The Achievement of Pipeline Safety in your City
“if you can't carry it in a bucket, It probably isn't safe”

Things to Do List:
1. Contact City Manager/Administrator and/or Emergency Management Coordinator to determine:
   a. pipeline locations in your city
   b. properties of products transmitted through your pipelines
   c. placement of this information on your city map

   Resources:
   Pipeline Companies
   Local Emergency Preparedness Committee (LEPC)
   State Agencies
   Dig-Test and/or One-Call Service Systems

2. Investigate your city’s preparedness to handle a breach in the transmission of products through your pipelines

3. Examine existing communication operations to your citizens in the event of a breach of safety (is upgrade necessary?)

4. Scrutinize your State Agency’s regulations in regards to municipal rights in public safety

FEDERAL ISSUES
1. Hazardous Volatile Liquids (HVLs) treated with same criteria as gas transmission pipelines

2. Pipelines located deeper to reduce risk of outside equipment damage

3. Prior Use & Condition of lines is criteria for change

4. Risk assessments must be performed & submitted to Local authority

5. Pipeline Companies must perform to educate Public Safety

6. Federal legislation to allow State Agencies increased authority

7. State Agencies notify Local Authorities for Change requests

8 Laws cannot supersede Local Authority

9. Stricter Testing Criteria

10. Mandatory Leak Detection Systems

More???
SAFETY
BY
DESIGN

NOT
SAFETY
BY
PROCEDURE
Don't let this happen in Friendwood!
Vapor Cloud Explosions

Explosive power is typically rated in tons of TNT equivalent
DOD used vapor cloud explosions (fuel-air bombs) in Vietnam
Vapor cloud explosions tend to be catastrophic events
Can cause significant damage over very large areas - greater than 1 mile radius
Examples Of Vapor Cloud Explosions

1987 Pampa, Texas - butane
1989 Pasadena, Texas - ethylene and isobutane
1992 Brenham, Texas - natural gas liquids (ethane, propane, butane)
1995 Liberty, Texas - propylene
Properties Of Ethane

Is a gas under normal atmospheric pressure

Liquid boiling point -127.5 deg. F

Ethane gas is slightly heavier than air (density = 1.04)

 Stored and transported as a liquid under high pressure (> 587 psig)
37.5 cubic feet of gas per gallon of liquid ethane - 75% more energy than natural gas

Much more hazardous than natural gas

Combination of ethane's physical & chemical properties results in vapor cloud formation when pressure is released

Liquefied ethane pipelines contain much more material than a natural gas pipeline because of higher density

HAZARDS OF ETHANE
WHAT
WE NEED
TO DO
LIQUID PIPELINE SAFETY ISSUES

EXECUTIVE SUMMARY

In early 1996 Exxon Pipeline Company began plans to convert a 30 year old crude oil pipeline in Texas to ethane service. Unlike liquid crude oil, ethane is a gas. Ethane can be liquefied at ambient temperature if constrained at pressures above 600 Psig. Normally ethane is transported by pipeline in a liquid state, i.e. at pressures over 600 Psig. If the constraining pressure is suddenly reduced, such as in a pipeline rupture, the ethane will rapidly vaporize and convert back to a gas. Liquefied ethane and other liquefied petroleum gases, such as propane and butanes, behave in a similar manner. These liquids are called volatile liquid hydrocarbons. Numerous pipeline incidences involving accidental releases and explosions of volatile liquid hydrocarbons have occurred in recent years. Several of these incidences have resulted in death, injury, and property loss.

The old Exxon pipeline originates in South Texas and was used to deliver crude oil to the Houston/Baytown area refineries, a distance of 107 miles. Since the original construction of the line, hundreds of homes have been built along the pipeline right-of-way in Friendswood, Texas. Exxon Pipeline requested a permit from the Texas Railroad Commission in February, 1996 to carry liquefied ethane from south Texas gas processing plants through the pipeline in Friendswood to final its destinations of salt dome storage in Mont Belvieu, Texas and chemical plants in Baytown, Texas.

The request met strong opposition from the city of Friendswood, because city officials and residents were concerned about the hazards of the old pipeline carrying a volatile liquid hydrocarbon through residential areas. Exxon contends that the same pipeline codes and regulations that apply to the crude oil service are applicable to the volatile liquid hydrocarbon service, and that the line can simply be converted to the new service. Friendswood citizens contend that several aspects of the old line such as age, past service, proximity to residences, depth of cover, and marginal design safety factors make it unsuitable for volatile liquid hydrocarbon service.

The city of Friendswood requested and was granted a hearing from the Texas Railroad Commission on the issue. On April 16, 1996 the Texas Railroad Commission conducted a preliminary public hearing in Friendswood. Over 400 residents attended the hearing to voice their opposition. On May 6, 1996 Exxon Pipeline withdrew its application to the Texas Railroad Commission, and announced that it would evaluate other options to transport the ethane.

This episode has pointed out that the codes and regulations governing liquid pipelines in the United States are in urgent need of revisions in order to protect the public safety. Some of the major issues are summarized as follows:
• If a highly volatile liquid hydrocarbon were to escape from a pipeline it would be a gas. Volatile liquid hydrocarbons are treated the same as non-volatile liquids in the current federal pipeline codes and regulations. This results in a lower design safety factor than would be applicable for hydrocarbon gases. From a public safety point of view, there is no logical, or justifiable engineering basis for designing highly volatile liquid hydrocarbon pipelines with safety factors less than those specifically prescribed by the Code for natural gas.

• The International Standards Organization (ISO) is currently meeting in Europe to finalize the draft code revisions to ISO-13623 -Design of Pipeline Systems. These code revisions will provide a uniform basis for pipeline design in the EEC countries. The ISO code treats volatile liquid hydrocarbons the same as gases with respect to design safety factors. The ISO code offers a more prudent approach to safety related aspects of pipeline design.

• The liquid Code allows change of service without adequate verification of the integrity and metallurgical condition of old pipelines due to its past service.

• The depth of pipeline cover is directly related to the failure risk from activities of people along the pipeline. The code requirements for depth of cover need to be revised in populated areas to minimize this risk.

• Risk assessment analysis of volatile liquid hydrocarbons are not specifically required by the code. This should be made a requirement.

• In the United States, the separate liquid Code and Gas Code exist largely because they evolved under separate regulatory authority. Today there is a need to follow the lead of ISO, and that is to develop and adopt a unified code and regulations covering both gases and liquids.
APPLICABLE FEDERAL CODES

The minimum design requirements for gas and liquid pipelines are set forth in the Code of Federal Regulations, Part 192 and Part 195, respectively. The requirements are derived directly from the American Society of Mechanical Engineers (ASME) Code for pressure piping, B31. The Code sets forth engineering requirements deemed necessary for safe design and construction of pressure piping. The Code consists of a number of individually published Sections, each an American National Standard. Two Code sections specifically deal with general public safety, these are:

1. ASME B31.8 - Gas Transmission and Distribution Piping Systems

2. ASME B31.4 Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols

The two above Code sections deal with gas and liquid pipelines which traverse private and public lands. Other Sections of the Code deal with piping systems such as chemical plant piping, refrigeration piping, steam boiler piping, etc. Therefore, these other Code Sections largely deal with industrial workplace safety.

DESIGN SAFETY FACTORS

The gas and liquid Code sections are significantly different with respect to design safety factors specified for populated areas.

Gas Code
The gas Code section specifically applies to any gas or mixture of gases suitable for domestic or industrial fuel. The common types are natural gas, manufactured gas, and liquefied petroleum gas distributed as a gas.1

The gas Code section defines Location Classes based on population density. The Location Classes thereby lead to more stringent design safety factors for populated areas. The rational for the application of higher safety factors in populated areas is stated in the gas Code section as follows:

“The most significant factor contributing to the failure of a gas pipeline is damage to the line caused by the activities of people along the route of the line. Damage will generally occur during construction of other facilities associated with providing the services associated with human dwellings, and commercial or industrial enterprises. These services, such as water, gas and electrical supply, sewage systems, drainage lines and ditches, buried power and communication cables, streets and roads, etc., become more prevalent and extensive, and the possibility of damage to the pipeline becomes greater with larger concentrations of

buildings intended for human occupancy. Determining the Location Class provides a method of assessing the degree of exposure of the line to damage. Additional measures are necessary to protect the integrity of the line in the presence of activities which might cause damage. One of the measures required by this Code is to lower the stress level in relation to increased public activity. This activity is quantified by determining Location Class and relating the design factor [i.e., safety factor] of the pipeline to the appropriate design factor.\(^2\)

The Location Classes are based on the population density within a 1/4 mile (440 yard) corridor encompassing the pipeline. The Location Classes are defined as follows:\(^3\)

Class 1 - Fewer than 10 buildings per mile, and intended to reflect areas such as wastelands, deserts, mountains, grazing land, farmland, and sparsely populated areas.

Class 2 - 10 to 46 buildings per mile, and intended to reflect areas such as fringe areas around cities and towns, industrial areas, ranch or country estates, etc.

Class 3 - More than 46 buildings per mile, and intended to reflect areas such as suburban housing developments, shopping centers, residential areas, industrial areas, and other populated areas not meeting Location Class 4 requirements.

Class 4 - Areas where multistory buildings are prevalent, and where traffic is heavy or dense and where there may be numerous other utilities underground.

The gas Code also stipulates that, regardless of Location Class, that pipelines near places of public assembly or concentrations of people such as churches, schools, multiple dwelling unit buildings, hospitals, or recreational areas of an organized nature shall, as a minimum, meet the requirements of Location Class 3.\(^4\)

The gas Code section specifies design factors each Location Class as follows:

<table>
<thead>
<tr>
<th>Location Class</th>
<th>Design Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>0.72</td>
</tr>
<tr>
<td>Class 2</td>
<td>0.60</td>
</tr>
<tr>
<td>Class 3</td>
<td>0.50</td>
</tr>
<tr>
<td>Class 4</td>
<td>0.40</td>
</tr>
</tbody>
</table>

The Design Factor above is applied to the specified minimum yield strength of the steel pipe to determine the required pipe wall thickness for a given design operating pressure.

