Proposed New Definitions 14.04.020:

Hazardous liquid and natural gas transmission pipelines: pipelines designed and operated for the purpose of transporting oil, diesel, jet fuel, gasoline, other petroleum products, or natural gas.

High Consequence Land Use: a land use that if located in the vicinity of a hazardous liquid or gas transmission pipeline represents an unusually high risk in the event of a pipeline failure due to characteristics of the inhabitants or functions of the use. High consequence land uses include:

(1) Land uses that involve a high-density on-site population and/or that are difficult to evacuate. These uses include schools, hospitals, clinics, multi-family housing, facilities exclusively for elderly or handicapped including adult group care facilities, stadiums or arenas, and day care centers, however does not include group care facilities or adult family homes.

(2) Land uses that serve critical "lifeline" or emergency functions, such as fire and police facilities, utilities providing regional service, or water supplies that if exposed to a significant risk that will curtail its lifeline function for a critical period of time.

(3) Uses with similar characteristics as determined by the Administrative Official.

Sensitive Utility Corridor: the geographic area located within [up to 660] feet of one or more of the four major hazardous liquid or gas transmission pipelines within Skagit County. This distance includes the "Potential Impact Radius" used in the gas transmission pipeline integrity management regulations (49 CFR 192.903).

Proposed New Section:

14.16.205 Sensitive Utility Corridor Overlay.

(1) Purpose.

The purpose of this Section is to help prevent damage and minimize unnecessary risk to the public health, safety, and welfare in direct proximity to hazardous liquid and natural gas transmission pipelines by:

(a) Supplementing existing federal and state regulations related to hazardous liquid and natural gas pipeline corridor management.

(b) Ensuring early communication between those developing property and pipeline operators.

(c) Minimizing the likelihood of damage to existing pipelines during development activities.

(d) Avoiding exposure of land uses with high on-site populations and/or are difficult to evacuate and land uses that serve emergency functions to the risk of injury or damage in the event of a pipeline failure.

(e) Helping reduce adverse impacts to life and property in the event of a pipeline failure.

(2) Determination of Sensitive Utility Corridor Overlay.

The provisions of this Section apply to all existing and proposed land uses within the Sensitive Utility Corridor. For purposes of this Section, the Sensitive Utility Corridor is that geographic area located within [up to 660] feet of one or more of the four major hazardous liquid or gas transmission pipelines within Skagit County. The pipeline locations and boundaries of the sensitive utility corridor are as delineated by Skagit County and depicted on the Skagit County Sensitive Utility Corridor Overlay map. Maps portraying the sensitive utility corridor shall be on file for public inspection in the Skagit County Planning and Development Services department and on the official County website.

(3) Application of Sensitive Utility Corridor Overlay Review.

Buildings, structures, land divisions, binding site plans, and/or land uses and their associated permits/approvals, which lie within the Sensitive Utility Corridor, shall be subject to the provisions of this subsection.

(a) High Consequence Land Uses and Essential Public Facilities

(i) New high consequence land uses and essential public facilities are prohibited within the [up to 660] feet of the Sensitive Utility Corridor nearest a hazardous liquid or natural gas transmission pipeline.

(ii) Modifications and/or expansions to existing high consequence land uses or essential public facilities located within the [up to 660] feet of the Sensitive Utility Corridor nearest a hazardous liquid or natural gas transmission pipeline must be designed to avoid an increase in the level of risk in the event of a pipeline failure to the greatest extent possible, and where feasible, reduce the risk compared to the existing development. Techniques to minimize or reduce risk include but are not limited to:

(A) Site design elements, such as increasing the distance between occupied structures, or structures that provide critical lifeline functions, and the hazardous liquid or natural gas transmission pipeline.

(B) Building features, such as building design and construction methods/materials to provide greater protection to on-site populations or to expedite evacuation.

(C) Technological features, such as building alarms or intercom systems to notify building occupants of the need to evacuate or other features that help avoid or limit damage and promote safety in the event of a pipeline failure.

(D) Operational features, such as emergency plans, early detection systems, notification and education programs for building occupants concerning pipeline safety.

(iii) Modifications to existing buildings that do not increase the onsite populations or impede or hinder evacuation routes are not required to comply with subsection (ii) above, but are encouraged to utilize the techniques outlined above to minimize or reduce risk.

