline failed because of excavation damage, killing an excavator working on the pipeline right-of-way. Pipeline incident reports submitted to PHMSA count third-party excavators as part of the "general public" if the excavator is not a contractor (second-party) or employee of the transmission pipeline operator (first-party). PHMSA recognizes that the nature of the risk faced by a third-party excavator working on the transmission pipeline right-of-way is similar to the risk faced by an operator's employee or contractor performing similar work.
- A natural gas transmission pipeline failed because of corrosion in a pipeline casing under a roadway crossing, leading to an explosion, fire, and fatal injury to the driver of a passing vehicle.
- A transmission pipeline failed at a weld and released propane, which ignited, resulting in the deaths of two occupants of nearby homes.
- A car left a roadway, crashed through barriers, and struck a gasoline pipeline facility. The incident resulted in a fire. The driver of the car died, but the cause of the fatality is uncertain.

Similarly, Tables 1 and 2 include road or railway incidents resulting in deaths and injuries from hazardous materials releases involving both operator personnel (drivers, etc.) and members of the general public (including first responders).

Table 3 includes the number of fatalities of operator employees (including contractor) and the general public for road, railway, and transmission pipeline transportation. These data show for 2005-2009:

- Road transportation had the highest rate of fatalities (10.2 per year).
- Railways and hazardous liquid pipelines had a lower rate of fatalities (2.4 per year).
- Gas transmission pipelines had the lowest rate of fatalities (1 per year).
- Road transportation had the lowest percentage of general public fatalities:
  - 14% (7 of 51) of fatalities due to road hazardous materials incidents were to the general public;
  - 86% (44 of 51) of fatalities were to employees of the operator.
- Railway transportation had the highest percentage of general public fatalities:
  - 83% (10 of 12) of fatalities due to railway hazardous materials incidents were to the general public;
  - 17% (2 of 12) were to operator employees.
- Relatively low percentages of transmission pipeline incident fatalities were suffered by the general public:
  - 25% (3 of 12) of hazardous liquid pipeline incident fatalities were to members of the general public.
  - 40% (2 of 5) of gas transmission pipeline incident fatalities were to members of the general public[35].

[35] One general public fatality was a fatality of a third-party excavator working on the pipeline right-of-way.

25

Table 3: Comparison of HazMat Fatality Statistics (2005-2009)
Operator Personnel vs. General Public for all Transportation Modes

	2005	2006	2007	2008	2009	Total	Average per Yr.
Road	24	6	10	8	3	51	10.2
Operator Employee	*19*	*5*	*10*	*8*	*2*	*44*	*8.8*
General Public	*5*	*1*	*0*	*0*	*1*	*7*	*1.4*
Railway	10	0	0	1	1	12	2.4
Operator Employee	*1*	*0*	*0*	*1*	*0*	*2*	*0.4*
General Public	*9*	*0*	*0*	*0*	*1*	*10*	*2.0*
Hazardous Liquid Onshore Only	2	0	4	2	4	12	2.4
Operator Employee and Contractor Employee	*2*	*0*	*2*	*1*	*4*	*9*	*1.8*
General Public	*0*	*0*	*2*	*1*	*0*	*3*	*0.60*
Gas Transmission Onshore only	0	3	2	0	0	5	1.0
Operator Employee and Contractor Employee	*0*	*2*	*1*	*0*	*0*	*3*	*0.60*
General Public	*0*	*1*	*1*	*0*	*0*	*2*	*0.40*

It should be noted that because of the relative infrequency of fatalities due to releases from transmission pipelines (as well as railways and, to a lesser extent, trucks), the figures shown in Table 3 could vary significantly from comparable statistics covering a different 5-year period. For example, releases from onshore gas transmission pipelines in 2010 (through September) resulted in at least 9 fatalities. Based on these incomplete totals for 2010, the 5-year period including 2006 through 2010 would have an average rate of at least 2.8 fatalities per year (compared to 1.0 per year for 2005-2009). The reason for this magnitude of fluctuation is that incidents resulting in multiple fatalities are infrequent, such that one may not occur at all during a given five year period, resulting in a low yearly rate of fatality for the period.

Table 4 includes the number of operator employee and general public injuries requiring hospitalization[36] due to road, railway, and transmission pipeline incidents for 2005-2009. These data show:

- The yearly rate of injuries incurred during 2005-2009 was higher for railway (25.6 per year) and road (21.8 per year) transportation than for gas (6.2 per year) and hazardous liquid (4 per year) transmission pipelines.
- The highest percentage of injuries incurred by the general public during 2005-2009 was due to railway incidents:
  - 78% (100 of 128) of injuries due to railway hazardous materials incidents were to the public;
  - 96% (96 of 100) of the general public hospitalization injuries in these data were due to two specific incidents in 2005 in Miller County, Arkansas and Aiken County, South Carolina.
  - 22% (28 of 128) of injuries from 2005-2009 were to railway employees.
- A somewhat lower percentage of injuries to the general public was due to hazardous liquid pipeline incidents:
  - 70% (14 of 20) of injuries due to hazardous liquid pipeline incidents were to the public.
  - 50% (7 of 14) of injuries to the public in these data were the result of one specific incident in 2007.
  - 30% (6 of 20) of the injuries due to hazardous liquid pipeline incidents were to pipeline operator employees or operator contractors.
- A significantly lower percentage of injuries to the public were due to gas transmission pipeline incidents. Most injuries due to gas transmission pipeline incidents were to pipeline operator employees or operator contractors:
  - 42% (13 of 31) of injuries due to gas transmission incidents were to the general public;
  - 58% (18 of 31) were to pipeline operator employees and operator contractors.
- The lowest percentage of injuries incurred by the general public was due to road transportation hazardous materials incidents:
  - 22% (24 of 109) of these injuries were to the general public;
  - 78% (85 of 109) of these injuries were to operator employees.

[36] Pipeline incident reports from transmission pipeline operators are required to report injuries if "inpatient hospitalization" is involved. An injury involving hospital treatment may not be reported if the injured individual is released without an overnight hospital stay.

Table 4: Comparison of HazMat Injury Statistics (2005-2009)
Operator Personnel vs. General Public for all Transportation Modes

	2005	2006	2007	2008	2009	Total	Average per Yr.
Road	33	21	34	10	11	109	21.8
Number of Operator Employees HOSPITALIZED	*25*	*20*	*22*	*10*	*8*	*85*	*17*
General Public HOSPITALIZED	*8*	*1*	*12*	*0*	*3*	*24*	*4.8*
Railway	99	9	5	7	8	128	25.6
Number of Operator Employees HOSPITALIZED	*3*	*7*	*5*	*7*	*6*	*28*	*5.6*
General Public HOSPITALIZED	*96*	*2*	*0*	*0*	*2*	*100*	*20*
Hazardous Liquid Onshore Only (HOSPITALIZATION only)	2	2	10	2	4	20	4
Number of Operator Employees and Contractor Employees	*0*	*0*	*1*	*2*	*3*	*6*	*1.2*
General Public	*2*	*2*	*9*	*0*	*1*	*14*	*2.8*
Gas Transmission Onshore Only (HOSPITALIZATION only)	5	3	7	5	11	31	6.2
Number of Operator Employees and Contractor Employees	*3*	*2*	*6*	*3*	*4*	*18*	*3.6*
General Public	*2*	*1*	*1*	*2*	*7*	*13*	*2.6*

VI. Summary and Conclusions

- It is important for local governments to make risk-informed decisions regarding land use planning and development in locations where residences and businesses are increasingly in proximity to transmission pipelines. PIPA has developed recommended practices to guide local land use and development decisions. Local governments should apply these recommended practices as appropriate, based on local conditions and the relative risk tolerance of their communities. The degree of risk tolerance is expected to vary across different communities in different parts of the country. Consequently, the application of specific PIPA recommended practices is expected to vary among different communities.
- Although transmission pipeline incidents are infrequent, they do have potentially serious consequences that may significantly impact the general public. Consequently, local governments should consider the risks, including both likelihood and consequences, of transmission pipeline incidents when making decisions related to land use planning and development. They should make full use of available resources and communicate with the transmission pipeline operators

in their communities to better understand the characteristics of the specific line pipe and/or ancillary facilities and the characteristics of the surrounding area that may affect risk. Local government decisions might include:

- Constraints on activities on or near transmission pipeline rights-of-way;
- Restrictions on the types of land use and development that is allowed along transmission pipeline rights-of-way;
- Specific design or construction features of the development;
- Measures to facilitate emergency response and evacuation in the event of a transmission pipeline incident.

- When weighing the potential risks of hazardous materials releases in areas proposed for development, local governments should base their decisions on a balanced consideration of all risks. A balanced view includes consideration of all modes of hazardous materials transportation in the area, including roads and railway transportation, as well as transmission pipelines. Local governments should obtain all available information to allow a better understanding of hazardous material risks in their community.
- A comparison of the frequency of incidents involving death or injury resulting from hazardous materials releases from different transportation modes over 2005-2009 shows:
  - The rate per mile of such incidents was substantially lower for transmission pipelines than for railways.
  - The rate per mile of such incidents is approximately equal for transmission pipelines and road transportation, counting incidents where hazardous materials directly caused the death or injury.
  - If only injuries requiring hospitalization are counted, then the incident rate per mile was higher for transmission pipelines than for roads, but lower than for railroads.
  - The average number of fatalities per year was highest for road transportation incidents where hazardous materials releases caused the fatality, compared to lower averages for railway transportation and transmission pipelines.
  - The average number of injuries requiring hospitalization per year was substantially lower for transmission pipelines than for road or railway transportation.
  - A minority of fatalities involved the general public for road transportation and transmission pipelines. The majority of fatalities from railway incidents involved the general public.
  - A minority of hospitalization injuries involved the general public for road transportation and gas transmission pipelines. The majority of injuries from railway and hazardous liquid pipelines involved the general public.
  - Incidents involving road and railway transportation may have been under-reported, possibly significantly. Since the numbers of incidents are the basis for these comparisons between road and railway transportation and transmission pipelines, the relative risk of road and railway transportation may be higher than indicated here by these comparisons.

Appendix: Pipeline Integrity Management Programs

Federal pipeline safety regulations governing the operation of hazardous liquid and gas transmission pipelines include targeted requirements for inspecting and managing the integrity of pipeline segments that have the potential to impact "high consequence areas" (HCAs). Under these requirements, transmission pipeline operators must develop "integrity management programs" that provide additional protection to HCAs. The extra safety precautions and preventive measures taken by transmission pipeline operators on pipeline segments that could potentially impact HCAs are intended to reduce the likelihood and the consequences of a pipeline release in those areas, which would include many of the populated areas involved in land use and development decisions.

HCAs are defined differently for hazardous liquid and gas transmission pipelines, because of the commodities' different properties for these two types of pipelines. For gas transmission pipelines, HCAs include more densely populated areas, areas with buildings that are difficult to evacuate, and areas where larger groups of people might assemble. This is because the risks from potential natural gas releases are concentrated in the area immediately around the release, and natural gas releases have little potential for more long-term environmental damage. Based on reports from transmission pipeline operators for 2008, only 7% of gas transmission pipeline mileage in the U. S. has the potential to impact HCAs.

Hazardous liquid pipeline HCAs include populated areas, ecologically sensitive areas, drinking water sources, and waterways used for commercial navigation. These criteria for HCAs recognize the potential long-term consequences of releases from hazardous liquid pipelines to the environment, as well as the potential immediate impacts in the vicinity of the release location[37]. Consequently, a higher percentage of hazardous liquid pipeline mileage is counted as having the potential to impact HCAs. Based on reports from hazardous liquid pipeline operators for 2008, 43% of hazardous liquid pipeline mileage in the U. S. has the potential to impact HCAs.

Operators of transmission pipeline segments that could affect HCAs are subject to additional requirements for periodically testing, inspecting, and assessing the integrity of these segments and repairing defects that could compromise pipe integrity. These operators are also subject to reporting requirements for these pipeline segments that are greater than the reporting requirements for other segments of their pipelines. These and other requirements for pipeline segments with the potential to affect HCAs are found in PHMSA's Integrity Management regulations[38].

Transmission pipeline operators are required to revise their integrity management programs to reflect additional development around the pipeline, if the new development creates additional HCAs as defined in the regulations. For example, if a new facility that is difficult to evacuate, such as a hospital or nursing home, is constructed close to a gas transmission pipeline, then a new HCA could result and the pipeline operator would be required to revise the integrity management program to cover that pipeline segment.

[37] More information on HCAs for hazardous liquid and gas transmission pipelines may be found at http://primis.phmsa.dot.gov/comm/FactSheets/FSHCA.htm.

[38] Integrity management regulations are found in Title 49 of the Code of Federal Regulations (CFR), Part 195.452 (for hazardous liquid pipelines) and Parts 192.901- 192.951 (for gas transmission pipelines).

Pipelines and Informed Planning Alliance

PipelineInformedPlanning.com

Partnering to Further Enhance Pipeline Safety In Communities Through Risk-Informed Land Use Planning

Final Report of Recommended Practices

November 2010

The Pipelines and Informed Planning Alliance is sponsored by the United States Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Office of Pipeline Safety.

The initial PIPA effort was conducted by approximately 130 stakeholder participants representing a wide range of interests, organizations, and viewpoints on pipelines and community planning. Appendix A of this report lists the initial PIPA participants.