\(^2\) Ibid., Sect. 840.1, p. 29  
\(^3\) Ibid., Sect. 840.2, p. 30  
\(^4\) Ibid., Sect. 840.3(b), p. 30
In other words, the pipe wall required for a Location Class 4 is 1.8 times thicker than the pipe wall thickness for a Location Class 1.

Liquid Code
The liquid Code section specifically applies to liquids such as crude oil, condensate, natural gasoline, natural gas liquids, liquefied petroleum gas, carbon dioxide, liquid alcohol, liquid anhydrous ammonia, and liquid petroleum products.\(^5\)

The liquid Code section does not specifically set forth Location Classes. The liquid Code section could be literally read to the effect that the design safety factor appropriate for liquid pipelines crossing deserts is appropriate for liquid pipelines crossing school playgrounds.

If a highly volatile liquid hydrocarbon were to escape from a pipeline it would be a gas. From a public safety point of view, there is no logical, or justifiable engineering basis for designing highly volatile liquid pipelines with safety factors less than those specifically prescribed by the Code for natural gas. Indeed, overwhelming evidence exists to support the fact that highly volatile hydrocarbons pose even greater safety hazards in the event of a pipeline failure. Volatile liquid hydrocarbons should, as a minimum, be treated the same as gas when assigning design safety factors. Therefore, the federal pipe line codes and regulations for highly volatile liquid hydrocarbons are seriously deficient with respect to appropriate design safety factors.

The design deficiencies are of concern to many responsible designers and operating companies in the United States. Regulatory authorities in other countries have taken steps to correct these deficiencies. This is supported by the following:

- Several engineering design firms and responsible operating companies in Texas and other areas of the United States do impose more stringent safety factors to highly volatile liquid pipelines in populated areas. Some use Location Class factors similar to those stipulated in the ASME B31.8 gas Code section.

- The codes of Western European counties also recognize the inherently higher risks posed by volatile liquid hydrocarbons. The International Standards Organization (ISO) Technical Committee 67-T2 is currently meeting in Europe to finalize the draft code revisions to ISO-13623 -Design of Pipeline Systems. These code revisions will provide a uniform basis for pipeline design in the EEC countries. As would be logically expected, the ISO code treats volatile liquid hydrocarbons the same as gases with respect to design safety factors.

- Mexico's codes stipulate Location Class factors which impose more stringent safety factors on volatile liquid pipelines.

LIQUID PIPELINE - CHANGE OF SERVICE

The liquid Code allows change of service without adequate verification of the integrity and metallurgical condition of old pipelines due to its past service. Among the concerns are:

1. Internal corrosion due to corrosive compounds in crude oil and other hydrocarbons.
2. External corrosion due to deficiencies in cathodic protection and deterioration of external coatings.
3. Stress corrosion cracking in the pipeline metal due to hydrogen, sulfides, chlorides, and other constituents of crude oil known to cause such effects.
4. Localized stresses and metal fatigue due to settlement and other external forces that the pipeline has been subjected to during its year life.
5. Potential shrinkage and loss of ductility of the pipeline steel due to cryogenic effects if the pipeline were to leak. These effects would be caused by the rapid cooling associated with sudden vaporization of a volatile liquid hydrocarbon.

RISK ASSESSMENT

Risk assessment analysis of volatile liquid hydrocarbons are not specifically required by the code. This should be made a requirement, along with the development of an emergency response plan. Such risk assessment should include vapor cloud dispersion modeling showing affected areas from the vapor cloud if a leak were to occur. Without such information, local emergency preparedness units cannot adequately prepare for possible emergencies in populated areas.

The risk assessment analysis should evaluate the reliability and adequacy of the pipeline control system, leak detection system, over pressure protection, emergency shut-down mechanisms, and emergency procedures that are absolutely essential to the safe operation of a highly volatile liquid pipeline through a populated area.

DEPTH OF PIPELINE COVER

The depth of pipeline cover is directly related to the failure risk from activities of people along the pipeline. The code requirements for depth of cover need to be revised in populated areas to minimize this risk.

UNIFORM PIPELINE CODE AND REGULATIONS

The European ISO pipeline code treats all fluids, whether gases or liquids, within one unified code. The fluids are grouped into appropriate categories. For example, hydrogen, natural gas, ethane, and other liquefied petroleum gases are given Category E. Each category of fluid is then subject to specific safety factors and other design considerations according to population densities along the pipeline. The ISO code offers a more prudent
approach to safety related aspects of pipeline design. Also, the unified ISO code facilitates standardization of reporting, record keeping, operation and safety procedures, and many other aspects of the design, construction, operation, and maintenance of pipelines.

In the United States, the separate liquid Code and Gas Code exist largely because they evolved under separate regulatory authority. Today there is a need to follow the lead of ISO, and that is to develop and adopt a unified code and regulations covering both gases and liquids.
THE CODE
ASME CODE FOR PRESSURE PIPING, B31
AN AMERICAN NATIONAL STANDARD

ASME B31.4a-1994

ADDENDA

to

ASME B31.4-1992 EDITION
PIPELINE TRANSPORTATION
SYSTEMS FOR LIQUID HYDROCARBONS
AND OTHER LIQUIDS

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS
United Engineering Center • 345 East 47th Street • New York, N.Y. 10017
This Addenda was approved by the American National Standards Institute on February 8, 1994, and designated ASME B31.4a-1994

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Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids

ASME B31.4-1992 EDITION

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FOREWORD

The need for a national code for pressure piping became increasingly evident from 1915 to 1925. To meet this need the American Engineering Standards Committee (later changed to the American Standards Association) initiated Project B31 in March 1926 at the request of The American Society of Mechanical Engineers, and with that society as sole sponsor. After several years' work by Sectional Committee B31 and its subcommittees, a first edition was published in 1935 as an American Tentative Standard Code for Pressure Piping.

A revision of the original tentative standard was begun in 1937. Several more years' effort was given to securing uniformity between sections and to eliminating divergent requirements and discrepancies, as well as to keeping the code abreast of current developments in welding technique, stress computations, and references to new dimensional and material standards. During this period a new section was added on refrigeration piping, prepared in cooperation with The American Society of Refrigeration Engineers and complementing the American Standard Code for Mechanical Refrigeration. This work culminated in the 1942 American Standard Code for Pressure Piping.

Supplements 1 and 2 of the 1942 code, which appeared in 1944 and 1947, respectively, introduced new dimensional and material standards, a new formula for pipe wall thickness, and more comprehensive requirements for instrument and control piping. Shortly after the 1942 code was issued, procedures were established for handling inquiries that require explanation or interpretation of code requirements, and for publishing such inquiries and answers in Mechanical Engineering for the information of all concerned.

Continuing increases in the severity of service conditions, with concurrent developments of new materials and designs equal to meeting these higher requirements, had pointed to the need by 1948 for more extensive changes in the code than could be provided by supplements alone. The decision was reached by the American Standards Association and the sponsor to reorganize the Sectional Committee and its several subcommittees, and to invite the various interested bodies to reaffirm their representatives or to designate new ones. Following its reorganization, Sectional Committee B31 made an intensive review of the 1942 code, and a revised code was approved and published in February 1951 with the designation ASA B31.1-1951, which included:

(a) a general revision and extension of requirements to agree with practices current at the time;
(b) revision of references to existing dimensional standards and material specifications, and the addition of references to new ones; and
(c) clarification of ambiguous or conflicting requirements.

Supplement No. 1 to B31.1 was approved and published in 1953 as ASA B31.1a-1953. This Supplement and other approved revisions were included in a new edition of B31.1 published in 1955 with the designation ASA B31.1-1955.

A review by B31 Executive and Sectional Committees in 1955 resulted in a decision to develop and publish industry sections as separate code documents of the American Standard B31 Code for Pressure Piping. ASA B31.4-1959 was the first separate code document for Oil Transportation Piping Systems and superseded that part of Section 3 of the B31.1-1955 code covering Oil Transportation Piping Systems. In 1966 B31.4 was revised to expand coverage on welding, inspection, and testing, and to add new chapters covering construction requirements and operation and maintenance procedures affecting the safety of the piping systems. This revision was published with the designation USAS B31.4-1966, Liquid Petroleum Transportation Piping Systems, since the American Standards Association was reconstituted as the United States of America Standards Institute in 1966.

The United States of America Standards Institute Inc., changed its name, effective October 6, 1969, to the American National Standards Institute Inc., and USAS B31.4-1966 was redesignated as ANSI B31.4-1966. The B31 Sectional Committee was redesignated as American National Standards Committee B31 Code
for Pressure Piping, and, because of the wide field involved, more than 40 different engineering societies, government bureaus, trade associations, institutes, and the like had one or more representatives on Standards Committee B31, plus a few “Individual Members” to represent general interests. Code activities were subdivided according to the scope of the several sections, and general direction of Code activities rested with Standards Committee B31 officers and an Executive Committee whose membership consisted principally of Standards Committee officers and chairmen of the Section and Technical Specialists Committees.

The ANSI B31.4-1966 Code was revised and published in 1971 with the designation ANSI B31.4-1971.

The ANSI B31.4-1971 Code was revised and published in 1974 with the designation ANSI B31.4-1974.

In December 1978, American National Standards Committee B31 was converted to an ASME Committee with procedures accredited by ANSI. The 1979 revision was approved by ASME and subsequently by ANSI on November 1, 1979, with the designation ANSI/ASME B31.4-1979.

Following publication of the 1979 Edition, the B31.4 Section Committee began work on expanding the scope of the code to cover requirements for the transportation of liquid alcohols. References to existing dimensional standards and material specifications were revised, and new references were added. Other clarifying and editorial revisions were made in order to improve the text.