(b) Other Development

(i) New land divisions shall not include any new building envelopes within the [up to 300] feet of the Sensitive Utility Corridor nearest a hazardous liquid or natural gas transmission pipeline. The land within this area may, however, be used for the purposes of calculating the overall density of the proposed land division.

(ii) Applicants for the following types of new or expanded development (excluding prohibited high consequence land uses and essential public facilities) within the [up to 300] feet of the Sensitive Utility Corridor nearest a hazardous liquid or natural gas transmission pipeline shall use appropriate mitigation measures to help reduce adverse impacts in the event of a pipeline failure:

(A) Commercial, industrial, or institutional.

(B) Religious facilities.

(C) Other developments as determined by the Administrative Official that, because of proximity to a hazardous liquid or gas transmission pipeline corridor, pose a safety concern due to characteristics of the occupants, development, or site.

(iii) Mitigation measures intended to reduce risk and minimize impact in the event of a pipeline failure include but are not limited to:

(A) Site and building design techniques such as maximizing the distance between new or expanded development and anticipated impact radius or flow paths for leaking hazardous materials and controlling ignition sources as well as construction methods/materials offering more protection to occupants.

(B) Emergency procedures such as emergency plans and guides, employee training and drills, and education programs for occupants and employees concerning pipeline safety, such as what to be aware of and how to respond in the event of a problem.

(1) Applicants shall consult with the Fire Marshal regarding the level of emergency planning and procedures appropriate for the proposed development. Based on the nature, occupancy, or location of a proposed development, the Fire Marshal may require emergency plans and procedures for any occupancy classifications.

(2) Emergency plans and procedures shall be consistent with the Fire Code and shall be approved by the Fire Marshal.

(c) Setback Requirements.

(i) No significant land disturbance or construction or expansion of structures are allowed within hazardous liquid or natural gas transmission pipelines easements without the express written consent of the pipeline operator.

(ii) Setbacks for buildings, structures, and land disturbance within the Sensitive Utility Corridor shall be measured from the edge of easement containing the hazardous liquid or natural gas pipeline and are as follows:

(A) New structures (for the purpose of human occupancy): [up to 150] feet.

(B) New structures (for the purpose of non-human occupancy): [up to 75] feet.

(C) Other activities (involving significant land disturbance): [up to 50] feet.

(D) Expansion of existing structures within the setback area is allowed provided that expansions of human occupied structures must meet the following:

(1) Site design elements are utilized to minimize or reduce risk, such as maximizing the distance between occupied structures and the hazardous liquid or natural gas transmission pipeline; and

(2) Building features, such as building design and construction methods/materials are used to provide greater protection to occupants.

(E) The Administrative Official may reduce the required setback through the Administrative Variance process due to site-specific conditions and an applicant's

demonstration that the purpose of this section will be met by proposed mitigation measures. In all cases, [up to 75] % of a minimum setback must maintained

(iii) Setbacks must be identified and protected prior to and during construction by placement of a temporary barricade and on-site notices. Barricades and on-site notices are subject to review throughout the development process.

(iv) The required setback from hazardous liquid and gas transmission pipeline corridors shall not deny all reasonable economic use of property. If an applicant demonstrates to the satisfaction of the Hearing Examiner through the Level II Variance process that strict application of the required setback would deny all reasonable economic use of the property, the setback may be lessened subject to appropriate conditions.

(A) An applicant for relief from strict application of the required setback shall demonstrate the following:

(1) No reasonable economic use of the applicant's property can be made if the required setback is strictly applied; and

(2) The proposed setback is the minimum necessary to provide the applicant with a reasonable economic use of the property; and

(3) All reasonable mitigation measures have or will be implemented or assured; and

(4) The inability to derive any reasonable economic use is not the result of the applicant's actions or those of the applicant's predecessors in title; and

(5) The location of the pipeline easement boundaries have been definitively determined.

(B) As a condition of any relief granted under this section, the applicant shall be required to record an instrument against the title of the property notifying all subsequent purchasers of the fact that a lesser than standard setback from the pipeline has been approved and of any and all conditions placed on the grant of relief.

(4) Development Application Submittal Requirements.

