SETBACKS AND ZONING FOR NATURAL GAS AND HAZARDOUS LIQUID TRANSMISSION PIPELINES

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While researching information for this paper, I reviewed a recent report prepared by the Transportation Research Board of the National Academies. The report provides an excellent summation of the information available concerning transmission pipeline setbacks and land use regulation.

This paper contains: a brief introduction, excerpts from a prepublication copy of the TRB report (which is 120 pages in length), and a concluding section containing my own recommendations. Attached are copies of the recently amended MRSC model setback ordinance, and code provisions enacted by Austin, Texas.

The full TRB report contains additional information regarding one call locator services, federal regulation of the pipeline industry, and extensive comments regarding the methodology for risk-informed guidance in land use planning. The full report, with appendices, bibliography, etc. can be found at:

trb.org/publications/sr/sr281.pdf

The TRB report is titled: ***Transmission Pipelines and Land Use – A Risk-Informed Approach,*** **Transportation Research Board of the National Academies, Special Report 281, 2004.**

INTRODUCTION
What Are We Trying To Accomplish?

Setbacks

The primary goal of pipeline easement setbacks is to protect pipelines from third party damage, thus lessening the likelihood of pipeline ruptures, with resulting injuries and property damage.

The TRB report states that the API [American Petroleum Institute] "recommends setbacks of 50 feet from petroleum and hazardous liquids lines for new homes, businesses, and places of public assembly (API 2003). It also recommends 25 feet for garden sheds, septic tanks, and water wells and 10 feet for mailboxes and yard lights." (See p. 2-4 of the TRB report.)

The TRB report also indicates that the most common current practice of local governments is to require setbacks of twenty-five feet.

Note that the TRB report defines setbacks as the minimum distances from particular structures to the center of the pipeline. Because the precise location of a pipeline within an easement is not always known, I recommend that setbacks be measured from the edge of the pipeline easement.

If the purpose of setbacks is to minimize the potential for third party damage to the pipelines, then setbacks for hazardous liquid and natural gas transmission pipelines should be the same.

Zoning

Local governments need to allow reasonable use of property adjoining transmission pipelines, but they also have the responsibility to protect their residents, particularly vulnerable populations.

Hazardous liquid pipeline ruptures can cause injuries and deaths far from the site of the rupture, as was so clearly evidenced in the Bellingham tragedy, where the gasoline flowed down a stream to the victims. Locations downhill from the point of rupture are at far more risk than uphill locations, and zoning to protect the public from the risks will be extremely difficult.

The situation is far different when zoning for *natural gas* transmission pipelines. Zoning can be used to limit the number of people living, working or recreating in the critical blast zone of such pipelines. A jurisdiction could choose to permit single family residences, but not multi-family housing, within a specified distance from the pipeline easement. A jurisdiction could choose to prohibit facilities such as nursing homes or hospitals within a certain distance from the pipeline easement (see the attached Austin zoning provisions). Zoning regulations can encourage mini-storage structures or similar uses near pipelines. The goal should be to zone in a way that minimizes the likelihood of large numbers of casualties in the event of a catastrophic rupture.

[The following text is taken verbatim from TRB Special Report 281.]

Executive Summary

The United States is heavily dependent on transmission pipelines to distribute energy because they are the safest mode available for transporting energy fuels. Virtually all natural gas, which accounts for about 28 percent of energy consumed annually, and two-thirds of petroleum products are transported by transmission pipelines, which make up 20 percent of the 1.8 million total miles of pipelines in the United States. Energy demand has increased by about 35 percent in the last decade, and recent estimates indicate that the demand for energy fuels may increase by another 36 percent between 2002 and 2010.

The nation's projected demand for energy, particularly in new and fast-growing metropolitan areas, may require many additional miles of transmission pipelines. Increasing urbanization, which is accompanying the increasing demand, is resulting in more people living and working closer to pipelines. In many cases, development near pipelines is occurring in formerly rural, unincorporated areas long after pipelines have been constructed but before local agencies develop land use regulations that take into account the risks of allowing such development to occur. Given these projections and the fact that pipeline incidents occur almost daily in the United States, regulatory agencies at the national level view pipeline safety as an issue that needs to be addressed.

In recent years major pipeline incidents have occurred, and public opposition to the construction of new pipeline rights-of-way has increased. These events have focused more attention on the need to assess carefully and rationally the actual risks associated with living and working in proximity to transmission pipelines and to consider land use controls near pipelines that will allow people and pipelines to coexist in a manner that does not pose undue risk to each other. In December 2002, Congress enacted the Pipeline Safety Improvement Act of 2002, which requires the Secretary of Transportation, in conjunction with the Federal Energy Regulatory Commission and in consultation with other relevant agencies, to conduct a study of population encroachment on rights-of-way. The Office of Pipeline Safety (OPS) in the U.S. Department of Transportation (USDOT) requested the Transportation Research Board (TRB) to assist in meeting this legislative mandate. Specifically, TRB was asked to convene a committee to consider the feasibility of developing risk-informed guidance that could be used in making land use–related decisions as one means of minimizing or mitigating hazards and risks to the public, pipeline workers, and the environment near existing and future hazardous liquids and natural gas transmission pipelines. In addition, the committee was asked to consider environmental resource conservation issues (e.g., preservation of trees and habitat) in pipeline rights-of-way.

DATA

Transportation of energy fuels via transmission pipelines is safer than transportation via other modes, but a significant failure can result in loss of life, personal injury, property damage, and environmental damage. In the last 3 years, hazardous liquids pipeline incidents have resulted in an average of 2 deaths, 11 injuries, and $97 million in property damage each year; natural gas transmission pipeline incidents have resulted in an annual average of 6 deaths, 10 injuries, and $20 million in property damage. From 2000 through 2002, the annual average number of gross barrels of hazardous liquids lost was 100,000, a decrease from the annual average of 270,000 gross barrels lost in the 1986 to 1989 time period. There are many causes and contributors to

pipeline failures, including construction errors, material defects, internal and external corrosion, operational errors, malfunctions of control systems or relief equipment, and outside force damage (e.g., by third parties during excavation). Excavation and construction-related damage to pipelines remains the leading cause of pipeline failure. Such failures in 2003 were estimated by USDOT to contribute 22 percent of hazardous liquids and 24 percent of natural gas transmission pipeline incidents. With the growth in population, urbanization, and land development activity near transmission pipelines and the addition of new facilities, the likelihood of pipeline damage due to human activity and the exposure of people and property to pipeline failures may increase.

