Pressure Testing Requirements for Hazardous Liquid Pipelines in California

OFFICE OF THE STATE FIRE MARSHAL
PIPELINE SAFETY DIVISION

May 2011 Revision

Introduction

To assist hydrostatic testing personnel and pipeline operators in understanding the requirements of the hydrostatic testing provisions of Chapter 5.5 of the California Government Code, the Office of the California State Fire Marshal (CSFM), has developed this Student Manual.

The information contained in this supplement is not new. Reporting procedures contained in this publication merely identify these requirements in a single easy-to-use student manual.

Comments, questions or recommendations concerning this document are welcome and encouraged. Please send your comments to:

CAL FIRE/State Fire Marshal
Pipeline Safety Division
3950 Paramount Blvd., Suite 210
Lakewood, CA 90712
Phone # (562) 497-9100
Fax # (562) 497-9104

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§195.2 Definitions.

Gathering line means a pipeline 219.1 mm (8 5/8 in) or less nominal outside diameter that transports petroleum from a production facility.

In-plant piping systems means piping that is located on the grounds of a plant and used to transfer hazardous liquid or carbon dioxide between plant facilities or between plant facilities and a pipeline or other mode of transportation, not including any device and associated piping that are necessary to control pressure in the pipeline under §195.406(b).

Line section means a continuous run of pipe between adjacent pressure pump stations, between a pressure pump station and terminal or breakout tanks, between a pressure pump station and a block valve, or between adjacent block valves.

Low stress pipeline means a hazardous liquid pipeline that is operated in its entirety at a stress level of 20 percent or less of the specified minimum yield strength of the line pipe.

Production facility means piping or equipment used in the production, extraction, recovery, lifting, stabilization, separation or treating of petroleum or carbon dioxide, or associated storage or measurement. (To be a production facility under this definition, piping or equipment must be used in the process of extracting petroleum or carbon dioxide from the ground or from facilities where carbon dioxide is produced, and preparing it for transportation by pipeline. This includes piping between treatment plants which extract carbon dioxide, and facilities utilized for the injection of carbon dioxide for recovery operations.)

Pipeline or pipeline system means all parts of a pipeline facility through which a hazardous liquid or carbon dioxide moves in transportation, including, but not limited to, line pipe, valves and other appurtenances connected to line pipe, pumping units, fabricated assemblies associated with pumping units, metering and delivery stations and fabricated assemblies therein, and breakout tanks.

Excerpts from 49 CFR Part §195.300 to §195.310

Subpart E- Hydrostatic Testing

§195.300 Scope

This subpart prescribes minimum requirements for the pressure testing of steel pipelines. However, this subpart does not apply to the movement of pipe under §195.424.

§195.302 General Requirements

(a) Except as otherwise provided in this section and in §195.305(b), *no operator may operate a pipeline unless it has been pressure tested under this subpart without leakage*. In addition, *no operator may return to service a segment of pipeline that has been replaced, relocated, or otherwise changed until it has been pressure tested under this subpart without leakage.*

(b) Except for pipelines converted under §195.5, the following pipelines may be operated without pressure testing under this subpart:

(1) Any hazardous liquid pipeline whose maximum operating pressure is established under §195.406(a)(5) that is-

(i) An interstate pipeline constructed before January 8, 1971;
(ii) An interstate offshore gathering line constructed before August 1, 1977;
(iii) An intrastate pipeline constructed before October 21, 1985; or
(iv) A low-stress pipeline constructed before August 11, 1994, that transports HVL.

(2) Any carbon dioxide pipeline constructed before July 12, 1991, that-

(i) Has its maximum operating pressure established under §195.406(a)(5); or
(ii) Is located in a rural area as part of a production field distribution system.

(3) Any low-stress pipeline constructed before August 11, 1994, that does not transport HVL.

(4) Those portions of older hazardous liquid and carbon dioxide pipelines for which an operator has elected the risk-based alternative under Sec. §195.303 and which are not required to be tested based on the risk-based criteria.

(c) Except for pipelines that transport HVL onshore, low-stress pipelines, and pipelines covered under Sec. §195.303, the following compliance deadlines apply to pipelines

under paragraphs (b)(1) and (b)(2)(i) of this section that have not been pressure tested under this subpart:

§195.303

Risk-based alternative to pressure testing older hazardous liquid and carbon dioxide pipelines.

§195.304 Test Pressure

The test pressure for each pressure test conducted under this subpart must be maintained throughout the part of the system being tested for at least ***4 continuous hours at a pressure equal to 125 percent***, or more, of the maximum operating pressure and, in the case of a pipeline that is not visually inspected for leakage during test, for at least an additional ***4 continuous hours at a pressure equal to 110 percent***, or more, of the maximum operating pressure.

§195.305 Testing Components

(a) Each pressure test under §195.302 must test all pipe and attached fittings, including components, unless otherwise permitted by paragraph (b) of this section.

(b) A component, other than pipe, that is the only item being replaced or added to the pipeline system need not be hydrostatically tested under paragraph (a) of this section if the manufacturer certifies that either-

- (1) The component was hydrostatically tested at the factory; or
- (2) The component was manufactured under a quality control system that ensures each component is at least equal in strength to a prototype that was hydrostatically tested at the factory

§195.306 Test Medium

(a) Except as provided in paragraph (b), (c), and (d) of this section, water must be used as the test medium.

(b) Except for offshore pipelines, liquid petroleum that does not vaporize rapidly may be used as the test medium if-

- (1) The entire pipeline under test is outside of cities and other populated areas;
- (2) Each building within 300 feet 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 percent of specified minimum yield strength;
- (3) The test section is kept under surveillance by regular patrols during the test; and,
- (4) Continuous communication is maintained along entire test section.

(c) Carbon dioxide pipelines may use inert gas or carbon dioxide as the test medium if-

(1) The entire pipeline section under test is outside of cities and other populated areas;
(2) Each building within 300 feet of the test section is unoccupied while the test pressure is equal to or greater than a pressure that produces a hoop stress of 50 percent of specified minimum yield strength;
(3) The maximum hoop stress during the test does not exceed 80 percent of specified minimum yield strength;
(4) Continuous communication is maintained along entire test section; and,
(5) The pipe involved is new pipe having a longitudinal joint factor of 1.00.

(d) Air on inert gas may be used as the test medium in low-stress pipelines.

§195.308 Testing of tie-ins.

Pipe associated with tie-ins must be pressure tested, either with the section to be tied in or separately.

§195.310 Records

(a) A record must be made of each pressure test required by this subpart, and the record of the latest test must be retained as long as the facility tested is in use.
(b) The record required by paragraph (a) of this section must include:

(1) The pressure recording charts;
(2) Test instrument calibration data;
(3) The name of the operator, the name of the person responsible for making the test, and the name of the test company used, if any;
(4) The date and time of the test;
(5) The minimum test pressure;
(6) The test medium;
(7) A description of the facility tested and the test apparatus;
(8) An explanation of any pressure discontinuities, including test failures, that appear on the pressure recording charts; and,
(9) Where elevation differences in the section under test exceed 100 feet, a profile of the pipeline that shows the elevation and test sites over the entire length of the test section.
(10) Temperature of the test medium or pipe during the test period.

Excerpts from the California Government Code Pertaining to Hydrostatic Testing

§51013.5 - Required Testing

(a) Every newly constructed pipeline, existing pipeline, or part of a pipeline system that has been relocated or replaced, and every pipeline that transports a hazardous liquid substance or highly volatile liquid substance, shall be tested in accordance with Subpart E (commencing with Section §195.300) of Part §195 of Title 49 or the Code of Federal Regulations.

(b) Every pipeline not provided with properly sized automatic pressure relief devices or properly designed pressure limiting devices shall be hydrostatically tested annually.

(c) Every pipeline over 10 years of age and not provided with effective cathodic protection shall be hydrostatically tested every three years, except for those on the State Fire Marshal's list of higher risk pipelines, which shall be hydrostatically tested annually.

(d) Every pipeline over 10 years of age and provided with effective cathodic protection shall be hydrostatically tested every five years, except for those on the State Fire Marshal's list of higher risk pipelines which shall be hydrostatically tested every two years.

(e) Piping within a refined products bulk loading facility served by pipeline shall be tested hydrostatically at 125 percent of maximum allowable operating pressure utilizing the product ordinarily transported in that pipeline if that piping is operated at a stress level of 20 percent or less of the specified minimum yield strength of the pipe. The frequency for pressure testing these pipelines shall be every five years for those pipelines with effective cathodic protection and every three years for those pipelines without effective cathodic protection. If that piping is observable, visual inspection may be the method of testing.

(f) Beginning on July 1, 1990, and continuing until the regulations adopted by the State Fire Marshal pursuant to subdivision

(g) Take effect, each pipeline within the State Fire Marshal's jurisdiction which satisfies any of the following sets of criteria shall be placed on the State Fire Marshal's list of higher risk pipelines until five years pass without a reportable leak due to corrosion or defect on that pipeline. Initially, pipelines on that list shall be tested by the next scheduled test date, or within two years of being placed on the list, whichever is first. On July 1, 1990, pipeline operators shall provide the State Fire Marshal with a list of all their pipelines, which satisfy the criteria in this subdivision as of July 1, 1990. If any pipeline becomes eligible for

the list of higher risk pipelines after that date, the pipeline company shall report that fact the State Fire Marshal within 30 days, and the pipeline shall be placed on the list retroactively to the date on which it became eligible for listing. Pipelines, which are found to belong on the list, but are not so reported by the operator to the State Fire Marshal, shall be placed on the list retroactively. Operators failing to properly report their pipelines shall be subject to penalties under Section §51018.6. Pipelines not covered under the risk criteria developed pursuant to subdivision (g) shall be deleted from the list when Regulations are adopted pursuant to that subdivision. For purposes of this subdivision, a leak which is traceable to an external force, but for which corrosion is partly responsible, shall be deemed caused by corrosion, "defect" refers to manufacturing or construction defects, and "leak" or "reportable leak" means a rupture required to be reported pursuant to Section §51018. As long as all pipelines are tested in their entirety at least as frequently as standard risk pipelines under subdivisions (c) and (d), it shall suffice for additional tests on higher risk pipelines to cover 20 pipeline miles in all directions along an operator's pipeline from the position of the leak or leaks which led to the inclusion or retention of that pipeline on the higher risk list. The interim list shall include pipelines, which meet any of the following criteria:

(1) Have suffered two or more reportable leaks, not including leaks during a certified hydrostatic pressure test, due to corrosion or defect in the prior three years;

(2) Have suffered three or more reportable leaks, not including leaks during a certified hydrostatic pressure test, due to corrosion, defects, or external forces, but not all due to external forces, in the prior three years;

(3) Have suffered a reportable leak, except during a certified hydrostatic pressure test, due to corrosion or defect of more than 50,000 gallons, or 10,000 gallons in a standard metropolitan statistical area, in the prior three years; or have suffered a leak due to corrosion or defect which the State Fire Marshal finds has resulted in more than 42 gallons of a hazardous liquid within the State Fire Marshal's jurisdiction entering a waterway in the prior three years; or have suffered a reportable leak of a hazardous liquid with a flashpoint of less than 140 degrees Fahrenheit, or 60 degrees centigrade, in the prior three years.