These revisions led to the publication of two addenda to B31.4. Addenda “b” to B31.4 was approved and published in 1981 as ANSI/ASME B31.4b-1981. Addenda “c” to B31.4 was approved and published in 1986 as ANSI/ASME B31.4c-1986.

The 1986 Edition of B31.4 was an inclusion of the two previously published addenda into the 1979 Edition.

Following publication of the 1986 Edition, clarifying and editorial revisions were made to improve the text. Additionally, references to existing standards and material specifications were revised, and new references were added. These revisions led to the publication of an addenda to B31.4, which was approved and published in 1987 as ASME/ANSI B31.4a-1987.

The 1989 Edition of B31.4 was an inclusion of the previously published addenda into the 1986 Edition.

Following publication of the 1989 Edition, clarifying revisions were made to improve the text. Additionally, references to existing standards and material specifications were revised and updated. These revisions led to the publication of an addenda to B31.4, which was approved and published in 1991 as ASME B31.4a-1991.

This new Edition of B31.4 is an inclusion of the previously published addenda into the 1989 Edition and a revision to valve maintenance. This Edition was approved by the American National Standards Institute on December 15, 1992, and designated as ASME B31.4-1992 Edition.
CHAPTER II
DESIGN

PART I
CONDITIONS AND CRITERIA

401  DESIGN CONDITIONS

401.1  General

Paragraph 401 defines the pressures, temperatures, and various forces applicable to the design of piping systems within the scope of this Code. It also takes into account considerations that shall be given to ambient and mechanical influences and various loadings.

401.2  Pressure

401.2.2 Internal Design Pressure. The piping component at any point in the piping system shall be designed for an internal design pressure which shall not be less than the maximum steady state operating pressure at that point, or less than the static head pressure at that point with the line in a static condition. The maximum steady state operating pressure shall be the sum of the static head pressure, pressure required to overcome friction losses, and any required back pressure. Credit may be given for hydrostatic external pressure, in the appropriate manner, in modifying the internal design pressure for use in calculations involving the pressure design of piping components (see para. 404.1.3). Pressure rise above maximum steady state operating pressure due to surges and other variations from normal operations is allowed in accordance with para. 402.2.4.

401.2.3 External Design Pressure. The piping component shall be designed to withstand the maximum possible differential between external and internal pressures to which the component will be exposed.

401.3  Temperature

401.3.1 Design Temperature. The design temperature is the metal temperature expected in normal operation. It is not necessary to vary the design stress for metal temperatures between -20°F (-30°C) and 250°F (120°C). However, some of the materials conforming to specifications approved for use under this Code may not have properties suitable for the lower portion of the temperature band covered by this Code. Engineers are cautioned to give attention to the low temperature properties of the materials used for facilities to be exposed to unusually low ground temperatures, low atmospheric temperatures, or transient operating conditions.

401.4  Ambient Influences

401.4.2 Fluid Expansion Effects. Provision shall be made in the design either to withstand or to relieve increased pressure caused by the heating of static fluid in a piping component.

401.5  Dynamic Effects

401.5.1 Impact. Impact forces caused by either external or internal conditions shall be considered in the design of piping systems.

401.5.2 Wind. The effect of wind loading shall be provided for in the design of suspended piping.

401.5.3 Earthquake. Consideration in the design shall be given to piping systems located in regions where earthquakes are known to occur.

401.5.4 Vibration. Stress resulting from vibration or resonance shall be considered and provided for in accordance with sound engineering practice.

401.5.5 Subsidence. Consideration in the design shall be given to piping systems located in regions where subsidence is known to occur.

401.5.6 Waves and Currents. The effects of waves and currents shall be provided for in the design of pipelines across waterways and offshore.
CHAPTER V
CONSTRUCTION, WELDING, AND ASSEMBLY

434 CONSTRUCTION

434.1 General

New construction and replacements of existing systems shall be in accordance with the requirements of this Chapter. Where written specifications are required, they shall be in sufficient detail to insure that the requirements of this Code shall be met. Such specifications shall include specific details on handling of pipe, equipment, materials, welding, and all construction factors which contribute to safety and sound engineering practice. It is not intended herein that all construction items be covered in full detail, since the specification should be all-inclusive. Whether covered specifically or not, all construction and materials shall be in accordance with good engineering, safety, and proven pipeline practice.

434.2 Inspection

The operating company shall make provision for suitable inspection of pipeline and related facilities by qualified inspectors to assure compliance with the construction specifications. Qualification of inspection personnel and the type and extent of inspection shall be in accordance with the requirements of para. 436. Repairs required during new construction shall be in accordance with paras. 434.5, 434.8, and 461.1.2.

434.3 Right of Way

434.3.1 Location. Right of way should be selected so as to minimize the possibility of hazard from future industrial or urban development or encroachment on the right of way.

434.3.2 Construction Requirements. Inconvenience to the landowner shall be a minimum and safety of the public shall be given prime consideration.

(a) All blasting shall be in accordance with governing regulations and shall be performed by competent and qualified personnel, and performed so as to provide adequate protection to the general public, livestock, wildlife, buildings, telephone, telegraph, and power lines, underground structures, and any other property in the proximity of the blasting.

(b) In grading the right of way, every effort shall be made to minimize damage to the land and prevent abnormal drainage and erosive conditions. The land is to be restored to as nearly original condition as is practical.

(c) In constructing pipeline crossings of railroads, highways, streams, lakes, rivers, etc., safety precautions such as signs, lights, guard rails, etc., shall be maintained in the interest of public safety. The crossings shall comply with the applicable rules, regulations, and restrictions of regulatory bodies having jurisdiction.

434.3.3 Survey and Staking or Marking. The route shall be surveyed and staked, and such staking or marking should be maintained during construction, except route of pipeline offshore shall be surveyed and the pipeline shall be properly located within the right of way by maintaining survey route markers or by surveying during construction.

434.4 Handling, Hauling, Stringing, and Storing

Care shall be exercised in the handling or storing of pipe, casing, coating materials, valves, fittings, and other materials to prevent damage. When applicable, railroad transportation of pipe shall meet the requirements of API RP 5L1. In the event pipe is yard coated or mill coated, adequate precautions shall be taken to prevent damage to the coating when hauling, lifting, and placing on the right of way. Pipe shall not be allowed to drop and strike objects which will distort, dent, flatten, gouge, or notch the pipe or damage the coating, but shall be lifted or lowered by suitable and safe equipment.
<table>
<thead>
<tr>
<th>Location</th>
<th>For Normal Excavation, in. (mm)</th>
<th>For Rock Excavation Requiring Blasting or Removal by Equivalent Means, in. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial, commercial, and residential areas</td>
<td>36 (0.9)</td>
<td>24 (0.6)</td>
</tr>
<tr>
<td>River and stream crossings</td>
<td>48 (1.2)</td>
<td>18 (0.45)</td>
</tr>
<tr>
<td>Drainage ditches at roadways and railroads</td>
<td>36 (0.9)</td>
<td>24 (0.6)</td>
</tr>
<tr>
<td>Any other area</td>
<td>30 (0.75)</td>
<td>18 (0.45)</td>
</tr>
</tbody>
</table>

NOTE: Minimum cover for pipelines transporting carbon dioxide, LPG, or liquid anhydrous ammonia shall be: 48 in. (1.2 m) for normal excavation in industrial, commercial, and residential areas, river and stream crossings, and drainage ditches at roadways and railroads; and 36 in. (0.9 m) for normal excavation in any other area.

434.5 Damage to Fabricated Items and Pipe

(a) Fabricated items such as scraper traps, manifolds, volume chambers, etc., shall be inspected before assembly into the mainline or manifolding and defects shall be repaired in accordance with provisions of the standard or specification applicable to their manufacture.

(b) Pipe shall be inspected before coating and before assembly into the mainline or manifolding. Distortion, buckling, denting, flattening, gouging, grooves, or notches, and all defects of this nature, shall be prevented, repaired, or eliminated as specified herein.

(1) Injurious gouges, grooves, or notches shall be removed. These defects may be repaired by the use of welding procedures prescribed in API 5L or removed by grinding, provided the resulting wall thickness is not less than that permitted by the material specification.

(2) When conditions outlined in para. 434.5(b)(1) cannot be met, the damaged portion shall be removed as a cylinder. Insert patching is not permitted. Weld-on patching, other than complete encirclement, is not permitted in pipelines intended to operate at a hoop stress of more than 20% of the specified minimum yield strength of the pipe.

(3) Notches or laminations on pipe ends shall not be repaired. The damaged end shall be removed as a cylinder and the pipe end properly beveled.

(4) Distorted or flattened lengths shall be discarded.

(5) A dent (as opposed to a scratch, gouge, or groove) may be defined as a gross disturbance in the curvature of the pipe wall. A dent containing a stress concentrator, such as a scratch, gouge, groove, or arc burn, shall be removed by cutting out the damaged portion of the pipe as a cylinder.

(6) All dents which affect the curvature of the pipe at the seam or at any girth weld shall be removed as in para. 434.5(b)(5). All dents which exceed a maximum depth of 1/4 in. (6 mm) in pipe NPS 4 and smaller, or 6% of the nominal pipe diameter in sizes greater than NPS 4, shall not be permitted in pipelines intended to operate at a hoop stress of more than 20% of the specified minimum yield strength of the pipe. Insert patching, overlay, or pouding out of dents shall not be permitted in pipelines intended to operate at a hoop stress of more than 20% of the specified minimum yield strength of the pipe.

(7) Buckled pipe shall be replaced as a cylinder.

434.6 Ditching

(a) Depth of ditch shall be appropriate for the route location, surface use of the land, terrain features, and loads imposed by roadways and railroads. All buried pipelines shall be installed below the normal level of cultivation and with a minimum cover not less than that shown in Table 434.6(a). Where the cover provisions of Table 434.6(a) cannot be met, pipe may be installed with less cover if additional protection is provided to withstand anticipated external loads and to minimize damage to the pipe by external forces.