LAND USE MEASURES

Awareness is growing among federal agencies and the pipeline industry that risk-based approaches to managing pipeline safety should be considered for the following reasons:

- The exposure to hazards associated with proximity to transmission pipelines carrying various commodities involves significant uncertainties.

- More people are living and working closer to transmission pipelines.

- Some new transmission pipelines will be constructed in densely populated areas.

Recently, OPS implemented the Integrity Management Program, a regulatory approach that requires pipeline operators to comprehensively assess, identify, and address the safety of pipeline segments that are located in areas where the consequences of a pipeline failure could be significant. However, this effort does not incorporate land use measures (e.g., comprehensive plans, zoning, and setbacks) that could be employed to manage the risks because such measures are primarily the responsibility of state and local governments.

The terms “land use” and “land use practices” are normally used to describe policies and practices of local governments that regulate the planning, development, and use of land. The committee expanded this definition to include a broader range of actions taken by all stakeholders—pipeline operators, regulators, contractors, private property owners, and the public—that affect the immediate vicinity of pipelines.

Under such a definition, the most common land use measures employed to preserve the integrity of pipelines involve actions taken by pipeline operators to create, inspect, and enforce their own pipeline rights-of-way. Pipeline companies typically negotiate easements with individual property owners that give the pipeline operator authority to use the rights-of-way for construction and operation of the pipeline, including the right to repair and maintain it. The authority of pipeline operators to control the use of the right-of-way is determined by the terms of the easement agreement; control does not extend to any property not covered by the easement/license.

Land use measures can reduce the risk of disturbing the pipelines by keeping human activity away from the immediate vicinity of the pipelines and by minimizing the exposure of those living and working near a transmission pipeline in the event of an incident. Some states set land use policy or mandate various kinds of land use and development regulation to protect against natural hazards.

Most local governments do not address pipeline issues. For those that do, there are few

or no standards on which to base zoning ordinances and other development regulations. Some communities that have experienced pipeline incidents are implementing ordinances and other policies to reduce the perceived risks attributable to transmission pipelines, but these proposed ordinances do not appear to be based on a systematic assessment of risks and costs.

Although there is a lack of risk-based technical guidance for making land use decisions near transmission pipelines, the committee noted that much can be learned from hazard mitigation management techniques and strategies that have been adopted by state and local governments in other areas. These may be instructive in applying a risk-informed approach to land use measures for managing pipeline risks. At present, numerous local governments employ building standards, site design requirements, land use controls, and public awareness measures to reduce losses due to natural hazards (such as earthquakes and floods). However, state and local officials lack guidance for pipelines, other than rules of thumb and existing practice concerning appropriate setbacks.

RISK-INFORMED GUIDANCE

While there is a general recognition that pipelines pose a hazard to people, property, and the environment, the extent of the danger is not well understood. Risk is inherent in the pipeline system—it can be reduced and managed, but it cannot be eliminated. Risk assessment practice attempts to answer the following questions:

- What can go wrong?
- How likely is it?
- What are the consequences?

Regulatory approaches can be risk-based, risk-informed, risk-informed performancebased, or other variations of these. In the risk-based approach, decisions or regulations are heavily based on risk assessment calculations, without other considerations. Because such an approach places a heavy burden on risk computation, which may suffer from lack of data or models or imperfect consideration of scenarios, its application is limited. In the risk-informed approaches, risk insights are used in conjunction with other information, both quantitative and qualitative, in making safety decisions. Because risk-informed approaches allow for the logical structuring of decisions by including relevant factors, they are of more practical value.

Effective use of a risk-informed approach requires an understanding of the relevant factors and the relationships among these factors. In a risk assessment, which is a systematic and comprehensive approach, the likelihood of initiating events, as well as the likelihood of the various outcomes that may result from each initiator, is a concern. In assessing likelihood, a fundamental issue is the metric to be used. Likelihood can be expressed in terms of probability, and the combinations needed to yield the various outcomes can be computed by the use of logic and probability theory. However, the data that go into such calculations may entail significant uncertainties. Unless these uncertainties are explicitly acknowledged, the viability of the whole approach in decision making is compromised.

Local governments are increasingly faced with issues of land use. It appears beneficial for them to have available an easy-to-apply means for making decisions in a manner that allows flexibility in choosing the level of risk deemed appropriate. This is possible if the decision process is structured in a risk framework as outlined above. In addition, most local governments

have neither the resources nor the in-house expertise to develop such a structure. Rather, a national-level effort is needed to develop a risk-informed approach and provide an appropriate level of abstraction that is easy to understand and use at all levels of government. Following implementation of selected options, system performance can be monitored to determine whether risk control measures are effective. This iterative process can, over time, continue to reduce overall risk.

For the pipeline system, there are many stakeholders—policy makers, planners and system design experts, pipeline workers, local officials, property owners, residents, pipeline companies, and trade associations. They all should be knowledgeable about the risks so that informed guidance can be provided. Involvement and a shared commitment among these interested parties, effective communication, training, and procedures can make managing the risks associated with pipeline operations more effective. A well-thought-out risk management framework that measures the risks and identifies a set of risk mitigation alternatives would facilitate discussions among the stakeholders.

FINDINGS

1. Pipeline incidents have potential for significant impact on life, property, and the environment.

2. Just as transmission pipelines pose a risk to their surroundings, so does human activity in the vicinity of pipelines pose a risk to pipelines. These risks increase with growth in population, urban areas, and pipeline capacity and network.

3. Land use decisions can affect the risks associated with increased human activity in the vicinity of transmission pipelines.

4. Pipeline safety and environmental regulation have generally focused on (*a*) the design, operation, and maintenance of pipelines and (*b*) incident response. They have not directed significant attention to the manner in which land use decisions can affect public safety and the environment.

5. For the most part, state and local governments have not systematically considered risk to the public from transmission pipeline incidents in regulating land use.

6. Risk-informed approaches are being used effectively in other domains (e.g., natural hazard mitigation, industrial hazard mitigation, nuclear reactor and waste disposal programs, tanker safety). These techniques are also being used to address other aspects of pipeline safety (e.g., pipeline integrity), but they have not been used to make informed land use decisions.

7. Currently, decision makers lack adequate tools and information to make effective land use decisions concerning transmission pipelines.

8. Many different forms of pipeline easements are in effect, and the terms and conditions vary widely. To the extent that an easement lacks clarity, enforcement of the right-of-way is more difficult.

9. Encroachments and inappropriate human activity within the right-of-way can adversely affect pipeline safety. There appears to be variability in the quality and extent of

inspections, maintenance, and enforcement of rights-of-way.