Our thanks go out to all of the PIPA participants and the many other unidentified individuals who may have supported the PIPA effort in one way or another.

Cycla Corporation supported the initial PIPA effort and provided assistance in preparing this report and integrating it into PHMSA's Stakeholder Communications website.

The PIPA logo was created by Sven Upsons and provided courtesy of The Danielle Dawn Smalley Foundation, Inc., Crandall, Texas.

PIPA information may be found online at PipelineInformedPlanning.com.

pipa
Pipelines and Informed Planning Alliance
PipelineInformedPlanning.com

PIPA Report, November 2010

PREFACE

Over the past 70 years, a nationwide system of gathering, transmission, and distribution pipelines has been constructed to transport almost 100 percent of the natural gas and about 66 percent of the ton-miles of oil and refined petroleum products consumed in the United States. Many portions of the transmission pipelines were originally constructed in sparsely populated areas; subsequent growth has transformed some of these previously rural and sometimes remote areas into urban and suburban areas with housing subdivisions, shopping centers, and business parks.

The goal of the Pipelines and Informed Planning Alliance (PIPA) is to reduce risks and improve the safety of affected communities and transmission pipelines through implementation of recommended practices related to risk-informed land use near transmission pipelines. The PIPA recommended practices describe actions that can be taken by key stakeholders relative to proposed changes in land use or new development adjacent to existing transmission pipelines. Local governments, property developers/owners, transmission pipeline operators, and state real estate commissions have key roles to enhance pipeline safety and ensure the protection of people, the environment and the pipeline infrastructure.

To address increasing trends of excavation damage to pipelines and to fulfill the requirements of the Transportation Equity Act for the 21st Century, the US Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) undertook a study of damage prevention practices associated with existing one-call notification systems. In 1999, PHMSA published the landmark Common Ground Study of One-call Systems and Damage Prevention Best Practices. Building on the success of the Common Ground Study, PHMSA facilitated the founding of the Common Ground Alliance to provide stewardship to help ensure acceptance and implementation of the Damage Prevention Best Practices across the country.

To further address the impact of community growth on pipeline safety, and the requirements of the Pipeline Safety Improvement Act of 2002, the Transportation Research Board (TRB) of the National Academies conducted a comprehensive study of pipeline safety and land use practices to better understand land use planning issues. The results, published in 2004 as TRB Special Report 281, "Transmission Pipelines and Land Use: A Risk-Informed Approach," included several recommendations for PHMSA. To address these recommendations, in August 2007 PHMSA facilitated the establishment of the Pipelines and Informed Planning Alliance.

Approximately 130 stakeholder participants undertook the work to develop the PIPA recommended practices. The initial PIPA effort has resulted in recommended practices for local governments, property developers and owners, transmission pipeline operators, and real estate boards to be aware of and to implement as appropriate. PHMSA plans to continue working with stakeholders to ensure that a sound implementation strategy is developed and that the PIPA recommended practices are communicated to and understood by those that need to adopt them.

GLOSSARY

Terms in the PIPA Report that may be unfamiliar to the reader are included in this Glossary. Some, such as "right-of-way," may be legal terms that normally have a specific meaning differing from their lay usage. Other terms may be defined strictly in accordance with their usage in the context of the PIPA Report.

Sources for the terms in this glossary include:

- PIPA participants
- Common Ground Alliance Best Practices, v6.0
- Transportation Research Board (TRB) Special Report 281, "Transmission Pipelines and Land Use: A Risk-Informed Approach"
- Washington Utilities and Transportation Commission (WUTC), Report: "Land Use Planning In Proximity to Natural Gas and Hazardous Liquid Transmission Pipelines in Washington State; Appendix D: Pipeline Typology and Glossary"
- Federal pipeline safety regulations, 49CFR Parts 190 – 199

Abandoned Pipeline – A transmission pipeline that has been permanently removed from service and left in place.

As-built Drawing – A detailed drawing or set of drawings depicting the actual configuration of installed or constructed facilities.

Backfill – The act of filling in the void in a utility ditch that was created by excavating, usually by replacing the soils that were removed. Also, the material used to fill the ditch.

Building Setback – See "Setback"

Cathodic Protection – The process of arresting corrosion on a buried or submerged metallic structure, by electrically reversing the natural chemical reaction. This includes, but is not limited to, installation of a sacrificial anode bed, use of a rectifier based system, or any combination of these or other similar systems. Wiring is installed between the buried or submerged structure and all anodes and rectifiers. Wiring is also installed to test stations which are used to measure the effectiveness of the cathodic protection system.

Consultation Zone – *Reference Recommended Practice BL05*. An area extending from each side of a transmission pipeline, the distance of which should be defined by local governments, to describe when a property developer/owner, who is planning new property development in the vicinity of an existing transmission pipeline, should initiate a dialogue with a transmission pipeline operator.

Damage – Any impact or exposure that results in the need to repair an underground facility due to a weakening or the partial or complete destruction of the facility, including, but not limited to, the protective coating, lateral support, cathodic protection or the housing for the line, device or facility.

Demolition – The partial or complete destruction by any means of a structure served by, or adjacent, to an underground line or facility.

Designer – Any architect, engineer or other person who prepares or issues a drawing or blueprint for a construction or other project that requires excavation or demolition work.

Developer – An individual or group of individuals who apply for permits to alter, construct and install buildings or improvements or change the grade on a specific piece of property.

Distribution Pipeline – A natural gas pipeline other than a gathering or transmission line (reference 49 CFR 192.3). A distribution pipeline is generally used to supply natural gas to the consumer and is found in a network of piping located downstream of a natural gas transmission line.

Easement – (1) A legal instrument giving a transmission pipeline operator a temporary or permanent right to use a right-of-way for the construction, operation, and maintenance of a pipeline. It may also include temporary permits, licenses, and other agreements allowing the use of one's property. (2) An easement is an acquired privilege or right, such as a right-of-way, afforded a person or company to make limited use of another person or company's real property. For example, the municipal water company may have an easement across your property for the purpose of installing and maintaining a water line. Similarly, oil and natural gas pipeline companies acquire easements from property owners to establish rights-of-way for construction, maintenance and operation of their pipelines. (3) A legal right, acquired from a property owner, to use a strip of land for installation, operation and maintenance of a transmission pipeline.

Emergency Preparedness – The act or state of being prepared to respond to and handle a pipeline emergency. Pipeline operators are required to have emergency preparedness programs, plans, and procedures in place to implement during pipeline emergencies.

Emergency Response – The actual response taken to address an emergency. The response to a pipeline emergency should be consistent with the pipeline operator's and other emergency responders' programs, plans, and procedures.

Encroachment – (1) A human activity, structure, facility, or other physical improvement that intrudes onto a transmission pipeline right-of-way. (2) Encroachment refers to the unauthorized use of a right-of-way in violation of the easement terms.

Excavation – Any operation using non-mechanical or mechanical equipment or explosives in the movement of earth, rock or other material below existing grade. This includes, but is not limited to, augering, blasting, boring, digging, ditching, dredging, drilling, driving-in, grading, plowing-in, pulling-in, ripping, scraping, trenching, and tunneling.

Excavator – Any person proposing to, or engaging in, excavation or demolition work for himself or for another person.

Facility Operator – Any person, utility, municipality, authority, political subdivision or other person or entity who operates or controls the operation of an underground line/facility.

Facility – A buried or aboveground conductor, pipe, or structure used to provide utility services, such as electricity, natural gas, liquids refined from oil, oil, telecommunications, water, sewerage, or storm water.

Feather Cut - A method to trim trees to create a natural looking profile. (Also see Hard Cut.)

Gas – Natural gas, flammable gas, or gas which is toxic or corrosive. (Reference 49 CFR 192.3) Gases are normally compared to air in terms of density. The specific gravity of air is 1.0. Any gas with a specific gravity less than 1.0 (such as natural gas) will rise and usually disperse. Any gas having a specific gravity greater than 1.0 will fall and collect near the ground or in low-lying areas such as trenches, vaults, ditches, and bell holes – such occurrences can be hazardous to human health and safety.

Gas Transmission Pipeline – A pipeline, other than a gathering line, that 1) transports gas from a gathering line or storage facility to a distribution center, storage facility, or large-volume customer that is not downstream from a distribution center; 2) operates at a hoop stress of 20 percent or more of specified minimum yield strength; or, 3) transports gas within a storage field. (Reference 49 CFR 192.3) A gas transmission pipeline includes all parts of those physical facilities through which gas moves in transportation, including pipe, valves, and other appurtenance attached to pipe, compressor units, metering stations, regulator stations, delivery stations, holders, and fabricated assemblies.

Geographic Information System (GIS) – An organized collection of computer hardware, software, and geographic data used to capture, store, update, maintain, analyze, and display all forms of geographically referenced information.

Hard Cut - A method to trim trees to create an abrupt, clearly delineated boundary. (Also see Feather Cut.)

Hazardous Liquid – Includes petroleum, petroleum products, anhydrous ammonia, and carbon dioxide. (Reference 49 CFR 195.2)

Hazardous Liquid Pipeline – All parts of a pipeline facility through which a hazardous liquids move in transportation, including, but not limited to, line pipe, valves, and other appurtenances connected to line pipe, pumping units, fabricated assemblies associated with pumping units, metering and delivery stations and fabricated assemblies therein, and breakout tanks.

High Consequence Area – A location that is specially defined in pipeline safety regulations as an area where transmission pipeline releases could have greater consequences to health and safety or the environment. Regulations require a transmission pipeline operator to take specific steps to ensure the integrity of a transmission pipeline for which a release could affect an HCA and, thereby, the protection of the HCA.

High-Priority Subsurface Installation –Sometimes referred to as high-priority underground installation, these include natural gas transmission pipelines operating at a pressure that creates a hoop stress of 20% or more of the steel specified minimum yield strength, hazardous liquid pipelines, high voltage electric supply lines, fiber optic lines, pressurized sewage pipelines, and other hazardous underground installations.

Incident – An unintentional release of product from a transmission pipeline that may or may not result in death, injury, or damage to property or the environment. (Note that as used in pipeline safety regulations, an "incident" is an event occurring on a natural gas pipeline for which the operator must make a report to PHMSA's Office of Pipeline Safety. Events of similar magnitude affecting hazardous liquid pipelines are considered "accidents". (Reference 49 CFR 191.3, 49 CFR 195.50)).

Line pipe – The lengths of pipe comprising the main part of transmission pipeline segments, line pipe is identified as only the pipe, excluding ancillary facilities and structures that are located on company property adjacent to the pipeline ROW.

Locate – The process of determining the existence and location of an underground facility, such as an oil or gas pipeline. Following the locate, the surface of the ground above the underground installation is normally marked through the use of stakes, flags or paint, or in some other customary manner. Such markings identify the location of the underground facility so that excavators can avoid damage to the facility when digging.

Locate Request – A communication between an excavator and one-call center personnel in which a notice of proposed excavation and request for locating underground facilities is processed. The one-call center subsequently passes this information to underground facility owners based on the location of the proposed excavation and underground facility data.

MAOP – See Maximum Allowable Operating Pressure

Mark – To indicate the existence and location of a line or facility by establishing a mark through the use of stakes, paint or some other customary manner.

Maximum Allowable Operating Pressure – The maximum pressure at which a gas transmission pipeline or segment of a pipeline may be operated under federal pipeline safety regulations (29 CFR Part 192).

Mitigation – Actions taken to alleviate, reduce the severity of, or moderate the consequences of failure.

NPMS – National Pipeline Mapping System – a geographic information system (GIS) database that contains the locations and attributes of hazardous liquid and gas transmission pipelines operating in the United States. The NPMS also includes data on the locations of other geographic features throughout the U.S. The NPMS supports queries by the public and local governments to determine if transmission pipelines are located near their communities and to determine areas that could be impacted by releases from these pipelines. The NPMS may be accessed at http://www.npms.phmsa.dot.gov/.

One-call Center – An entity that administers a one-call system through which a person can notify transmission pipeline operators of proposed excavations.

One-call System – A system that enables an excavator to communicate through a one-callcenter to transmission pipeline operators to provide notification of intent to excavate. The one-call center will gather information about the intended excavation and then issue tickets to notify affected member transmission pipeline operators. The operators can then clear the tickets or locate and mark the location of their pipelines before the excavation begins. Excavators can then take care when excavating to avoid damaging the transmission pipelines. All 50 states within the U.S. are covered by one-call systems. Most states have laws requiring the use of the one-call system at least 48 hours before beginning an excavation.

Ordinance – An authoritative public rule, law or regulation, such as a zoning ordinance, issued by a local community government. A zoning ordinance is a device of land use planning used by local governments to designate permitted uses of land based on mapped zones which separate one set of land uses from another. Zoning may be use-based (regulating the uses to which land may be put), or it may regulate building height, lot coverage, and similar characteristics, or some combination of these.

Person – Any individual or legal entity, public or private.

Petroleum Products – Flammable, toxic, or corrosive products obtained from distilling and processing of crude oil, unfinished oils, natural gas liquids, blend stocks and other miscellaneous hydrocarbon compounds.

Pipeline – Used broadly, pipeline includes all parts of those physical facilities through which gas, hazardous liquid, or carbon dioxide moves in transportation.

Pipeline Easement – See "Easement"

Pipeline Operator – For natural gas transmission pipelines, a person who engages in the transportation of gas (reference 49 CFR 192.3). For hazardous liquid pipelines, a person who owns or operates pipeline facilities (reference 49 CFR 195.2). Generally, an operator is a company or person responsible for the operation, maintenance and management of the transmission pipeline.