(4) Are less than 50 miles long, and have experienced a reportable leak, except during a certified hydrostatic pressure test, due to corrosion or a defect in the prior three years. For the purposes of this paragraph, the length of a pipeline with more than two termini shall be the longest distance between two termini along the pipeline.

(5) Have experienced a reportable leak in the prior five years due to corrosion or defect, except during a certified hydrostatic pressure test, on a section of pipe more than 50 years old. For pipelines which fall in this category, and no other category of higher risk pipeline, additional tests required by this subdivision shall be required only on segments of the pipe more than 50 years old as long as all pipe more than 50 years old which is within 20

pipeline miles from the leak in all directions along an operator's pipeline is tested.

(h) In addition to the requirements of subdivisions (a) to (e) inclusive, the State Fire Marshal may require any pipeline subject to this chapter to be subjected to a pressure test, or any other test or inspection, at any time, in the interest of public safety.

(i) Test methods other than the hydrostatic tests required by subdivisions (b), (c), (d), and (e), including inspection by instrumented internal inspection devices, may be approved by the State Fire Marshal on an individual basis. If the State Fire Marshal approves an alternative to a pressure test in an individual case, the State Fire Marshal may require that the alternative test be given than the testing frequencies specified in more frequently subdivisions (b), (c), (d), and (e).

§51014 -Testing procedure pursuant to Section §51013.5; Test Pressure.

(a) The pressure tests required by subdivisions (b), (c) and (d) of Section §51013.5 shall be conducted in accordance with Subpart E (commencing with Section §195.300) of Part 195 of Title 49 of the Code of Federal Regulations, except that an additional four-hour leak test, as specified in subsection (c) of Section §195.302 of Title 49 of the Code of Federal Regulations, shall not be required under subdivisions (b), (c) and (d) of Section §51013.5. The State Fire Marshal may authorize the use of liquid petroleum having a flashpoint over 140 degrees Fahrenheit or 60 degrees centigrade as the test medium. The State Fire Marshal shall make these authorizations in writing. Pressure tests performed under subdivisions (b), (c) and (d) of Section §51013.5 shall not show an hourly change for each section of the pipeline under test at the time in excess of either 10 gallons or the sum of one gallon and an amount computed at a rate in gallons per mile equivalent to one-tenth of the nominal internal diameter of the pipe in inches.

(b) Test pressure shall **be at least 125 percent** of the **actual pipeline operating pressure**.

§51014.3 - Notice to State Fire Marshal prior to hydrostatic test

(a) Each pipeline operator shall notify the State Fire Marshal and the local fire department having fire suppression responsibilities at least three working days prior to conducting a hydrostatic test, which is required by this chapter. The notification shall include all of the following information:

(1) The name, address and telephone number of the pipeline operator.

(2) The specific location of the pipeline section to be tested and the location of the test equipment.
(3) The date and time the test is to be conducted.
(4) An invitation and a telephone number for local fire departments to call for further information on what they should do in event of a leak during testing.
(5) The test medium
(6) The name and Telephone/Fax numbers of the independent testing firm or person responsible for certification of the test results.

(b) The State Fire Marshal **may observe tests** conducted pursuant to this chapter.

§51014.5 - Certification and submission of test results

(a) When hydrostatic testing is required by Section §51013.5, the test results shall be certified by an independent testing firm or person who is selected from a list, provided by the State Fire Marshal, of independent testing firms or persons approved annually by the State Fire Marshal. The State Fire Marshal may charge a fee for consideration and approval of an independent testing firm or person pursuant to this subdivision, not to exceed the reasonable costs of that consideration and approval.

(b) The results of the tests required by Section §51013.5 shall be submitted by the independent testing firm or person within 30 days after completion of the test to the State Fire Marshal, who may review the results. The report shall show all of the following information:
(1) The date of the test
(2) A description of the pipeline tested including a map of suitable scale showing the route of the pipeline.
(3) The results of the test
(4) Any other test information that may be specifically requested by the State Fire Marshal.

(c) The State Fire Marshal ***shall not supervise***, ***control*** or ***otherwise direct the testing***

Date of Test

Pipelines which are required to be tested by subdivisions (b), (c) and (d) of Section §51013.5 shall be tested within 90 days after the anniversary date of the last hydro-test. Requests for a waiver to this requirement must be made in writing to the address listed below. Each request will be reviewed on an individual basis and the operator will receive a written response from CSFM.

CALFIRE/ State Fire Marshal
Pipeline Safety Division
3950 Paramount Blvd. #210
Lakewood, California 90712

Test Date Extensions

Intrastate – *5 years plus 90 days – Verbal request should be made to CSFM*. ***No written notification is required*.**

Intrastate – *5 years + 3 months to 5 years +8 months – Operator must write and ask for a time extension* ***not to exceed 5 years + 8 months*.**

Interstate – *No written notification required as long* as *they comply with their IMP plan intervals*. – ***Extensions need to go to PHMSA for approval.***

Notification of Test to the CSFM

It is the responsibility of the **pipeline operator** to notify the CSFM Pipeline Safety Division at least three working days prior to a pressure test date. ***Do not E-Mail hydrotest request notifications.*** Fax hydrotest requests to: (562) 497-9104.
In an emergency, a notification period of less than three working days may be allowed if approved in advance by CSFM. An emergency hydrotest request notification can be called into: (562) 497-9100.

The **notification requirement is satisfied only for the date the test is first scheduled** and any consecutive days as long the testing process continues. ***If the testing process is postponed or delayed to a later date, The operator must notify the CSFM and local fire department of the new test date*.**
Each test will be given a test identification number which must be included with the results of the test.

Notification to the Local Fire Department

It is the responsibility of the pipeline operator to notify the local authority having fire suppression authority *at least three working days prior to each hydrostatic test*.
It is not necessary to notify the local Fire Department when conducting a hydrotest on pretested pipe.

Method of Testing

Pressure tests performed in compliance with Subdivisions (b), (c), and (d) of Section §51013.5, California Government Code, shall not show an hourly change for each pipeline segment under test in excess of either 10 gallons or the sum of one gallon and an amount computed at a rate in gallons per mile equivalent to one-tenth of the nominal internal diameter of the pipe in inches.

Allowable Hourly Change in Gallons (not to exceed 10 gallons) =

$$1 + \left[\frac{ID(inches)}{10} \; X \; \frac{L(ft)}{5280(ft)} \right]$$

ID: the internal diameter of the pipe segments.

Hourly Change: that amount of fluid that cannot be accounted for by direct measurement or through temperature/pressure/volume calculations. In other words, after accounting for fluid measurements and temperature change, the amount of unaccounted fluid loss is limited to the above formula.

Measurement of Pressure

A deadweight tester capable of measuring to 1psi increments shall be present during each test. The deadweight may be used either continuously throughout the test or at the beginning and at the end of the test. *<u>The deadweight tester shall be calibrated to a standard acceptable to the State Fire Marshal at least once every two years</u>*. ***(According to the Manufacturer Specifications)***

REQUIREMENTS:

1. Deadweight pressure readings shall be taken at a minimum of 1 hour increments.

2. A pressure recording chart shall continuously record the pressure on the pipe during the test. *<u>The pressure recording chart shall be calibrated prior to every test</u>.* ***(According to the Manufacturer Specifications)***

3. Except for pre-tested pipe, ***<u>a pressure gauge or similar device shall be provided at each end of the test segment</u>*** to indicate that the entire test segment is pressurized. *<u>The Pressure Gauge shall be calibrated</u>* ***(According to the Manufacturer Specifications).***

Measurement of Temperature

The temperature measurement devices shall be placed so as to provide a representative sample of the entire pipeline segment under test.

Responsibilities of Independent Hydrostatic Testing Company

*The role of the independent hydro-testing testing company's **representative** **is** **to witness the pressure test** for the **prescribed time**, ascertain the extent of the test, **record the necessary data** and **forward the results to the CSFM**.*

Section §51014.5, California Government Code requires that each hydrostatic test be certified by an independent testing firm or person approved by CSFM. ***It does not require nor authorize the testing firm or person to approve the test*****.** *It is **the pipeline operator's responsibility** and **decision to verify** and **certify the test results**.*

The name of the hydrostatic testing company's employee approved to witness the testing must be included on the current CSFM list of Approved Hydrostatic Testing Companies.

The witness must be present for the entire required test period. The required test periods are:

Newly constructed pipelines and pipelines where any segment is not entirely visible ....8 hours

Pipelines tested per DOT Integrity Management Program.........8 hours

Pipelines where each segment under test is entirely visible (Pre-Tested Pipe) ....4 hours

Pipelines tested solely for CA Government Code ....4 hours
(For pipelines on the California State Fire Marshal's (corrosion) high risk pipeline list (two - year test cycle)

***Pipeline Operator** is **responsible** for **determining type of test** and **length of test**.*

The independent testing firm shall not witness or certify a test conducted on a pipeline on which they have performed new construction or repair work. This does not prohibit a testing firm or person from certifying test results on a pipeline they previously performed work on. ***The requirement is designed to prevent a company from witnessing and/or certifying results for pipeline segments where the company has performed the repair or installation.***

Minimum Requirements for Independent Testing Company

1. Determine the extent of the test. Verify that the entire test segment is under test.
2. ***Account for any fluid added to or drained from the pipeline***. If a flange leaks during the test, ***<u>measurement of the amount must be taken into account</u>***.
3. Observe and document the test pressure for the required test period. Record the minimum test pressure observed during the test. ***(This is critical since the pipelines operating pressure is based on this pressure).***
4. ***<u>Provide a sketch, drawing or map of the pipeline segment tested.</u>***
5. Each witness should be qualified and be familiar with the minimum testing requirements.
6. Any testing inconsistencies should be brought to CSFM's attention immediately.
7. ***GPS coordinates of the start and end of pipelines shall be included in the form.***
8. *Independent hydro-testing testing company's OQ documentation shall be made available to the CSFM Pipeline Safety Engineer upon request.*

Test Results

Only the Test results required by CSFM shall be submitted in the format included in Appendix B-2. ***<u>Test results shall be mailed within 30 days of the completion of the test to:</u>***

CALFIRE/ State Fire Marshal
Pipeline Safety Division
3950 Paramount Blvd., Suite 210
Lakewood, California 90712

Facsimile or computer generated reports are also acceptable.