CONCLUSIONS

Conclusion 1. Judicious land use decisions can reduce the risks associated with transmission pipelines by reducing the probabilities and the consequences of incidents.

Pipeline safety is a shared responsibility. Land use decisions and control of activities and development near transmission pipelines may be undertaken by the pipeline operator, safety regulators, state and local officials, and the property developers and owners. Appropriate land use measures applied by local governments could bolster and complement a pipeline company's efforts to protect the right-of-way and preclude uses that could pose a public safety risk.

Rational land use decisions that provide appropriate physical separation between people and pipelines could reduce the risk associated with the increasing numbers of people in proximity to transmission pipelines. Possible land use techniques include, for example, establishing setbacks; regulating or prohibiting certain types of structures (such as schools, hospitals, and apartment buildings) and uses near transmission pipelines; and encouraging, through site and community planning, other types of activities and facilities (e.g., linear parks, recreational paths) within or in the vicinity of pipeline rights-of-way. Utilization of such tools can be legitimate exercises of the local jurisdictional police power if they are appropriately instituted, particularly if such exercises are grounded in objective, scientifically derived data.

Conclusion 2. It is feasible to use a risk-informed approach to establish land use guidance for application by local governments.

Various forms of risk-informed management of pipeline safety are already in wide use within the pipeline industry. Moreover, the integrity management regulations governing liquids and natural gas pipelines recently promulgated by OPS require private operators to prioritize enhanced riskreduction efforts by using risk assessment.

The probability of failure of any transmission pipeline is a function of several distinct but interrelated factors including materials of construction, fabrication, corrosion, effectiveness of pipeline coatings and cathodic protection systems, pressurization, and depth of cover. Data and models are lacking for making precise predictions about specific lines, but estimates can be developed at an aggregate level and adjusted to account for local conditions. The possible consequences of an event could be estimated on the basis of the product carried, degree of pressurization, depth of cover, surrounding development, and other considerations. The appropriateness and acceptable cost of various measures to reduce probability and consequence could be derived from local values. Although such a risk-informed approach may be somewhat simplistic initially, it could be improved over time to a sufficient degree to help government officials regulate land use. The committee envisions an ongoing process that would involve risk assessment experts and stakeholders in the development, ongoing refinement, and application of such information.

Conclusion 3. The federal government could serve a useful role by providing leadership in the development of risk-informed land use guidance for application by local, state, and federal governments.

Pipeline safety is a national issue because the United States is traversed by 380,000 miles of transmission pipelines transporting numerous products, most of which could pose a threat to life,

property, and the environment in the event of a pipeline failure. Because of the numerous stakeholders concerned about pipeline safety and their divergent interests and the national breadth of the concerns, the federal government may be best positioned to initiate an open process of developing risk-informed guidance. OPS has already played a similar role in fostering and initially supporting the Common Ground Alliance. Land use policies relevant to transmission pipelines are made at all levels of government and need to be based on an unbiased, scientific analysis of the risks posed by pipelines to their immediate surroundings. Local governments generally lack the resources and incentives to undertake such an effort on their own. The advantage of consistent guidance across jurisdictional lines also argues for federal leadership.

Conclusion 4. There is clear evidence that guidelines can be developed that would assist in preserving habitat while maintaining rights-of-way in a state that facilitates operations and inspection.

As an adjunct to its main charge, the committee was asked to consider the problem of habitat loss when rights-of-way are initially cleared and subsequently maintained to allow for inspection, which is required by federal law. Right-of-way maintenance facilitates such inspection, usually conducted by aerial surveillance, and reduces the potential for tree roots to interfere with pipelines, which may contribute to failure. Rights-of-way can provide useful and functional habitat for plants, nesting birds, small animals, and migrating animals. In developed or urban areas, the ecological function of such rights-of-way may be useful but can be marginal, in large part because of the narrowness of the right-of-way and the already extensive habitat fragmentation. There is an overriding environmental benefit in effective inspection of pipelines to avoid incidents with consequent releases and environmental damage.

RECOMMENDATIONS

Recommendation 1. OPS should develop risk-informed land use guidance for application by stakeholders. The guidance should address

- **Land use policies affecting the siting, width, and other characteristics of new pipeline corridors;**
- **The range of appropriate land uses, structures, and human activities compatible with pipeline rights-of-way;**
- **Setbacks and other measures that could be adopted to protect structures that are built and maintained near pipelines; and**
- **Model local zoning ordinances, subdivision regulations, and planning policies and model state legislation that could be adopted for land uses near pipelines.**

Such a risk-informed guidance system should include three interrelated components:

1. **A decision framework informed by risk analysis,**
2. **Guidelines based on the analysis, and**
3. **Alternative actions that could be taken on the basis of the guidelines.**

Recommendation 2. The process for developing risk-informed land use guidance should (*a*) involve the collaboration of a full range of public and private stakeholders (e.g., industry and federal, state, and local governments); (*b*) be conducted by persons with expertise in risk analysis, risk communication, land use management, and development regulation; (*c*) be transparent, independent, and peer reviewed at appropriate points along the way; and (*d*) incorporate learning and feedback to refine the guidance over time.

Recommendation 3. 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. 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 following text is taken from page 1-5 of Special Report 281, cited at the beginning of this paper.]

Environmental Issues Concerning Rights-of-Way

In built-up communities traversed by transmission pipelines, the right-of-way itself can become a natural buffer between properties, especially as the intensity of development increases. These rights-of-way can become sources of habitat and provide pathways for animal migration. Residents accustomed to mature vegetation can be dismayed when pipeline companies periodically clear trees and other vegetation to allow for visual inspection by aircraft. Companies are required by federal regulation to inspect their rights-of-way on a regular basis; they often do so by using aircraft, especially for properties lacking public access. Without regular clearing of the rights-of-way, such inspection can be ineffective. Tree roots can also be a source of outside damage to pipelines, so allowing mature trees in rights-of-way poses a safety hazard.

The congressional request to OPS and FERC that led to this study included a provision that would "address how to best preserve environmental resources in conjunction with maintaining pipeline rights-of-way, recognizing pipeline operators' regulatory obligations to maintain rights-of-way and to protect public safety" (H.R. 3609, Section 3609, 107th Congress). Evidence cited in Chapter 2 indicates that rights-of-way can be useful habitat, but little formal guidance is available from federal agencies concerning strategies that both protect safety and environmental features of rights-of-way.

[The following is taken from pp. 1-14 & 1-15 of Special Report 281.]