Pipeline Segment – A discrete portion of a transmission pipeline system as defined by the pipeline operator. A pipeline segment usually consists of a length of line pipe and may contain ancillary structures and other appurtenances associated with the pipeline. The end points defining the boundaries of a pipeline segment are usually determined by geographic features (e.g., mile posts) and/or features of the pipeline itself, such as welds, valves, etc.

Planning – An activity at the beginning of a project where information is gathered and decisions are made regarding the route or location of a proposed excavation based on constraints including the locations of existing facilities, anticipated conflicts and the relative costs of relocating existing facilities or more expensive construction for the proposed facility.

Planning Area – *See Recommended Practice BL06*. An area surrounding a transmission pipeline that is defined by ordinance and is based on characteristics of the pipeline and the area surrounding the pipeline. Local governments and property developers/owners should consider implementing a planning area to protect communities where new development is planned near transmission pipelines.

Plat – A map or representation on paper of a piece of land subdivided into lots, with streets, alleys, etc., usually drawn to a scale.

Project – An activity or task (or set of related activities or tasks) that is contemplated, devised, or planned and carried out for the purpose of accomplishing a goal. For example, a communication project could involve a planned set of activities to communicate the PIPA recommended practices to affected stakeholders. Usually thought of as affecting construction, maintenance or development activities, projects that could affect a transmission pipeline could be as simple as the planting of a tree or as complex as multi-million dollar construction projects.

Right-of-way (ROW) – (1) Property, usually consisting of a narrow, unobstructed strip or corridor of land of a specific width, which a pipeline company and the fee simple landowners have legal rights to use and occupy. A ROW is a string of contiguous properties on which easements have been acquired along which the pipeline operator has rights to construct, operate and maintain a pipeline. (2) A defined strip of land on which an operator has the right to construct, operate and maintain a pipeline. The operator may own a right-of-way outright or an easement may be acquired for specific use of the right-of-way. (Also see Rights-of-way.)

Right-of-way Agreement – See "Easement"

Rights-of-way – See "Right-of-way"

Risk – the product of the probability or likelihood of an undesired event occurring and the consequences that may result from that event.

Risk Informed – Having adequate knowledge of associated risk to be able to make appropriate decisions relative to the risk.

Risk Reduction – Measures taken to minimize the probability or likelihood and/or consequences of risk.

Rural – An area outside the limits of any incorporated or unincorporated city, town, village, or any other designated residential or commercial area such as a subdivision, a business or shopping center, or community development. (Reference 49 CFR 195.2)

Setback – The minimum distance between a pipeline or the edge of a pipeline easement, and a building or other structure. A line established by local government ordinance, within a property, defining the minimum distance between any building or structure or portion thereof to be erected or altered, and an adjacent right-of-way, street or property line. The setback is usually expressed as the minimum distance between the line of demarcation (e.g., a pipeline or the edge of a pipeline easement) and a building or other structure.

Statutory Agency – A governmental agency empowered with the authority to implement and enforce statutory codes and regulations.

Temporary Work Space – An area of land within which certain activities are authorized for a specified purpose and period of time, typically of short duration.

Third-party Damage – Third-party damage includes outside force damage to underground facilities (e.g., transmission pipelines) that can occur during excavation activities and is caused by someone other than the facility operator or its contractors.

Ton-miles – Describes the units of measure to measure the quantity and traffic of transportation used in transportation statistics, planning, and their related fields. A ton-mile is equivalent to moving one ton of freight product one mile.

Transmission Pipeline – When not specified includes both hazardous liquid and gas transmission pipelines. Transmission pipelines carry oil, petroleum products, natural gas, natural gas liquids, anhydrous ammonia and carbon dioxide from producing regions of the country to markets.

Transmission Pipeline Corridor – A pipeline corridor is a linear area where two or more pipelines (either part of the same or different pipeline systems) are closely grouped in a single right -of-way.

Urban – 1) Relating to or concerned with a city or densely populated area (e.g., "urban development"); 2) Located in or characteristic of a city or city life (e.g., "urban property owners").

Vapor Pressure – (also equilibrium vapor pressure) is the pressure of a vapor in thermodynamic equilibrium with its condensed phases in a closed container. Said another way, the vapor pressure of a liquid is the pressure exerted by its vapor when the liquid and vapor are in dynamic equilibrium. All liquids and solids have a tendency to evaporate into a gaseous form, and all gases have a tendency to condense back to their liquid or solid form. The equilibrium vapor pressure is an indication of a liquid's evaporation rate. It relates to the tendency of particles to escape from the liquid (or a solid). A substance with a high vapor pressure at normal temperatures is often referred to as *volatile*.

PIPA Report, November 2010

CONTENTS

PREFACE ... i

GLOSSARY ... i

CONTENTS ... i

EXECUTIVE SUMMARY ... 1

SCOPE ... 2

INTRODUCTION ... 3

Approaching the Issues ... 6

Demonstration Projects ... 6

KEY STAKEHOLDERS ... 9

Local Government ... 9

Property Developer/Owner ... 9

Transmission Pipeline Operator ... 9

Real Estate Commission ... 10

TRANSMISSION PIPELINE BENEFITS AND RISK ... 11

The Benefits of Transmission Pipelines ... 12

Transmission Pipeline Risks ... 13

Transmission Pipeline Risk Mitigation ... 14

GENERAL INFORMATION ON RECOMMENDED PRACTICES ... 17

BL01 Obtain Transmission Pipeline Mapping Data ... 21

BL02 Incorporated into other recommended practices. Page is otherwise blank. ... 22

BL03 Utilize Information Regarding Development around Transmission Pipelines ... 23

BL04 Adopt Transmission Pipeline Consultation Zone Ordinance ... 25

BL05 Define Transmission Pipeline Consultation Zone ... 26

BL06 Implement New Development Planning Areas around Transmission Pipelines ... 30

BL07 Understand the Elements of a Transmission Pipeline Easement ... 32

BL08 Manage Land Records ... 35

BL09 Document and Record Easement Amendments ... 37

BL10 Implement Communications Plan ... 38

BL11 Effectively Communicate Pipeline Risk and Risk Management Information ... 39

i

BL12 Notify Stakeholders of Right-of-Way Maintenance Activities 40

BL13 Prevent and Manage Right-of-Way Encroachment 43

BL14 Participate to Improve State Excavation Damage Prevention Programs 44

BL15 Enhance Damage Prevention Practices near High-Priority Subsurface Facilities 46

BL16 Halt Dangerous Excavation Activities near Transmission Pipelines 48

BL17 Map Abandoned Pipelines 49

BL18 Disclose Transmission Pipeline Easements in Real Estate Transactions 50

ND01 Incorporated into other recommended practices. Page is otherwise blank. See PIPA Recommended Practices BL03 and BL05 for guidance. 51

ND02 Gather Information for Design of Property Development near Transmission Pipelines 52

ND03 Review Acceptability of Proposed Land Use of Transmission Pipeline Right-of-Way Prior to Design 54

ND04 Coordinate Property Development Design and Construction with Transmission Pipeline Operator 55

ND05 Incorporated into other recommended practices. Page is otherwise blank. 58

ND06 Require Consideration of Transmission Pipeline Facilities in Land Development Design 59

ND07 Define Blanket Easement Agreements When Necessary 60

ND08 Collaborate on Alternate Use and Development of Transmission Pipeline Right-of-Way 61

ND09 Provide Flexibility for Developing Open Space along Transmission Pipeline Rights-of-Way 63

ND10 Record Transmission Pipeline Easements on Development Plans and Final Plats 64

ND11 Reduce Transmission Pipeline Risk through Design and Location of New Parking Lots and Parking Structures 65

ND12 Reduce Transmission Pipeline Risk through Design and Location of New Roads 67

ND13 Reduce Transmission Pipeline Risk through Design and Location of New Utilities and Related Infrastructure 69

ND14 Reduce Transmission Pipeline Risk through Design and Location of Aboveground Water Management Infrastructure 70

ND15 Plan and Locate Vegetation to Prevent Interference with Transmission Pipeline Activities 71

ND16 Locate and Design Water Supply and Sanitary Systems to Prevent Contamination and Excavation Damage 72

ND17 Reduce Transmission Pipeline Risk in New Development for Residential, Mixed-Use, and Commercial Land Use 73

ND18 Consider Transmission Pipeline Operation Noise and Odor in Design and Location of Residential, Mixed-Use, and Commercial Land Use Development 76

ND19 Reduce Transmission Pipeline Risk through Design and Location of New Industrial Land Use Development 78

ND20 Reduce Transmission Pipeline Risk through Location, Design, and Construction of New Institutional Land Use Developments 80

ND21 Reduce Transmission Pipeline Risk through Design and Location of New Public Safety and Enforcement Facilities 82

ND22 Reduce Transmission Pipeline Risk through Design and Location of New Places of Mass Public Assembly (Future Identified Sites) 84

ND23 Consider Site Emergency Response Plans in Land Use Development 86

ND24 Install Temporary Markers on Edge of Transmission Pipeline Right-of-Way Prior to Construction Adjacent to Right-of-Way 88

ND25 Contact Transmission Pipeline Operator Prior to Excavating or Blasting 90

ND26 Use, Document, Record and Retain Encroachment Agreements or Permits 91

ND27 Use, Document and Retain Letters of No Objection and Conditional Approval Letters 93

ND28 Document, Record and Retain Partial Releases 94

Appendix A: PIPA Participants 1

Steering Group 1

PHMSA and Cycla Project Support 1

Task Team 1 – Protecting Communities 1

Task Team 2 – Protecting Transmission Pipelines 3

Task Team 3 - Communications 3

Other Participants 5

Appendix B: Model Ordinance 1

Appendix C: Incorporating Transmission Pipeline ROW in New Developments 1

Example 1 – Rural: Green Space Development 2

Example 2 – Rural: Agricultural 3

Example 3 – Rural: Bridge crossing 5

Example 4 – Rural: Soft Surface Walking Trail 7

Example 5 – Suburban: Shared utility corridor with asphalt walking path 8

Example 6 – Suburban: Green space 9

Example 7 – Suburban: Walking Trail 10

Example 8 – Suburban: Green space 11

Examples 9a, 9b and 9c – Suburban: Walking Trails 12

Example 10 – Suburban: Formal garden with shallow rooted plantings 15

Example 11 – Suburban: Playground equipment and removable sport court 16

Example 12 – Urban: Formal garden with shallow rooted plants. 17

Example 13 – Urban: Church 18

Example 14 – Trees in the right-of-way 19

Examples 15a, 15b and 15c – Tree roots may damage transmission pipelines 20

Examples 15d, 15e and 15f – Tree Roots May Damage Transmission Pipelines 23

Example 16 – New Development Built to the Edge of the Right-of-Way 26

Example 17 – Temporary Structures in the Right-of-Way 27

Appendix D: Proposed Land Uses for Transmission Pipeline ROW 1

Appendix E: Seven-Step Communication Model 1

Introduction 1

Seven Step Communication Model 3

Conclusion 13

Appendix F: Barriers to Effective Communication 1

Leading Practices for Transmission Pipeline Operators to Engage Stakeholders 2

CGA Best Practices Version 6.0 3

Guidance for Communicating with Transmission Pipeline Companies 4

Communicating Pipeline Risk and How Risk is Managed 6

Leading Practices to Communicating Risk 7

Additional resources for transmission pipeline operators 11

Overarching Recommendations 12

Appendix G: ROW Acquisition and INGAA Commitment 1

Summary Example of a Transmission Pipeline Operator's Right-Of-Way Acquisition Process 1

General Route Evaluation - Project Feasibility Analysis Phase 1

Operator's Due Diligence Phase 2

INGAA Member Company Commitment to Landowners 6

Appendix H: Acronyms 1

Appendix I: Calculation of Site-Specific Planning Area Distances 1

Planning Area: Natural Gas Transmission Pipelines and Other Gas Transmission Pipelines 1

Planning Area: Liquid Pipelines 2

PIPA Report, November 2010

EXECUTIVE SUMMARY

The Pipelines and Informed Planning Alliance (PIPA) is a stakeholder initiative led and supported by the US Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA). PIPA's goal is to reduce risks and improve the safety of affected communities and transmission pipelines through implementation of recommended practices related to risk-informed land use and development near transmission pipelines. The PIPA recommended practices describe actions that can be taken by key stakeholders, including local government, transmission pipeline operators, property developers/owners, and real estate commissions.

The landmark Common Ground Study of One-call Systems and Damage Prevention Best Practices identified best practices for all stakeholders to prevent excavation damage to underground facilities. However, land use planning and development near transmission pipelines is not addressed in the Common Ground Best Practices. The PIPA recommended practices fill this gap.

To further address the impact of community growth on pipeline safety, and the requirements of the Pipeline Safety Improvement Act of 2002, a comprehensive study of pipeline safety and land use practices was conducted by the Transportation Research Board (TRB) of the National Academies. The results, published in 2004 as TRB Special Report 281, "Transmission Pipelines and Land Use: A Risk-Informed Approach," included several recommendations for PHMSA. To address those recommendations PHMSA facilitated the establishment of the Pipelines and Informed Planning Alliance.