(b) Width and grade of ditch shall provide for lowering of the pipe into the ditch to minimize damage to the coating and to facilitate fitting the pipe to the ditch.

(c) Location of underground structures intersecting the ditch route shall be determined in advance of construction activities to prevent damage to such structures. A minimum clearance of 12 in. (0.3 m) shall be provided between the outside of any buried pipe or component and the extremity of any other under-
434.5 Damage to Fabricated Items and Pipe

(a) Fabricated items such as scraper traps, manifolds, volume chambers, etc., shall be inspected before assembly into the mainline or manifolding and defects shall be repaired in accordance with provisions of the standard or specification applicable to their manufacture.

(b) Pipe shall be inspected before coating and before assembly into the mainline or manifolding. Distortion, buckling, denting, flattening, gouging, grooves, or notches, and all defects of this nature, shall be prevented, repaired, or eliminated as specified herein.

(1) Injurious gouges, grooves, or notches shall be removed. These defects may be repaired by the use of welding procedures prescribed in API 5L or removed by grinding, provided the resulting wall thickness is not less than that permitted by the material specification.

(2) When conditions outlined in para. 434.5(b)(1) cannot be met, the damaged portion shall be removed as a cylinder. Insert patching is not permitted. Weld-on patching, other than complete encirclement, is not permitted in pipelines intended to operate at a hoop stress of more than 20% of the specified minimum yield strength of the pipe.

(3) Notches or laminations on pipe ends shall not be repaired. The damaged end shall be removed as a cylinder and the pipe end properly rebeveled.

(4) Distorted or flattened lengths shall be discarded.

(5) A dent (as opposed to a scratch, gouge, or groove) may be defined as a gross disturbance in the curvature of the pipe wall. A dent containing a stress concentrator, such as a scratch, gouge, groove, or arc burn, shall be removed by cutting out the damaged portion of the pipe as a cylinder.

(6) All dents which affect the curvature of the pipe at the seam or at any girth weld shall be removed as in para. 434.5(b)(5). All dents which exceed a maximum depth of 1/4 in. (6 mm) in pipe NPS 4 and smaller, or 6% of the nominal pipe diameter in sizes greater than NPS 4, shall not be permitted in pipelines intended to operate at a hoop stress of more than 20% of the specified minimum yield strength of the pipe. Insert patching, overlay, or pounding out of dents shall not be permitted in pipelines intended to operate at a hoop stress of more than 20% of the specified minimum yield strength of the pipe.

(7) Buckled pipe shall be replaced as a cylinder.

434.6 Ditching

(a) Depth of ditch shall be appropriate for the route location, surface use of the land, terrain features, and loads imposed by roadways and railroads. All buried pipelines shall be installed below the normal level of cultivation and with a minimum cover not less than that shown in Table 434.6(a). Where the cover provisions of Table 434.6(a) cannot be met, pipe may be installed with less cover if additional protection is provided to withstand anticipated external loads and to minimize damage to the pipe by external forces.

(b) Width and grade of ditch shall provide for lowering of the pipe into the ditch to minimize damage to the coating and to facilitate fitting the pipe to the ditch.

(c) Location of underground structures intersecting the ditch route shall be determined in advance of construction activities to prevent damage to such structures. A minimum clearance of 12 in. (0.3 m) shall be provided between the outside of any buried pipe or component and the extremity of any other under-
ground structures, except for drainage tile which shall have a minimum clearance of 2 in. (50 mm), and as permitted under para. 461.1.1(d).

(d) Ditching operations shall follow good pipeline practice and consideration of public safety. API RP 1102 will provide additional guidance.

434.7 Bends, Miters, and Elbows

Changes in direction, including sags or overbends required to conform to the contour of the ditch, may be made by bending the pipe or using miters, factory made bends, or elbows. [See limitations in para. 406.2.]

434.7.1 Bends Made From Pipe

(a) Bends shall be made from pipe having wall thicknesses determined in accordance with para. 404.2.1. When hot bends are made in pipe which has been cold worked in order to meet the specified minimum yield strength, wall thicknesses shall be determined by using the lower stress values in accordance with para. 402.3.1(d).

(b) Bends shall be made in such a manner as to preserve the cross-sectional shape of the pipe, and shall be free from buckling, cracks, or other evidence of mechanical damage. The pipe diameter shall not be reduced at any point by more than 2½% of the nominal diameter, and the completed bend shall pass the specified sizing pig.

(c) The minimum radius of field cold bends shall be as specified in para. 406.2.1(b).

(d) Tangents approximately 6 ft (2 m) in length are preferred on both ends of cold bends.

434.7.2 Mitered Bends

(a) Mitered bends are permitted subject to limitations in para. 406.2.2.

(b) Care shall be taken in making mitered joints to provide proper spacing and alignment and full penetration welds.

434.7.3 Factory Made Bends and Elbows

(a) Factory made wrought steel welding bends and factory made elbows may be used subject to limitations in para. 406.2.3, and transverse segments cut therefrom may be used for changes in direction provided the arc distance measured along the crotch is at least 2 in. (50 mm) on pipe size NPS 4 and larger.

(b) If the internal diameter of such fittings differs by more than 1/4 in. (5 mm) from that of the pipe, the fitting shall be treated as indicated in Fig. 434.8.6(a)-(2) or use a transition nipple not less than one-half pipe diameter in length with acceptable joint designs as illustrated in Fig. 434.8.6(a)-(2).

434.8 Welding

434.8.1 General

(a) Scope. Welding herein applies to the arc and gas welding of pipe in both wrought and cast steel materials as applied in pipelines and connections to apparatus or equipment. This includes butt joints in the installation of pipe, valves, flanges, fittings, and other equipment, and fillet welded joints in pipe branches, slip-on flanges, etc. It does not apply to the welding of longitudinal or spiral joints in the manufacture of pipe, fittings, and valves, or to pressure vessels or assemblies manufactured in accordance with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 or 2.

(b) Welding Terms. Definitions pertaining to welding as used in this Code conform to the standard definitions established by the American Welding Society and contained in ANSI/AWS A3.0 and API 1104.

(c) Safe Practices in Cutting and Welding. Prior to cutting and welding in areas in which the possible leakage or presence of vapor or flammable liquid constitutes a hazard of fire or explosion, a thorough check shall be made to determine the presence of a combustible gas mixture or flammable liquid. Cutting and welding shall begin only when safe conditions are indicated.

434.8.2 Welding Processes and Filler Metal. Welding shall be done by shielded metal arc welding, submerged arc welding, gas tungsten arc welding, gas metal arc welding, or oxyacetylene welding process using a manual, semiautomatic, or automatic welding technique or combination of these techniques. Filler metal shall comply with the requirements of API 1104.

434.8.3 Welding Qualifications

(a) Prior to any welding covered by this Code, a welding procedure shall be established and qualified by testing to demonstrate that welds having suitable mechanical properties and soundness can be continuously produced. Welding procedures and each welder or welding operator shall be qualified under API 1104, or Section IX of the ASME Boiler and Pressure Vessel Code, whichever is appropriate for the type of welding to be performed. The qualified welding procedure shall specify the preheating and interpass temperature, and postweld heat treatment followed when materials, welding consumables, mechanical restraints, or weather conditions make any or all of them necessary. The welding procedure shall be adhered to during welding performed under this Code.

(b) API 1104 and Section IX of the ASME Boiler and Pressure Vessel Code contain sections entitled “Essential Variables” applicable to welding procedures and also to welders. These shall be followed except that for
the purposes of this Code, all carbon steels which have a carbon content not exceeding 0.32% (heat analysis) and a carbon equivalent (C + 1/4 Mn) not exceeding 0.65% (heat analysis) are considered to come within the limits of materials listed as P1, in Section VIII, Division 1 or 2, or Section IX. Alloy steels having weldability characteristics demonstrated to be similar to these carbon steels shall be welded, preheated, and postweld heat treated as prescribed for such carbon steels.

Other alloy steels shall be welded, preheated, and given a postweld heat treatment as prescribed in Section VIII, Division 1 or 2, unless it can be demonstrated by procedure qualification, and hardness testing per NACE MR-01-75 when applicable, that preheat or postweld heat treatment, or both, are not necessary.

(c) Welder requalification tests shall be required if there is some specific reason to question a welder's ability or the welder is not engaged in a given process of welding (i.e., arc or gas) for a period of 6 months or more.

(d) Qualification Records. The welding procedure followed during the qualifying tests shall be recorded in detail. Records of the tests that establish the qualification of a welding procedure shall be retained as long as that procedure is in use. A record of the welders qualified, showing the date and results of the tests, shall be retained during the construction involved and for 6 months thereafter.

(e) The operating company shall be responsible for qualifications of procedures and welders.

434.8.4 Welding Standards. All the welding done under this Code shall be performed under a specification which embodies the minimum requirements of this Code and shall encompass the requirements of API 1104 except as provided in paras. 434.8.3(a) and (b).

434.8.5 Welding Quality

(a) Inspection Methods

(1) The quality of welding shall be checked by nondestructive methods or by removing completed welds as selected and designated by the inspector for destructive testing.

(2) Nondestructive inspection shall consist of radiographic examination or other acceptable nondestructive methods. The method used shall produce indications of potential defects which can be accurately interpreted and evaluated. Radiographic examination, when employed, shall meet the requirements under "Radiographic Procedure" in API 1104. The welds shall be evaluated on the basis of para. 434.8.5(b).

(3) To be acceptable, completed welds which have been removed for destructive examination shall meet the requirements of API 1104 for Welder Qualification by Destructive Testing. Trepanting methods of testing shall not be used.