Box 1-3
Land Use Approaches in
Bellingham, Washington, and Austin, Texas,
in Response to Pipeline Incidents

Bellingham, Washington, Example

Following the deaths of three boys resulting from a ruptured gasoline transmission line and the subsequent ignition of the fuel in June 1999 in Bellingham, Washington, the community and state began addressing the need for more effective state and local scrutiny of pipeline operations. One of the outgrowths of that effort was a directive by the state legislature that a model ordinance be developed for consideration and use by local governments (Municipal Research and Services Center of Washington n.d.). The model ordinance recommends a minimum setback of 50 feet for hazardous liquids. For gas transmission lines, in contrast, it recommends setback distances "consistent with the hazard area radius" for pipelines of various diameters and pressurization that were developed in a report for the Gas Research Institute (Stephens 2000). Furthermore, it would require setback distances to be doubled for buildings where the public gathers for education, recreation, sports, conventions, hospitalization, or worship. OPS has ruled that these setbacks would exceed federal requirements and are therefore preempted by federal law.

The model ordinance also encourages local government to exercise more influence over pipeline operators through the negotiations that accompany the granting of franchise agreements. The ordinance outlines a number of requirements too detailed to summarize here. Worth noting are the provisions related to construction in or near rights-of-way: in general they would require grantees to develop and implement detailed plans for closely monitoring and reporting on any excavation activity in the right-of-way.

Other outgrowths of the Bellingham incident include the development of an active citizen action group, Safe Bellingham (www.safebellingham.org), and the Washington City and County Safety Consortium, a collection of local governments in Washington State concerned about pipeline safety (www.pipelinesafetyconsortium.org). Both organizations have developed websites that include technical reports, press releases, letters, testimony, links, and other materials of interest to concerned citizens and public officials.

Austin, Texas, Example

The city of Austin developed a new, more aggressive ordinance concerning transmission pipelines in response to a proposal in 2000 by Longhorn Partners Pipeline LP to convert a crude oil pipeline traversing the city to one for shipping refined petroleum products. The pipeline runs through a heavily populated area in south Austin and through the environmentally sensitive drinking water protection zone. The ordinance is a three-part performance-based approach that applies to areas near hazardous liquids pipelines: (*a*)

subdivision requirements, (*b*) zoning uses/site plan construction, and (*c*) financial responsibility. Subdivision requirements prohibit platted lots or structures within the pipeline easement and specify minimum setbacks for special populations (e.g., those with limited mobility). The zoning uses part establishes requirements within 200 and 500 feet of the pipeline. These distances are based on fire modeling and development requirements set to meet fire safety standards. For example, the ordinance bans new buildings within 25 feet of a hazardous liquids pipeline and increases construction and building standards on most structures within 200 feet of a pipeline. The ordinance forbids new structures requiring extra evacuation assistance, such as schools and hospitals, within 200 feet of a pipeline. A council approved variance is required for such structures within 500 feet of a pipeline. The city's attempt to force the pipeline operator to carry at least $90 million in accident insurance, the third part of the ordinance, was struck down in federal court in October 2003. The ordinance's other provisions, however, remain intact. The ordinance does not apply to structures existing before April 21, 2003; these preexisting structures may be repaired, rebuilt, or added to without complying with ordinance structural requirements.

The model setback ordinance and model franchise ordinances developed by Municipal Research & Services Center can be found in the Pipeline Safety section of their web page. See: http://www.mrsc.org/subjects/pubsafe/pipesafety.aspx The MRSC website contains numerous other pipeline safety related documents.

Austin, Texas Ord. 030410-12 is provided at the end of this paper, along with the Austin code provisions incorporating the land use portions of the ordinance.

[The following text is taken from pp. 2-2 through 2-5 of Special Report 281.]

Land Use Within and Near the Pipeline Right-of-Way

Land use regulation is widely viewed as an exclusively local government prerogative, though, in fact, local land use practices derive from powers delegated to cities, towns, villages, and counties by their states. In some states, the states themselves set land use policy on subjects such as growth management or mandate various kinds of land use and development regulation to protect sensitive and critical environments and mitigate natural hazards (Burby et al. 1997). Moreover,

the federal government has strongly influenced land use in legislation and regulation affecting coastal zones, floodplains, and wetlands. The federal government also frequently preempts state and local prerogatives in interstate commerce, and this is particularly true in pipeline regulation. For example, FERC is empowered to override private landowners, as well as state and local governments if need be, in siting new interstate natural gas transmission pipelines. Even so, the principal agent of land use regulation is local government, and this is particularly true in the case of separating people and pipelines.

Many local governments set forth general principles and guidelines for land development through comprehensive plans. In principle, comprehensive plans can guide urban development away from pipeline rights-of-way when other, equally suitable areas are available to satisfy demands for land for urban growth and development. Plans are implemented, in the main, through zoning ordinances, decisions by zoning boards about requests for variances, and subdivision regulations. Local governments that do not have comprehensive plans nonetheless shape development through zoning and subdivision ordinances and their handling of applications for individual parcels.

Most land use planning and regulatory practices developed in the United States during the 20th century. Often they were driven by development and population growth that had already occurred. Land use planning is, therefore, typically most fully developed in urban and metropolitan areas. In contrast, formerly rural areas that are traversed by transmission pipelines laid 25 to 50 years ago and that are in the path of metropolitan expansion often have had or are experiencing development that has little or no zoning or subdivision requirements. Indeed, anecdotal evidence of building development, including schools, adjacent to transmission pipelines suggests that managing the risks to the public near pipelines has not been considered by many local governments.

Information from federal pipeline safety regulators, representatives of pipeline companies, and local officials provided to the committee over the course of its meetings indicated a few examples of actions taken by local governments. For instance, some only allow the lowest-density development around transmission pipelines and locate walking paths, bike paths, and recreational areas along pipeline rights-of-way. Some local government proposals have gone considerably further, often in reaction to spills and explosions. In general, however, the few examples of local governments' attempting more stringent controls have not been based on a systematic analysis of risk or of benefits and costs.