The initial PIPA effort has resulted in recommended practices for local governments, property developers and owners, transmission pipeline operators, and real estate boards to be aware of and to implement as appropriate. Two key practices address the development and implementation of "consultation zones" and "planning areas" when making decisions regarding land use planning and development near transmission pipelines.

Transmission pipeline failures present risks that may impact people and property beyond the edge of pipeline rights-of-way (ROW). To address these risks, some communities have imposed zoning restrictions, including fixed-distance building setbacks for development along transmission pipeline ROW. Building setbacks are typically used by local governments to provide separation between the community and potential risks, in this case pipelines. However, fixed-distance setbacks commonly don't consider the risks involved with a specific pipeline and the physical environment in which the pipeline operates. Individual transmission pipelines differ in character – some are large-diameter, high-pressure, cross-country pipelines traversing mostly rural areas, while others are located in urban areas and densely-populated urban centers. Transmission pipelines operated within urban areas may be located underneath public streets and roadways in areas that are already well-developed. Federal regulations attempt to mitigate the risk of transmission pipelines located in more densely-populated areas by imposing more stringent requirements. For example, gas transmission pipelines located in heavily populated urban areas are generally required to adhere to additional design, operation, and maintenance requirements. However, each situation is unique relative to the pipeline characteristics and the areas surrounding the pipeline ROW. Thus, PIPA recommends that implementing a risk-informed approach to land use planning and development and establishing good communication with the transmission pipeline operator is more appropriate than establishing a fixed-distance setback to be applied in all situations.

Consultation zones and planning areas are important, as transmission pipeline failures are classic examples of events of low probability but potentially high consequence, and the consequences may adversely affect the general public. It is important for local governments and other stakeholders to make risk-informed decisions regarding land use planning and development in locations where residences and businesses are increasingly in proximity to transmission pipelines. Local governments should make full use of available resources and communicate with the operators of the transmission pipelines in their communities to better understand the characteristics of the specific pipelines involved and the characteristics of the surrounding areas that can affect risks.

Some communities began adopting some of the PIPA recommended practices prior to the issuance of the PIPA report. After soliciting proposals, PHMSA provided community Technical Assistance Grants (TAG) to four communities to demonstrate and evaluate implementation of some aspects of the draft PIPA recommended practices.

The PIPA recommended practices are not mandated by any public or private entity. However, they were developed by task teams of representative stakeholders who agreed on the practices using a consensus agreement process similar to that used during the Common Ground Study. All stakeholders are encouraged to become aware of and implement the PIPA recommended practices where appropriate.

PHMSA plans to continue working with pipeline safety and land use planning stakeholders to ensure that a sound implementation strategy is developed and that the recommended practices are communicated to and understood by those that need to adopt them. Lessons learned from implementation of these practices are expected to lead to their improvement and expansion. The most current version of this information will be available on PHMSA's Pipeline Safety Stakeholder Communications website.

SCOPE

The recommended practices developed by the Pipelines and Informed Planning Alliance apply to land use planning and development in proximity to hazardous liquid or gas transmission pipelines. Our energy pipeline transportation system also includes networks of production, gathering, and distribution pipelines. However, the PIPA initiative focuses exclusively on transmission pipelines and the PIPA recommended practices are not intended to apply to those production, gathering, and distribution pipeline systems.

Some of the PIPA recommended practices may not be appropriate for consideration in the siting of new pipelines. There is an extensive network of federal and state regulatory and judicial processes involved with the evaluation and approval of new transmission pipeline siting and construction. These are beyond the scope of the PIPA recommended practices. Additionally, the PIPA recommended practices do not specifically address environmental resource conservation issues in pipeline rights-of-way.

The PIPA recommended practices associated with reducing the risks of excavation damage may be applicable to all underground facilities. However, the PIPA recommended practices are considered to complement the damage prevention best practices developed, maintained and promoted by the Common Ground Alliance (CGA) and are not intended to replace or conflict with any of the CGA best practices.

The PIPA recommended practices are not mandated by any public or private entity. However, they were developed by task teams of representative stakeholders using a consensus agreement process and the PIPA participants recommend that all stakeholders become aware of and implement the PIPA recommended practices, as appropriate, to reduce risks and ensure the safety of affected communities and transmission pipelines .

INTRODUCTION

The Pipelines and Informed Planning Alliance is a broad stakeholder initiative led and supported by the US Department of Transportation's Pipeline and Hazardous Materials Safety Administration. The goal of PIPA is to reduce risks and improve the safety of affected communities and transmission pipelines through implementation of recommended practices related to risk-informed land use and development near transmission pipelines. The PIPA recommended practices describe actions that can be taken by stakeholders when there are proposed changes in land use or new development adjacent to existing transmission pipelines.

Over the past 70 years, a nationwide system of gathering, transmission, and distribution pipelines has been constructed to transport almost 100 percent of the natural gas and two-thirds of the ton-miles of oil and refined petroleum products consumed in the United States. The majority of these hazardous liquid and gas commodities are transported via large diameter transmission pipelines as intrastate or interstate commerce. Many portions of the transmission pipelines were originally constructed in sparsely populated areas; however, subsequent growth has transformed some of these previously rural and sometimes remote areas into urban and suburban areas, with housing subdivisions, shopping centers, and business parks. In turn, this widespread growth of new communities has spurred the construction of even more pipelines to meet growing energy needs.

The Transportation Equity Act for the 21st Century (TEA-21) was signed into law in June 1998. To address increasing trends of excavation damage to pipelines and to fulfill the requirements of TEA-21, in 1999 PHMSA sponsored and supported the landmark Common Ground Study of One-call Systems and Damage Prevention Best Practices. The focus of the Common Ground Study was to identify and promote best practices for all stakeholders to prevent excavation damage to underground facilities.

Building on the success of the Common Ground Study, Congress directed PHMSA to support and facilitate the formation of a nonprofit entity to provide stewardship to help ensure acceptance and implementation of the Damage Prevention Best Practices across the country. With continuing stakeholder support, this led to the founding of the Common Ground Alliance (CGA). Today, the CGA continues to refine and promote the Damage Prevention Best Practices, develop educational programs, and collect excavation damage data. The CGA programs reduce the risk of excavation damage for all types of underground facilities, including gas and hazardous liquid pipelines, electrical and communications systems, water systems, and sewer systems. However, land use planning and development near transmission pipelines are not addressed in the Common Ground best practices. The PIPA recommended practices are intended to fill this gap by providing land use planning guidance to key stakeholders, including local officials, property developers/owners, transmission pipeline operators and real estate commissions.

In 2000 and 2001, PHMSA undertook research and solicited input on how to communicate pipeline risks to communities. PHMSA initiated a cooperative agreement with the Transportation Research Board (TRB) of the National Academies to undertake a comprehensive study of pipeline safety and land use practices, to better understand land use planning issues. The results were published in TRB Special Report 281 "Transmission Pipelines and Land Use: A Risk-Informed Approach" in October 2004, and included several recommendations for PHMSA related to the development of risk-informed land use guidance. Two of those recommendations were for PHMSA to:

(1) Develop risk-informed land use guidance for application by stakeholders and
(2) Develop the guidance through a process that:
    a. involves the collaboration of a full range of public and private stakeholders;
    b. is conducted by persons with expertise in risk analysis, risk communication, land use planning, and development regulation;
    c. is transparent, independent, and peer reviewed; and
    d. incorporates learning and feedback to refine the guidance over time.

It should be noted that the TRB Report also recommended "The transmission pipeline industries should develop best practices for the specification, acquisition, development, and maintenance of pipeline rights-of-way. In so doing, they should work with other stakeholders." (See Appendix G) The third recommendation stated, "With regard to the specific maintenance issue of clearing rights-of-way to allow for inspection, the federal government should develop guidance about appropriate vegetation and environmental management practices that would provide habitat for some species, avoid threats to pipeline integrity, and allow for aerial inspection." The PIPA recommended practices do address vegetation management along the transmission pipeline ROW but do not specifically address environmental resource conservation issues.

To address the TRB recommendations, PHMSA brought together representatives of several stakeholder organizations to form the PIPA Steering Committee in August 2007 (See Appendix A). The PIPA Steering Committee invited organizations representing key stakeholders in land use planning to join traditional pipeline safety stakeholders in an effort to define land use planning practices that could provide safety benefits to communities and to transmission pipelines.

PIPA is a collaborative effort by stakeholder representatives, similar to the Common Ground Study. The initial PIPA effort included about 130 stakeholder representatives of the pipeline industry, local city and county governments, the public, developers, fire marshals, and state and federal regulators (See Appendix A). The participants represented the following organizations:

PIPA Report, November 2010

- American Gas Association (AGA)
- American Land Title Association (ALTA)
- American Public Works Association (APWA)
- Association of Oil Pipelines (AOPL)
- Common Ground Alliance (CGA)
- U. S. Department of Housing and Urban Development (HUD)
- Federal Energy Regulatory Commission (FERC)
- Gas Processors Association (GPA)
- International Right-of-Way Association (IROW)
- Interstate Natural Gas Association of America (INGAA)
- National Association of Counties (NACo)
- National Association of County Planners (NACP)
- National Association of Home Builders (NAHB)
- National Association of Industrial and Office Properties (NAIOP)
- National Association of Local Government Environmental Professionals (NALGEP)
- National Association of Pipeline Safety Representatives (NAPSR)
- National Association of Realtors (NAR)
- National Association of Regulatory Utility Commissioners (NARUC)
- National Association of State Fire Marshals (NASFM)
- National Fire Protection Association (NFPA)
- National League of Cities (NLC)
- US Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA)
- Pipeline Safety Trust (PST)
- Virginia Utility Protection Services (VUPS)

During 2008 and 2009, the three PIPA task teams met numerous times to discuss and develop recommended practices to address the following questions:

- <u>Protecting Communities</u> – What should transmission pipeline safety stakeholders do, or avoid doing, adjacent to the transmission pipeline right-of-way to reduce the risk to communities?
- <u>Protecting Transmission Pipelines</u> – What should transmission pipeline safety stakeholders do, or avoid doing, on the right-of-way to reduce the risk to transmission pipelines while preserving environmental resources?
- <u>Communication</u> – How should the risks to transmission pipelines and communities be communicated among pipeline safety stakeholders?

The task teams followed a process similar to one used in the Common Ground Study in which consensus agreement was needed by all team participants for each recommended practice. Consensus was defined as requiring that each participant must be able to "live with" the team recommendations and decisions, even if not ideal. The process of developing consensus is considered to have increased each participant's appreciation for the legitimate needs and concerns of the other stakeholders.

Approaching the Issues

Changes in land use and new developments near transmission pipelines can create risks to communities and to the pipelines. New development near existing transmission pipeline facilities may also experience noise and odors from these facilities that may lead to dissatisfaction among residents of the new development. Early communication and action among stakeholders can help to ensure these actions can be accomplished safely. The PIPA recommended practices are intended to enhance safety by guiding stakeholder communications and actions early in the planning stages.

Achieving the PIPA goal of reducing risk and improving the safety of affected communities and transmission pipelines can be challenging due to the differing and sometimes conflicting concerns of stakeholders. Property developers/owners are concerned with their options for and the economic feasibility of developing land. Local governments need to adopt development decision-making processes that protect the safety of their residents while encouraging and allowing planned development to occur. Transmission pipeline operators need to protect their pipelines from potential damage by activities on or near the pipeline rights-of-way and to provide unrestricted access for maintenance and emergency response. These and other stakeholders, such as land surveyors, development design professionals, other underground utility operators, real estate professionals, and federal and state pipeline regulators are best served by a decision-making process that is efficient, effective, and not unduly time-consuming or costly.

Fortunately, safety is a common goal for all stakeholders and should be considered when decisions are made that impact life, property, or the environment. When transmission pipelines are located in proximity to where people live, work, shop, or travel, pipeline safety concerns must be incorporated into every level of the decision-making and land development approval process.

The input of the PIPA participants has been gathered and reviewed during the PIPA process. The concepts and examples they discussed evolved into recommended practices to advance the mutual understanding of all stakeholders to transmission pipeline and land use planning issues adjacent to the pipeline right-of-way. When each stakeholder understands the relevant roles, interests, and issues of other stakeholders, fruitful communication, cooperation, and mutually agreeable compromise are achievable.

Demonstration Projects

Some communities began early adoption of some of the PIPA recommended practices prior to the issuance of the PIPA report. After soliciting proposals through a Federal Register Notice (FRN), PHMSA provided community technical assistance grants to four communities to demonstrate and evaluate implementation of some aspects of the draft PIPA recommended practices. The four communities included Brookings County, SD; Montgomery County, VA; City of St. Peters, MO; and the City of Fort Worth, TX.

- Using its TAG grant, Brookings County developed and implemented a revised zoning ordinance for developments near existing transmission pipelines, upgraded its geographic information system (GIS) mapping capabilities to show the location of existing pipelines, and developed an associated safety brochure for the public. The new "Transmission Pipeline Risk Reduction

Overlay District" incorporated into the zoning ordinance utilized recommendations from the PIPA recommend practices. Brookings County enacted new consultation zone and planning zone requirements. Brookings County worked with multiple stakeholders, including two transmission pipeline operators, in establishing the appropriate distances for the consultation and planning zones. A copy of the final report submitted by Brookings County is available at: http://primis.phmsa.dot.gov/tag/PrjHome.rdm?prj=326.