The test results submitted to the CSFM for review must include any calculations made to adjust for changes in volume due to temperature, pressure and elevation changes. Calculations used must represent commonly accepted standards such as those used by the American Petroleum Institute (API), industry or university level engineering courses. The operator may use test calculations provided by the independent testing firms.

If no calculations are provided, CSFM staff will evaluate the test results utilizing a standard formula and constants listed in Appendix C-2.

Test results will be reviewed by CSFM to insure the allowable hourly change criteria are met. If a test result is submitted without supporting calculations and shows an hourly

loss greater than allowed, the operator must retest the pipeline or provide additional data or calculations.

The hydrotest results shall include the following information:

- *GPS coordinates of the start and end of pipelines shall be included in the form.*
- *CSFM Pipeline I.D. Number & Operator Description.*
- *Equipment: (DWT, Pressure & Temperature Recorder, Pressure Gauges & Temperature Gauges) Calibration Documentation.*
- *Date Stamp, Company Inspector (Tester) & Independent Witness Signatures, CSFM Pipeline I.D. #, CSFM Hydrotest I.D. #, written on Pressure Charts & Temperature Charts.*
- *The CSFM test I.D. number shall be placed in the upper right hand corner of every page of the hydrotest paperwork submitted for review.*

Pre-tested Pipe

Pre-tested pipe is piping which has been hydrostatically tested prior to installation.

Hydrostatic testing of pre-tested pipe shall be witnessed by an approved representative of a certified independent hydrostatic testing company for a minimum of 4 hours.

The following information ***shall be*** marked ***on the outside of the pre-tested pipe*** at ***intervals of approximately five feet:***

CSFM Test ID No.
Date of Test.
Test Pressure.

Leaks Occurring During Hydrostatic Testing

Except for failures of pre-tested pipe, ***any leak on a pipeline undergoing a pressure test shall immediately be reported to the local fire department and to the California Emergency Management Agency (Cal-EMA).*** The 24-hour emergency telephone number for ***California Emergency Management Agency*** (**Cal-EMA**) is **1-(800) 852-7550**. It may be helpful to indicate to Cal-EMA personnel that this notification is being made pursuant to state fire marshal requirements.

Except for small leaks on pipe valves or flange gaskets***, all leaks occurring on the pipeline as a result of the testing process must be reported to CSFM on the hydrostatic test form*.** **Information must include the *location and cause of the failure*.**

How to Become a CSFM Approved Hydrostatic Testing Company

Section §51014.5, California Government Code, requires that all hydrostatic testing results submitted to the State Fire Marshal must be certified by an independent testing firm or person approved by the State Fire Marshal. Each year, the State Fire Marshal publishes a list of companies and persons who are approved to certify and witness hydrostatic tests for the following fiscal year.

Companies wishing to conduct hydrostatic testing or certify test results must make application to the State Fire Marshal using the form found in the Initial Application Approval as an Independent Hydrostatic Testing Firm form and pay the appropriate fee. Application form is available on SFM website: ***http://osfm.fire.ca.gov.***

§2040. - Fees

In order to implement Chapter 5.5 of the Government Code, California Pipeline Safety Act of 1981, the following fees will be assessed on a fiscal year basis:

Intrastate Pipelines

(1) Independent Hydrostatic Testing Firm $1,500

Engineering staff will examine the completed application and evaluate the qualifications, experience and training of the applicant's employees. An on-site evaluation will be conducted of the company's business location to determine if adequate equipment is available.

The applicant will be notified in writing of the approval or denial of the application. Approved applicants and their staff will be included on the State Fire Marshal's annual list of Approved Hydrostatic Companies.

Renewal of Annual Hydrostatic Testing Approval

Approved hydrostatic testing companies must submit application for renewal of their approved status to the State Fire Marshal each year. The State Fire Marshal will send each approved company an invoice and renewal form during May. Application and fees must be received prior to the beginning of the fiscal year. ***Companies who do not renew their approved status in a timely fashion may not be included in the annual***

publication of the State Fire Marshal's Approved Hydrostatic Testing Company list.

Pressure Tests Using Liquid Petroleum with a Flashpoint Over 140°F as the Test Medium

CSFM may authorize the use of liquid petroleum having a flashpoint over 140°F (60°C) as the test medium. All pressure tests using a liquid petroleum, which exceeds the maximum operating pressure, must be approved by the State Fire Marshal. *These include tests, which are not required by the California Government Code.*

The pipeline operator must apply in writing to:

CALFIRE/State Fire Marshal
Pipeline Safety Division
3950 Paramount Blvd. Suite 210
Lakewood, California 90712

The request must contain the API or specific gravity and flashpoint of the test medium and all of the following data:

1. Necessity to use a product other than water
2. Proposed product to be used for testing
3. Test pressure (% of SYMS)
4. Pressure test procedures, which, at a minimum, address the following:
   (a) Communication along the entire pipeline route.
   (b) Personnel stationed at sensitive areas.
   (c) Procedures to follow in the event of a leak.
   (d) Notification of local fire departments.
5. **CSFM personnel will observe each test where possible**.
6. Material Safety Data Sheet (MSDS) - verification of product flash point must be included.
7. CSFM I.D. Number and Pipeline description
8. These items shall be provided on the wavier request letter prior to review.

CSFM will review the application and provide a written response to the pipeline operator. **CSFM staff may observe the testing at any time.**

51018.7. (a) Any person who willfully and knowingly violates any provision of this chapter or a regulation issued pursuant thereto shall, upon conviction, be subject, for each offense, to a fine of not more than twenty-five thousand dollars ($25,000), imprisonment for a term not to exceed five years, or both.

(b) Any person who willfully and knowingly defaces, damages, removes, or destroys any pipeline sign or right-of-way marker required by federal or state law or regulation <u>shall,</u> upon conviction, be subject, for each offense, to a fine of not more than five thousand dollars ($5,000), imprisonment for a term not to exceed one year, or both.

<u>State Fire Marshal Pipeline Safety – Best Practices</u>

- ***Do not e-mail hydrotest request form to the State Fire Marshal's Office (****Fax hydrotest request****) Fax # (562) 497-9104.***

- §***195.302 &*** §***195.303 The California State Fire Marshal does not allow risked-based testing.***

- **Hydrostatic Testing of Valves**
  Hydrotesting through a valve dose not count as a seat and shell test as required by §195.116 (d) - Valves. Each valve must be both hydrostatically shell tested and hydrostatically seat tested without leakage to at least the requirements set forth in Section 10 of API Standard 6D (incorporated by reference, see §195.3).

- *Hydrotest Test heads need to be completely welded,* ***(not just root pass) Also the test head welds need to be 100% X-rayed (before hydrotesting).***

- **Testing performed to comply with the** PHMSA (DOT) Integrity Management Rule must meet the requirements of Part §195.306 ***Test Medium***. ***A written waiver to use product may be required, Please plan ahead because this process takes up to six months.***

- *If you plan on using pre-tested pipe and required hydrotest information* ***<u>is not visibly marked on the out side of the pipe</u> (<u>every 5-feet</u>),*** *the pre-tested pipe is* ***<u>void</u>*** *and the pipe will have to be re-hydrotested* ***(<u>unless you plan on hydrotesting the whole line</u>).***

- ***Do not bury the temperature probe next to the pipeline and then immerse the probe in puddle of water*** *(This falsifies the temperature readings).*

- ***Do not use a Thermal Coupling Temperature Probe as your ambient Temperature Probe.***

- ***A Fatality that occurred in the state of California while depressurizing a Hazardous Liquid pipeline into a vacuum truck.***
  Pipeline was being purged using nitrogen and two rubber spheres in preparation for a relocation tie-in. After the spheres reached The Facility, as indicated by a pig-signal, a vacuum truck began receiving crude and nitrogen through a four-inch hose connected by a cam-lock to a six-inch line from the pipeline. Shortly after the vacuum truck was approximately ¼ full, the cam-lock connection

separated, spraying the area with crude oil and fragments from a rubber sphere into the face of the vacuum truck operator, going into the lungs and resulting in a fatality. *State Fire Marshal* ***does not allow depressurizing a Hazardous Liquid pipeline into a vacuum truck.*** *A baker tank and hard piped connections may be used.*

- ***Vacuum truck hoses have failed due to over pressurization from pipelines*** If vacuum truck hoses are used on a pipeline for anything other than vacuuming up product, the vacuum truck hoses must be the high pressure rated steel braded re-enforced hoses. ***Hard piped connections must be used. No cam-lock connections.***

- ***It is the responsibility of the certified independent testing company to certify each of their employees,*** *The State Fire Marshal only certifies the independent testing company as an approved independent testing company* ***(The State Fire Marshal does not certify individuals)*** *Attending a State Fire Marshal Hydrotest Class does not DOT (PHMSA) or Part §195 OQ certify you****.***

- ***Companies who do not renew their approved status*** *in a timely fashion may not be included in the annual publication of the State Fire Marshal's Approved Hydrostatic Testing Company list*.

- ***Dead leg piping*** - all dead legs must be located prior to hydrotesting, under Integrity Management Program Operators need to address the problems associated with dead legs; these problems can be solved by designing dead legs to be self draining and by installing drains on dead legs with valves. For hydrotesting purposes the dead legs need to have pressure gauges and bleeder valves installed on them prior to hydrotesting, this is to insure the all air has been removed from the dead leg and that the dead leg has been pressurized for the hydrotest.

- **Gathering Lines -** need to be included in Operators Integrity Management Plan testing cycles.