(4) When the pipeline is to be operated at a hoop stress of more than 20% of the specified minimum yield strength of the pipe, certain girth welds shall be inspected. A minimum of 10% of the welds completed each day shall be randomly selected by the operating company and inspected. The inspection shall be by radiographic or other accepted nondestructive methods (visual inspection excepted). Each weld inspected shall be inspected completely around its circumference. In the following locations or conditions, all girth welds in the pipe shall be completely inspected. If some of the girth welds are inaccessible, a minimum of 90% of the welds are to be inspected.

(a) within populated areas such as residential subdivisions, shopping centers, and designated commercial and industrial areas;

(b) river, lake, and stream crossings within the area subject to frequent inundation; and river, lake, and stream crossings on bridges;

(c) railroad or public highway rights of way, including tunnels, bridges, and overhead railroad and road crossings;

(d) offshore and inland coastal waters;

(e) old girth welds in used pipe;

(f) tie-in girth welds not hydrostatically tested in accordance with para. 437.4.1.

(b) Standards of Acceptability. Standards of acceptability for inadequate penetration and incomplete fusion, burn-through, slag inclusions, porosity or gas pockets, cracks, accumulation of discontinuities, and undercutting as set forth under "Standards of Acceptability — Nondestructive Testing" in API 1104 are applicable to the determination of the size and type of discontinuities located by visual inspection, radiography, or other nondestructive methods. These standards shall not be used to determine the quality of welds which are subjected to destructive testing.

434.8.6 Types of Welds, Joint Designs, and Transition Nipples

(a) Butt Welds. Butt welded joints may be of the single vee, double vee, or other suitable type of groove. Joint designs shown in Fig. 434.8.6(a)-(1) or applicable combinations of these joint design details are recommended for ends of equal thickness. The transition between ends of unequal thickness may be accomplished by taper or welding as shown in Fig. 434.8.6(a)-(2), or by means of a prefabricated transition nipple not less than one-half pipe diameter in length with acceptable joint designs as illustrated in Fig. 434.8.6(a)-(2).
CHAPTER VI
INSPECTION AND TESTING

436 INSPECTION

436.1 General

Construction inspection provisions for pipelines and related facilities shall be adequate to assure compliance with the material, construction, welding, assembly, and testing requirements of this Code.

436.2 Qualification of Inspectors

Inspection personnel shall be qualified by training and experience. Such personnel shall be capable of performing the following inspection services:

(a) right of way and grading;
(b) ditching;
(c) line up and pipe surface inspection;
(d) welding;
(e) coating;
(f) tie-in and lowering;
(g) backfilling and clean up;
(h) pressure testing;
(i) special services for testing and inspection of facilities, such as station construction, river crossings, electrical installation, radiography, corrosion control, etc., as may be required.

436.5 Type and Extent of Examination Required

436.5.1 Visual

(a) Material

(1) All piping components shall be visually inspected to insure that no mechanical damage has occurred during shipment and handling prior to being connected into the piping system.

(2) All pipe shall be visually inspected to discover any defects as described in paras. 434.5 and 434.8.7.

(3) On systems where pipe is telescoped by grade, wall thickness, or both, particular care shall be taken to insure proper placement of pipe. Permanent records shall be kept showing the location as installed of each grade, wall thickness, type, specification, and manufacturer of the pipe.

(b) Construction

(1) Visual inspection for detection of surface defects in the pipe shall be provided for each job just ahead of any coating operation and during the lowering-in and backfill operation.

(2) The pipe swabbing operation shall be inspected for thoroughness to provide a clean surface inside the pipe.

(3) Before welding, the pipe shall be examined for damage-free bevels and proper alignment of the joint.

(4) The stringer bead shall be inspected, particularly for cracks, before subsequent beads are applied.

(5) The completed weld shall be cleaned and inspected prior to coating operations, and irregularities that could protrude through the pipe coating shall be removed.

(6) When the pipe is coated, inspection shall be made to determine that the coating machine does not cause harmful gouges or grooves in the pipe surface.

(7) Lacerations of the pipe coating shall be inspected prior to repair of coating to see if the pipe surface has been damaged. Damaged coating and pipe shall be repaired before the pipe is lowered in the ditch.

(8) All repairs, changes, or replacements shall be inspected before they are covered up.

(9) The condition of the ditch shall be inspected before the pipe is lowered in to assure proper protection of pipe and coating. For underwater crossings and offshore pipelines, the condition of the ditch and fit of the pipe to the ditch shall be inspected when feasible.

(10) The fit of the pipe to ditch shall be inspected before the backfilling operations.

(11) Except for offshore pipelines, the backfilling operations shall be inspected for quality and compaction of backfill, placement of material for the control of erosion, and possible damage to the pipe coatings. For offshore pipelines the backfill shall be inspected when feasible.
437.1.4 Testing After New Construction

(a) Systems or Parts of Systems

Within the scope of this Code, regardless of stress, shall be tested after construction. Carbon dioxide systems shall be hydrostatically tested.

(2) Systems to be operated at a hoop stress of more than 20% of the specified minimum yield strength of the pipe shall be hydrostatically tested in accordance with para. 437.4.1.

(3) Systems to be operated at a hoop stress of 20% or less of specified minimum yield strength of the pipe may be subjected to a leak test in accordance with para. 437.4.3 in lieu of the hydrostatic test specified in para. 437.4.1.

(4) When testing piping, in no case shall the test pressure exceed that stipulated in the standards of material specifications (except pipe) incorporated in this Code by reference and listed in Table 423.1 for the weakest element in the system, or portion of system, being tested.

(5) Equipment not to be subjected to test pressure shall be disconnected from the piping or otherwise isolated. Valves may be used if valve including closing mechanism is suitable for the test pressure.

(b) Testing Tie-Ins. Because it is sometimes necessary to divide a pipeline into test sections and install test heads, connecting piping, and other necessary appurtenances for testing, or to install a pretested replacement section, it is not required that tie-in welds be tested; however, tie-in welds and girth welds joining lengths of pretested pipe shall be inspected by radiographic or other accepted nondestructive methods in accordance with para. 434.8.5(a)(4) if system is not pressure tested after tie-in. After such inspection, the joint shall be coated and inspected in accordance with para. 461.1.2 before backfilling.

(c) Testing Controls and Protective Equipment. All controls and protective equipment, including pressure limiting devices, regulators, controllers, relief valves, and other safety devices, shall be tested to determine that they are in good mechanical condition; of adequate capacity, effectiveness, and reliability of operation for the service in which they are employed; functioning at the correct pressure; and properly installed and protected from foreign materials or other conditions that might prevent proper operation.

437.4 Test Pressure

437.4.1 Hydrostatic Testing of Internal Pressure Piping

(a) Portions of piping systems to be operated at a hoop stress of more than 20% of the specified mini-
imum yield strength of the pipe shall be subjected at any point to a hydrostatic proof test equivalent to not less than 1.25 times the internal design pressure at that point (see para. 401.2.2) for not less than 4 hr. When lines are tested at pressures which develop a hoop stress, based on nominal wall thickness, in excess of 90% of the specified minimum yield strength of the pipe, special care shall be used to prevent overstrain of the pipe.

(1) Those portions of piping systems where all of the pressured components are visually inspected during the proof test to determine that there is no leakage require no further test. This can include lengths of pipe which are pretested for use as replacement sections.

(2) On those portions of piping systems not visually inspected while under test, the proof test shall be followed by a reduced pressure leak test equivalent to not less than 1.1 times the internal design pressure for not less than 4 hr.

(b) API RP 1110 may be used for guidance for the hydrostatic test.

(c) The hydrostatic test shall be conducted with water, except liquid petroleum that does not vaporize rapidly may be used provided:

(1) the pipeline section under test is not offshore and is outside of cities and other populated areas, and each building within 300 ft (90 m) of the test section is unoccupied while the test pressure is equal to or greater than a pressure which produces a hoop stress of 50% of the specific minimum yield strength of the pipe;

(2) the test section is kept under surveillance by regular patrols during test; and

(3) communication is maintained along the test section.

(d) If the testing medium in the system will be subject to thermal expansion during the test, provisions shall be made for relief of excess pressure. Effects of temperature changes shall be taken into account when interpretations are made of recorded test pressures.

(e) After completion of the hydrostatic test, it is important in cold weather that the lines, valves, and fittings be drained completely of any water to avoid damage due to freezing.

(a) Carbon dioxide pipelines, valves, and fittings shall be dewatered and dried prior to placing in service to prevent the possibility of forming a corrosive compound from carbon dioxide and water.

437.4.3 Leak Testing. A 1 hr hydrostatic or pneumatic leak test may be used for piping systems to be operated at a hoop stress of 20% or less of the specified minimum yield strength of the pipe. The hydrostatic test pressure shall be not less than 1.25 times the internal design pressure. The pneumatic test gage pressure shall be 100 psi (7 bar) or that pressure which would produce a nominal hoop stress of 25% of the specified minimum yield strength of the pipe, whichever is less.

437.6 Qualification Tests

Where tests are required by other sections of this Code, the following procedures shall be used.

437.6.1 Visual Examination. Used or new pipe to be laid shall be visually examined in accordance with para. 436.5.1.

437.6.2 Bending Properties

(a) For pipe of unknown specification or ASTM A 120, bending properties are required if minimum yield strength used for design is above 24,000 psi (165 MPa), and after type of joint has been identified in accordance with para. 437.6.4. For pipe NPS 2 and smaller, bending test shall meet the requirements of ASTM A 53 or API 5L. For pipe larger than NPS 2 in nominal diameter, flattening tests shall meet the requirements in ASTM A 53, API 5L, or API 5LU.

(b) The number of tests required to determine bending properties shall be the same as required in para. 437.6.6 to determine yield strength.