- Montgomery County's project utilized its TAG grant to initiate communication and establish a working relationship with the various pipeline operators within the county. The Montgomery County GIS staff and pipeline operators discussed Montgomery County's pipeline database to confirm pipeline locations and pipeline characteristics. County mapping was updated to include pipeline information to assist the County with land use planning and building permit reviews. Following discussions with the pipeline operators, educational materials were developed and are now being distributed to the public by County staff. These results helped to achieve the original objectives of the project to increase communication with existing pipeline operators within Montgomery County; increase GIS mapping database, analysis and modeling capabilities and knowledge of pipeline characteristics and properties; increase awareness of pipeline safety; increase planning awareness adjacent to pipelines; and, increase public safety awareness and knowledge of how to respond to a potential incident. A copy of the final report submitted by Montgomery County is available at: http://primis.phmsa.dot.gov/tag/PrjHome.rdm?prj=328.
- The City of St. Peters' TAG project was to develop an educational public webpage for residents, property owners, contractors, and developers to enhance community awareness of pipeline safety issues and provide education regarding land use planning, damage prevention, rights-of-way issues and other concerns regarding development near transmission pipelines. More information on the City of St. Peters' TAG project is available at: http://primis.phmsa.dot.gov/tag/PrjHome.rdm?prj=325.
- The City of Fort Worth utilized its TAG grant in a project to convert paper-based pipeline records to a public GIS to be used for land use planning. Fort Worth retained a GIS consultant to develop an import process manual for current and backlogged as-built gas pipeline data. The consultant determined the data requirements and needs of individual departments and met with the gas pipeline operators to ascertain which of the many different data formats are currently being used in submittals to the city. A data import process manual and a prototype model were developed to demonstrate functionality of the process and how the data can be viewed. A key feature is a hyperlink to as-built plans and agreements between the pipeline operators and the city. This allows users to quickly and accurately retrieve data and information relevant to managing the expanding pipeline systems across the Dallas and Fort Worth metropolitan area. The city will also make information available through a public map viewer to city departments, citizens, developers and private contractors as it is imported into the city's GIS database. More information on the City of Fort Worth's TAG project is available at: http://primis.phmsa.dot.gov/tag/PrjHome.rdm?prj=327.

PIPA Report, November 2010

The PIPA participants encourage all stakeholders to consider adopting and integrating the PIPA recommended practices into the culture of their local communities, companies, and organizations in order to reduce risks, to enhance pipeline safety, and protect communities. PHMSA plans to enlist the help of PIPA stakeholders in maintaining the ideas and recommended practices developed to date. With stakeholder participation, the ideas and recommended practices will be refined over time, and new and better methods for coordinating pipeline safety and land use planning on a national basis will be developed.

KEY STAKEHOLDERS

Local Government

Local government officials (typically the town, city, county, or parish legislative body) are responsible for the health, safety, and welfare of the residents and for establishing development regulations and zoning. In more populated areas, detailed recommendations regarding land use regulations, zoning, and in some cases comprehensive plans, are made by professional planning staff. Some jurisdictions also incorporate planning commissions into their planning process. Though there are many variations in the way local governments are structured, land development is important in every community. Major decisions regarding land use planning, zoning, and development are generally made by the elected local government legislative body.

Property Developer/Owner

The property developer/owner is responsible for project planning relating to a parcel of land. This involves gathering all available and necessary information and making decisions affecting a planned development project, such as proposed excavation, construction, or development activity, as well as developing the project plans and getting the necessary approvals and permits to ensure all zoning and construction requirements are met.

Site planning decisions should include consideration of project constraints, including the location of and anticipated conflicts resulting from transmission pipeline facilities existing within the development area and the relative costs and benefits associated with resolving or accommodating such conflicts. Planning must also consider the constraints imposed by community development plans and zoning regulations.

Transmission Pipeline Operator

Transmission pipeline operators are responsible for the safe operation and maintenance of hazardous liquid and/or natural gas transmission pipelines. These pipelines are subject to federal pipeline safety regulations administered either directly by PHMSA or by a state agency. Operator responsibilities include taking actions to avoid pipeline damage or failure. Such actions include: periodic testing and continued maintenance of transmission pipeline facilities, development of emergency plans, performance of leak surveys, continuing surveillance, encroachment mitigation and right-of-way patrolling, and the development and implementation of damage prevention programs and public awareness programs. These activities are required by federal pipeline safety regulations, and transmission pipeline companies frequently augment these requirements.

For public awareness programs, transmission pipeline operators must follow the federal pipeline safety regulations (49 CFR 192.616, 49 CFR 195.440) which incorporate by reference the general program recommendations of the American Petroleum Institute (API) Recommended Practice (RP) 1162. Each operator's program must specifically include provisions to educate the public, appropriate government organizations, and persons engaged in excavation related activities on:

1. Use of one-call notification systems prior to excavation and other damage prevention activities;

PIPA Report, November 2010

2. Possible hazards associated with unintended releases from a pipeline facility;
3. Physical indications that such a release may have occurred;
4. Steps that should be taken for public safety in the event of a pipeline release; and
5. Procedures for reporting pipeline releases.

Under the regulations, each operator's public awareness program must also include activities to advise affected municipalities, school districts, businesses, and residents of pipeline facility locations. The program and the media used must be as comprehensive as necessary to reach all areas in which the operator transports hazardous liquid or carbon dioxide. The program must be conducted in English and in other languages commonly understood by a significant number and concentration of the non-English speaking population in the operator's area.

Real Estate Commission

Real estate commissions are generally established to protect the public interest in real estate brokerage transactions in each state. The commission may have many diverse goals and objectives. For example, one goal may be to assure that licensees are competent and morally fit to act as real estate brokers. The objective of this goal could be to effectively administer, monitor and improve the quality of the real estate pre-licensing education program, license examination program, and the continuing education program.

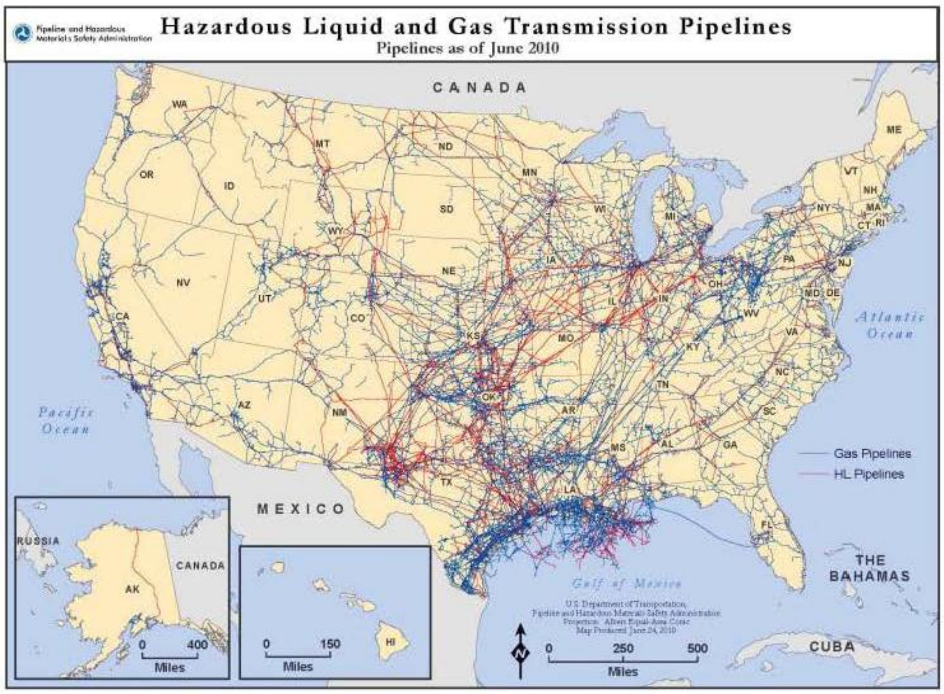
Another goal may be to ensure that real estate licensees comply with the real estate practice standards imposed by the real estate license law and commission rules. Objectives related to this goal could include actions to process, inquire into or investigate, and prosecute complaints against licensees in a thorough, timely, and efficient manner. Another objective related to this goal could be to serve as a real estate information resource for licensees and consumers.

Finally, a third goal may be to identify and address issues affecting real estate consumers and practitioners. Objectives of this goal could include detection and monitoring of special problems and areas of concern affecting real estate consumers and licensees, adopting positions, promulgating rules and proposing legislation to address problems and concerns, and disseminating information and addressing subjects of special interest and concern to licensees and consumers.

PIPA Report, November 2010

TRANSMISSION PIPELINE BENEFITS AND RISK

Our nation's economic well-being and security depend upon a vast network of pipelines to transport the huge volumes of energy products that we consume every day. There are over 295,000 miles of natural gas transmission pipelines and over 164,000[1] miles of hazardous liquid pipelines moving energy products throughout the U.S. every day. Approximately 66 percent of the ton-miles of oil and refined petroleum products and almost 100 percent of the natural gas that we consume are transported by pipeline.



As communities develop and evolve, we are very likely to see an increase in community development in proximity to existing transmission pipelines. It is important that local governments, property developers/owners, transmission pipeline operators, and state real estate commissions are aware of and understand the actions they can take to reduce risks and enhance the safety of their communities when there are proposed changes in land use or new development adjacent to existing transmission pipelines.

[1]PHMSA Office of Pipeline Safety (OPS) pipeline mileage data from Annual Reports. Mileage cited is from 2008 annual reports submitted as of May 2010.

11

PIPA Report, November 2010

The Benefits of Transmission Pipelines

Transmission pipelines provide benefits to our general economy and security by providing efficient, cost effective, reliable, safe and secure delivery of the energy products we rely upon. Some people who live near pipelines may not see themselves as being direct beneficiaries of pipeline transportation; they may instead consider the beneficiaries to be communities and cities perhaps hundreds of miles away. However, everyone in the US uses and benefits from the energy and consumer products produced from natural gas and petroleum made available by pipeline transportation.

Transportation – Approximately 97 percent of our transportation energy is supplied by petroleum.[2] More than one out of every ten workers in America is employed in transportation and transportation-related industries.

Refined petroleum products provide the fuel to power all motorized transportation in America such as cars, motorcycles, buses, trucks, locomotives, ships and airplanes. All of these refined fuel products (and others) come from crude oil, most of which is first transported to refineries by a system of gathering and transmission pipelines. After the refining process, the petroleum products are transported, generally by transmission pipeline, to storage and distribution centers.

Heating – Approximately 22 percent of the energy consumed annually in the U.S. comes from natural gas.[3] More than 62.5 percent of the nation's 66.8 million homes use natural gas stoves, furnaces, water heaters, clothes dryers, and other household appliances.[4] Another seven percent of the homes in the U.S., primarily in the Northeast, use oil as their main heating fuel. Natural gas and heating oil are transported through transmission pipelines over long distances.

Electricity – Electricity is also used for our residential and industrial energy needs, and a growing percentage of our electricity is generated by natural gas. Approximately 19 percent[5] of our nation's electricity is generated from over 1,700 power plants that use natural gas, of which almost all is delivered by pipelines. Most power plants built in the last decade are fueled by natural gas due to the improved flexibility in siting and operating the plants, reasonable generation costs, and lower environmental emissions. Natural gas-fired electricity generation is projected to increase dramatically over the next 15 years as new electric generation capacity that is now being constructed or planned comes online.

National Defense - The U.S. armed services rely on pipelines to meet their energy needs. The Defense Department buys more refined oil products than any other single buyer in the world – roughly $11.4 billion of petroleum and $24.9 million of natural gas in 2007[6]. Much of this fuel is delivered by transmission pipelines. More than 100 Air Force, Army, Marine Corps, and Navy installations in the U.S. have direct connections to transmission pipelines so they can receive the natural gas and petroleum supplies they need to meet their missions.

[2] Introduction to Energy, The Need Project, 2007, p.11.
[3] Energy Information Administration, *Natural Gas Annual 2006*, December 2007.
[4] Energy Information Administration, *Natural Gas Annual 2006*, December 2007.
[5] Energy Information Administration website, 2006 data.
[6] Defense Energy Support Center Fact Book, 2007.

12

PIPA Report, November 2010

Total Economic Impact – More than ten percent of our nation' Gross Domestic Product, or about $1.3 trillion, stems directly from the transportation sector.[7] Since 97 percent of all American transportation energy comes from petroleum, the importance of transmission pipelines to the American economy is clear. Many U.S. industries also rely on raw materials that are derived from large volumes of crude oil and natural gas delivered by transmission pipelines. A significant percentage of the economic benefits from our core national industry sectors, including food products, pharmaceuticals, plastics and resins, industrial organic chemicals, and automotive, would not be possible without oil and natural gas energy and related feed stocks transported by transmission pipelines.

Transmission Pipeline Risks

PHMSA provides statistical reports of pipeline incidents and consequences. Additional information on transmission pipeline risks and risk mitigation can be found in a separate report prepared by PHMSA in 2010 entitled: "Building Safe Communities: Pipeline Risk and its Application to Local Development Decisions".

Risks associated with transmission pipelines result from accidental releases of the transported products, which can impact public safety, the environment, national security and our economy. Economic impacts may result from business interruptions, damaged infrastructure, and loss of energy fuel supplies. Accidental releases can result in injuries or fatalities from fires or explosions caused by ignition of the released product, as well as from possible toxicity and asphyxiation effects. The potential consequences of transmission pipeline releases vary according to the transported commodity as well as characteristics of the surrounding area.