Responsibilities of Operators

- ***Plan to use more than one temperature recorder on a buried line to allow averaging. If pipeline is buried, predetermine locations to install temperature recorders that will yield representative temperature readings. Install recorders in bell holes away from exposed sections of the pipeline.***

- ***Provide cell phone number of the on-site supervisor.***

- ***Have pipeline physical characteristics data readily available at the test site.***

- ***Give testing firm pipeline routing and profile drawings when they arrive on site.***

- ***Use a pig and/or high point vents to eliminate air inside pipeline.***

- ***Provide pressure gauge connections at all ends of the pipeline, so testing firm can verify that the entire test section is under test pressure.***

- ***Provide detailed directions to test site.***

- ***Independent testing firm shall not witness or certify a test conducted on a pipeline on which they have previously performed new construction or repair work.***

- ***It is pipeline operator's responsibility to verify and certify the test results***

Responsibilities of Testing Company

- ***Determine extent of test***

- ***Account for any fluid added or drained from line***

- ***Observe and document test pressure for required period***

- ***Provide sketch or drawing of pipeline segment, appurtenances, valves, etc.***
- ***Witness shall be qualified***
- ***Any testing inconsistencies must be brought to attention of CSFM***
- ***Independent testing firm shall not witness or certify a test conducted on a pipeline on which they have previously performed new construction or repair work***

PHMSA Advisory Bulletins

Alert Notice ALN-88-01

Date: 01/28/88

CFR Reference(s): 192; 195
Keyword(s): ERW

Subject:
Recent findings relative to factors contributing to operational failures of pipelines constructed with ERW prior to 1970.

US Department of Transportation, 400 Seventh Street, SW. ....
Research and Special Programs Administration, Washington, DC 20590

PIPELINE SAFETY ALERT NOTICE

Alert Notice: ALN-88-01 Date: 01/28/88

To: All Natural Gas Pipeline Transmission Operators & All Hazardous Liquid Pipeline Operators

Subject:

Purpose:

The purpose of this letter is to advise you of recent findings relative to factors contributing to operational failures of pipelines constructed with Electric Resistance Weld (ERW) pipe manufactured prior to 1970. If you have such pipe in your pipeline system, the Office of Pipeline Safety (OPS) recommends that you read the enclosed "ALERT NOTICE: and take appropriate preventive steps.

Richard L. Beam, Director, Office of Pipeline Safety

Notice:

Background:

OPS has data on 12 hazardous liquid pipeline failures that occurred during 1986 and 1987 involving pipe seams manufactured prior to 1970 by the ERW process. The purpose of this notice is to advise pipeline operators who have such pipe in their systems of the data currently available to OPS and of actions which the operator may take to reduce the risk of failure.

These recent failures have caused OPS to reevaluate the safety of continued operation of all pre-1970 ERW pipelines. This reevaluation has included more definitive metallurgical examinations of failed ERW seams. Of particular significance to the OPS evaluation of ERW pipe is the failure of an 8-inch diameter pipeline in Mounds View, Minnesota. The Mounds View pipeline carrying gasoline which failed at 1434 psig had been hydrostatically pressure tested to 1900 psig just 2 years prior to this accident. An independent failure analysis conducted by Battelle Columbus Laboratories concluded that the cause of the Mounds View failure was selective corrosion in the ERW seam in an area of inadequate cathodic protection. Similar metallurgical tests have identified at least 2 other recent failures where selective corrosion of the ERW seam in an area characterized by coating disbondment and inadequate cathodic protection contributed to the cause of the failure.

Studies of available data by OPS staff have shown that ERW seams have been involved in 145 service failures in both hazardous liquid and natural gas pipelines since 1970, and that of these failures, all but 2 occurred on pipe manufactured prior to 1970. Although definitive metallurgical examination of the failures, to establish cause, had not been done, selective seam corrosion appears to be a contributing cause of failure in a significant number of these incidents.

Past OPS regulatory and enforcement actions have resulted in hydrostatic testing of some ERW pipelines thus reducing the risk of seam failures. First, when the gas pipeline safety standards (49 CFR Part 192) were initially promulgated by OPS, natural gas operators were required to establish an upper limit on operating pressure for each pipeline. In many cases, the operator had to perform a hydrostatic test in order to

qualify the pipeline for the desired pressure. Additionally, in 1980, OPS promulgated new regulations for highly volatile liquid (HVL) pipelines (49 CFR Part 195) requiring operators of those pipelines to test all HVL pipelines to establish a maximum operating pressure not to exceed 80% of a previous operating or test pressure. Further, state or federal enforcement actions have required certain hazardous liquid pipeline operators to hydrostatic test a number of specific segments of their pipeline systems that had experienced ERW seam failures. Collectively, these actions involved the testing of thousands of miles of gas transmission, highly volatile liquid and other hazardous liquid pipelines. This testing resulted in the removal from service of several hundred joints of pipe having defective seams and provided additional assurance of the integrity of the remaining pipe in the tested pipelines. Pre-1970 ERW pipelines which were hydrotested have, in most cases, operated safely since they were tested.

Therefore, in view of these recent findings, OPS recommends that all operators reevaluate the potential for safety problems on their high pressure pre-1970 ERW pipelines. All operators who have pre-1970 ERW pipe in their systems should carefully review their leak, failure, and test history as well as their corrosion control records to ensure that adequate cathodic protection has been and is now being provided. In areas where cathodic protection has been deficient for a period or periods of time, the operators should conduct an examination of the condition of the pipeline, including close interval pipe-to-soil corrosion surveys, selective visual examination of the pipe coating, and/or other appropriate means of physically determining the effects of the environment on the pipe seam. If an unsatisfactory condition is found, or if a pre-1970 ERW pipeline has not been hydrostatically tested to 125% of the maximum allowable pressure, operators should consider hydrostatic testing to assure the integrity of the pipeline.

Alert Notice ALN-89-01

Date: 03/08/89

CFR Reference(s):
Keyword(s): ERW

Subject:
UPDATE (01/28/88): Additional findings relative to factors contributing to operational failures of pipelines constructed by ERW prior to 1970.

US Department of Transportation, 400 Seventh Street, SW. ....
Research and Special Programs Administration, Washington, DC 20590

PIPELINE SAFETY ALERT NOTICE

Alert Notice: ALN-89-01 Date: 03/08/89

To: All Natural Gas Transmission Operators & All Hazardous Liquid Pipeline Operators

Subject:

Purpose:
The purpose of this letter is to advise you of additional findings since the January 2, 1922, "ALERT NOTICE" relative to factors contributing to operational failures of pipelines constructed with ERW pipe manufactured prior to 1970. If you have such pipe

in your pipeline system, OPS recommends that you read the enclosed copy of the latest "ALERT NOTICE" and take appropriate preventive steps.

Richard L. Beam, Director, Office of Pipeline Safety

Notice:

Background:

On January 28, 1988, OPS issued an Alert Notice advising pipeline operators who have pipe manufactured by ERW process of the occurrence of 12 hazardous liquid pipeline failures and of actions which operators may take to reduce the risks of similar failures.

The continuing failure of ERW seams remains a matter of concern to RSPA. Since the issuance of that Alert Notice, RSPA has data on 8 additional hazardous liquid pipeline failures and 1 on a gas transmission pipeline involving pie seams manufactured prior to 1970 by the ERW process. Of the 8 additional hazardous liquid pipeline failures, 2 appear to be due to selective corrosion of the ERW seam. As stated in the 1988 Alert Notice (ALN-88-01), seams with selective corrosion occurring in an area of manufacturing defects may be particularly vulnerable to failure. However, the other failures appear to have resulted from flat growth of manufacturing defects in the ERW seam.

Two of these failures resulted in some of the most significant spills (more than 20,000 bbls.) in recent years. Both of these failure involved pipelines which had not been hydrostatically tested in accordance with current standards. One of the failures occurred after the long-standing operating pressure had been increased a relatively short period of time before the failure. This increase in pressure clearly decreased the margin of safety between the operating pressure and highest pressure ever experienced during the life of the pipeline and contributed to the acceleration of the growth of a defect to failure.

RSPA is planning to conduct research aimed at characterizing ERW defects and their growth rates for a variety of environmental conditions, in addition to the pipe having cathodic protection at less than standard pipe-to-soil potentials, coating disbondment, fatigue, and corrosion fatigue. If the research is successful, the resulting data could provide a basis for establishing criteria regarding when an ERW pipeline should be re-hydrotested.

In view of the continuing ERW seam failures, OPS recommends that all pipeline operators having ERW pipelines installed prior to 1970:

(1) Consider hydrostatic testing on all hazardous liquid pipelines that have not been hydrostatically tested to 125% of the maximum allowable pressure, or alternatively reduce the operating pressure 20%;

(2) Avoid increasing a pipeline's long-standing operating pressure;

(3) Assure the effectiveness of the cathodic protection system. Consider the use of close interval pipe-to-soil surveys after evaluating the pipe coating and corrosion/cathodic protection history; and

(4) In the event of an ERW seam failure, conduct metallurgical examinations in order to determine the probable condition of the remainder of the ERW seams in the pipeline.

Advisory Bulletin ADB-04-01 (Addition)

[Notices][Page 58225-58226]

DEPARTMENT OF TRANSPORTATION

Research and Special Programs Administration

Pipeline Safety: Hazards Associated With De-Watering of Pipelines

AGENCY: Research and Special Programs Administration (RSPA), DOT.

ACTION: Notice; issuance of advisory bulletin.

SUMMARY: On June 21, 2004, the Research and Special Programs Administration's Office of Pipeline Safety (RSPA/OPS) issued Advisory Bulletin ADB-04-01 to owners and operators of gas and hazardous liquid pipelines to consider the hazards associated with pipeline de-watering operations. This advisory bulletin was originally issued jointly with the Department of Labor's Occupational Safety and Health Administration (OSHA) as Safety and Health Information Bulletin SHIB 06-21-2004. Operators are strongly encouraged to follow the recommended work practices and guidelines to reduce the potential for unexpected separation of temporary de-watering pipes.

FOR FURTHER INFORMATION CONTACT: Richard Huriaux, (202) 366-4565; or by e-mail, richard.huriaux@rspa.dot.gov. This document can be viewed at the OPS home page at http://ops.dot.gov The original advisory bulletin issued by OSHA can be viewed at http://www.osha.gov. General information about the RSPA/OPS programs may be obtained by accessing RSPA's home page at http://rspa.dot.gov.

SUPPLEMENTARY INFORMATION:

Background

The OSHA Allentown and Wilkes-Barre Area Offices recently investigated two fatalities that occurred in conjunction with de-watering processes associated with newly constructed gas pipelines. In both cases, the temporary de-watering piping violently separated from its couplings, striking and fatally injuring employees. In one instance, the separated section of pipe was thrown 45 feet from where it had been attached to the temporary de-watering valve. OSHA determined that a major contributing factor to both of the accidents was temporary de-watering pipelines that were not adequately secured to prevent the piping from moving or separating. In one case, the failure occurred at a pipe coupler that was not being used within the safe tolerances established by the manufacturer.