There is a considerable tradition in land use regulation of relying on distance to separate the public from industrial hazards. Local government zoning and other land use regulations attempt to separate industrial facilities from residences and other sensitive facilities and apply performance standards to provide protection from industrial harm (e.g., Chapin 1965; O'Harrow 1981; Rolf Jensen & Associates 1982; Schwab 1989). Buffers contained in zoning regulations vary widely. In Baton Rouge, Louisiana, for example, industrial uses are required to be separated by 25-foot buffers from adjacent uses. In Durham, North Carolina, facilities for the storage of flammable liquids and gases must be set back 100 feet from the property line. Facilities for the storage of explosives must be set back 200 feet from residences, but railroad cars carrying explosive or flammable material must not be parked within 1,000 feet of residences, hospitals, or other buildings used for public assembly. Similarly, Denver, Colorado, requires a 1,000-foot setback from aboveground fuel tanks. [See Schwab (1989) for extracts from these ordinances.] Data compiled by the Louisiana Advisory Committee to the U.S. Commission on Civil Rights (1993) indicate that 17 states have regulations specifying buffers around major facilities where accidents can harm surrounding land uses. Such buffers range from 500 feet to 3 miles. States also have established buffer zone requirements for hazardous waste facilities that range from 150 feet to ½ mile, with the most common being 200 feet.

The Bellingham, Washington, and Austin, Texas, ordinance examples (described in Box 1-3 of Chapter 1) illustrate common actions to establish large setbacks in response to pipeline accidents and new uses for existing pipelines. Setbacks, which are the recommended minimum distances from particular structures to the center of the pipeline (API 2004), are only one element of zoning and subdivision ordinances. However, they are of particular interest because they specify a minimum standard for separating development from pipelines. As illustrated in the examples from Bellingham and Austin, setbacks expand on an existing right-of-way or easement by limiting what a property owner may do with his or her property. For transmission pipelines, there are limits on construction or excavation that involve separating activities such as planting of trees or digging foundations some number of feet from the pipeline. API recommends setbacks of 50 feet from petroleum and hazardous liquids lines for new homes, businesses, and places of public assembly (API 2003). It also recommends 25 feet for garden sheds, septic tanks, and water wells and 10 feet for mailboxes and yard lights. As of the most recent report examining these issues, setbacks of 25 feet from residential property lines were the most common examples in practice (TRB 1988).

The committee was unable to find examples of comprehensive analytical efforts to establish setbacks from pipelines on the basis of risk. Research conducted during the 1980s with regard to liquids pipelines showed that two-thirds of deaths and damage and three-fourths of injuries occurred within 150 feet of the point of discharge; only 8 percent of deaths, none of the injuries, and 6 percent of property damage extended as far as ½ mile from the pipeline (Rusin and Savvides-Gellerson 1987 cited in TRB 1988). The example from the Municipal Research and Services Center of Washington model ordinance (see Box 1-3 in Chapter 1) is a beginning at developing a risk-informed setback, but it accounts only for the probable area of effect should an explosion occur, without taking into account the probability of such an event. As indicated in Chapter 3, the probability of such an event has not been formally estimated and would be a challenge to develop.

Establishing an appropriate setback would not be a simple task. Consider the following:

- Rights-of-way/setbacks for high-pressure natural gas transmission and hazardous liquids pipelines would have to be wide to minimize risk as a result of a high-consequence event and therefore could be costly if interpreted as a regulatory "taking" requiring compensation to property owners.

- A cost–benefit analysis of setbacks wider than current practice has not been conducted.

- Setbacks based on, or informed by, some level of risk assessment could be complex to account for given the variation in product, pipe dimensions, pressurization, depth of cover, and related characteristics.

- Local governments generally prefer simple, rather than complex, regulatory approaches.

• Increased land and housing costs reduce the number of households that can afford to purchase homes—by 424,000 for every $1,000 increase in the price of a new home costing $100,000 or more (Emrath and Eisenberg 2002). In some cases, this adverse effect can be avoided if localities provide adequate housing densities in areas not at risk from pipeline accidents.

New requirements may render many existing homes nonconforming, a status that could reduce their value and inhibit their opportunity to make improvements.

Thus, there are many practical and cost implications of introducing setbacks significantly greater than already exist. The next chapter suggests a risk-informed approach that would take into account issues such as those described above.

[The following text is taken from pp. 2-9 & 2-10 of Special Report 281.]

ENVIRONMENTAL ISSUES WITHIN RIGHTS-OF-WAY

The need to keep rights-of-way cleared to permit inspection and maintenance of the pipelines must be balanced against the need to allow a degree of ecological function and vegetation growth. Installation of transmission pipelines requires that the work area be cleared of vegetation and graded, if necessary, to accommodate construction activities. This usually results in a loss of habitat in the area during construction of the pipeline. After installation, the work area is typically seeded to a mixture of grasses, and within a short time a grassland community develops that provides habitat to a wildlife community adapted to this early successional vegetative stage (Adams and Geis 1979). In addition, these open, grassy areas are attractive nesting and feeding areas for a number of woodland wildlife species (Everett et al. 1979; Ladino and Gates 1979). The extent of change depends in large part on the type of vegetative cover that is traversed by the pipeline. Small changes occur in active agricultural fields, and the greatest changes occur when forested areas are cleared to accommodate construction activities.

During operation of the transmission pipeline, the portion of the land atop the pipeline is typically maintained in a grassland community to facilitate inspection. Shrub communities on utility rights-of-way can provide a source of browse to certain woodland wildlife species (Lunseth 1987) and have been found to increase the abundance and diversity of wildlife species in adjacent wooded areas (Hanowski et al. 1993). In addition, because the outer edges of the right-of-way are not maintained, they often revert to shrub communities and provide habitat to a diverse wildlife community (Schreiber et al. 1976; Santillo 1993).

The installation and subsequent maintenance of a transmission pipeline can bring about a change in habitat along a narrow linear corridor. This can result in a change in wildlife species composition along the pipeline but typically does not have an adverse effect on the abundance or distribution of regional wildlife populations (Hanowski et al. 1993). However, in certain situations a particular habitat is sensitive to disturbance, and pipeline construction and maintenance activities could have a negative impact on wildlife species. For example, threatened

or endangered species habitat or unique wetlands, if disturbed by construction activities, could adversely affect wildlife populations that rely on these sensitive habitats. Rights-of-way can also act as disturbance corridors for the movement and spread of invasive species.

From a landscape ecology perspective, rights-of-way in urban and suburban settings can provide enough natural habitat so that they become wildlife corridors and allow the movement of animals from one patch of natural habitat to another. In this setting they are important landscape management features for increasing the number of native flora and fauna species existing in an area. The more the rights-of-way are maintained in a natural state, the better wildlife corridor they become.

In contrast, pipeline rights-of-way in rural settings and the wide-open spaces of the West often function as one more landscape fragmentation feature, along with roads, canals, and power
 lines. Thus, in this setting rights-of-way tend to retard the movement of certain animals within
their habitat.

