Subject Matter Study Report

**Transmission Pipelines and Land Uses**

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By

Royce Don Deaver, P.E.

DEATECH Consulting Company

203 Sarasota Circle South

Montgomery, Texas 77356

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**Transmission Pipelines and Land Uses**

**Executive Summary**

In 2004, the Transportation Research Board (TRB) of the National Academics issued Special Report 281 titled “*Transmission Pipelines and Land Use*”. The study was sponsored by the Office of Pipeline Safety in the U.S. Department of Transportation (DOT) and the Federal Energy Regulatory Commission (FERC). PSA 2002 required the U.S. DOT and FERC conduct a study of population encroachment on pipeline rights-of-way. The U.S. DOT asked the TRB to conduct such a study. More specifically, the TRB was tasked to:

1. Consider the feasibility of developing risk-informed guidance that could be used in making land use decisions as one means of minimizing or mitigating hazards and risks to the public, pipeline workers, and the environment near existing and future transmission pipelines;
2. Consider the hazards posed by transmission pipelines to life, property, and the environment;
3. Consider existing or proposed land use and zoning practices, competing needs for uses, and multiple use of rights-of-way;
4. Consider pipeline design, age, diameter, pressurization, and burial depth; and
5. Consider environmental resource conservation issues in pipeline rights-of-way.

Transportation Safety Board (TRB) Special Report 281 included many conclusions on the lack of attention taken by Federal Energy Regulatory Commission (FERC) and the U.S. Department of Transportation (DOT) on the risks to people due to living close to large, high pressure gas pipelines.

In general, the conclusions and recommendations applied equally to hazardous liquid transmission lines or trunklines. General conclusions in TRB 281 included:

1. There is general recognition that pipelines pose a hazard to people.
2. More people are living and working closer to gas transmission pipelines.
3. Some of the newer gas transmission pipelines are being constructed in densely populated areas.
4. Federal pipeline safety regulations do not address pipeline siting or location.
5. Most local governments do not address pipeline issues.
6. Most local governments do not have the means or expertise to make appropriate risk based decisions on land use.
7. Judicious land use decisions can reduce the risk associated with transmission pipelines by reducing the probabilities and the consequences of incidents.
8. Rational land use decisions that provide appropriate physical separation between people and pipelines could reduce risk to the public.

R. D. Deaver, P.E.

DEATECH Consulting Company

rddeaver.com

**Transmission Pipelines and Land Uses**

**Introduction on** **Transportation Research Board Report 281**

In 2004, the Transportation Research Board (TRB) of the National Academics issued Special Report 281 titled “*Transmission Pipelines and Land Use*”. The study was sponsored by the Office of Pipeline Safety in the U.S. DOT and the Federal Energy Regulatory Commission (FERC). PSA 2002 required the U.S. DOT and FERC conduct a study of population encroachment on pipeline rights-of-way. The U.S. DOT asked the TRB to conduct such a study. More specifically, the TRB was tasked to:

1. Consider the feasibility of developing risk-informed guidance that could be used in making land use decisions as one means of minimizing or mitigating hazards and risks to the public, pipeline workers, and the environment near existing and future transmission pipelines;
2. Consider the hazards posed by transmission pipelines to life, property, and the environment;
3. Consider existing or proposed land use and zoning practices, competing needs for uses, and multiple use of rights-of-way;
4. Consider pipeline design, age, diameter, pressurization, and burial depth; and
5. Consider environmental resource conservation issues in pipeline rights-of-way.

**Land Use Measures Issues**

Issues involving land use in the report include:

1. More people are livening and working closer to transmission pipelines.
2. Some of the newer transmission pipelines will be constructed in densely populated areas.
3. Federal pipeline safety regulations do not address pipeline siting or location.
4. Land use practices are normally used to describe policies and practices of local governments that regulate planning, development, and use of land.
5. Most local governments do not address pipeline issues.
6. There are few or no standards on which to base zoning ordinances and other development regulations.
7. State and local officials lack guidance for pipelines concerning appropriate setbacks.
8. 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.
9. Most local governments have neither the resources nor the in-house expertise to develop a mean for making appropriate risk based decisions on land use.