After a pipeline is laid, a hydrostatic test is conducted to ensure its integrity. Hydrostatic testing may also be conducted during the service life of the pipeline to evaluate its operational integrity. The hydrostatic test consists of pumping water into the pipeline, pressuring up the line to specified test pressures, and holding that pressure for a discrete period of time in accordance with applicable regulations and guidelines, including regulations promulgated by RSPA/OPS. After completion of the hydrostatic test, the pressure is relieved and the water is removed from the pipeline during de-watering procedures.

The de-watering process involves connecting a temporary de-watering line to the main pipeline with mechanical couplers and adequately securing the temporary de-watering line to prevent displacement. A de-watering pig is then forced through the main pipeline using several hundred pounds pressure of compressed air. As the pig is forced through the pipeline with air pressure, the water remaining in the line from hydrostatic testing is pushed out of the main pipeline through the temporary de-watering line.

During the de-watering process, significant and sudden variations in pressure often occur within the main pipeline and temporary de-watering line. These variations can be caused by changes in pig velocity as it passes through bends in the pipeline or changes in pig and water velocity due to changes in pipeline elevation. Compressed air escaping around the pig, which can combine with air already present in the main pipeline at high spots in the pipe, can also create a source for stored energy within the main pipeline. These sudden pressure changes produce surges that are transferred from the main pipeline to the temporary de-watering line. This can result in movement of the temporary de-watering line, as the pressures can easily exceed the working pressures and bending capabilities of the temporary de-watering line couplers. The movement of the de-watering line can result in violent failure of the temporary piping system, particularly when the temporary piping is not properly anchored. This situation can be exacerbated when the temporary pipeline suddenly changes direction, when couplers or pipe sections have worn beyond the specified tolerances established by the manufacturer of the de-watering piping system, or when the entire de-watering manifold is inadequately designed for the stresses that can be imposed while de-watering.

RSPA/OPS recognizes the existence of hazards associated with testing pipelines and requires operators to protect their employees and the public during hydrostatic testing.

Section 192.515(a) states that `` * * * each operator shall insure that every reasonable precaution is taken to protect its employees and the general public during the testing.'' In addition, Sec. 195.402(c) requires each pipeline operator to prepare and follow procedures for safety during maintenance and normal operation.

Advisory Bulletin (ADB-04-01)

To: Owners and operators of gas and hazardous liquid pipeline systems.
Subject: Hazards associated with de-watering of pipelines.
Purpose: To advise owners and operators of gas and hazardous liquid pipelines to consider hazards associated with pipeline de-watering operations and to follow recommended work practices and guidelines to reduce the potential for unexpected separation of temporary de-watering pipes.

Advisory: Each operator of a gas or hazardous liquid pipeline should take recommended precautions against the unexpected separation of temporary de-watering pipes during de-watering procedures. This advisory bulletin was originally issued jointly with the Department of Labor's Occupational Safety and Health Administration (OSHA) as Safety and Health Information Bulletin SHIB 06-21-2004. The original advisory bulletin issued by OSHA can be viewed at http://www.osha.gov, or the RSPA/OPS Web site at http://www.ops.gov.

The following guidelines will help reduce the risk of injury to employees involved in de-watering activities:

· Study the piping system. During the initial planning stage of a de-watering operation, an engineering analysis of the existing and temporary piping system should be performed to identify the pressure associated with fluids and other forces that could adversely affect the integrity of the pipeline or the stability of the drainage and its components. The operator should design the de-watering system and develop installation techniques based on the expected forces of the particular project. Alternatively, designs and techniques could be developed for a ``worst case'' scenario that could be applied to all de-watering projects.

· Anchor the de-watering lines. It is accepted industry practice to adequately anchor or secure de-watering piping to prevent movement and separation of the piping. Operators should establish effective anchoring systems based on expected forces and ensure that the systems are used during de-watering projects.

· Ensure condition of couplings and parts. All couplings and parts of the de-watering system need to be properly selected for their application. The associated piping which the couplings connect is a significant variable in the entire mechanical piping system. The couplings are manufactured in a controlled environment, and variations in the quality of the couplings should be limited. Operators should ensure that

couplings are within manufacturer's tolerances and free of damage that may result in connection failure. A chain is only as strong as its weakest link--in de-watering piping systems, the weakest link frequently is the temporary de-watering pipe connections.

· Provide adequate employee training. This training should instruct employees on de-watering installation designs and techniques, including proper coupling and anchoring methods. Operators should ensure that employees understand the potential hazards of improperly installed de-watering systems, provide employees a means of determining whether the pipe groove meets manufacturer's tolerances, and the procedures they should implement to protect themselves and others working around them.

· Proper procedures. Operators should ensure that proper installation and de-watering procedures are followed on the job site.

Operators may refer to recommended practices provided by national consensus standards organizations, such as American Petroleum Institute (API) Recommended Practice for Occupational Safety for Oil and Gas Well Drilling and Servicing Operations (API RP 54-1999, Section 12.4.3); American National Standards Institute (ANSI) Power Piping (ANSI B31.1-
1973, Section 121.2); and U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM 285-1-1, 1996 Section 20).

Issued in Washington, DC, on September 23, 2004.
Stacey L. Gerard,
Associate Administrator for Pipeline Safety.
[FR Doc. 04-21829 Filed 9-28-04; 8:45 am]

BILLING CODE 4910-60-P

OFFICE OF THE STATE FIRE MARSHAL
PIPELINE SAFETY DIVISION
3950 Paramount Blvd. #210
Lakewood, CA 90712

NOTIFICATION OF HYDROSTATIC TEST OR PROPOSED PIG RUN

Operator must FAX request to: (562) 497-9104

Operator:	Test Date:	Test ID#
Line ID#:	Facility ID#:	Duration of Test: ☐ 4 Hours ☐ 8 Hours
Person Requesting:	Independent Testing Firm:	
Telephone #:	FAX #:	☐ Notify the local Fire Department at least three working days prior to the Hydrostatic Test for pipeline tests in public areas..

Kind of Test:	☐ 2 Year. . ☐ Newly constructed pipeline ☐ Pre-Tested Pipe ☐ Replacement/ Relocation ☐ 5 Year ☐ Other: (describe below) ☐ Facility (includes: Valves, Receivers, Inplant Piping.

Hydrotest: ☐ Yes ☐ No	Test Medium: ☐ Water ☐ Jet Fuel ☐ Diesel ☐ Fuel Oil ☐ Crude ☐ Nitrogen ☐ Other ______________________________		
Pig Run: ☐ Yes ☐ No	Test Length (In Feet):	Test Pressure (psig):	MOP Max. Pressure (psig):

Test Equipment Location:

If other than water, has a waiver been granted? ☐ Yes ☐ No	Waiver Date:

Comments (additional information):

Call Received By:	Date Received:

APPENDIX B

APPENDIX B TO PART 195 – RISK-BASED ALTERNATIVE TO PRESSURE TESTING OLDER HAZARDOUS LIQUID AND CARBON DIOXIDE PIPELINES

RISK-BASED ALTERNATIVE

This Appendix provides guidance on how a risk-based alternative to pressure testing older hazardous liquid and carbon dioxide pipelines rule allowed by Sec. 195.303 will work. This risk-based alternative establishes test priorities for older pipelines, not previously pressure tested, based on the inherent risk of a given pipeline segment. The first step is to determine the classification based on the type of pipe or on the pipeline segment's proximity to populated or environmentally sensitive area. Secondly, the classifications must be adjusted based on the pipeline failure history, product transported, and the release volume potential.

Tables 2-6 give definitions of risk classification A, B, and C facilities. For the purposes of this rule, pipeline segments containing high risk electric resistance-welded pipe (ERW pipe) and lap-welded pipe manufactured prior to 1970 and considered a risk classification C or B facility shall be treated as the top priority for testing because of the higher risk associated with the susceptibility of this pipe to longitudinal seam failures.

In all cases, operators shall annually, at intervals not to exceed 15 months, review their facilities to reassess the classification and shall take appropriate action within two years or operate the pipeline system at a lower pressure. Pipeline failures, changes in the characteristics of the pipeline route, or changes in service should all trigger a reassessment of the originally classification.

Table 1 explains different levels of test requirements depending on the inherent risk of a given pipeline segment. The overall risk classification is determined based on the type of pipe involved, the facility's location, the product transported, the relative volume of flow and pipeline failure history as determined from Tables 2-6.

Table 1. Test Requirements-Mainline Segments Outside of Terminals, Stations, and Tank Farms

Pipeline segment	Risk classification	Test deadline [1]	Test medium
Pre-1970 Pipeline Segments susceptible to longitudinal seam failures [2].	C or B	12/7/2000 [3] ……….	Water only.
	A	12/7/2002 [3] ……….	Water only.
All Other Pipeline Segments …………	C	12/7/2002 [4] ……….	Water only.
	B	12/7/2004 [4] ……….	Water/Liq. [5]
	A	Additional pressure testing not required	

[1] If operational experience indicates a history of past failures for a particular pipeline segment, failure causes (time-dependent defects due to corrosion, construction, manufacture, or transmission problems, etc.) shall be reviewed in determining risk classification (See Table 6) and the timing of the pressure test should be accelerated.

[2] All pre-1970 ERW pipeline segments may not require testing. In determining which ERW pipeline segments should be included in this category, an operator must consider the seam-related leak history of the pipe and pipe manufacturing information as available, which may include the pipe steel's mechanical properties, including fracture toughness; the manufacturing process and controls related to seam properties, including whether the ERW process was high-frequency or low-frequency, whether the weld seam was heat treated, whether the seam was inspected, the test pressure and duration during mill hydrotest; the quality control of the steel-making process; and other factors pertinent to seam properties and quality.

[3] For those pipeline operators with extensive mileage of pre-1970 ERW pipe, any waiver requests for timing relief should be supported by an assessment of hazards in accordance with location, product, volume, and probability of failure considerations consistent with Tables 3, 4, 5, and 6.

[4] A magnetic flux leakage or ultrasonic internal inspection survey may be utilized as an alternative to pressure testing where leak history and operating experience do not indicate leaks caused by longitudinal cracks or seam failures.