(a) Prior to the issuance of any development permit within the Sensitive Utility Corridor, a letter from the affected pipeline company shall be received by Planning and Development Services indicating they have reviewed they project and including any comments. The applicant may work with the pipeline company prior to application submittal in order to reduce application review time. If the required letter from the pipeline company is not submitted with the application, Planning & Development Services will notify the pipeline company and additionally the applicant will be notified of the requirement during the application review process. The letter must include the following: Pipeline Company letterhead, the address and/or location of the proposed project, a description of the project reviewed, and a statement indicating that no comments from the pipeline company will be forthcoming or a statement including any comments and/or concerns. Pipeline companies will have fifteen (15) days to respond to such inquiries.

(i) Any comments provided by the pipeline operators will be provided to the applicant. Planning and Development Services may require modifications to project proposals in response to pipeline company comments based on severity of risk.

(ii) If no response is forthcoming from the affected pipeline company within fifteen (15) days or an applicant is unable to contact the affected pipeline company, the applicant must submit a written account of the attempted contact including: the name, phone number, address or other contact information as well as the dates of attempted contact. Where failed contact is documented, Planning and Development Services may proceed with permit issuance absent a response from the affected pipeline company.

(b) Applicants for development permits within the Sensitive Utility Corridor on parcels including pipeline easement(s) must show the location of the pipeline easement on the site plan and such permits will be conditioned that applicants notify utilities through the one-call locater service prior to any land disturbance.

(c) All land division applications for property within the Sensitive Utility Corridor must include required overlay setbacks and a note on the subdivision map including the following language:

(i) The subject property is located within the Sensitive Utility Corridor Overlay which is defined as an area within [up to 660] feet of one or more of the four major hazardous liquid or gas transmission pipelines within Skagit County.
[Note to code publisher: Also amend SCC 14.18.200(2) to include new subsection (x) with the language shown in (c)(i) above.]

(d) SEPA environmental checklists for all development within the Sensitive Utility Corridor must include reference to affected pipeline and provide information concerning any impact the activity will have upon the integrity of the transmission pipeline(s).

(e) All other applicable development application submittal requirements of this Section and this Chapter apply.

(5) Notice and Acknowledgement. The owner of any parcel, for which an application for a development permit within the Sensitive Utility Corridor is submitted, shall record a title notification with the Skagit County Auditor. The content and form must be approved by the Administrative Official and the Prosecuting Attorney. The notice shall be notarized and shall be recorded prior to approval of any development proposal for the site, and include the following language:

NOTICE AND ACKNOWLEDGEMENT
SENSITIVE UTILITY CORRIDOR OVERLAY

Permit Number: _____

Property Legal Description:

_____

_____

Property Address/Location:

_____

* *

NOTICE

The above referenced property is located wholly or partially within the Sensitive Utility Corridor Overlay and within [up to 660] feet of one or more of the four major hazardous liquid or natural gas transmission pipelines in Skagit County. This disclosure shall be notice that the subject property is within the "Potential Impact Radius" of a transmission pipeline as identified in the gas transmission pipeline integrity management regulations (49 CFR 192.903). Any development within the Sensitive Utility Corridor Overlay may be subject to safety, maintenance, or nuisance potential that may arise due to the proximity of a hazardous liquid and/or natural gas transmission pipeline to this property. The subject pipeline(s) are depicted on the maps attached as exhibit(s).

ACKNOWLEDGEMENT

I, _____, the owner of the referenced property, hereby acknowledge that I have read and understand the NOTICE provided above. I understand that this NOTICE AND ACKNOWLEDGEMENT will be recorded with the Skagit County Auditor.

The Auditor will convey notice of its contents to all persons or entities acquiring or obtaining an interest or right to occupancy in or on the subject property. I have freely executed this ACKNOWLEGEMENT as a condition of approval for permit/subdivision/binding site plan application number _____, as required by SCC 14.16.205(5).

Dated the _____ day of _____, 20___.