437.6.3 Determination of Wall Thickness. When the nominal wall thickness is not known, it shall be determined by measuring the thickness at quarter points on one end of each piece of pipe. If the lot of pipe is known to be of uniform grade, size, and nominal thickness, measurement shall be made on not less than 5% of the individual lengths, but not less than 10 lengths; thickness of the other lengths may be verified by applying a gage set to the minimum thickness. Following such measurement, the nominal wall thickness shall be taken as the next nominal wall thickness below the average of all the measurements taken, but in no case greater than 1.14 times the least measured thickness for all pipe under NPS 20, and no greater than 1.11 times the least measured thickness for all pipe NPS 20 and larger.

437.6.4 Determination of Weld Joint Factor. If the type of longitudinal or spiral weld joint is known, the corresponding weld joint factor E (Table 402.4.3) may be used. Otherwise, as noted in Table 402.4.3, the factor E shall not exceed 0.60 for pipe NPS 4 and smaller, or 0.80 for pipe over NPS 4.

437.6.5 Weldability. For steel pipe of unknown specification, weldability shall be determined as follows. A qualified welder shall make a girth weld in the pipe. This weld shall be tested in accordance with the requirements of para. 434.8.5. The qualifying weld shall be made
under the most severe conditions under which welding will be permitted in the field and using the same procedure as to be used in the field. The pipe shall be considered weldable if the requirements set forth in para. 434.8.5 are met. At least one such test weld shall be made for each number of lengths to be used as listed below.

<table>
<thead>
<tr>
<th>Nominal Pipe Size</th>
<th>Number of Lengths per Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 6</td>
<td>400</td>
</tr>
<tr>
<td>6 through 12</td>
<td>200</td>
</tr>
<tr>
<td>Larger than 12</td>
<td>100</td>
</tr>
</tbody>
</table>

All test specimens shall be selected at random.

437.6.6 Determination of Yield Strength. When the specified minimum yield strength, minimum tensile strength, or minimum percent of elongation of pipe is unknown, the tensile properties may be established as follows.

Perform all tensile tests prescribed by API 5L or 5LU, except that the minimum number of such tests shall be as follows.

<table>
<thead>
<tr>
<th>Nominal Pipe Size</th>
<th>Number of Lengths per Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 6</td>
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<tr>
<td>6 through 12</td>
<td>100</td>
</tr>
<tr>
<td>Larger than 12</td>
<td>50</td>
</tr>
</tbody>
</table>

All test specimens shall be selected at random.

437.6.7 Minimum Yield Strength Value. For pipe of unknown specification, the minimum yield strength may be determined as follows.

Average the value of all yield strength tests for a test lot. The minimum yield strength shall then be taken as the lesser of the following:

(a) 80% of the average value of the yield strength tests;

(b) the minimum value of any yield strength test, except that in no case shall this value be taken as greater than 52,000 psi (358 MPa);

(c) 24,000 psi (165 MPa) if the average yield–tensile ratio exceeds 0.85.

437.7 Records

A record shall be maintained in the files of the operating company relative to design, construction, and testing of each mainline within the scope of this Code. These records shall include material specifications; route maps and alignments sheets for “as-built” condition; location of each pipe size, grade, wall thickness, type of seam (if any), and manufacturer; coatings; test data; and for carbon dioxide pipelines, toughness requirements. These records shall be kept for the life of the facility. See para. 436.5.1(a)(3).
THE FRIENDSWOOD STORY
SIR, CAN YOU TELL US ABOUT THE ETHANE PIPELINE WHICH RUNS THROUGH OUR CITY...

BOOM!

WHAT PIPELINE?
City requests formal hearing on pipeline

By HEIDI LUTZ
The Daily News

FRIENDSWOOD — The city of Friendswood has formally asked the State Railroad Commission for a public hearing about Exxon's proposed ethane pipeline.

The Railroad Commission currently is considering a permit application from Exxon to change the content of the pipeline from crude oil to ethane, which is a highly volatile gas that is transported as a liquid.

"That really is our only recourse," said David Townsend, a chemical engineer who is a member of Friendswood's pipeline safety committee. "The city doesn't have any ability to say no you can't do that."

The issue, he said, is safety. While the pipeline safety committee would rather Exxon not run the pipeline through a residential community, Townsend said, there are safer ways to do it.

Larry Harlan, a spokesman for Exxon Pipeline Co., however, said that Exxon continues to stand behind its choice and believes the pipeline is secure enough to transport ethane.

Friendswood, he said, is the only city along the proposed pipeline route that has raised the question of safety.

"No questions have been raised whatsoever outside of Friendswood on the content of this line," Harlan said. "The very logical and the safest way of moving this product is through pipeline."

According to the complaint filed with the Railroad Commission Feb. 28, the city alleges that Exxon has not proved it meets the minimum safety requirements to convert the old crude oil line to ethane.

The complaint also questions whether Exxon has taken the nec-

See PIPELINE, 12-A

12-A THE DAILY NEWS TUESDAY, MARCH 5, 1996

Pipeline

Continued from 1-A

essary steps to prepare for emergencies along the 5.7 miles stretch of the pipeline that runs through Friendswood.

The complaint states:

"If the change from crude oil to ethane service requested by Exxon is viewed by the Commission as merely modifications or updates to existing permits, then Friendswood complains that the line is so unsafe, or so improperly equipped, or so managed as likely to result in waste."

the issue, as well as a list of 21 other requirements of Exxon including forcing the pipeline company to give residents copies of tests, test analyses and internal documents relating to tests on the pipeline.

Exxon also is requested to commission a study to determines if surface and subsurface waters will be affected if the pipeline should leak and to notify each property owner near the line about the change.

State Rep. Craig Eiland, D-Galveston, said he asked each of the railroad commission about a week ago to have a public hearing in Friendswood about the pipeline permit. He said Commission Chairwoman Carol Keaton told him the commission would have it in Friendswood when the time comes for a public hearing.

"It's important that everyone in Friendswood has an opportunity to participate," Eiland said. "If they had it in Austin, then

fidence in the hearing or what occurred at the hearing."

The commission is reviewing Friendswood's complaint and will wait for a written response from Exxon before deciding to have a public hearing, said Brian Schaible, a spokesman for the commission.

It is common for companies to apply for a permit to let them change what is being pumped through the pipelines, Schaible said.

But because of the formal complaint and the discussion about the safety of the pipeline, the commission is taking a closer look at the application, he said.

"We would have to have some kind of safety concerns or some other concerns about whether the pipeline could be operated safely as an ethane line in order to deny them permission to do that," he said. "That's something we're taking a look at and making
PIPELINE SAFETY COMMITTEE

GOALS

February 20, 1996

1. TO PREVENT CONVERSION OF THE CRUDE OIL LINE FOR ETHANE TRANSMISSION SERVICE THROUGH THE CITY OF FRIENDSWOOD.

2. TO REQUIRE EXXON TO IMPLEMENT NEW DESIGN CRITERIA SUBJECT TO MORE STRINGENT SAFETY MEASURES FOR THIS PIPELINE.

3. TO EMPHASIZE TOTAL SAFETY AWARENESS OF ALL EXISTING PIPELINES.

4. TO PROVIDE EDUCATION OF ALL ISSUES REGARDING PIPELINE COMPANIES IN ENOUGH DETAIL TO SATISFY ALL LEVELS OF CITIZENS' CONCERNS.

5. TO IMPROVE EMERGENCY PREPAREDNESS.

6. TO ANALYZE EXCAVATION PERMIT REQUIREMENTS AND ENHANCE PUBLIC AWARENESS OF SAME.

7. TO ENHANCE PIPELINE-MARKING REQUIREMENTS.

8. TO PREPARE AND SEND SUGGESTIONS TO STATE AND NATIONAL AUTHORITIES FOR NEW LEGISLATION.

9. TO ANALYZE FRIENDSWOOD'S OIL AND GAS ORDINANCE.
Guiding Principles

1. To recognize and respond to community concerns about chemicals and our operations.

2. To develop and produce chemicals that can be manufactured, transported, used and disposed of safely.

3. To make health, safety and environmental considerations a priority in our planning for all existing and new products and processes.

4. To report promptly to officials, employees, customers and the public, information on chemical-related health or environmental hazards and to recommend protective measures.

5. To counsel customers on the safe use, transportation and disposal of chemical products.

6. To operate our plants and facilities in a manner that protects the environment and the health and safety of our employees and the public.

7. To extend knowledge by conducting or supporting research on the health, safety and environmental effects of our products, processes and waste materials.

8. To work with others to resolve problems created by past handling and disposal of hazardous substances.

9. To participate with government and others in creating responsible laws, regulations and standards to safeguard the community, workplace and environment.

10. To promote the principles and practices of Responsible Care® by sharing experiences and offering assistance to others who produce, handle, use, transport or dispose of chemicals.
Public hearing granted about ethane pipeline

By HEIDI LUTZ
The Daily News

FRIENDSWOOD — The Texas Railroad Commission has granted a public hearing in Friendswood on the safety of an ethane pipeline proposed by Exxon.

The commission notified attorneys for both sides last week that the formal hearing scheduled for Monday has been postponed, and a public hearing has been scheduled for Tuesday in Friendswood.

Friendswood has intervened in Exxon’s application for a permit to change a crude oil line, which runs through about 10 miles of Friendswood, to an ethane line.

Friendswood residents have argued that the line does not meet the safety requirements necessary to transport a volatile gas like ethane.

Exxon, however, contends that the line meets the minimum safety requirements, and in some cases, exceeds what is required by the state.

At the public hearing, residents will have a chance to speak about the safety of the proposed pipeline.

Each speaker will be given three minutes, and the comments must be related to safety matters.

A tape of the public hearing will be sent to the Railroad Commission.

Before the public hearing, attorneys from both sides will meet with the state’s hearing examiners for a prehearing conference.

The prehearing conference is a chance for both sides to let the state know about how much time each needs to present the cases, how many witnesses each side expects to call, how many exhibits each will present and whether there is any information one side needs from the other before the hearing.