[5] Pressure tests utilizing a hydrocarbon liquid may be conducted, but only with a liquid which does not vaporize rapidly.

Using LOCATION, PRODUCT, VOLUME, and FAILURE HISTORY ``Indicators'' from Tables 3, 4, 5, and 6 respectively, the overall risk classification of a given pipeline or pipeline segment can be established from Table 2. The LOCATION Indicator is the primary factor which determines overall risk, with the PRODUCT, VOLUME, and PROBABILITY OF FAILURE Indicators used to adjust to a higher or lower overall risk classification per the following table.

Table 2.-Risk Classification

Risk Classification	Hazard location indicator	Product/volume indicator	Probability of failure indicator
A ……………………..	L or M ………………	L/L ……………………	L.
B ……………………..		Not A or C Risk Classification	
C …………………….	H …………………….	Any ……………………..	Any.

H=High M=Moderate L=Low.

Note: For Location, Product, Volume, and Probability of Failure Indicators, see Tables 3, 4, 5, and 6.

Table 3 is used to establish the LOCATION Indicator used in Table 2. Based on the population and environment characteristics associated with a pipeline facility's location, a LOCATION Indicator of H, M or L is selected.

Table 3.-Location Indicators-Pipeline Segments

Indicator	Population [1]	Environment [2]
H ……………………………….. M L ………………………………….	Non-rural areas ………………. …………………………………. Rural areas …………………….	Environmentally sensitive [2] areas. Not environmentally sensitive [2] areas.

[1] The effects of potential vapor migration should be considered for pipeline segments transporting highly volatile or toxic products.
[2] We expect operators to use their best judgment in applying this factor.

Tables 4, 5 and 6 are used to establish the PRODUCT, VOLUME, and PROBABILITY OF FAILURE Indicators respectively, in Table 2. The PRODUCT Indicator is selected from Table 4 as H, M, or L based on the acute and chronic hazards associated with the product transported. The VOLUME Indicator is selected from Table 5 as H, M, or L based on the nominal diameter of the pipeline. The Probability of Failure Indicator is selected from Table 6.

Table 4.-Product Indicators

Indicator	Considerations	Product examples
H ……………………………….. M ……………………………….. L ………………………………..	(Highly volatile and flammable)….. Highly toxic ……………………….. Flammable – flashpoint < 100F …. Non-flammable – flashpoint 100+F.. Highly volatile and non-flammable/non-toxic	(Propane, butane, Natural Gas Liquid (NGL), ammonia) (Benzene, high Hydrogen Sulfide content crude oils). (Gasoline, JP4, low flashpoint crude oils) (Diesel, fuel oil, kerosene, JP5, most crude oils). Carbon Dioxide.

Considerations: The degree of acute and chronic toxicity to humans, wildlife, and aquatic life; reactivity; and, volatility, flammability, and water solubility determine the Product Indicator. Comprehensive Environmental Response, Compensation and Liability Act Reportable Quantity values can be used as an indication of chronic toxicity. National Fire Protection Association health factors can be used for rating acute hazards.

Table 5.-Volume Indicators

Indicator	Line size
H ………………………..	>= 18”.
M ………………………..	10” – 16” nominal diameters.
L ………………………...	<= 8” nominal diameter.

H=High   M=Moderate   L=Low.

Table 6 is used to establish the PROBABILITY OF FAILURE Indicator used in Table 2. The ``Probability of Failure" Indicator is selected from Table 6 as H or L.

Table 6.-Probability of Failure Indicators [in each haz. location]

Indicator	Failure history (time-dependent defects) [2]
H[1] ………………………….	> Three spills in last 10 years.
L ………………………….	<= Three spills in last 10 years.

H=High   L=Low.

[1] Pipeline segments with greater than three product spills in the last 10 years should be reviewed for failure causes as described in subnote [2]. The pipeline operator should make an appropriate investigation and reach a decision based on sound engineering judgment, and be able to demonstrate the basis of the decision.

[2] Time-Dependent Defects are defects that result in spills due to corrosion, gouges, or problems developed during manufacture, construction or operation, etc.

[Amdt 195-65 , 63 FR 59475, Nov 4, 1998, as amended by Amdt 195-65A, 64 FR 6814, February 11, 1999]

Appendix C – Standard Formulas used for Pressure / Temperature Calculations

CSFM Standardized formula for performing pressure – temperature calculations to determine volume change.

Basic Formula: $\Delta V / V = Kp\, \Delta P + Kt\, \Delta T$

Where: $Kp = [(D / t)(5 / 4 - \mu) / E] + 1 / \beta = (1.9\, D / 2\, E\, t) + 1 / \beta$

And: $Kt = 3a - g$

ΔP	=	Liquid Pressure Change
ΔT	=	Liquid Temperature Change
ΔV	=	Liquid Volume added to that inside the pipe (negative if flows out)
V	=	Nominal Pipe Volume = $\pi D^2 L / 4$
D	=	Inside Pipe Diameter
L	=	Pipe Length
t	=	Pipe wall thickness
μ	=	Poisson's ratio = 0.3
E	=	Young's Modulus = 30 * 10^6 psi
β	=	Liquid Bulk Modulus, a function of Pressure and Temperature
g	=	Liquid Volumetric expansion coefficient, a function of Pressure and Temperature
a	=	Linear coefficient of Thermal Expansion = 6.5 * 10^ -6 1/ ^{0}F

Appendix C-2 – Standard Formulas used for Pressure / Temperature Calculations

Name of Range: BULK

Bulk Modulus Values for water x 10^3

	Temperature																	
Pressure	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
14.70	306.50	307.50	308.40	309.10	310.00	310.70	311.20	312.00	312.70	313.20	314.00	314.60	315.20	315.70	316.20	316.90	317.50	318.00
100	306.97	307.50	308.40	309.10	310.00	310.70	311.20	312.00	312.70	313.20	314.00	314.60	315.20	315.70	316.20	316.90	317.50	318.00
200	307.44	307.50	308.40	309.10	310.00	310.70	311.20	312.00	312.70	313.20	314.00	314.60	315.20	315.70	316.20	316.90	317.50	318.00
300	307.91	307.50	308.40	309.10	310.00	310.70	311.20	312.00	312.70	313.20	314.00	314.60	315.20	315.70	316.20	316.90	317.50	318.00
400	308.38	307.50	308.40	309.10	310.00	310.70	311.20	312.00	312.70	313.20	314.00	314.60	315.20	315.70	316.20	316.90	317.50	318.00
500	308.85	307.50	308.40	309.10	310.00	310.70	311.20	312.00	312.70	313.20	314.00	314.60	315.20	315.70	316.20	316.90	317.50	318.00
600	309.32	307.50	308.40	309.10	310.00	310.70	311.20	312.00	312.70	313.20	314.00	314.60	315.20	315.70	316.20	316.90	317.50	318.00
700	309.79	307.50	308.40	309.10	310.00	310.70	311.20	312.00	312.70	313.20	314.00	314.60	315.20	315.70	316.20	316.90	317.50	318.00
800	310.26	307.50	308.40	309.10	310.00	310.70	311.20	312.00	312.70	313.20	314.00	314.60	315.20	315.70	316.20	316.90	317.50	318.00
900	310.73	307.50	308.40	309.10	310.00	310.70	311.20	312.00	312.70	313.20	314.00	314.60	315.20	315.70	316.20	316.90	317.50	318.00
1000	311.20	312.00	312.70	313.60	314.50	315.30	316.00	316.60	317.60	318.30	319.20	320.00	320.50	321.00	322.00	322.50	323.00	323.50
1100	311.20	312.00	312.70	313.60	314.50	315.30	316.00	316.60	317.60	318.30	319.20	320.00	320.50	321.00	322.00	322.50	323.00	323.50
1200	311.20	312.00	312.70	313.60	314.50	315.30	316.00	316.60	317.60	318.30	319.20	320.00	320.50	321.00	322.00	322.50	323.00	323.50
1300	311.20	312.00	312.70	313.60	314.50	315.30	316.00	316.60	317.60	318.30	319.20	320.00	320.50	321.00	322.00	322.50	323.00	323.50
1400	311.20	312.00	312.70	313.60	314.50	315.30	316.00	316.60	317.60	318.30	319.20	320.00	320.50	321.00	322.00	322.50	323.00	323.50
1500	311.20	312.00	312.70	313.60	314.50	315.30	316.00	316.60	317.60	318.30	319.20	320.00	320.50	321.00	322.00	322.50	323.00	323.50
1600	311.20	312.00	312.70	313.60	314.50	315.30	316.00	316.60	317.60	318.30	319.20	320.00	320.50	321.00	322.00	322.50	323.00	323.50
1700	311.20	312.00	312.70	313.60	314.50	315.30	316.00	316.60	317.60	318.30	319.20	320.00	320.50	321.00	322.00	322.50	323.00	323.50
1800	311.20	312.00	312.70	313.60	314.50	315.30	316.00	316.60	317.60	318.30	319.20	320.00	320.50	321.00	322.00	322.50	323.00	323.50
1900	311.20	312.00	312.70	313.60	314.50	315.30	316.00	316.60	317.60	318.30	319.20	320.00	320.50	321.00	322.00	322.50	323.00	323.50
2000	316.00	317.00	317.90	319.00	319.60	320.20	321.00	322.00	322.80	323.50	324.50	325.20	326.00	326.50	327.10	328.00	328.50	329.00
2100	316.00	317.00	317.90	319.00	319.60	320.20	321.00	322.00	322.80	323.50	324.50	325.20	326.00	326.50	327.10	328.00	328.50	329.00
2200	316.00	317.00	317.90	319.00	319.60	320.20	321.00	322.00	322.80	323.50	324.50	325.20	326.00	326.50	327.10	328.00	328.50	329.00
2300	316.00	317.00	317.90	319.00	319.60	320.20	321.00	322.00	322.80	323.50	324.50	325.20	326.00	326.50	327.10	328.00	328.50	329.00
2400	316.00	317.00	317.90	319.00	319.60	320.20	321.00	322.00	322.80	323.50	324.50	325.20	326.00	326.50	327.10	328.00	328.50	329.00
2500	316.00	317.00	317.90	319.00	319.60	320.20	321.00	322.00	322.80	323.50	324.50	325.20	326.00	326.50	327.10	328.00	328.50	329.00
2600	316.00	317.00	317.90	319.00	319.60	320.20	321.00	322.00	322.80	323.50	324.50	325.20	326.00	326.50	327.10	328.00	328.50	329.00
2700	316.00	317.00	317.90	319.00	319.60	320.20	321.00	322.00	322.80	323.50	324.50	325.20	326.00	326.50	327.10	328.00	328.50	329.00
2800	316.00	317.00	317.90	319.00	319.60	320.20	321.00	322.00	322.80	323.50	324.50	325.20	326.00	326.50	327.10	328.00	328.50	329.00
2900	316.00	317.00	317.90	319.00	319.60	320.20	321.00	322.00	322.80	323.50	324.50	325.20	326.00	326.50	327.10	328.00	328.50	329.00
3000	320.60	321.80	322.50	323.70	324.40	325.20	326.10	327.05	327.90	328.90	329.30	330.30	330.90	331.50	332.40	332.90	333.70	334.10