Owner Signature _____

Owner Signature _____

Printed Name _____

Printed Name _____

(Acknowledgement for Individual Grantor)

(Acknowledgement for Corporate Grantor)

Jurisdiction	Consultation Zone	Setbacks	Prohibited Uses	Development Submittal Requirements	Mitigation Measures	Lot Size Calculation	Reasonable Use Provision
Skagit County Proposal	0 to 660 feet	Pipelines corridors identified and protected during construction Occupied: 0 to 150 feet Non-occupied: 0 to 75 feet Land disturbance: 0 to 50 feet New building sites: 0 to 300 feet	New HCLU prohibited within 0 to 660 feet of pipeline	Pipeline easements shown on site plans and plat maps. Plat note required for land divisions. Letter from Pipeline Co.	For expansions to existing HCLU and EPF: Site/building design, technological features, and operational features Other development: Site/building design Emergency procedures	Pipeline area included in density calculations	HE process Title notice Location of pipeline
MRSC Model Ordinances	660 feet *(1)*	50 feet		Mapping Site Plans	Site/building design Construction standards Ingress/egress		
King County		100 feet					
Whatcom County	500 feet *(1)(3)*	Pipelines corridors identified and protected during construction	New structures for HCLU prohibited within 500 feet of pipeline	Pipeline corridor and setbacks identified on for HCLU, EPF, and land divisions within 500 feet of pipeline. Letter from Pipeline Co.	For expansions to existing HCLU and EPF: Site/building design, technological features, and operational features		
Redmond	One-call service notification verified	Pipelines corridors identified and protected during construction 25 feet minimum from edge of easement. May be administratively expanded. *(2)*	New HCLU prohibited within 500 feet of pipeline	Pipeline corridor and setbacks identified on site plans and plat maps within 150 feet of pipeline.	For expansions to existing HCLU and EPF: Site/building design, technological features, and operational features Other development: Site/building design Emergency procedures		HE process Title notice Location of pipeline
City of La Center	641 feet *(1)*		HCLU prohibited within 250 feet of pipeline. Uses proposed 250 - 641feet may or may not be approved through a HE SPU process with required mitigation measures.	Mapping and notice of restricted pipeline area (i.e. pipeline easement). Letter from Pipeline Co.		Pipeline area removed from density calculations	

(HCLU) - High Consequence Land Uses Schools, hospitals, multi-family housing or facilities exclusively for elderly or handicapped housing or facilities, stadiums, and day care centers. As well as uses that serve critical "lifeline" or emergency functions, fire & police. Essential Public Facilities (EPF)

1) *From centerline of transmission pipeline easement (corridor)*
2) *For construction or expansion of structures or other activities with Significant Land Disturbance (SLD). Setback may be expanded due to site-specific conditions, such as Extraordinary Land Disturbance (ELD). If setbacks are reduced, minimum distance of 30 feet from pipeline or actual easement edge whichever is greater.*
3) *Distance may be lessened for certain development activities if reviewed by pipeline operator(s) and found to be consistent with prudent pipeline operation.*

PLANNING & DEVELOPMENT SERVICES

GARY R. CHRISTENSEN, AICP, DIRECTOR
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Administrative Coordinator

TIM DEVRIES, CBO, ACO
Building Official & Floodplain Manager

To: Skagit County Planning Commission

From: Carly Ruacho, Senior Planner

Date: May 17, 2011

Proposal:

Amendments to the Skagit County Unified Development Code, Title 14, to include procedures and development standards for lands in close proximity to hazardous liquid/natural gas transmission pipelines.

Rationale for proposal:

1. Address a gap in the existing federal and state regulations related to hazardous liquid and natural gas pipeline corridor management.
2. Promote communication among County government, land owners, developers, and industry representatives to seek improvements in safety measures for transmission pipelines.
3. Reduce opportunities for accidental damage to hazardous liquid and natural gas pipelines.
4. Avoid exposing structures with high on-site populations and/or those uses that are difficult to evacuate, emergency facilities, and similar high consequence structures to risk of injury or damage in the event of a pipeline failure.
5. Promote awareness of the pipeline corridor through education.
6. Reduce opportunities for environmental damage.

Pipeline transmission, and land use compatibility and public safety options available to local governments are:

1. Impose few, if any, public safety measures, hoping that no catastrophic pipeline failures occur within your neighborhood or community. There are no federal or state "mandates" requiring that a local government consider pipeline safety issues.
2. Assume the worst and impose draconian regulations to safeguard the public from all possible risk in the event that a pipeline does rupture and ignite.
3. Choose from the range of recommended practices that seek to protect the pipelines from damage and lessen the injuries and damage if a pipeline failure does occur.