After the public hearing, the formal hearing in Austin will be scheduled.
EXXON PIPELINE COMPANY STANDS BEHIND THE EXTENSIVE SAFETY FEATURES AND ECONOMIC BENEFITS RELATED TO ITS ETHANE PIPELINE PROJECT

Exxon Pipeline Company remains committed to its position that the proposed ethane pipeline project that runs through Friendswood meets or exceeds all regulatory requirements of the Texas Railroad Commission. To further assure the integrity of the line, the company has run additional tests prior to changing the product from crude oil to ethane. "The safety of Friendswood, its people and their homes is our highest priority," said George Persyn, the company's Environmental, Regulatory, and OIMS Compliance Manager. "That's exactly why we have taken comprehensive steps to go beyond the regulations to make sure this project is safe. This pipeline has operated for thirty years with an excellent safety record. We are committed to continuing that record unabated."

Steps taken to enhance the safety of the line include the placement of additional valves, increased surveillance, 24-hour-a-day pressure monitoring, and enhanced cathodic protection measurement. Additional tests include internal tests to check for corrosion called smart pig runs and hydrostatic pressure testing of the line. "We tested the line to 33% above its regulatory operating limit and 50% above the normal expected operating pressure for ethane. This pipeline can handle the pressure," said Persyn.

Another key aspect of this project is the economic benefit that it will provide to Southeast Texas. This pipeline will support over 300 petroleum industry jobs while delivering a product that is important to society. Ethane is used in the manufacturing of syringes, blood bags, iv bags and a variety of plastic products. Pipelines in general are critical to the chemical industry. They are the safest mode of transportation for products such as ethane. Without pipelines, the chemical industry in Texas, employing over 83 thousand people, would not exist.

Exxon Pipeline Company is committed to the safety of its employees and the communities where it operates. The company looks forward to continued communication with the residents of Friendswood and welcomes the opportunity to present the facts through the hearing process.
Pipeline protest flares in Friendswood

Energy town opposes Exxon conversion of crude oil line to ethane

By Ann de Rouffignac
Houston Business Journal

Residents of Friendswood are protesting a proposed pipeline project beneath their city. But this is no ordinary opposition from upset property owners against the pipeline, chemical and petrochemical industries.

The target of their protest is Exxon Pipeline Co., a subsidiary of Exxon Corp., which originally developed Friendswood as a company town for Exxon employees.

Many of the town’s 28,000 residents still earn their livelings in the energy pipeline business and have no objection to the various pipelines already in place underneath the town. But they have come together in an attempt to prevent Exxon Pipeline from converting an existing crude oil pipeline to transport volatile and highly flammable liquid ethane instead.

The issue came to a head in late March, when Friendswood City Council filed a motion with the Texas Railroad Commission for a full public hearing to allow residents to formally voice their concerns. The commission has jurisdiction over safety in interstate pipelines.

Residents fear that the pipeline was not designed to transport ethane and could leak from corrosion or suffer damage from routine digging in yards and city streets. Ethane is kept under very high pressure to keep it liquid, and the pressure must be increased to move it through a pipeline. Residents argue that a leak would depressurize the line and send ethane to the sur-

See FRIENDSWOOD, page 18

Friendswood Mayor Pro Tem Janice Lowes: “It’s not a matter of if it happens, it’s where we’ll be when it happens.”

Friendswood

continued from page 1

face as a colorless, odorless gas, where it could ignite and cause property damage and loss of life.

“We’re not hysterical idiots. We support the petrochemical industry and work in it,” says Ben Malek, a chemical engineer with PCI Consultant Inc. and chairman of the pipeline committee created by city council to spearhead the protest.

“One guy with a backhoe and it goes off,” Malek contends. “This is an unacceptable risk.”

Peter Blackett, a mechanical engineer at Fina Oil and Chemical Co., who resides on the pipeline route, says he is accustomed to working every day in plastic plants where feedstocks include ethane and butane, but he’s still concerned about this particular project.

“My issue is not with pipelines. My issue is with the location and safety of this one. Quite honestly, I’m scared to death,” Blackett says.

Janice Lowe, Friendswood’s mayor pro tem, claims that an accident is inevitable.

“It’s not a matter of if it happens, it’s where we’ll be when it happens,” says Lowe.

Exxon officials insist that the pipeline is safe.

“Truly, we believe it’s a safe pipeline that meets or exceeds all Railroad Commission regulations for an ethane line,” says Larry Harlan, a spokesman for Exxon Pipeline.

He says the company ran tests on the entire pipeline last year to check for thinning walls and leaks, and the tests revealed nothing unsafe.

“It’s not an issue about money,” Harlan says. “We are just as confident with that line as any new line we have constructed for this use.”

Friendswood resident Malek believes that in this case Exxon has pushed the Railroad Commission code governing liquids pipelines to the absolute limit, resulting in a very low margin of safety.

“An ethane pipeline can be made safe, I could design one that I’ll sleep on. But I would not put my professional seal on this (existing) design,” Malek says.

State code requirements for a pipeline carrying liquids apparently are less stringent than those for a pipeline carrying natural gas and other volatile or toxic gases. Gas pipelines must be thicker and buried deeper. The same requirements apply to a liquids pipeline, whether it’s in the middle of a prairie or underneath a shopping center.

The 16-inch pipeline slated for conversion runs a total of 107 miles, originating in a gas processing plant near Kingsville and terminating in Exxon’s Mont Belvieu petrochemical plant.

“Originally used only for crude oil, about nine miles of the pipeline run through populated areas within the city limits of Friendswood, according to the original complaint filed with the Railroad Commission by the City of Friendswood.

Residents want the pipeline routed around the populated areas of their community. Barring a new route, they insist that the pipeline be made safe enough so they feel comfortable around it, says Robert Rima, attorney for the City of Friendswood.

“We want the Railroad Commission to exercise its safety jurisdiction over the pipeline and determine what it will take to make it safe to go through a community,” says Rima.

Exxon Pipeline’s Harlan says that rerouting the pipeline would take it through the even more heavily populated Interstate 45 corridor.

He describes the dispute as a “difference of opinion” among engineers and says the burden of deciding who is right will fall on the Railroad Commission which will determine if this pipeline is safe.
The Honorable Carol Keeton Rylander  
Chairman, Railroad Commission of Texas  
1701 North Congress Avenue  
William B. Travis Building  
Austin, Texas 78701

Dear Chairman Rylander:

Thank you for holding and attending the hearing on the attempted Exxon ethane pipeline conversion. I know that you heard concerned citizens with emotional pleas for your consideration and help. More importantly, you listened to knowledgeable, experienced, technical residents with expertise in several scientific and engineering fields directly related to the details at hand and the ultimate safety of this pipeline.

I urge your fellow commissioners to take the two hours to watch the tape well in advance of the July 22nd hearing and the filing of the briefs. It will give them a good beginning basis for the serious discussions to come.

Once again, thank you for holding the hearing in Friendswood. I know that it gives the citizens a sense that they are not being "railroaded" and that someone is willing to stop and listen. I, also, personally, appreciate your keeping your promise to me and for paying close attention during the hearing.

Sincerely yours,

Craig Eiland

P.S. The gentleman who mentioned re-election in the political process is a Republican candidate for District Judge in Galveston County.

cc: Commissioners Williamson and Matthews
May 7, 1996

The Honorable Janis Lowe
Mayor Pro-tem, City of Friendswood
910 S. Friendswood Drive
Friendswood, TX 77546

Dear Councilmember Lowe,

This letter is to advise you that Exxon Pipeline Company today is withdrawing its T-4 registration before the Texas Railroad Commission for the ethane pipeline project running through Friendswood. The purpose of this action is for the company to undertake a comprehensive evaluation of alternatives for moving this project forward expeditiously. It is our sincere hope that the result of this evaluation will be an option for moving ethane that is satisfactory to the Friendswood community, the Railroad Commission, and Exxon Pipeline Company.

The timing for completing this evaluation is uncertain. It will depend on the number of alternatives identified and their complexity. A variety of possibilities will be evaluated including the use of other facilities, modifications of existing facilities, or the resubmittal of the original plan for transporting ethane.

Exxon Pipeline Company remains committed to the safety of its operations, for the benefit of its employees and the public. The company continues to believe that the pipeline meets or exceeds all regulations but is willing to take the extra time to re-consider and evaluate new and existing options. We hope that this process will provide for constructive dialogue and support our long term relationship with Friendswood. We look forward to sharing our conclusions as soon as possible. Please feel free to give Larry Harlan or me a call at 656-5431 with any questions you may have.

[Signature]
Exxon withdraws pipeline application from Texas Railroad Commission

JOAN LAKE-CUMMINGS
Reports News

There is much cause for rejoicing in the City of Friendswood as early Tuesday afternoon, Exxon Pipeline Company announced it is withdrawing its application before the Texas Railroad Commission to register and operate an ethane pipeline project between South Texas and the Baytown/Mont Belvieu area.

In an unprecedented move for an oil and gas company, Exxon said its decision to withdraw the application was based on feedback from the citizens and elected officials of Friendswood as well as discussions with its customers.

"From the beginning, we wanted open communications with the city," said Exxon President Richard A. Rabinow. "We have heard the issues raised by the city and we want to explore options that address the public's concerns and the needs of our customers."

Exxon's customers include the chemical industry who use ethane to make plastic products for the medical industry. Items such as intravenous bags, syringes, plastic disposal bags and blood bags are made from ethane.

Rabinow continued to say the company would invest the "appropriate time and energy" in evaluating alternatives that would be acceptable for both Friendswood and the company's customers.

"We have heard the issues raised by the city and we want to explore options that address the public's concerns and the needs of our customers."

-Richard A. Rabinow
President
Exxon Pipeline Company

While it still maintains the 16 inch pipeline is safe to transport ethane and complies with all regulatory requirements, the company said it would conduct a thorough analysis of options to complete the project and communicate its findings to the city, the Texas Railroad Commission and the public upon its completion.