Bulk Modulus of Water as a Function of Pressure and Temperature

Appendix C-2 – Standard Formulas used for Pressure / Temperature Calculations

Name of Range: BULK

Bulk Modulus Values for water x 10^3

	Temperature																	
Pressure	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
14.70	318.60	319.00	319.50	320.00	320.50	321.00	321.50	321.80	322.30	322.50	322.70	323.00	323.50	323.90	324.00	324.50	324.90	325.00
100	318.60	319.00	319.50	320.00	320.50	321.00	321.50	321.80	322.30	322.50	322.70	323.00	323.50	323.90	324.00	324.50	324.90	325.00
200	318.60	319.00	319.50	320.00	320.50	321.00	321.50	321.80	322.30	322.50	322.70	323.00	323.50	323.90	324.00	324.50	324.90	325.00
300	318.60	319.00	319.50	320.00	320.50	321.00	321.50	321.80	322.30	322.50	322.70	323.00	323.50	323.90	324.00	324.50	324.90	325.00
400	318.60	319.00	319.50	320.00	320.50	321.00	321.50	321.80	322.30	322.50	322.70	323.00	323.50	323.90	324.00	324.50	324.90	325.00
500	318.60	319.00	319.50	320.00	320.50	321.00	321.50	321.80	322.30	322.50	322.70	323.00	323.50	323.90	324.00	324.50	324.90	325.00
600	318.60	319.00	319.50	320.00	320.50	321.00	321.50	321.80	322.30	322.50	322.70	323.00	323.50	323.90	324.00	324.50	324.90	325.00
700	318.60	319.00	319.50	320.00	320.50	321.00	321.50	321.80	322.30	322.50	322.70	323.00	323.50	323.90	324.00	324.50	324.90	325.00
800	318.60	319.00	319.50	320.00	320.50	321.00	321.50	321.80	322.30	322.50	322.70	323.00	323.50	323.90	324.00	324.50	324.90	325.00
900	318.60	319.00	319.50	320.00	320.50	321.00	321.50	321.80	322.30	322.50	322.70	323.00	323.50	323.90	324.00	324.50	324.90	325.00
1000	324.00	324.90	325.30	326.00	326.30	326.80	327.00	327.50	327.90	328.20	328.80	329.10	329.50	329.70	330.00	330.20	330.50	330.80
1100	324.00	324.90	325.30	326.00	326.30	326.80	327.00	327.50	327.90	328.20	328.80	329.10	329.50	329.70	330.00	330.20	330.50	330.80
1200	324.00	324.90	325.30	326.00	326.30	326.80	327.00	327.50	327.90	328.20	328.80	329.10	329.50	329.70	330.00	330.20	330.50	330.80
1300	324.00	324.90	325.30	326.00	326.30	326.80	327.00	327.50	327.90	328.20	328.80	329.10	329.50	329.70	330.00	330.20	330.50	330.80
1400	324.00	324.90	325.30	326.00	326.30	326.80	327.00	327.50	327.90	328.20	328.80	329.10	329.50	329.70	330.00	330.20	330.50	330.80
1500	324.00	324.90	325.30	326.00	326.30	326.80	327.00	327.50	327.90	328.20	328.80	329.10	329.50	329.70	330.00	330.20	330.50	330.80
1600	324.00	324.90	325.30	326.00	326.30	326.80	327.00	327.50	327.90	328.20	328.80	329.10	329.50	329.70	330.00	330.20	330.50	330.80
1700	324.00	324.90	325.30	326.00	326.30	326.80	327.00	327.50	327.90	328.20	328.80	329.10	329.50	329.70	330.00	330.20	330.50	330.80
1800	324.00	324.90	325.30	326.00	326.30	326.80	327.00	327.50	327.90	328.20	328.80	329.10	329.50	329.70	330.00	330.20	330.50	330.80
1900	324.00	324.90	325.30	326.00	326.30	326.80	327.00	327.50	327.90	328.20	328.80	329.10	329.50	329.70	330.00	330.20	330.50	330.80
2000	329.50	330.00	330.50	331.00	331.80	332.20	332.50	333.00	333.50	334.00	334.50	335.00	335.40	335.90	336.20	336.50	336.90	337.10
2100	329.50	330.00	330.50	331.00	331.80	332.20	332.50	333.00	333.50	334.00	334.50	335.00	335.40	335.90	336.20	336.50	336.90	337.10
2200	329.50	330.00	330.50	331.00	331.80	332.20	332.50	333.00	333.50	334.00	334.50	335.00	335.40	335.90	336.20	336.50	336.90	337.10
2300	329.50	330.00	330.50	331.00	331.80	332.20	332.50	333.00	333.50	334.00	334.50	335.00	335.40	335.90	336.20	336.50	336.90	337.10
2400	329.50	330.00	330.50	331.00	331.80	332.20	332.50	333.00	333.50	334.00	334.50	335.00	335.40	335.90	336.20	336.50	336.90	337.10
2500	329.50	330.00	330.50	331.00	331.80	332.20	332.50	333.00	333.50	334.00	334.50	335.00	335.40	335.90	336.20	336.50	336.90	337.10
2600	329.50	330.00	330.50	331.00	331.80	332.20	332.50	333.00	333.50	334.00	334.50	335.00	335.40	335.90	336.20	336.50	336.90	337.10
2700	329.50	330.00	330.50	331.00	331.80	332.20	332.50	333.00	333.50	334.00	334.50	335.00	335.40	335.90	336.20	336.50	336.90	337.10
2800	329.50	330.00	330.50	331.00	331.80	332.20	332.50	333.00	333.50	334.00	334.50	335.00	335.40	335.90	336.20	336.50	336.90	337.10
2900	329.50	330.00	330.50	331.00	331.80	332.20	332.50	333.00	333.50	334.00	334.50	335.00	335.40	335.90	336.20	336.50	336.90	337.10
3000	335.10	335.80	336.00	337.00	337.50	337.90	338.40	338.95	339.20	339.80	340.30	340.70	340.95	341.20	341.90	342.30	342.50	342.90