Options one and two are extreme positions. The current proposal reflects the ideas of option three and addresses: education about pipeline safety, recommended land use practices, assessment of the level of safety concern in a community, and reasonable measures to promote the health and safety of the community.

Background

In 2010, Planning and Development Services applied for and received a $50,000 grant from the US Department of Transportation Pipeline Safety and Hazardous Materials Administration (PHMSA) to study the issue of pipeline safety in Skagit County and develop new procedures and development standards. The PHMSA grant is awarded to 20 recipients nationwide each year. In 2011, approximately 180 jurisdictions applied for the technical assistance. Other Washington state jurisdictions that have previously adopted pipeline safety standards include: King County, Whatcom County, the City of Redmond, and the City of La Center. Municipal Research Center has also produced guidance for local jurisdictions on this issue and has drafted model ordinances relating to pipeline setbacks as well as consultation zones.

During the development of the proposed land use measures pertaining to transmission pipelines, County staff met with pipeline operators from all four major pipelines located in Skagit County (BP, Kinder Morgan, Williams, and Cascade Natural Gas). Affected landowners were also directly notified via an informational mailing sent to the 3,200 individual owners with property in close proximity (1,000) of one or more of the transmission pipelines (see below).

Skagit County Commissioners hearing room. The purpose of the meeting was to allow the public an opportunity to ask questions and discuss the issue and the project in an informal setting prior to the public hearing. There were approximately 40 individuals who attended the meeting. All four of the major transmission pipeline companies were also invited to attend. Three staff members from Williams pipeline participated in answering questions from the public and presenting information about transmission pipelines and pipeline safety. Several Skagit County Planning and Development

Services staff were present as well as two County Commissioners. The discussion and questions pertained primarily to how the regulations will impact landowner's property values, taxes, and uses.

Pipelines

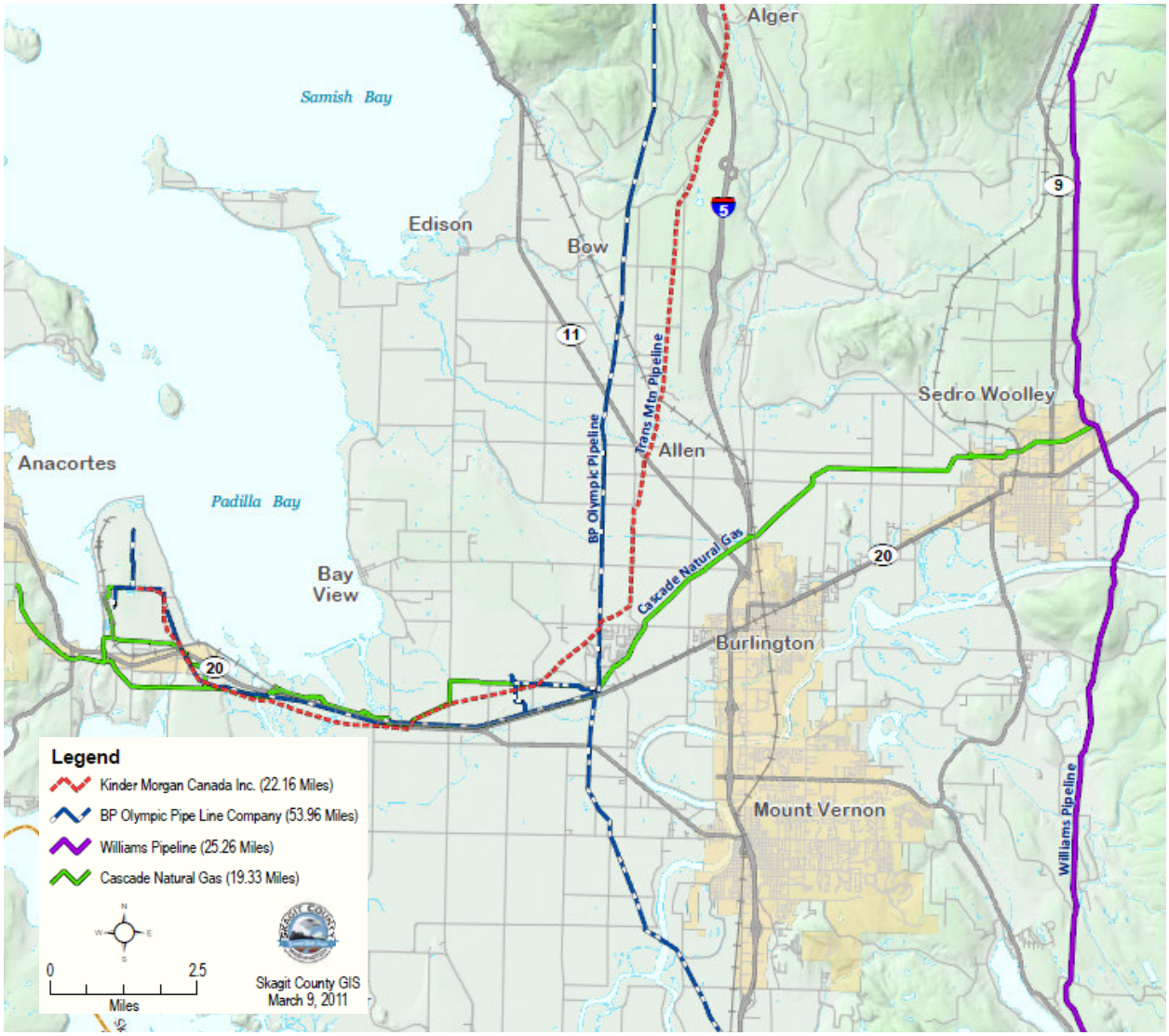
Skagit County has approximately 121 miles of hazardous liquid/natural gas transmission pipelines comprised of the infrastructure of 4 companies: BP (Olympic Pipeline), Kinder Morgan (Trans Mountain Pipeline), Williams (Northwest Pipeline), and Cascade Natural Gas. Each of the companies installed their first pipelines in Skagit County during the same general timeframe (1960's). Several companies have added additional lines within their existing easements over the last 50 years. Many of the pipelines have changed ownership since their initial installation as well as changed characteristics over time. With federal approval, pipelines may transition from one product to another in an existing pipe.