Mayor Evelyn Newman said she was delighted Exxon has withdrawn its application. Given the time to study the problem, Newman said the city would probably meet with Exxon in the next two to three months.

Mayor Pro Tem Janis Lowe said, "We are very pleased Exxon is very sensitive to our community concerns. We look forward to working with the company in the future, if they concern Friendswood. This was never a good plan and I am pleased they have seen this."

Exxon's Public Affairs Director Larry Harlan, who has been instrumental in conveying information from the city to his company, and holding information sessions with homeowners associations, had this to say, "The company is going to go back and look at identifying options that make good, business sense and get back to the city, in the hope that we all can find some common ground."

Harlan said the company looks forward to a constructive dialogue with the City of Friendswood while seeking to find a workable solution. In the meantime, citizens of Friendswood have illustrated in the best possible way what can happen when people ban together for a common cause. Everyone who lives with a pipeline under or around their home can rest a little easier now."
Exxon cancels plans
Company abandons its proposal for Friendswood ethane pipeline

By HEIDI LUTZ
The Daily News

FRIENDSWOOD — Exxon Pipeline Co. said Tuesday it will search for an alternative to pumping ethane through a 30-year-old pipeline here.

After receiving considerable opposition from the residents of Friendswood, Exxon decided to withdraw its application with the Texas Railroad Commission and start looking for a different way to transport ethane from south Texas to a storage facility in Mont Belvieu.

"It was a culmination of all our discussions with the city," said Larry Harlan, a spokesman for Exxon Pipeline Co. "We can now go back and take a look at the different options."

For Friendswood, Exxon's decision is a partial victory in the city's fight for safer pipeline transmission.

When Exxon first decided to change a 30-year-old crude oil line to an ethane pipeline, several residents of southeast Friendswood approached the City Council.

Pipeline

Continued from 1-A

They were concerned about the safety of a pipeline previously used to transport oil, which Exxon proposed to use to transport a highly volatile gas beneath their homes.

After several weeks of discussions, a pipeline safety committee was created by the council and the city filed a formal complaint with the Railroad Commission; which regulates intrastate pipelines.

A public hearing was held in Friendswood, and a formal hearing in Austin was scheduled for July so the commission could hear both sides of the case.

Friendswood representatives urged the state regulatory agency to set new requirements, said Councilwoman Janis Lowe, who has worked with the city's pipeline safety committee.

"It is great news that the company has withdrawn the request," she said. "It doesn't take us out of the woods, but we're out of danger."

It was a unique experience for Exxon to have such strong opposition to a pipeline project, Harlan said.

Friendswood was the only city along the more than 200 miles of pipeline to object to the change from crude oil to ethane transportation.

"We've written pipeline history," Lowe said. "The entire case was unprecedented."

Exxon, however, continues to maintain that its project is safe and will be safe should it pursue the same route in the future.

During the coming weeks, Exxon will evaluate its options and try to find a solution that meets the needs of Exxon, its customers and the residents of Friendswood, Harlan said.

And until Exxon develops another plan, some residents of Friendswood will not be comfortable with the solution.

Robert Bludworth, a member of the safety committee, said he is happy the company has withdrawn its application, but is waiting to celebrate until he knows what the alternative is.

But others are rejoicing about Exxon's decision and believe it is the start of more attention being brought to the issue of pipeline safety.

"It's real pleasing to us that they made that decision," said Clayton Stevens, a member of the pipeline safety committee. "I think it's a wise decision on their part."

Pipelines, he said, are safe ways to transport chemicals. But in this case, he said the residents didn't feel safe.

"I believe this is a step in the right direction — a safe direction," state Rep. Craig Eiland, D-Galveston, said in a prepared statement. "I congratulate the citizens of the city of Friendswood, the City Council and especially the pipeline safety committee for raising significant technical safety concerns with the condition of the pipeline and its proposed conversion to ethane."

Lowe said the committee will continue to meet and urge the state to change the regulations regarding pipeline safety.

With more and more people moving to the areas where pipelines are already located, the issue of safety is important, she said — and more needs to be done at the state level to ensure safety in pipeline design.

"Our issue wasn't just about this pipeline," she said. "Our issue was pipeline safety."
pipeline

pipeline request

Exxon withstand

by Michael A. Smith

friendwood journal

We strongly believe that the pipeline is
needed to ensure a steady supply of
energy to our customers, and the
Exxon pipeline company has
already invested substantial
resources in its construction.

The pipeline is currently under
construction and is expected to
be completed by the end of
2023.

By John Alva, Spokesman
at Exxon

See pipeline, page 2
Exxon cancels Friendswood pipeline plans

By RUTH RENDON
Houston Chronicle

Exxon Pipeline Co. on Tuesday withdrew plans to transport a flammable gas from South Texas to chemical plants in Mont Belvieu and Baytown.

Exxon, whose plans had been under scrutiny from the city of Friendswood because of safety concerns, said it would postpone its South Texas ethane project plans until it further evaluates all options.

The company's decision was based on feedback from the residents and elected officials of Friendswood as well as discussions with its customers, said Exxon spokesman Larry L. Harlan.

The plan called for transporting ethane through a 107-mile, 30-year-old pipeline that originated in a 19-inch pipeline.

Exxon Pipeline had requested a permit from the Texas Railroad Commission in February to carry crude oil. The line originates in Vandebilt in Jackson County, bypasses Corpus Christi and Bay City before entering north Friendswood from Brazoria County. The pipeline travels through eight subdivisions before entering Webster and Harris County.

Exxon Pipeline had requested a permit from the Texas Railroad Commission in February to carry crude oil. The line originates in Vandebilt in Jackson County, bypasses Corpus Christi and Bay City before entering north Friendswood from Brazoria County. The pipeline travels through eight subdivisions before entering Webster and Harris County.

The request met strong opposition from the city of Friendswood, where the ethane would have been transported in a 19-inch pipeline.

See Exxon on Page 37A.

Exxon

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converted to carry ethane instead of crude oil.

More than 200 residents attended a public hearing in Friendswood before two Texas Railroad Commission hearing examiners last month to voice their opposition to Exxon's plans. The residents were especially concerned about the possible hazards of having the pipeline run through residential areas.

Richard A. Rabinow, president of Exxon Pipeline, said the company's goal from the beginning was to have "open communications with the city. We have heard the issues raised by the city, and we want to explore options that address the public's concerns and the needs of Exxon Pipeline Company's customers."

Andy Ruth, a spokesman for the RRC, said no other opposition to Exxon's plans had been registered with the commission.

Exxon officials gave no timetable for completing its evaluation of its ethane project.

"We plan to invest the appropriate time and energy to evaluate alternatives that can result in an acceptable solution for all concerned," Rabinow said.

The company had not released a price tag for the project but did say that it would support 300 petroleum industry jobs.

The city, which established a pipeline safety committee, has not suggested any alternatives to Exxon for transporting the ethane, City Manager Ron Cox said.

Exxon continues to maintain that its pipeline is safe and meets or exceeds all state and federal regulatory requirements. The company has said it conducted additional tests on the line before changing it to allow it to carry ethane instead of crude oil. Exxon also said it had placed additional valves on the pipeline and implemented 24-hour-a-day pressure monitoring.

"Everyone is just thrilled," Friendswood City Councilwoman Janis Lowe said Tuesday. "The telephone lines are ringing with neighbors calling neighbors to say that Exxon has withdrawn its request. I think the company realized that sensitivity to the community's concerns was the best way to go."

Lowe, a member of the pipeline safety committee, said Exxon's plans mean the city is out of danger for now but not out of the woods.

"This was not about not only stopping this application but about creating pipeline safety. The committee is not going to stop its work," she said.

Cox said he was pleased that "Exxon has recognized the seriousness of the situation, particularly the citizens' safety. Although they still contend the pipeline would be safe, they still recognize what the level of concern here is and want to take a look at alternatives."

Cox said 45 miles of transmission-pipeline runs through the community, including another Exxon ethane pipeline in the northern section of town.

"The difference is that the other pipelines were constructed for those products," he said. "This particular pipeline is 30 years old and has always been operated as such. We are concerned that the conversion would highlight hazards in an existing pipeline that wouldn't normally show up in crude oil transportation."

Ethane, a component of natural gas, is used in the chemical industry to make plastics such as syringes, blood bags, IV bags and a variety of other products. When pressurized, the odorless and colorless ethane turns into a liquid. Exxon planned to transport the gas via the pipeline as a liquid.
Friendswood City Council will have an executive session at 7 p.m. before it begins its regular meeting. The executive session is expected to last about an hour.

City Manager Ron Cox says that in the closed session, the council will discuss alternatives suggested by Exxon Pipeline Co. for resolving the city's objections over Exxon's desire to transport ethane liquid gas through a 16-inch crude oil pipeline that stretches from the King Ranch area in South Texas to Exxon's Baytown plant.

Earlier this year, Exxon withdrew its application to the Texas Railroad Commission (RRC) for a state permit to pump ethane gas through the unused pipeline, which passes through Friendswood. Exxon pulled back after Friendswood City Council voted to oppose the application before the RRC.

Cox says Exxon yanked the application, subject to talks with Friendswood officials and a pipeline safety committee, composed of Friendswood area residents.

Cox says council will be briefed on the results of those discussions tonight. Council can not vote on any of the alternatives in the executive session, and Cox says council is not scheduled to take a vote on the pipeline issue during its regular session afterward.

The council can give its attorney in the pipeline talks, Robert Rima of Austin, instructions during the closed meeting. Cox says he's unsure of what council will do.

Cox says Friendswood opposes transportation of Ethane gas through the oil pipeline because the gas is "highly volatile." He says the pipeline was made to handle up to 60 PSI in transporting oil. The gas, he says, would be under 900 to 1,000 PSI in the pipeline. Friendswood officials fear the pipe would rupture under higher pressure.

Ethane gas is used in the production of plastic products.

Cox says council typically ends its meetings by 10 p.m.