Most pipeline regulations have to do with construction and remediation of any damage the construction causes. They are intended to prevent such losses as wetland destruction, excessive soil erosion, agricultural soil structure alteration, and river and stream bottom changes. The regulations do not prevent such ecological changes as increases in exotic or invasive vegetation species, so from an ecological perspective, they do not address completely the issues of preservation of resources and habitat. Some regulations require monitoring to be carried out after construction to ensure that basic environmental characteristics (plant cover, sedimentation control, hydrologic features) have returned to preconstruction status.

Once a pipeline is in place there is little guidance or regulation as to how the right-of-way should be managed to protect the environment or encourage habitat preservation. Many guidelines are available for the construction of pipelines in regard to the natural environments through which the pipelines run, whether uplands or wetlands (e.g., FERC 2003a; FERC 2003b; Moorhouse 2000; Van Dyke et al. 1994). In addition, many studies are being conducted on the impact of pipeline construction on habitats (e.g., Hinkle et al. 2000). Because the potential for damage is significant in the wetland environments, there is much more literature and debate about construction of pipeline rights-of-way through wetland than through upland environments (e.g., see www.fpb.gov.bc.ca/COMPLAINTS/IRC08/irc08s.htm). However, stricter regulations and more “watchdog” groups are widely believed to have brought about a reduction in the damage caused by the construction of pipelines though wetlands (see, for example, www.es.anl.gov/htmls/wetlands.html). None of the federal land managing agencies has guidelines that require habitat management. Many pipeline operators consider right-of-way management to be a maintenance task with structural goals but no ecological goals.

A growing body of information is available on how to restore damaged ecosystems (see www.ser.org), on landscape ecology and management, and on the ecology of species and communities. Such information would make feasible the development of guidelines that would assist in preserving habitat and species. It should be possible to develop guidance allowing certain types of vegetation—other than large trees—that would provide some habitat and natural

buffer between properties while allowing for visual inspection of the pipeline. A path directly above the pipeline might be maintained free of woody vegetation, but the path need not be very wide. Shrubs, vines, grasses, and other similar native woody vegetation could be allowed to grow on either side of the path. Pruning would still be required periodically to make the path visible from above.

[Chapter 3 of Special Report 281 contains an attempt to outline the various factors involved in assessing the risks posed by transmission pipelines. Anyone who can glean practical advice from this chapter is a genius. Basically, the report concludes that the federal Office of Pipeline Safety (OPS) should initiate a process that would develop "risk-informed guidance". The following text is taken from Chapter 3 of Special Report 281.]

STRUCTURING A DECISION

A decision to do nothing is still a decision. Thus, avoidance of action because of an inability to measure uncertainty cannot be considered a sound approach to managing risk. On the other hand, a misapplication of risk analysis that could produce misleading results must be avoided. A deliberative process is needed that is well documented, and the process should include effective communication among and involvement of all stakeholders. The starting point of such a process is illustrated in Figure 3-2. The net private benefits axis is a net gain that incorporates the income from operating the pipeline as well as expenses of operation, including maintenance and accident prevention measures (inspection, maintenance of rights-of-way, etc.). The net public benefits axis includes community gains (e.g., new jobs) as well as losses due to restricted land use. The fear factor is intangible, yet it needs to be taken into consideration because pipeline safety involves local governments and millions of individuals, all with different levels of comprehension of the technical issues involved. Clearly, additional considerations (axes) may be involved. . . .

TOWARD A PROCESS FOR RISK-INFORMED GUIDANCE

Local governments are increasingly faced with issues of land use. The availability of an easy-to apply means for making decisions, in a manner that allows flexibility in accepting the level of risk deemed appropriate in a particular case, would be beneficial. This is possible if the decision process is structured in a risk framework as outlined above.

Most local governments have neither the resources nor the expertise to engage in developing such a structure on their own. Moreover, this approach appears inappropriate because it would involve much duplicative work done by necessity at a superficial level. Instead, a risk-informed effort is needed at the national level that results in an appropriate abstraction easily understood and used at the local government level. The necessary steps are shown in Figure 3-4. Much of the success of such an effort depends on the competence of the team engaged in the study (past performance should be a key factor in selecting the team and organizing the effort) and adherence to an open, deliberative, peer-reviewed process that iterates freely between risk assessments and decision structuring. Furthermore, the process should be open to updates and refinements as needed. Properly conducted, such an effort naturally leads to

an optimal mix of prevention and mitigation measures, and this mix may be different for each class of pipelines (see Figure 3-5).

Proposed Process

The committee believes that OPS should initiate a process, perhaps by designating an organization to convene the appropriate stakeholders, that would develop risk-informed guidance. The development of this guidance would require the commissioning of qualified and experienced analysts. In consultation with the stakeholders, the analysts would develop a methodology for a risk assessment that would—after incorporating peer review—lead to technical guidance and then a prototype set of risk guidance. The committee believes that data and methods, perhaps drawn in part from techniques described in Appendix D, are available for developing a set of risk estimates, which will only be approximations and will entail considerable uncertainty. The prototype guidance would be beta tested by users to determine their applicability and appropriateness. Refinements would be made on the basis of the beta testing. The stakeholder group would then share the results with federal, state, and local officials for implementation as they deem appropriate. Research would be commissioned by government and industry to improve on the initial version. Over time, the stakeholder group would refine the guidance on the basis of feedback from users and new technical information.

Example of Guidance

The technical guidance the committee envisions might take the form of recommended practices that would allow state and local governments to select a setback, building code specification, or other mitigation strategy that could be applied to manage development and activities near a transmission pipeline. The choices would be based on the communities' decisions about an appropriate level of risk and an acceptable cost burden for both the pipeline companies and the communities. For example, the risk assessment for setbacks might be based on calculations of expected risk at various distances from transmission pipelines, which would vary by product type, pressurization, and so forth. The guidance would include procedures that could be applied to estimate the cost burden at various distances, which would significantly depend on the nature of the built environment.

RISK COMMUNICATION

There are many stakeholders in the pipeline system who should be knowledgeable about the risks so that informed guidance can be provided. However, the subject is technical and often complex, which can lead to misunderstanding, confusion, and distrust (NRC 1989). Thus, effective risk communication, which is an interactive process of timely and credible information and opinion exchange (NRC 2003) that is used to raise the level of understanding of relevant issues and actions, is difficult. Society increasingly expects government and industry to provide new levels of protection from industrial hazards. In particular, the public increasingly demands that corporations do more than merely comply with safety regulations. And industry is realizing that it has an incentive to go beyond regulatory compliance to prevent even larger costs from litigation settlements and legal transactions and the damage to reputation and market share when bad things happen.