British Petroleum (BP) operates a hazardous liquid pipeline known as the Olympic Pipeline. The pipeline runs north to south through entire length of the County, west of I-5, and additionally, east to west from west of Burlington to the Tesoro refinery on March's Point. The Olympic pipeline is comprised of two parallel lines running within the same corridor. The 16" and 20" lines carry gasoline, diesel, and aviation fuel on a three day cycle. The pressure in the lines is generally 1200 to 1400 psi (pounds per square inch). The pipeline is monitored in and controlled remotely from the Operations Control Center in Renton, WA.

Kinder Morgan operates a hazardous liquid pipeline known as the Trans Mountain Pipeline. The pipeline includes approximately 22 miles within Skagit County and runs generally north to south from the County line near Alger to a pressure station near Hwy 20 at a diameter of 20". The pipe changes direction east of Burlington and runs out to March's Point with a pipe diameter of 16". Kinder Morgan transports strictly crude oil and is monitored from Edmonton, Alberta.

The Williams (Northwest) and Cascade Natural Gas pipelines carry natural gas. The Williams pipeline runs the length of the County from north to south generally along Hwy 9, with pipe diameters of 30" and 36". Cascade Natural Gas pulls it's product from Williams pipeline and runs the transmission line east to west from Sedro-Woolley to Anacortes. Williams pipeline is monitored and controlled from Salt Lake City. Cascade Natural Gas is owned by MDU Resources and is monitored out of Idaho.

The easement width for each pipeline varies, from company to company and even for a single pipeline. The location of the pipelines within their respective easements varies as well. While the pipelines are typically buried at a depth of 3 to 4 feet, this also varies and can change over time due to erosion or excavation. Pipelines in Skagit County have been found to be as shallow as 20" from the surface.



Pipeline Safety

The pipeline infrastructure transporting our nation's petroleum and natural gas products is a necessary and important part of our everyday life. The alternatives to pipeline transmission of these products include utilizing our freeway and/or railway systems. The use of trucks and/or trains to transport these products in infeasible due to the quantities required on a daily basis by us, the consumers. Pipelines are an efficient, effective, and generally safe means of conveying these volatile products. Although the pipeline companies are vigilant in their efforts to ensure the safety of their pipelines and the public, there are nonetheless several occurrences of pipeline failures each year.