Hazardous liquid pipelines can transport a variety of products. Releases of hazardous liquids having a high vapor pressure, such as propane, pose an acute hazard of fire or explosion. Some of these high vapor pressure commodities have densities greater than air and tend to remain near the ground where they can present asphyxiation risks. Releases of hazardous liquids such as gasoline and crude oil pose both acute and more long-term potential risks, as these products can spread over land and water, flowing downhill into valleys, ravines, and waterways. This can result in the risks being presented some distance from the initial point of release.

The primary hazard from natural gas is an explosion and/or fire immediately following and near the point of the release. For fire or explosion to occur an ignition source must be involved, otherwise the released gas will dissipate and the explosion/fire hazard will be reduced over a relatively short period. It is possible that the size or movement of the vapor cloud of the gas could result in consequences away from the initial point of the release, but as natural gas is lighter than air, this situation rarely occurs.

Accidental pipeline releases can result from a variety of causes, including natural disasters, excavation and other outside force damage, internal and external corrosion, mechanical failure, and operator error. And, although transmission pipeline incidents are infrequent, they do have potential serious consequences that may significantly impact the general public. Pipeline incident and accident data,

[7] The Transportation Challenge, Moving the U.S. Economy, prepared for the National Chamber Foundation, 2008.

13

including data for injuries, fatalities and property damage, and for the causes of pipeline incidents are available on PHMSA's Stakeholder Communications website.

According to the data[8], during the ten years between 2000 and 2009, there was a combined average of four fatalities per year resulting from onshore hazardous liquid and natural gas transmission pipeline incidents. Although pipeline releases have caused relatively few fatalities in absolute numbers, a single pipeline accident can be catastrophic. One such example occurred in Bellingham, Washington in 1999, when a gasoline pipeline accident caused three fatalities and millions of dollars of ecological damage. Another serious incident occurred near Carlsbad, New Mexico, in August of 2000. In that incident, 12 people were killed when a natural gas transmission pipeline ruptured and the released natural gas ignited.

As noted above, more information is available from PHMSA's Stakeholder Communications website and the aforementioned report "Building Safe Communities: Pipeline Risk and its Application to Local Development Decisions". In spite of the relatively low numbers, we must continue our efforts to reduce risks and improve the safety of our communities and transmission pipelines when there are proposed changes in land use or new development adjacent to existing transmission pipelines.

Transmission Pipeline Risk Mitigation

Reducing transmission pipeline risks and enhancing safety is best achieved through proper pipeline operation and maintenance by pipeline operators. Comprehensive and effective public awareness and damage prevention programs, risk-informed planning, design and construction of industrial, commercial and residential developments near transmission pipelines, and effective regulatory oversight of operators for compliance with applicable pipeline safety regulations can also contribute significantly to reducing pipeline risks.

The pipeline industry takes numerous steps to prevent pipeline incidents and to mitigate their risks by reducing the likelihood and consequences of accidents. Transmission pipeline operators are required by law and by pipeline safety regulations to develop and implement programs and processes that focus specifically on safe operating and maintenance activities. These include system design and construction, operator qualifications, pipeline and pipeline rights-of-way inspections, public education and awareness, and excavation damage prevention programs. Pipeline operators are required to adhere to numerous other regulations and safety standards and their compliance is audited by federal and state regulatory agencies.

However, regulatory requirements and operator actions to prevent and mitigate accidents do not negate the need for all stakeholders to work together to further ensure pipeline safety. All stakeholders can communicate issues concerning pipeline safety and support initiatives related to damage prevention. This includes activities such as following safe excavation practices, including use of the one-call process (e.g., calling 811); monitoring and reporting suspicious activity on pipeline right-of-ways, keeping right-of-ways free from obstructions and encroachments, and following PIPA recommendations

[8] PHMSA Significant Incident Files, February 17, 2010

on land use and development near transmission pipelines. Working together, transmission pipeline operators and other stakeholders can reduce the risks to people, communities, and to the environment.

Transmission pipelines are typically located in easements on land owned by governments, corporations, tribal nations, or private citizens. The rights of both the property owner and the transmission pipeline operator are typically described in a written easement agreement. When individual easements are strung together to form a corridor for the pipeline, the corridor is generally referred to as a right-of-way (ROW). While transmission pipeline systems are comprised of many parts, generally only line pipe and associated appurtenances (inline valves, branch connections, etc.) are located within a pipeline ROW. Other parts of a pipeline system such as tank farms and pump or compressor stations are generally located on company owned property off of the ROW.

Transmission pipeline failures present risks that may impact people and property beyond the edge of pipeline rights-of-way (ROW). To address these risks, some communities have imposed zoning restrictions, including fixed-distance building setbacks for development along transmission pipeline ROW. Building setbacks are typically used by local governments to provide separation between the community and potential risks, in this case pipelines. However, fixed-distance setbacks commonly don't consider the risks involved with a specific pipeline and the physical environment in which the pipeline operates. Individual transmission pipelines differ in character – some are large-diameter, high-pressure, cross-country pipelines traversing mostly rural areas, while others are located in urban areas and densely-populated urban centers. Transmission pipelines operated within urban areas may be located underneath public streets and roadways in areas that are already well-developed. Federal regulations attempt to mitigate the risk of transmission pipelines located in more densely-populated areas by imposing more stringent requirements. For example, gas transmission pipelines located in heavily populated urban areas are generally required to adhere to additional design, operation, and maintenance requirements. However, each situation is unique relative to the pipeline characteristics and the areas surrounding the pipeline ROW. Thus, PIPA recommends that implementing a risk-informed approach to land use planning and development and establishing good communication with the transmission pipeline operator is more appropriate than establishing a fixed-distance setback to be applied in all situations.

PIPA focuses on the safety risks of new development occurring adjacent to pipeline rights-of-way, and the safety risks the transmission pipelines pose to affected communities. Local governments, property developers/owners, transmission pipeline operators, and state real estate commissions have key roles to enhance pipeline safety and ensure the protection of people, the environment and the pipeline infrastructure.

Two of the PIPA recommended practices address consultation zones and planning areas. These are important concepts to put into practice. As transmission pipeline failures may adversely affect the general public, it is important for local governments to make risk-informed decisions regarding land use planning and development in locations where residences and businesses are increasingly in proximity to transmission pipelines. Consequently, local governments should consider the risks, including both likelihood and consequences, of transmission pipeline incidents when making decisions related to land use planning and development. They should make full use of available resources and communicate with the operators of the transmission pipelines in their communities to better understand the characteristics of the specific pipelines involved and the characteristics of the surrounding area that affect risks.

Local government actions may include:

- Constraints on activities on or near transmission pipeline rights-of-way;
- Restrictions on the types of land use and development that is allowed along transmission pipeline rights-of-way;
- Specific design or construction features of the development;
- Measures to facilitate emergency response and evacuation in the event of a transmission pipeline incident.

When weighing the potential risks of hazardous materials releases in areas proposed for development, local governments should obtain all available information and base decisions on a balanced consideration of all risks. This includes consideration of all modes of hazardous materials transportation in the area, including roads, railway transportation, and transmission pipelines.

Other PIPA-recommended practices address mapping, land records management, communications, and design and development considerations. Stakeholders in land use planning and development and transmission pipeline safety are encouraged to become aware of and to implement PIPA-recommended practices as appropriate.

GENERAL INFORMATION ON RECOMMENDED PRACTICES

As mentioned earlier, the recommended practices developed by the PIPA stakeholder participants are not mandated by any public or private entity. Furthermore, in some cases implementation of the recommended practices may not be feasible or cost effective. They are intended to provide guidance to pipeline operators, local officials, property owners and developers to provide for the safe use of land near transmission pipelines. Some local governments may want to adopt certain practices within their development regulations or simply encourage voluntary adoption by their local development community. Both approaches have been used by communities around the country.

During the development of the recommended practices, it was recognized that a wide variety of technology is used by local governments both for mapping and development proposal processing. Local governments with limited technology and funding may not be able to fully implement the recommended practices.

Also, consider a property developer/owner with a small parcel of land with a significant portion of the property contiguous to a transmission pipeline right-of-way. The size and shape of the parcel would limit the ability of the property developer/owner to implement the development recommended practices as included in this report.

The recommended practices are grouped into one of two scenarios. Each recommended practice includes the practice title, a brief practice statement, the stakeholder audience intended to take action to implement the practice, practice details, and references if applicable. The practices are numbered and arranged roughly in a logical order within each scenario. The scenarios are:

- Baseline (BL) Recommended Practices – *These practices should be implemented by stakeholders in preparation for future land use and development.*
- New Development (ND) Recommended Practices – These practices should be implemented by stakeholders when specific new land use and development projects are proposed.

All stakeholders are encouraged to become familiar with each of the recommended practices. Even though you may not be taking action under a practice, you may be affected by another stakeholder implementing the practice. The following table shows each recommended practice and the key stakeholder(s) that should take action based on the recommended practice.

	Recommended Practice	Local Government	Property Developer/ Owner	Transmission Pipeline Operator	Real Estate Commission
	BASELINE (BL) RECOMMENDED PRACTICES				
BL01	Obtain Transmission Pipeline Mapping Data	X			
BL02	**n/a** – *Recommendation is incorporated into other practices.*				
BL03	Utilize Information Regarding Development around Transmission Pipelines	X		X	
BL04	Adopt Transmission Pipeline Consultation Zone Ordinance	X			
BL05	Define Transmission Pipeline Consultation Zone	X			
BL06	Implement New Development Planning Areas around Transmission Pipelines	X			
BL07	Understand the Elements of a Transmission Pipeline Easement		X		
BL08	Manage Land Records		X	X	
BL09	Document and Record Easement Amendments		X	X	
BL10	Implement Communications Plan			X	
BL11	Effectively Communicate Pipeline Risk and Risk Management Information			X	
BL12	Notify Stakeholders of Right-of-Way Maintenance Activities			X	
BL13	Prevent and Manage Right-of-Way Encroachment			X	
BL14	Participate to Improve State Excavation Damage Prevention Programs	X	X	X	
BL15	Enhance Damage Prevention Practices near High-Priority Subsurface Facilities			X	
BL16	Halt Dangerous Excavation Activities near Transmission Pipelines	X		X	
BL17	Map Abandoned Pipelines			X	
BL18	Disclose Transmission Pipeline Easements in Real Estate Transactions				X

PIPA Report, November 2010

	Recommended Practice	Local Government	Property Developer/ Owner	Transmission Pipeline Operator	Real Estate Commission
	NEW DEVELOPMENT (ND) RECOMMENDED PRACTICES				
ND01	**n/a –** *Recommendation is incorporated into other practices.*				
ND02	Gather Information for Design of Property Development near Transmission Pipelines		X	X	
ND03	Review Acceptability of Proposed Land Use of Transmission Pipeline Right-of-Way Prior to Design		X		
ND04	Coordinate Property Development Design and Construction with Transmission Pipeline Operator		X	X	
ND05	**n/a –** *Recommendation is incorporated into other practices.*				
ND06	Require Consideration of Transmission Pipeline Facilities in Land Development Design	X	X		
ND07	Define Blanket Easement Agreements When Necessary	X	X	X	
ND08	Collaborate on Alternate Use and Development of Transmission Pipeline Right-of-Way	X	X	X	
ND09	Provide Flexibility for Developing Open Space along Transmission Pipeline Rights-of-Way	X			
ND10	Record Transmission Pipeline Easements on Development Plans and Final Plats	X	X		
ND11	Reduce Transmission Pipeline Risk through Design and Location of New Parking Lots and Parking Structures	X	X		
ND12	Reduce Transmission Pipeline Risk through Design and Location of New Roads	X	X		
ND13	Reduce Transmission Pipeline Risk through Design and Location of New Utilities and Related Infrastructure	X	X		
ND14	Reduce Transmission Pipeline Risk through Design and Location of Aboveground Water Management Infrastructure	X	X		
ND15	Plan and Locate Vegetation to Prevent Interference with Transmission Pipeline Activities	X	X		
ND16	Locate and Design Water Supply and Sanitary Systems to Prevent Contamination and Excavation Damage	X	X		
ND17	Reduce Transmission Pipeline Risk in New Development for Residential, Mixed-Use, and Commercial Land Use	X	X		

19

PIPA Report, November 2010

	Recommended Practice	Local Government	Property Developer/ Owner	Transmission Pipeline Operator	Real Estate Commission
ND18	Consider Transmission Pipeline Operation Noise and Odor in Design and Location of Residential, Mixed-Use, and Commercial Land Use Development	X	X	X	
ND19	Reduce Transmission Pipeline Risk through Design and Location of New Industrial Land Use Development	X	X		
ND20	Reduce Transmission Pipeline Risk through Location, Design, and Construction of New Institutional Land Use Developments	X	X		
ND21	Reduce Transmission Pipeline Risk through Design and Location of New Public Safety and Enforcement Facilities	X	X		
ND22	Reduce Transmission Pipeline Risk through Design and Location of New Places of Mass Public Assembly (Future Identified Sites)	X	X		
ND23	Consider Site Emergency Response Plans in Land Use Development	X	X		
ND24	Install Temporary Markers on Edge of Transmission Pipeline Right-of-Way Prior to Construction Adjacent to Right-of-Way	X	X		
ND25	Contact Transmission Pipeline Operator Prior to Excavating or Blasting	X	X	X	
ND26	Use, Document, Record and Retain Encroachment Agreements or Permits	X	X	X	
ND27	Use, Document and Retain Letters of No Objection and Conditional Approval Letters	X	X	X	
ND28	Document, Record and Retain Partial Releases		X	X	

BL01 Obtain Transmission Pipeline Mapping Data

Practice Statement Local government agencies responsible for land use and development planning or the issuance of development permits should obtain mapping data for all transmission pipelines within their areas of jurisdiction from PHMSA's National Pipeline Mapping System or from the transmission pipeline operators and show these pipelines on maps used for development planning.