**Study Conclusions**

Conclusions from the study included:

1. Judicious land use decisions can reduce the risk associated with transmission pipelines by reducing the probabilities and the consequences of incidents.
2. 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.
3. It is feasible to use a risk-informed approach to establish land use guidance for application by local governments.
   1. The probability of failure of any transmission pipeline is a function of several interrelated factors including:
      1. Materials of construction,
      2. Corrosion,
      3. Effectiveness of pipeline coatings and cathodic protection,
      4. Pressurization, and
      5. Depth of cover.
   2. Data and models are lacking for making precise predictions about specific pipelines, but estimates can be developed at an aggregate level and adjusted to account for local conditions.
   3. Possible consequences of an event could be estimated on the basis of product carried, degree of pressurization, depth of cover, surrounding development, and other considerations.
   4. The appropriateness and acceptable cost of various measures to reduce probability and consequences could be derived from local values.
   5. 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.
   6. The committee envisions an ongoing process that would involve risk assessment experts and stakeholders in the development, ongoing refinement, and application of such information.
4. The Federal government could serve a useful role by providing leadership in the development of risk-informed land use guidelines for application by local, state, and federal governments.
   1. The federal government may be the best positioned to initiate a process of developing this risk-informed guidance.
   2. The advantage of consistence across jurisdictional lines (state and local governments) argues for federal leadership.
5. There is clear evidence that guidelines can be developed in preserving habitat while maintaining right-of-way in a state that facilitates operations and inspection.
6. Possible land use techniques include establishing:
   1. Setback distances;
   2. Regulating or prohibiting certain structures and activities as schools, hospitals, and apartment buildings near pipelines; and
   3. Develop recreational uses within or in the vicinity of pipeline rights-of-way.

**Recommendations**

Recommendations in the report included:

1. Develop risk-informed land use guidelines for applications by stakeholders. This guidance should include:
   1. Land use policies affecting the siting, width, and other characteristics of new pipeline corridors;
   2. Range of appropriate land uses, structures, and human activities compatible with pipeline rights-of-way;
   3. Setbacks and other measures that could be adopted to protect structures that are built and maintained near pipelines;
   4. Model land use zoning ordinances and subdivision regulations and planning policies; and
   5. Model state legislation that could be adopted for land uses near pipelines.
2. Develop guidance on appropriate vegetation and environmental management practices to provide habitat for some species, avoid threats to pipeline integrity, and allow for aerial inspection.

Develop best practices for the specifications, acquisition, development, and maintenance of pipeline rights-of-way.

**Other Information and Conclusions in the Report**

Other information and conclusions included in the report included:

1. The exposure to hazards associated with proximity to pipelines carrying various commodities is not well established.
2. Some new pipelines will be constructed in densely populated areas.
3. Pipeline incidents occur almost daily.
4. Total fatality data for only 2000 was included for truck, rail, motorcycle, water transportation, oil pipelines, and gas transmission pipelines. The fatality data was not limited to hazardous material transportation and included people transportation.
5. From 1989 through 2000, the number of incidents resulting in death, injury, or property damage above $50,000 increased by 2.2 percent per year.
6. Natural gas consumption increased by 35 percent (35%) during 1990 to 2000 and is expected to increase another 36 percent (36%) between 2002 and 2010.
7. About 38,000 more miles of new interstate natural gas transmission lines will be constructed by 2015.
8. In the next 20 years, the demand for petroleum products was expected to increase by 48 percent (48%).
9. The existing pipeline infrastructure must be maintained and sections of existing pipelines will need to upgraded or replaced.
10. Tree roots can be a source of outside damage to pipelines, so allowing mature trees in the rights-of-way poses a safety hazard.
11. The Natural Gas Pipeline Safety Act of 1968 gave the Federal Power Commission (FPC) jurisdiction over the siting of new interstate natural gas pipelines.
12. U.S. DOT assumes no authority over land use practices outside of the pipeline rights-of-way.
13. For interstate natural gas transmission pipelines, a federally granted power of eminent domain to establish rights-of-way is given to pipelines.
14. FERC is empowered to override private landowners, as well as state and local governments in siting new interstate natural gas transmission pipelines.
15. There is considerable tradition in land use regulation of relying on distance to separate the public from industrial hazards. Examples include:
    1. Durham, North Carolina requires railroad cars carrying explosive or flammable material must not be parked within 1,000 feet of residences, hospitals, or places of assembly.
    2. Denver, Colorado requires a 1,000 foot setback from aboveground fuel tanks.
    3. Seventeen states have regulations specifying buffers around major facilities where accidents can harm surrounding land users. These buffers range from 500 feet to three miles. Buffers from hazardous waste facilities range from 150 feet to 0.5 mile, with 200 feet being the most common.
    4. API recommends setbacks of 50 feet from petroleum and hazardous liquid pipelines.
16. With large, high pressure pipelines, injury has occurred out to 1,000 feet, but pipeline rights-of-way are rarely more than 50 feet wide.
17. The study committee was unable to find examples of comprehensive analytical efforts to establish setbacks from pipelines on the basis of risk.
18. A cost-benefit analysis of setbacks wider than current practices has not been conducted.
19. Setbacks based on some level of risk assessment could be complex. Local governments generally prefer simple, rather than complex, regulatory approaches.
20. The common practice of obtaining a measure of risk by multiplying probabilistic and consequences is, in general, not adequate for pipeline safety risk assessment. The problem is a high-consequence, low probability event is not distinguished from a low-consequence, high probability event. For example, the loss of 10 lives during an event every 10 years is not the same as the loss of 100 lives during an event every 100 years.
21. There is considerable amount of uncertainty in risk assessment data and analysis. A 90 percent (90%) estimate of risk data uncertainty is conservative and a 99 percent (99%) estimate of risk data is even more conservative.
22. A robust treatment of risk must distinguish between random uncertainty and systematic uncertainty.
23. A systems approach to risk management using mitigation measures (such as setbacks, warning signs, alarms, and evacuation procedures) and prevention measures (such as design, inspection, and maintenance of pipelines) would likely improve pipeline safety across the nation.
24. The only local governments that have any power over pipelines are municipalities that have the power to grant franchises or licenses to pipeline operators to install pipelines on public property.
25. The cost of transportation represents only a small portion of the total cost of petroleum products. For example, the cost to transport by pipeline a gallon of gasoline from Houston to New Jersey was about three cents per gallon in 2001.
26. Natural gas transmission pipeline systems are operated by about 785 companies.
27. Interstate petroleum pipeline systems are operated by about 220 companies.
28. States are allowed to recover up to fifty percent (50%) of their pipeline enforcement costs from the U.S. DOT.
29. As of 1999, forty-nine states were certified to implement an intrastate gas pipeline safety program. Nine states were also certified to administer the interstate natural gas pipeline safety program.
30. Twelve states are certified to implement intrastate hazardous liquid pipeline safety programs, and four states are certified to administer interstate hazardous liquid pipeline safety programs.
31. Many of the pipeline safety regulations are written as performance standards, which set the minimum level of safety and allow the pipeline operator to use various technologies to achieve this minimum level of safety.
32. OPS is tasked to ensure people and the environment are protected from the risk of pipeline incidents.
33. Traditionally, OPS has carried this oversight responsibility by requiring all pipeline operators to comply with uniform minimum standards.
34. In 1993, FERC signed a Memorandum of Understanding on Natural Gas Transportation Facilities giving the U.S. DOT exclusive authority to promulgate federal safety standards and in the transportation of natural gas. An applicant for a certificate of convenience must certify it will design, install, inspect, test, construct, operate, replace, maintain, and inspect the facility in accordance with U.S. DOT federal standards.
35. When a natural gas pipeline company is planning to build an interstate pipeline, a notice of intent to prepare an environmental assessment or an environmental impact statement is prepared and sent to federal, state, and local agencies, and to landowners. The notice will request comments on the proposal.

**Comments on TRB 281**

Opinions, comments and questions on the information included in TRB 281 include:

1. Although TRB 281 contains considerable worthwhile information, the findings and opinions do not convey a consistent message. The report also contains conflicting, opinionated, and misleading statements including:
   1. NGPSA of 1968 did not specifically give the Federal Power Commission jurisdiction over routing, siting, or location.
   2. The U.S. DOT does have jurisdiction outside pipeline rights-of-way in setting class locations and defining high consequence areas for natural gas pipelines. However, the regulations in these areas are inadequate.
   3. Interstate gas transmission pipeline companies should not be allowed to override private landowners as well as state and local governments.
   4. Since the cost of pipeline transportation is low, gas transmission companies do not need to have unlimited power of eminent domain and should be more judicious in their routing other than taking a near “straight line approach” between start and end points.
   5. Performance based standards such as Title 49 CFR Parts 192 and 195 do not set a clear minimum level of safety.
   6. Although OPS is tasked to ensure people and the environment are protected from the risk of pipeline incidents, OPS has done little to aggressively enforce standards.
   7. Federal pipeline safety regulations are not “uniform minimum standards”. They are general and sometimes vaguely stated standards using performance, not prescriptive language.
   8. The FERC and U.S. DOT memorandum of understanding should provide a basis for the U.S. DOT to address pipeline routing and siting if the U.S. DOT is willing to exercise this authority.
2. TRB 219 was more balanced and consistent with its message than TRB 281. However, both TRB reports failed to identify the solutions to new pipeline encroachment on populated areas and population encroachment on existing pipelines.
3. As stated in the section on TRB 219, FERC has to be willing to give up their antiquated, ineffective authority over pipeline routing and facility siting.
4. If the U.S. DOT is providing this authority which is already part of pipeline design function, regulatory solutions can be worked.
5. After all, FERC does not have authority over pipeline safety, siting is related to pipeline safety, this matter should have been resolved many years ago. All that was missing was the political will of the Secretary of Transportation.
6. Additional comments on the information in TRB 281 on pipeline encroachment include:
   1. I strongly agree that risk-based guidelines can be developed for setbacks for all pipelines transporting hazardous materials.
   2. Any solutions on setback distances from the pipeline industry are likely to be biased and understated.
   3. The OPS has not shown the technical competence to understand the complexity of setback distance criteria. However, any complex problem can and must have simple solutions.
   4. The U.S. DOT has failed to develop an extensive database for a qualitative cost-benefit analysis of setbacks distances.
   5. Any solution will have to begin with a risk-informed analysis of benefits of setbacks. An engineering approach can be developed.
   6. The PIR equation in 49 CFR Part 192 is partially appropriate for the purpose of setback for structures, not people outside a structure.
   7. Right-of-way activities that preserve habitat will not permit aerial patrol of the right-of-way. Regulation will need to require ground inspection of the rights-of-way in such areas.
   8. Pipeline safety will be limited as long as FERC continues to maintain authority over pipeline siting. After all, FERC does not have specific regulations covering setbacks and other public safety considerations involving pipeline siting.
7. The solution to limited setback distance restrictions in highly populated areas should be a rupture proof design criterion for pipelines. Present design requirements in Title 49 CFR Part 192 and in ASME B31.8 do not provide for such criteria. However, development of a rupture proof, leak without breaking criteria is feasible with the present level of pipeline knowledge.

**Failure of FERC and U.S. DOT to Apply TRB 219 and TRB 281 to Their Review of**

**Natural Gas Projects**

The inverse of public encroachment of the public to locations near pipelines covered in TRB 219 and TRB 281 is eminent domain activities of pipelines. The effects to public and environmental safety are the same, because both activities “close the gap” needed between hazardous facilities such as pipelines from the public and high value environmental resources.

FERC and the U.S. DOT since 2004 have ignored the conclusions in TRB 281 which included:

1. Judicious land use decisions can reduce the risk associated with transmission pipelines by reducing the probabilities and the consequences of incidents.
2. Rational land use decisions that provide appropriate physical separation between people and pipelines could reduce the risk associated with the increasing number of people in proximity to transmission pipelines.
3. It is feasible to use a risk-informed approach to establish land use guidance for application by local government.
4. The probability of failure of any transmission pipeline is a function of several interrelated factors including:
   1. Materials of construction,
   2. Corrosion,
   3. Effectiveness of pipeline coatings and cathodic protection,
   4. Pressurization, and
   5. Depth of cover.
5. Data and models are lacking for making precise predictions about specific pipelines, but estimates can be developed at an aggregate level and adjusted for local conditions.
6. Possible consequences of an event could be estimated on the basis of product carried, degree of pressurization, depth of cover, surrounding development, and other considerations.
7. An ongoing process that would involve risk assessment experts and stakeholders is needed to develop and apply such information.
8. Possible land use techniques to address risk include establishing:
   1. Setback distances;
   2. Prohibiting certain structures and activities such as schools, hospitals, and apartment buildings near pipelines; and
   3. Develop recreational uses in the vicinity of pipeline rights-of-way.
9. FERC has antiquated, ineffective authority over pipeline routing and facility siting.

Included in the TRB 281 report were the following recommendations:

1. Develop risk-informed land use guidelines for applications by stakeholders including:
   1. Land use policies affecting the siting, width, and other characteristics of new pipeline corridors;
   2. Appropriate land uses, structures, and human activities compatible with pipeline rights-of-way;
   3. Setbacks and other measures that could be adopted to protect structures that are built and maintained near pipelines;
   4. Model land use zoning ordinances and subdivision regulations and planning policies; and
   5. Promote state legislation for land use near pipelines.
2. Develop best practices for the specifications, acquisition, development, and maintenance of pipeline rights-of-way.

Both FERC and the U.S. DOT have failed to follow up on the conclusions and recommendations in both TRB 219 and TRB 281. Both agencies have grossly failed to address public and environmental safety activities within their jurisdictions.

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R. D. Deaver, P.E.

DEATECH Consulting Company

rddeaver.com

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