Risk information would allow public officials to make informed decisions about how to mediate between pipelines and the public, and it would allow the public to participate and feel comfortable in accepting such decisions. How this information is communicated will affect siting of new pipelines, planning for capacity expansion, development of property next to pipelines, precautions during excavation near pipelines, real estate values and assessments, and public acceptance of pipelines.

SUMMARY AND CONCLUSIONS

A systems approach to risk management that uses quantifiable mitigation measures (such as setbacks, warning signs, and alarm and evacuation procedures) and prevention measures (such as design, inspection, and maintenance of pipelines) would likely improve pipeline safety across the nation. The committee suggests that now is an appropriate time to pursue such an approach. It suggests that the methodology should involve the following principal components, as well as a tight interaction and integration between them:

- A high-quality risk assessment, conducted at the national level, that acknowledges the various classes of pipelines and respective classes of risk profiles in a manner that encompasses the variety of conditions that exist in the field;

- Reduction and generalization of these results into simple and easy-to-use decision guiding tools with regard to risk levels associated with various extents of setbacks, rights-of-way, and procedures involved in maintenance, inspections, and mitigation in emergencies;

- A management plan for implementation that renders help to local communities according to need and builds on the experience gained from use of the approach in the field;

- A management plan for long-term communication of risk and interplay of perceptions among all stakeholders, especially pipeline operators, local officials, and the public; and

- A management plan for integrating all the preceding components and refining them on a continuing basis by using actual experience, both in implementation and in the safety records obtained.

[The text below is, obviously NOT taken from Special Report 281.]

Recommendations of Jim Doherty

Recommendation 1:

> Don't wait for the federal government to tell you what risks are acceptable for your community – bring the issue to your planning commission and start the process for enacting reasonable land use regulations that will minimize risks to your residents.

Recommendation 2:

> Establish setbacks for hazardous liquid and natural gas transmission pipelines that minimize the risk of third-party damage to the pipelines.

Recommendation 3:

> Make sure that your permit counter personnel are aware of the exact location of every transmission pipeline easement in your jurisdiction, and that nobody obtains a permit for work near a transmission pipeline without clear information regarding the location and the setback restrictions. One-Call regulation compliance is a minimum requirement. Coordination of construction activity with transmission pipeline companies should be required during any excavation work done within one hundred feet (?) of the pipeline.

Recommendation 4:

> Use zoning to limit the land uses that will bring large numbers of people into prolonged close proximity to a natural gas transmission pipeline, particularly if those uses involve vulnerable populations. Keep in mind that individuals inside buildings are protected, to some degree, from a natural gas pipeline rupture and explosion; exits should be provided on the side of the building away from the pipeline.

Recommendation 5:

> Make sure that all new plats and all city land use/planning documents clearly mark and label the location of transmission pipeline easements.

Recommendation 6:

> Support enactment of statewide legislation that requires disclosure of the proximity of a transmission pipeline whenever real property interests are conveyed. My recommendation for *natural gas* pipelines is that such disclosure should be made whenever the property is within 600 feet of the easement. For *hazardous liquid* pipelines, the reasonable distance could be 100 feet. The bottom line is that people should know

about transmission pipelines before they purchase nearby property. That gives them an opportunity to exercise their own judgment regarding whether to accept the risk.

MRSC Model Setback Requirements Ordinance

for Transmission Pipelines

See Also **Commentary on the Model Setback Regulations for Natural Gas Transmission Pipelines** ***following the text of model ordinance***

ORDINANCE NO. _____

AN ORDINANCE ESTABLISHING SETBACK REQUIREMENTS FOR NEW HAZARDOUS LIQUID AND GAS TRANSMISSION PIPELINES WITHIN AND THROUGH THE CITY OF _____.

NOW, THEREFORE, THE CITY OF _____ DOES ORDAIN:

Section 1. Definition.

Pipeline Corridor shall mean the pipeline pathway through the jurisdiction [designate city or county] in which the pipelines and facilities of a pipeline operator are located, including public rights-of-way and easements over and through public or private property.

Section 2. Omitted

Section 3. Setback Requirement for Gas Pipelines.

3.1 Setback requirements from gas transmission pipelines for general residential, commercial, and industrial buildings shall be a minimum of 50 feet. The setback distance shall be measured from the nearest edge of the pipeline corridor.

3.2 Setback distances shall be doubled for all principle buildings used for community recreation services, private or public education, spectator entertainment or sports, exhibition and convention facilities, major health services, religious assemblies, or facilities used for public gatherings.

Section 4. Setback Requirement for Hazardous Liquid Pipelines.

4.1 The setback requirement from a hazardous liquid pipeline corridor for all general residential, commercial, and industrial buildings shall be a minimum of 50 feet.

4.2 Setback distances shall be doubled for all principle buildings used for community recreation services, private or public education, spectator entertainment or sports, exhibition and convention facilities, major health services, religious assemblies, or facilities used for public gatherings.

Section 5. Effective Date.

[Insert appropriate wording.]

PASSED BY CITY COUNCIL this ____ day of _____ , 20___.

_____

Clerk

APPROVED by me this _____ day of _____ , 20___.

_____

Mayor

Approved as to form:

_____

Office of the City Attorney

Date of Publication: _____

Commentary on the Model Setback Regulations for Natural Gas Transmission Pipelines

The model setback ordinance was first published by Municipal Research in 2001. Some commentary may help others understand the complex issues involved in establishing setbacks and zoning regulations for high pressure, large diameter, natural gas transmission pipelines.

Encroachment

The primary reason for establishing setbacks from transmission pipelines is to avoid encroachment on the pipeline right-of-way, thereby reducing the likelihood of third party damage to the pipeline. Typically such damage in urban settings is caused by construction activity or underground utility work. Third party damage can certainly be lessened by consistent use of one-call utility locator systems, but experience shows that keeping construction or utility work away from pipeline easements or corridors is preferable. An adequate setback for avoiding third party damage can be far less than the setback distance needed to protect individuals from the energy of a catastrophic rupture.

Personal Safety

There are no generally accepted zoning standards for land uses in close proximity to natural gas transmission pipelines. In the absence of accepted standards, a priority of local governments should be the protection of the lives and property of those living, working or recreating in the vicinity of natural gas transmission pipelines. There was a recent industry sponsored study that provides an empirical method for determining the risk to individuals if there is a rupture and ignition resulting in an explosion: A Model for Sizing High Consequence Areas Associated with Natural Gas Pipelines," authored by Mark J. Stephens, prepared for the Gas Research Institute, and dated October 2000. Figure 2.4 of that study contains a graph showing the area at risk depending upon the diameter of the pipe and the operating pressure. The study assumes that individuals are on open terrain, not protected by buildings or any intervening land form, and that such "at risk" individuals can quickly leave the area or reach adequate shelter.