Audience Local Government

Practice Description Transmission pipeline operators are required to submit pipeline location information to PHMSA's National Pipeline Mapping System (NPMS). Operators must update the information annually and include identification of an operator contact and an estimation of data accuracy. PHMSA combines data submittals from all transmission pipeline operators and displays the pipelines through a geographic information system (GIS) called the Pipeline Integrity Management Mapping Application (PIMMA). The raw GIS data viewed through PIMMA is available to local government officials.

When technically feasible, local governments should apply for raw NPMS data, which is available in ESRI shape file format. Details on obtaining the data appear below. The mapping data in NPMS is a valuable tool to initially obtain pipeline location data. Operators may provide more detailed maps. When transmission pipelines are shown on local government planning maps, they should be accompanied by a warning that the pipeline location information is not to be used as a substitute for calling the one-call damage prevention system before excavating. Since NPMS is updated annually by transmission pipeline operators, local governments should obtain updated data from the NPMS annually to check for the addition or retirement of pipelines. As mentioned, NPMS data includes contact information for each transmission pipeline operator if local governments need to contact them for additional information.

Online Data Access

It is recommended that local government agencies establish PIMMA accounts to view transmission pipeline data sets at the county level. The application for a PIMMA account is available online.

Access to PIMMA allows local government users to view transmission pipeline maps and pipeline attributes for transmission pipelines within their areas of jurisdiction. They may also create or print maps in the Adobe portable document format (PDF).

The NPMS Public Viewer is available to the general public. It allows users to view pipeline maps for a user-specified state and county, but does not offer as many attributes or as large a scale as the password-protected PIMMA viewer does. The NPMS Public Viewer is available online.

Raw Data Distribution

Local government agencies can also request pipeline GIS data in ESRI format for transmission pipelines within their areas of jurisdiction. Information about requesting raw data can be found online.

BL02 Incorporated into other recommended practices. Page is otherwise blank.

PIPA Report, November 2010

BL03 Utilize Information Regarding Development around Transmission Pipelines

Practice Statement Transmission pipeline operators should provide information about their pipelines to local governments and property developers/owners who are planning development around their pipelines. Local government authorities regulating development should use this information to establish requirements regarding land use and development around transmission pipelines.

Audience Local Government, Transmission Pipeline Operator

Practice Description

As required by federal pipeline safety regulations and, through incorporation to the regulations by reference, the American Petroleum Institute's Recommended Practice (API RP) 1162, transmission pipeline operators must provide information regarding their pipelines to local government organizations. Pipeline operators should include local government organizations having jurisdiction for regulating land use and property development. This will help ensure adequate understanding of the risks posed by transmission pipelines and encourage land use planners to incorporate pipeline coordination in their plan approval process.

Operators should also provide information related to transmission pipeline characteristics and associated hazards to local governments to enable them to make risk-informed decisions on proposed developments and/or development plans in relation to the pipeline risks.

By providing clear information and guidelines, transmission pipeline operators can standardize, to some degree, their own requirements and processes for coordinating development near their pipelines.

Educating property developers/owners regarding the rights of the transmission pipeline operator can lessen the likelihood that excavators will use construction techniques or procedures that threaten the integrity of the transmission pipeline. It can also reduce the likelihood of development designs that fail to take into account encroachment on pipeline rights-of-way a transmission pipeline operator's need for access to the pipeline for maintenance and repairs.

The information and guidelines should be made readily available through the operators' websites, and communicated via e-mail and other methods to organizations that represent the various stakeholder constituent groups (local government planning and zoning organizations, builders associations, engineering organizations, etc.).

Local government authorities regulating development should use this information to establish requirements for development around transmission pipelines and to make informed decisions relevant to pipeline risks on proposed developments and/or land use and development plans. Those requirements should also consider other Pipelines and Informed Planning Alliance (PIPA) recommended practices.

References:

- El Paso Pipeline Group "Developer Handbook"
- Northern Natural Gas Company "Developers' Handbook"
- Marathon Pipeline "A Guideline for Property Development"

23

- Canadian Standards Association (CSA) document, Land Use Planning for Pipelines: A Guideline for Local Authorities, Developers, and Pipeline Operators (CSA PLUS 663)
- Municipal Research and Services Center of Washington, Land Use Planning In Proximity to Natural Gas and Hazardous Liquid Transmission Pipelines in Washington State
- City of Austin, TX, City Code, Title 25, § 25-2-516, Development Near a Hazardous Pipeline
- American Petroleum Institute Recommended Practice (API RP) 1162, Public Awareness Programs for Pipeline Operators, First Edition, December 2003
- 49 CFR Parts 192.616 and 195.440
- Common Ground Alliance Best Practices

PIPA Report, November 2010

BL04 Adopt Transmission Pipeline Consultation Zone Ordinance

Practice Statement Local governments should adopt land development procedures requiring property developers/owners to consult with transmission pipeline operators early in the development process, so that development designs minimize risks to the populace living or working nearby and are consistent with the needs and legal rights of the operators.

Audience Local Government

Practice Description

Local governments should adopt ordinances requiring that property developers/owners must review their proposed projects with the transmission pipeline operators for any application for a land use or development permit within a transmission pipeline "consultation zone". This applies for developments in either urban or rural areas.

Local developers are not transmission pipeline experts; therefore, they should consult with the pipeline operator to determine whether a proposed land use or development will impact the integrity of the nearby transmission pipeline or the future safety of persons or property. If the transmission pipeline operator is involved early in the development process, there should be adequate time to incorporate the operator's concerns into the design.

During the consultation, the pipeline operator and the property developer/owner should develop a mutually agreeable timeline for the operator's review of the proposed project. If the pipeline operator and property developer/owner cannot reach agreement on pipeline-related issues, the operator can provide input to the local government planning and zoning organization regarding potential impacts of the proposed project, *before* the project is approved and permits are issued.

The goal of this recommended practice is to avoid situations where transmission pipeline operators learn of proposed land use and development projects only after the design is complete or construction begins. In those situations, it is often difficult or impossible to make cost-effective changes that may be needed to enhance public safety and ensure operator access to the pipeline facilities.

Section 2 of the Model Ordinance in Appendix B includes requirements for property developers/owners to notify and provide development information to transmission pipeline operators when applying for a land use permit for property within the consultation zone.

References:

- Whatcom County, Washington, Proposed Pipeline Safety and Development Changes, Docket #ZON2007-00014 (2008)
- Washington Model Pipeline Ordinances, Municipal Research & Services Center, Seattle
- "Land use planning for pipelines: A guideline for local authorities, developers and pipeline operators" Canadian Standards Association (CSA) 2004

BL05 Define Transmission Pipeline Consultation Zone

Practice Statement Local governments should define a "consultation zone" to provide a mechanism for communication between property developers/owners and operators of nearby transmission pipelines when new land uses and property developments are being planned.

Audience Local Government

Practice Description

Local governments should define a consultation zone to provide a mechanism to initiate communication between property developers/owners and operators of nearby transmission pipelines when new land uses and property developments are being planned. Optimally, the consultation zone distance should be measured from the transmission pipeline centerline and should be based on specific pipeline characteristics and local conditions.

The intent of this recommended practice is to initiate a dialogue between the property developer/owner and the transmission pipeline operator when new land use or property development is planned near a transmission pipeline. This dialogue will serve to: (1) protect the transmission pipeline by promoting adequate consideration of the potential safety impacts of the proposed land use or property development on the pipeline; and (2) raise awareness of the potential safety impacts of the transmission pipeline on the proposed land use or development so they can be taken into account during planning and design.

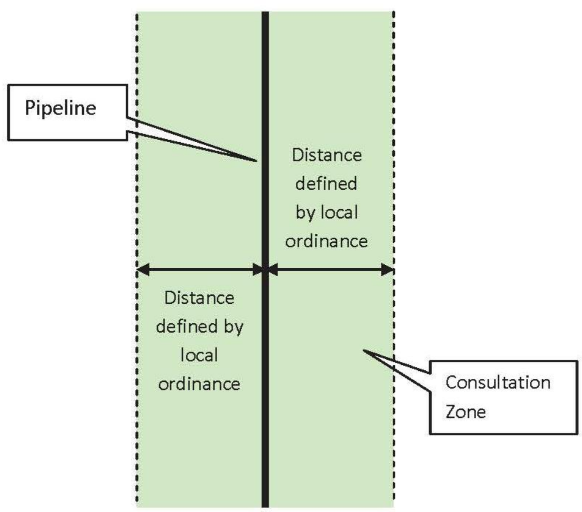
For proposed new land uses and developments within the consultation zone, the property developer/owner should be required to initiate consultation with the transmission pipeline operator as early as possible in the development planning process. The local government and the property developer/owner should consult local land records to determine if transmission pipelines are located in the proposed development area. In addition, the National Pipeline Mapping System (NPMS), http://www.npms.phmsa.dot.gov/, may be utilized, with the caution that the accuracy of pipeline locations in the NPMS vary from pipeline to pipeline and may be as much as +/- 500 feet. Also, neither local land records nor the NPMS should ever be used in lieu of calling the one-call center to have the actual position of transmission pipelines and other underground facilities located and marked prior to excavation. In most cases an excavator can generally dial 811 to contact the one-call center.

Once consultation has begun, specific considerations to further enhance safety and protect communities where new development is planned near transmission pipelines may be taken into account. Several additional considerations are discussed in PIPA recommended practices BL06 and ND11 through ND23. Recommended Practice BL06 addresses the development and implementation of a "planning area".

A consultation zone distance should be measured from the transmission pipeline centerline. So that consultation zone requirements are appropriately applied to proposed land uses and developments, a site-specific distance based on the characteristics of the pipeline (e.g., pipeline diameter, operating pressure, potential spill volumes, transported commodities, unrestrained flow characteristics of transported commodities) and the area surrounding the pipeline (e.g., topography, population density, vegetation, structures, etc.) should be determined. Local governments should work with the pipeline operators to determine site-specific pipeline characteristics when developing their consultation zone distances.

Absent site-specific information, it is suggested that a standard consultation zone distance, on either side of the pipeline centerline, of 660 feet be used for natural gas transmission pipelines. For hazardous liquid pipelines, also absent site-specific information, it is suggested that a standard consultation zone distance in a range from 660 to 1,000 feet be considered. However, in either case it is recommended that communities develop and utilize site-specific distances for consultation zones, based on the unique characteristics for the pipeline and the area surrounding the pipeline. As noted, the transmission pipeline operator can be helpful and should be consulted in assisting local governments to better understand the pipeline characteristics when they develop site-specific consultation zone distances.

Generally, consultation zone distances larger or smaller than the standard distances may be warranted. High/low operating pressure, large/small pipe diameters, type of product carried and local topography can influence the potential impact on nearby development. Related information on refining planning area distances (see PIPA Recommended Practice BL06) is provided in Appendix I. Additionally, American Petroleum Institute Recommended Practice (API RP) 1162, Public Awareness Programs for Pipeline Operators, First Edition, December 2003, includes recommendations for collaboration among pipeline operators, property owners/developers and emergency response officials that may be helpful in developing criteria for a planning area. API RP 1162 applies within 660' of a hazardous liquid pipeline.



Local requirements should be clear that the consultation zone is only intended to:

- Alert the transmission pipeline operator that a development near its pipeline is being planned;

- Help protect transmission pipelines by promoting adequate consideration of the potential safety impacts of the development on the transmission pipeline; and
- Raise awareness of the potential safety impacts of the transmission pipeline on the development.

Satisfying these objectives may help to avoid costly changes in land use and development plans at a later date and potential damage to the pipeline.

Relationship to Practice BL04

PIPA Recommended Practice BL04 encourages local governments to enact ordinances, regulations, or procedural recommendations that require property developers/owners to consult with transmission pipeline operators as part of the land use planning and permitting process, when development is planned within a consultation zone. The definition of a consultation zone, as provided here in Recommended Practice BL05, helps to simplify the determination of when such consultations should be initiated. Verification that the requirements for consultation are met should not impose an undue burden on the landowner, developer, or pipeline operator.

Relationship to Pipeline Operator Public Awareness Programs

The purpose for and size of a consultation zone does not affect the requirements for transmission pipeline operators to develop and implement pipeline public awareness programs as defined by PHMSA pipeline safety regulations.

Information the Transmission Pipeline Operator may need from the Property Developer/Owner

During consultation, a transmission pipeline operator may need information from the property developer/owner in order to discuss appropriate considerations for the proposed development.