Unfortunately, even though the occurrences of pipeline failures are rare, they often result in environmental and property damage as well as serious injury and even death. Pipeline facilities, if ruptured or damaged, can pose a significant risk to public safety and the environment due to the high operating pressure and the highly flammable, explosive, and toxic properties of the transported products.

The Office of Pipeline Safety reports 583 serious injuries or deaths resulting from transmission pipeline incidents between 1986 and 2003. 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. When a natural gas pipeline ruptures and ignites, the blast and heat are centered at the point of rupture rather than a potentially much larger area in the case of hazardous liquid pipelines.

In June 1999, a section of BP's Olympic pipeline in Bellingham ruptured, spilling 237,000 gallons of gasoline into Whatcom Creek. Three people died and eight others were injured when the fuel ignited and burned 1.5 miles in and along the creek channel. Extensive fires burned a 25 acre area for four days. The failure caused extensive damage to the City of Bellingham's water treatment facility and resulted in $45 million in property damages.

A 30" natural gas transmission line running through a suburban community near San Francisco, CA (San Bruno) failed in September 2010, damaging 120 homes, destroying 38, and killing eight people. The fiery blast caused by the pipeline failure burned at an estimated 2,000 degrees Fahrenheit. The company operating the failed pipeline, Pacific Gas & Electric, had released a list of its 100 riskiest transmission pipeline segments, but the segment of pipe that failed in San Bruno was not on the list. As shown in this instance, pipeline failures can cause catastrophic damage where high density developments are within pipeline hazard area radius.

Proposed Amendments

The proposed amendments to the Skagit County Unified Development Code seek to address the issue of pipeline safety within the unincorporated areas of the County. The purpose of the new code chapter is to help prevent and minimize unnecessary risk to the public health, safety, and welfare due to hazardous liquid and natural gas transmission pipelines. The amendments include four main components:

1. **Consultation Zones**
   The purpose of consultation zones is to improve communication between property owners and transmission pipeline operators early in the development process to provide guidance to property owners about minimizing risk through site design or construction.
2. **High Consequence Land Use Restrictions** (e.g. schools, hospitals, multi-family housing)
   The purpose of this section is to limit exposure of land uses with high on-site populations and/or uses that are difficult to evacuate and essential public facilities that serve critical "lifeline" or emergency functions from the risk of large-scale injury or damage in the event of a pipeline failure.
3. **Setbacks**
   The purpose of the proposed setbacks is to address the potential incompatibility of human occupied structures with hazardous liquid/natural gas transmission pipelines. Increasing distance between structures and pipeline(s) minimizes the risk of inadvertent damage to transmission pipelines and as well as lessens the likelihood of casualties and property damage in the event of a pipeline failure.
4. **New Land Division Limitations**
   Thoughtful planning and site design for additional, newly created lots in close proximity to existing transmission pipeline(s) is desired. Providing for adequate separation of pipelines

and new building lots provides greater protection for both the pipeline as well as building occupants.

Value Ranges

The proposed code amendment is drafted to provide a range of dimensional standards (distances) for consideration by the public and decision makers. Environmental review and public comment will include all values up to the maximum distance indicated in the proposal. The value ranges are indicated in the document by brackets and include the words [up to]. In each instance, the range being proposed is from 0 to the bracketed number (i.e. [up to 660] feet reflects a proposed range from 0 to 660 feet). Although there are models to calculate the expected results of pipeline failures, the hazard area radius for each failure has proven to be unpredictable. Absent any state or federal regulations mandating specific standards, it is left to each jurisdiction to assess the risks and decide on appropriate land use measures. The Department recommends adoption of the "up to" value of each range as the larger distances provide the greatest protection. The values listed as the high end of the ranges were carefully selected. Both higher and lower values were considered for each provision. The proposal relies on research indicating distance offset from pipeline failure sites to fatality, injury, and burn extent. The proposal also considers other jurisdictional approaches, MRSC model ordinances, as well as other recommended planning practices relating to planning near pipelines.

The following figures were excerpted from *A Model for Sizing High Consequence Areas Associated with Natural Gas Pipelines, Mark J. Stephens, October 2000.* 660 feet is the hazard area radius utilized by the industry based on the HCA model (Figure 2.4 below). Although 660' is the accepted standard for hazard area sizing, significant damage and casualties have occurred at greater distances in several instances. The offset to injury for the incidents shown is just under 300' and the offset to fatality is 150'.