A jurisdiction could choose to permit single family residences, but not multi-family housing, within a specified distance from the pipeline easement. A jurisdiction could choose to prohibit facilities such as nursing homes or hospitals within a certain distance from the pipeline easement. Zoning regulations can encourage mini-storage structures or similar uses near pipelines. The goal should be to zone in a way that minimizes the likelihood of large numbers of casualties in the event of a catastrophic rupture.

Financial Impacts

Because of increasing urbanization in the areas surrounding existing pipeline easements, zoning regulations involve a balancing of the financial interests of property owners in proximity to the pipelines and the safety of the increased numbers of people who would be placed within the zone of risk if more intensive development is permitted.

Zoning regulations would be less controversial if existing and future natural gas transmission pipelines could be routed through farmland or other undeveloped lands. When originally constructed, many of the older, major natural gas transmission pipelines were sited in that way. But population growth and development patterns have brought increased population densities to the areas surrounding many of these transmission pipelines, and difficult decisions must now be made.

Pipeline operators generally favor substantial setbacks for established pipeline easements. That lessens the likelihood of third party damage from encroachment activity and lessens the possibility of personal injuries if there is a release from a transmission pipeline. However, when a new natural gas transmission pipeline is being sited, pipeline operators don't want to pay for a wide easement. A financial burden is imposed on landowners whose property adjoins or is near the pipeline easement because they generally are not compensated for reduced development potential if the easement is not on their property.

Local Government Discretion

A city or county, as part of the normal planning process, needs to establish setbacks and zoning regulations for the natural gas transmission pipelines that are within its jurisdiction. Those regulations are a quantification of the risk that the local government decides is acceptable. To what extent should a city or county choose to protect its residents from the relatively low probability of a catastrophic pipeline rupture? Residents of the Puget Sound basin, by choosing to live here, accept the risk of a major earthquake, but it is unclear if the risks of a major pipeline rupture are known or appreciated by those who live in close proximity to a natural gas transmission pipeline. The unfortunate reality is that in our increasingly dense cities development will generally occur to the extent allowed by current land development regulations, and people will buy homes adjoining pipeline easements, assuming that construction permits would not have been issued by the city if the development was not safe. Residents rely upon cities and counties to provide safe environments to live and work, and establishing prudent setbacks is part of that difficult task.

Austin, Texas City Code sections related to pipelines – from Ordinance 030410-12

§ 25-2-516 DEVELOPMENT NEAR A HAZARDOUS PIPELINE.

(A) In this section:

(1) HAZARDOUS PIPELINE means a pipeline designed for the transmission of a "hazardous liquid", as defined by Title 49, Code of Federal Regulations, Section 195.2, with an inside diameter of eight inches or more.

(2) NEW CONSTRUCTION means the construction after April 20, 2003 of a structure intended for human occupancy, and includes the construction of a new structure, the construction of an addition to an existing structure and the reconstruction of a portion of an existing structure. The term excludes an addition to or the reconstruction or replacement of a structure existing on April 21, 2003 used for:

(a) single-family residential use;

(b) small lot single-family residential use;

(c) single-family attached residential use;

(d) duplex residential use;

(e) two-family residential use;

(f) mobile home residential use; or

(g) in a neighborhood plan combining district:

(i) cottage special use;

(ii) urban home special use; or

(iii) secondary apartment special use.

(3) RESTRICTED PIPELINE AREA includes an area within 25 feet of a hazardous pipeline and an area within a hazardous pipeline easement.

(4) USE REQUIRING EVACUATION ASSISTANCE includes the following uses:

(a) congregate living;

(b) convalescent services;

(c) detention facilities;

(d) day care services (commercial);

(e) hospital (general);

(f) hospital (limited);

(g) medical offices exceeding 5,000 square feet of gross floor area;

(h) private primary educational facilities;

(i) private secondary educational facilities;

(j) public primary educational facilities;

(k) public secondary educational facilities; and

(l) retirement housing (large site).

(B) A use requiring evacuation assistance is prohibited in a structure intended for human occupancy that is located within 500 feet of a hazardous pipeline. This prohibition does not apply to a structure that is located between 200 and 500 feet of a hazardous pipeline if by resolution the Council determines, after receiving a recommendation from the fire chief, that:

(1) the structure has a performance-based design that provides an adequate time period for occupant evacuation to a safe place in the event of a pipeline leak or fire associated with the pipeline, after considering:

(a) the requirements of Chapter 25-12, Article 7 (*Uniform Fire Code*) and the 2000 edition of the National Fire Protection Association 101 Life Safety Code;

(b) the site and structure design;

(c) the structure's building materials;

(d) the structure's distance from the pipeline;

(e) the use of radiant energy barriers;

(f) access to the site and the structure by emergency responders;

(g) available on-site resources for emergency responders;

(h) the topography and other natural features;

(i) the use of the structure; and

(j) the evacuation capability of the occupants;

(2) the structure incorporates a system for the early detection and notification of a pipeline leak, if the fire chief determines that an appropriate system is commercially available; and

(3) the performance-based design for occupant evacuation and the early detection and notification system are certified and sealed by an engineer registered in Texas.

(C) A person may not build new construction within 200 feet of a hazardous pipeline unless:

(1) the fire chief determines that:

(a) the new construction has a performance-based design that provides a minimum one-hour time period for occupant evacuation to a safe place in the event of a pipeline leak or a fire associated with the pipeline, in accordance with Chapter 25-12, Article 7 (*Uniform Fire Code*) or the 2000 edition of the National Fire Protection Association 101 Life Safety Code;

(b) the new construction incorporates a system for the early detection and notification of a pipeline leak, if the fire chief determines that an appropriate system is commercially available; and

(c) the performance-based design for occupant evacuation and the early detection and notification system are certified and sealed by an engineer registered in Texas; or

(2) the new construction complies with the standards for construction near a pipeline prescribed by the Fire Criteria Manual.

(D) A person may not place a structure or excavate within a restricted pipeline area.

(1) This prohibition does not apply to:

(a) the pipeline or an appurtenance;

(b) a facility that produces, consumes, processes, or stores the product transported by the pipeline, including a power generation facility;