1. What is the street address (or if not available, the general location) of the property.
2. Is the property encumbered by a pipeline easement? If so, please attach a copy of the easement or provide the recording (volume and page) information.
3. Is there visual evidence of a pipeline on subject property (e.g., aerial markers, above-ground appurtenances, etc.)?
4. Will the proposed development of the property require/entail (and if so, please describe briefly):
    a. Road crossings over the pipeline?
    b. Other utility lines crossing over or under the pipeline?
    c. Permanent structures or paving within the easement area (e.g., paving, parking lots, buildings, pedestrian paths, signage, poles, retaining walls, septic systems, basketball/tennis courts, etc.)?
    d. Extensive landscaping (including irrigation systems) within the easement area?
    e. Changing the amount of cover (by adding or removing dirt) within the easement area?
    f. Construction equipment crossing the pipeline?
    g. Blasting, seismic vibration testing, pile driving, or similar event which produces significant shock and/or sound waves?

   h. Significant excavation (underground parking structures or building foundations, core samples, rock/mineral quarries, dams, etc.)?
   i. Impounding water or building drainage ditches or other drainage facilities?
   j. Fencing running parallel to (within 100 feet) or crossing the pipeline?
   k. Storing materials, equipment, vehicles, or other items within the easement area (e.g., construction materials, junk or scrap heaps, cut timber, boats, military equipment, etc.)
5. What is the approximate distance of the proposed building closest to the pipeline?
6. Has the pipeline operator been previously contacted regarding this development? If so, by whom.
7. Provide a site plan if available.

Information Transmission Pipeline Operators may provide during Consultation

Some examples of information that transmission pipeline operators may provide to local governments and/or property developers/owner to assist them in developing consultation zone distances or planning specific developments:

1. Pipeline diameter and wall thickness
2. Age of pipeline
3. Depth of cover
4. Typical operating pressure and maximum allowable operating pressure
5. Material transported and typical daily flow rate
6. Estimated worst case spill volume in the area of the development

References:

- California Department of Education, Guidance Protocol for School Site Pipeline Risk Analysis, 2007
- American Petroleum Institute (API) Recommended Practice (RP) 1162, Public Awareness Programs for Pipeline Operators.
- References on Potential Gas Pipeline Impacts:
  - Gas Research Institute GRI-00/0189, A Model for Sizing High Consequence Areas Associated with Natural Gas Pipelines, 2000
  - 49 CFR 192.5, 49 CFR 192.903
  - ASME B31.8-2004, *Managing System Integrity of Gas Pipelines*

PIPA Report, November 2010

BL06 Implement New Development Planning Areas around Transmission Pipelines

Practice Statement Local governments should consider implementing "planning areas" to enhance safety when new land use and property development is planned near transmission pipelines.

Audience Local Government

Practice Description

Local governments should consider implementing "planning areas" to enhance safety when new land use and property development is planned near transmission pipelines. A planning area can provide for the application of additional development regulations, standards, or guidelines to ensure safety when development occurs in close proximity to a transmission pipeline. PIPA recommended practices ND11 through ND23 describe additional considerations for use within a planning area.

Risk is defined as the product of the probability of an incident occurring and the consequences of that incident. Existing pipeline safety regulations focus on reducing pipeline risk by prescribing strict design, construction, operation and maintenance, and inspection requirements for pipeline operators. However, transmission pipeline operators have direct control only over activities within their easements or rights-of-way.

Land use planning regulations that address the development of property near a pipeline easement are generally developed and implemented by local governments (cities, towns, townships, counties, parishes). Such measures can help reduce the potential consequences and, thereby, the potential risks of transmission pipeline incidents. Local governments should make informed, risk-based decisions on how to manage land use and property development near transmission pipeline rights-of-way. These decisions should be balanced with other planning considerations to avoid placing undue burdens on land use and property development near transmission pipelines.

A planning area distance should be measured from the transmission pipeline centerline. So that planning area requirements are appropriately applied to proposed land uses and developments, a site-specific distance based on the characteristics of the pipeline (e.g., pipeline diameter, operating pressure, potential spill volumes, transported commodities, unrestrained flow characteristics of transported commodities) and the area surrounding the pipeline (e.g., topography, population density, vegetation, structures, etc.) should be determined. Local governments should work with the pipeline operators to determine site-specific pipeline characteristics when developing their planning area distances.

A planning area should not be construed as an unsafe area and the planning area distance is not intended to be used as a fixed setback distance. Rather, a planning area is a corridor in which additional measures, such as those described in PIPA recommended practices ND11 through ND23, may have potential benefits in protecting transmission pipelines, mitigating the immediate consequences of a transmission pipeline incident, and facilitating emergency response to a potential transmission pipeline incident.

Absent site-specific information, it is suggested that a standard planning area distance, on either side of the pipeline centerline, of 660 feet be used for natural gas transmission pipelines. For hazardous liquid pipelines, also absent site-specific information, it is suggested that a standard planning area distance in a

30

range from 660 to 1,000 feet be considered. The suggested standard distances are intended to apply to common pipeline sizes and pressures and don't take into account the possibility of flow of liquid or heavier than air gases. Thus, in either case it is recommended that communities develop and utilize site-specific distances for planning areas, based on the unique characteristics for the pipeline and the area surrounding the pipeline. As noted, the transmission pipeline operator can be helpful and should be consulted in assisting local governments to better understand the pipeline characteristics when they develop site-specific planning area distances.

Generally, planning areas larger or smaller than the standard distances may be warranted. High/low operating pressure, large/small pipe diameters, type of product carried and local topography can influence the potential impact of a transmission pipeline incident on nearby development. More information on further refining planning area distances is provided in Appendix I. American Petroleum Institute (API) Recommenced Practice (RP) 1162 includes recommendations for collaboration among pipeline operators, property owners/developers and emergency response officials that may be helpful in developing criteria for a planning area. PHMSA and state pipeline safety regulators may also be consulted. API RP 1162 applies within 660' of gas transmission and hazardous liquid pipelines.

References:

- Gas Research Institute GRI-00/0189, A Model for Sizing High Consequence Areas Associated with Natural Gas Pipelines, 2000
- 49 CFR 192, subpart O (Gas Transmission Pipeline Integrity management)
- 49 CFR 195. 450, 49 CFR 195.452 (Liquid Pipeline Integrity Management)
- ASME B31.8-2004, *Managing System Integrity of Gas Pipelines*
- NISTIR 6546 Thermal Radiation from Large Pool Fires

PIPA Report, November 2010

BL07 Understand the Elements of a Transmission Pipeline Easement

Practice Statement Property developers/owners should have an understanding of the elements of and rights conveyed in a transmission pipeline easement.

Audience Property Developer/Owner

Practice Description Understanding the elements of and rights conveyed in a transmission pipeline easement can improve the relationship among stakeholders and ultimately pipeline and public safety.

An easement agreement and survey (and/or accurate drawing) should be available to the affected landowner. Easement agreements and survey documents may be available from various sources, including the pipeline operator and the county/municipal land records department.

The property developer/owner should consider what is allowed under the easement agreement relative to the pipeline operator's rights to site aboveground transmission pipeline facilities, such as compressor stations, metering stations, valves, pipeline markers, and cathodic protection systems (see PIPA Recommended Practice ND18). The property developer/owner and local government should work with the pipeline operator to ensure that any land use and development plans would not interfere with the current or potential future locations of such pipeline facilities or the operation and maintenance of the pipeline and related facilities.

What are the elements of an easement?

The forms of transmission pipeline right-of-way easements differ from company to company, and the legal requirements of a right-of-way easement differ from state to state. Easements can range from one page with a few provisions to twenty or more pages that attempt to address every eventuality. To be enforceable, the agreement must conform to all of the requirements set out by state law.

While requirements for easement provisions vary, the following items are typical for most easements.

1. The easement must designate a grantee and a grantor. The grantor is normally the landowner or an agent of the landowner, and the grantee is normally the transmission pipeline company.
2. The granting clause is normally the first or second paragraph of an easement and describes the rights granted to the grantee. For transmission pipeline easements, this clause usually lists the rights granted to the pipeline company such as: "lay, construct, maintain, alter, replace, change the size of, and remove a pipeline or pipelines...."
3. Most states require that all real estate-related documents provide for compensatory consideration. The object is to provide the landowner with just or adequate compensation in exchange for the easement.
4. The property over which the easement is granted and the locations and dimensions of the easement and of the transmission pipeline are described in some manner. Legacy easements may exist where the location of the pipeline or the boundaries of the right-of-way were not defined. New easements should define both.

32

In most states, the property can be described by referencing its deed of acquisition or other related documents in the chain of title, by written description, or by plat or drawing. (Note: In some states, a drawing must be attached to an easement or right-of-way grant before the document can be recorded). The easement to be granted can be described by written description, by drawing or by a defined reference such as, for example: "Said right of way being fifty foot in width and extending twenty-five feet from each side of the centerline of the pipeline installed hereunder, together with the right to use a strip of land adjacent to the said right of way as temporary work space during construction of said pipeline, (all as generally depicted on Exhibit "A" attached hereto), on, over, under, and through the following described lands...."

There may be a second, separate and fairly wide, temporary working easement. The easement should be surveyed and marked before construction begins.

5. Optimally, easements should have a series of applicable provisions that further establish the rights and responsibilities of each party. Such provisions may include but are not limited to:

   a. Construction related provisions, including specifications of: temporary workspace, restoration requirements, timetable or time of day for construction, temporary crossings across open trenches or ditches, backfilling and compaction of trenches.

   b. Site-specific environmental issues.

   c. Other transmission pipeline details, such as: depth of cover requirements; number and size of pipelines; additional line rights; product transported; maximum size; maximum pressure; and above-ground facilities, such as but not limited to: test leads, markers, rectifiers, casing vents, valves and valve actuators, meter stations and pig launcher/receivers.

   d. Encroachments: driveways, access roads, gates or cattle guards where easement crosses fence lines, acceptable landowner uses (see PIPA Recommended Practice ND08)

   e. Routes of ingress and egress: maintenance of access roads, gates and/or cattle guards.

   f. Inspection and maintenance: right-of-way clearing, pipeline operator maintenance and inspection schedules.

   g. Pipeline and appurtenance abandonment: disposition of the transmission pipeline and easement after the pipeline is abandoned. Disposition of idled or out of use but not abandoned transmission pipelines.

   h. Liability for certain damages or negligence.

   i. Indemnification: An indemnity agreement provides that one party will save and hold harmless the other party against any legal causes of action, including environmental, levied as a result of activities both on and off the land. The indemnity could include both judgments and any legal fees incurred in defense of a suit. Each party should consider indemnification from the other.

PIPA Report, November 2010

j. Notification of assignment to a third party: "Assignment" is the ability of a transmission pipeline operator to transfer the easement with the sale of the pipeline to another party. Landowners may want to be notified if the operator sells the pipeline to another entity.

k. State and local government requirements.

l. Payment: Payment may be specified, for example, for the easement, damages to crops, timber or other products located within or outside of the easement, impact to land entitlements, division between the landowners and the surface tenant, duration, survey fees, legal review fees, recording fees, and taxes on payment.

6. The date of the document, signatures of the grantors and their acknowledgements are not provisions but are mandatory requirements of an easement or real estate type documents. Signatures of the grantors of the easement documents must be exactly as they appear on the previous documents confirming their capacity in which they hold title to the property. Notary public information is below the landowner and pipeline company signatures. Easements are recorded with the appropriate statutory body and are accessible to the public.

BL08 Manage Land Records

Practice Statement Land use agreements between pipeline operators and property owners should be documented and managed and, when necessary, recorded.

Audience Property Developer/Owner, Transmission Pipeline Operator

Practice Description

Allowable property owner activities and uses of a transmission pipeline right-of-way (ROW) are initially created when an easement agreement (see PIPA Recommended Practice BL07) is signed between the property owner and the pipeline company. These agreements are normally recorded with the appropriate statutory office. Once an easement agreement is executed, the property owner may have limited rights to perform certain activities within the boundaries of the easement. Usually, the property owner may make use of the easement in any manner that is consistent with and that will not interfere with the rights and activities granted to the pipeline operator in the easement. The character and extent of the rights created for both the grantor and grantee by a grant of easement is determined by the language of the grant.

A property owner may desire to use the land within the boundaries of the easement in a manner that was not allowed in the original easement agreement. To do so, the property owner will need to consult with the transmission pipeline operator to gain permission to perform the desired activity or use. If permission is granted, the agreement may be documented in the form of an encroachment agreement (see PIPA Recommended Practice ND26), a letter of no objection (Practice ND27), a partial release (Practice ND28), or an easement amendment (Practice BL09). The type of agreement document may vary, depending on the type and scope of the proposed activity or use of the easement.

Anyone who subdivides property, including subdivision developers, should provide purchasers of individual lots copies of applicable easements and, if available, a survey or drawing showing the location of the transmission pipeline and extent of the pipeline easement (see PIPA Recommended Practice ND10). Subdivision developers should record in the deeds the existing pipeline easements covering each lot in the subdivision.

Land documents should be recorded in order to provide public access to the records and public notice (i.e. constructive notice) of encumbrances on the affected property. Recording land documents is the official means by which interests in real property are made a matter of public record, and is necessary when public access to information related to easements, encroachment agreements, partial releases, letters of no objection, etc. is needed. Affected parties are charged with "constructive notice" of all recorded documents. Unrecorded easements and other interests may be challenged if a subsequent purchaser of a property subject to an easement buys it with no actual notice of the easement or other interest.

Transmission pipeline operators or property owners should record property easements and similar agreements as soon as possible after acquiring them. If existing easements were not recorded when they were acquired, they still can be recorded. In order to maintain or protect rights or meet obligations, the property owner and transmission pipeline operator must know such rights or obligations exist. A