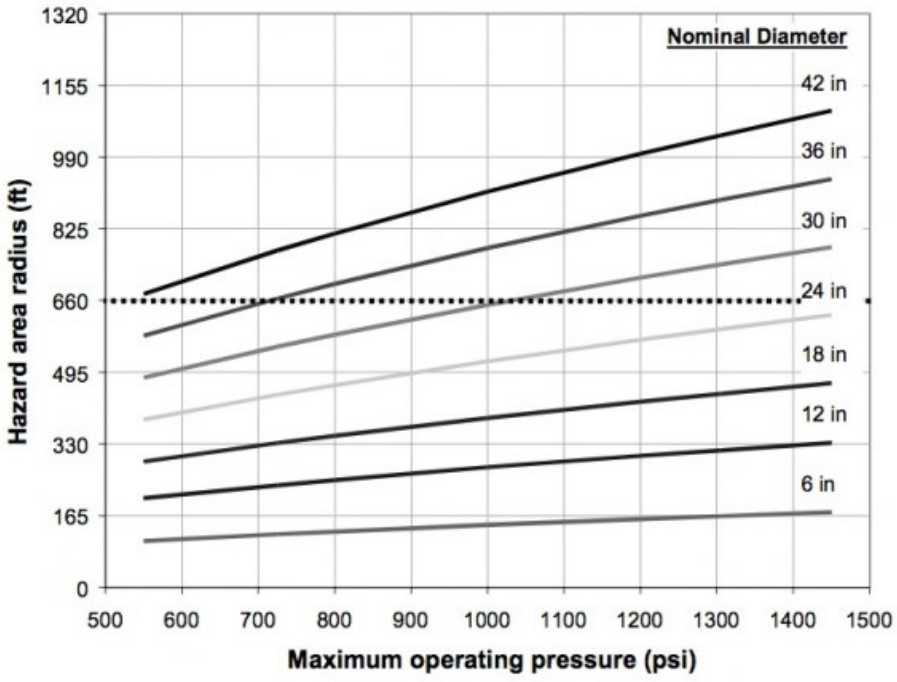


Figure 2.4 Proposed hazard area radius as a function of line diameter and pressure.

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.

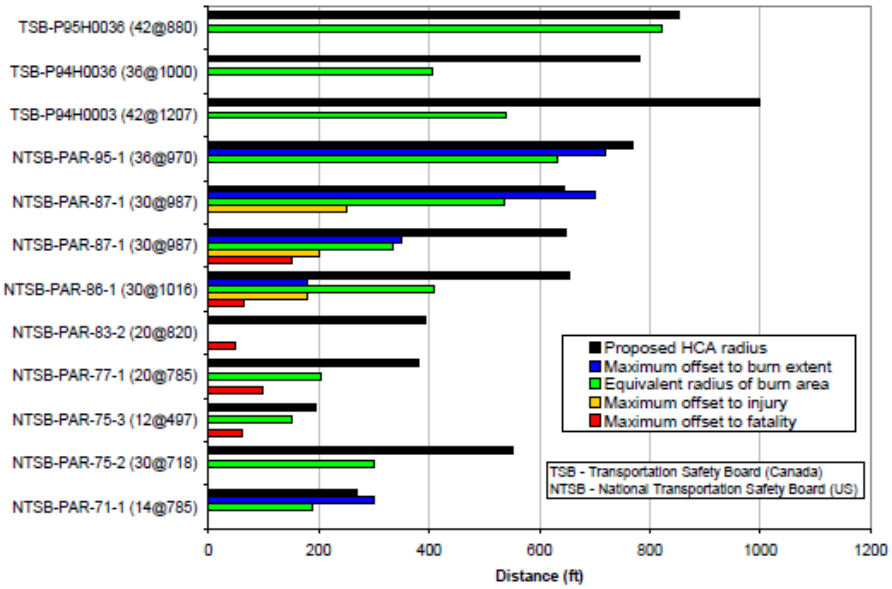


Figure 3.1 Comparison between actual incident outcomes and the proposed hazard area model.

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.
- 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.