Bulk Modulus of Water as a Function of Pressure and Temperature

Appendix C-2 – Standard Formulas used for Pressure / Temperature Calculations

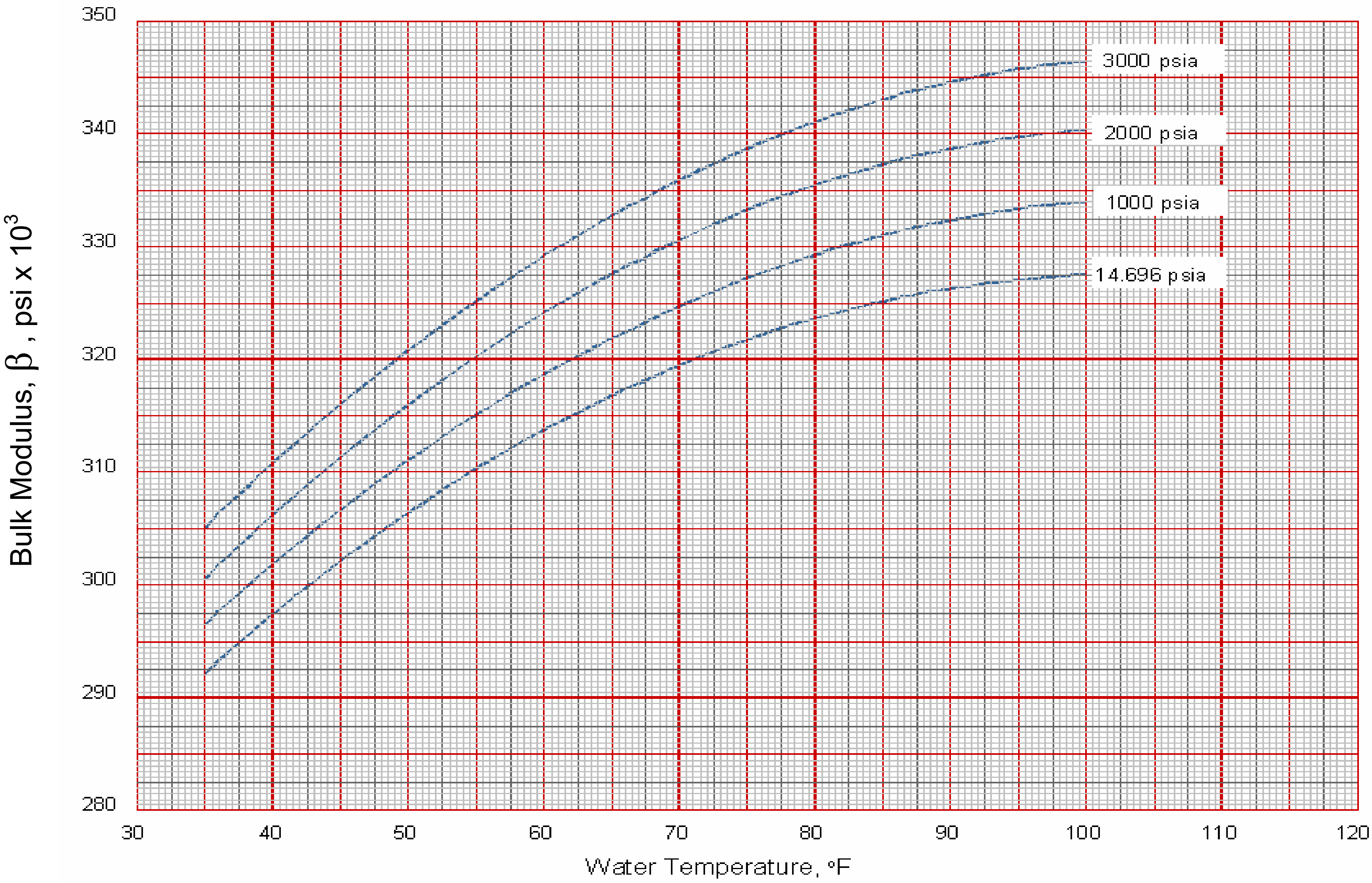
Name of Range: BULK

Bulk Modulus Values for water x 10^3

	Temperature														
Pressure	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
14.70	325.30	325.50	325.70	325.90	326.00	326.20	326.50	326.60	326.70	326.90	327.10	327.30	327.50	327.70	327.80
100	325.30	325.50	325.70	325.90	326.00	326.20	326.50	326.60	326.70	326.90	327.10	327.30	327.50	327.70	327.80
200	325.30	325.50	325.70	325.90	326.00	326.20	326.50	326.60	326.70	326.90	327.10	327.30	327.50	327.70	327.80
300	325.30	325.50	325.70	325.90	326.00	326.20	326.50	326.60	326.70	326.90	327.10	327.30	327.50	327.70	327.80
400	325.30	325.50	325.70	325.90	326.00	326.20	326.50	326.60	326.70	326.90	327.10	327.30	327.50	327.70	327.80
500	325.30	325.50	325.70	325.90	326.00	326.20	326.50	326.60	326.70	326.90	327.10	327.30	327.50	327.70	327.80
600	325.30	325.50	325.70	325.90	326.00	326.20	326.50	326.60	326.70	326.90	327.10	327.30	327.50	327.70	327.80
700	325.30	325.50	325.70	325.90	326.00	326.20	326.50	326.60	326.70	326.90	327.10	327.30	327.50	327.70	327.80
800	325.30	325.50	325.70	325.90	326.00	326.20	326.50	326.60	326.70	326.90	327.10	327.30	327.50	327.70	327.80
900	325.30	325.50	325.70	325.90	326.00	326.20	326.50	326.60	326.70	326.90	327.10	327.30	327.50	327.70	327.80
1000	330.90	331.10	331.40	331.80	332.00	332.20	332.50	332.70	332.80	333.00	333.10	333.30	333.50	333.70	333.90
1100	330.90	331.10	331.40	331.80	332.00	332.20	332.50	332.70	332.80	333.00	333.10	333.30	333.50	333.70	333.90
1200	330.90	331.10	331.40	331.80	332.00	332.20	332.50	332.70	332.80	333.00	333.10	333.30	333.50	333.70	333.90
1300	330.90	331.10	331.40	331.80	332.00	332.20	332.50	332.70	332.80	333.00	333.10	333.30	333.50	333.70	333.90
1400	330.90	331.10	331.40	331.80	332.00	332.20	332.50	332.70	332.80	333.00	333.10	333.30	333.50	333.70	333.90
1500	330.90	331.10	331.40	331.80	332.00	332.20	332.50	332.70	332.80	333.00	333.10	333.30	333.50	333.70	333.90
1600	330.90	331.10	331.40	331.80	332.00	332.20	332.50	332.70	332.80	333.00	333.10	333.30	333.50	333.70	333.90
1700	330.90	331.10	331.40	331.80	332.00	332.20	332.50	332.70	332.80	333.00	333.10	333.30	333.50	333.70	333.90
1800	330.90	331.10	331.40	331.80	332.00	332.20	332.50	332.70	332.80	333.00	333.10	333.30	333.50	333.70	333.90
1900	330.90	331.10	331.40	331.80	332.00	332.20	332.50	332.70	332.80	333.00	333.10	333.30	333.50	333.70	333.90
2000	337.50	337.80	338.00	338.40	338.70	339.00	339.20	339.40	339.50	339.70	339.85	340.00	340.10	340.20	340.30
2100	337.50	337.80	338.00	338.40	338.70	339.00	339.20	339.40	339.50	339.70	339.85	340.00	340.10	340.20	340.30
2200	337.50	337.80	338.00	338.40	338.70	339.00	339.20	339.40	339.50	339.70	339.85	340.00	340.10	340.20	340.30
2300	337.50	337.80	338.00	338.40	338.70	339.00	339.20	339.40	339.50	339.70	339.85	340.00	340.10	340.20	340.30
2400	337.50	337.80	338.00	338.40	338.70	339.00	339.20	339.40	339.50	339.70	339.85	340.00	340.10	340.20	340.30
2500	337.50	337.80	338.00	338.40	338.70	339.00	339.20	339.40	339.50	339.70	339.85	340.00	340.10	340.20	340.30
2600	337.50	337.80	338.00	338.40	338.70	339.00	339.20	339.40	339.50	339.70	339.85	340.00	340.10	340.20	340.30
2700	337.50	337.80	338.00	338.40	338.70	339.00	339.20	339.40	339.50	339.70	339.85	340.00	340.10	340.20	340.30
2800	337.50	337.80	338.00	338.40	338.70	339.00	339.20	339.40	339.50	339.70	339.85	340.00	340.10	340.20	340.30
2900	337.50	337.80	338.00	338.40	338.70	339.00	339.20	339.40	339.50	339.70	339.85	340.00	340.10	340.20	340.30
3000	343.10	343.40	343.80	344.00	344.20	344.60	344.90	345.10	345.30	345.50	345.70	345.90	346.10	346.30	346.50

Bulk Modulus of Water as a Function of Pressure and Temperature

Appendix C-2 – Standard Formulas used for Pressure / Temperature Calculations



Bulk Modulus of Water as a Function of Pressure and Temperature

Appendix C-2 - Standard Formulas used for Pressure / Temperature Calculations

Name of Range: Expand

	Temperature																	
Pressure	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
14.70	4.55	5.00	5.50	5.90	6.30	6.50	7.00	7.50	8.00	8.30	8.60	9.00	9.45	9.75	10.00	10.50	10.75	11.10
100	4.55	5.00	5.50	5.90	6.30	6.50	7.00	7.50	8.00	8.30	8.60	9.00	9.45	9.75	10.00	10.50	10.75	11.10
200	4.55	5.00	5.50	5.90	6.30	6.50	7.00	7.50	8.00	8.30	8.60	9.00	9.45	9.75	10.00	10.50	10.75	11.10
300	4.55	5.00	5.50	5.90	6.30	6.50	7.00	7.50	8.00	8.30	8.60	9.00	9.45	9.75	10.00	10.50	10.75	11.10
400	4.55	5.00	5.50	5.90	6.30	6.50	7.00	7.50	8.00	8.30	8.60	9.00	9.45	9.75	10.00	10.50	10.75	11.10
500	4.55	5.00	5.50	5.90	6.30	6.50	7.00	7.50	8.00	8.30	8.60	9.00	9.45	9.75	10.00	10.50	10.75	11.10
600	4.55	5.00	5.50	5.90	6.30	6.50	7.00	7.50	8.00	8.30	8.60	9.00	9.45	9.75	10.00	10.50	10.75	11.10
700	4.55	5.00	5.50	5.90	6.30	6.50	7.00	7.50	8.00	8.30	8.60	9.00	9.45	9.75	10.00	10.50	10.75	11.10
800	4.55	5.00	5.50	5.90	6.30	6.50	7.00	7.50	8.00	8.30	8.60	9.00	9.45	9.75	10.00	10.50	10.75	11.10
900	4.55	5.00	5.50	5.90	6.30	6.50	7.00	7.50	8.00	8.30	8.60	9.00	9.45	9.75	10.00	10.50	10.75	11.10
1000	5.50	6.00	6.40	6.60	7.00	7.45	8.00	8.40	8.65	9.00	9.35	9.50	10.00	10.40	10.65	11.00	11.40	11.75
1100	5.50	6.00	6.40	6.60	7.00	7.45	8.00	8.40	8.65	9.00	9.35	9.50	10.00	10.40	10.65	11.00	11.40	11.75
1200	5.50	6.00	6.40	6.60	7.00	7.45	8.00	8.40	8.65	9.00	9.35	9.50	10.00	10.40	10.65	11.00	11.40	11.75
1300	5.50	6.00	6.40	6.60	7.00	7.45	8.00	8.40	8.65	9.00	9.35	9.50	10.00	10.40	10.65	11.00	11.40	11.75
1400	5.50	6.00	6.40	6.60	7.00	7.45	8.00	8.40	8.65	9.00	9.35	9.50	10.00	10.40	10.65	11.00	11.40	11.75
1500	5.50	6.00	6.40	6.60	7.00	7.45	8.00	8.40	8.65	9.00	9.35	9.50	10.00	10.40	10.65	11.00	11.40	11.75
1600	5.50	6.00	6.40	6.60	7.00	7.45	8.00	8.40	8.65	9.00	9.35	9.50	10.00	10.40	10.65	11.00	11.40	11.75
1700	5.50	6.00	6.40	6.60	7.00	7.45	8.00	8.40	8.65	9.00	9.35	9.50	10.00	10.40	10.65	11.00	11.40	11.75
1800	5.50	6.00	6.40	6.60	7.00	7.45	8.00	8.40	8.65	9.00	9.35	9.50	10.00	10.40	10.65	11.00	11.40	11.75
1900	5.50	6.00	6.40	6.60	7.00	7.45	8.00	8.40	8.65	9.00	9.35	9.50	10.00	10.40	10.65	11.00	11.40	11.75
2000	6.40	6.75	7.10	7.50	7.95	8.20	8.55	9.00	9.40	9.55	10.00	10.40	10.60	11.00	11.40	11.65	12.00	12.35
2100	6.40	6.75	7.10	7.50	7.95	8.20	8.55	9.00	9.40	9.55	10.00	10.40	10.60	11.00	11.40	11.65	12.00	12.35
2200	6.40	6.75	7.10	7.50	7.95	8.20	8.55	9.00	9.40	9.55	10.00	10.40	10.60	11.00	11.40	11.65	12.00	12.35
2300	6.40	6.75	7.10	7.50	7.95	8.20	8.55	9.00	9.40	9.55	10.00	10.40	10.60	11.00	11.40	11.65	12.00	12.35
2400	6.40	6.75	7.10	7.50	7.95	8.20	8.55	9.00	9.40	9.55	10.00	10.40	10.60	11.00	11.40	11.65	12.00	12.35
2500	6.40	6.75	7.10	7.50	7.95	8.20	8.55	9.00	9.40	9.55	10.00	10.40	10.60	11.00	11.40	11.65	12.00	12.35
2600	6.40	6.75	7.10	7.50	7.95	8.20	8.55	9.00	9.40	9.55	10.00	10.40	10.60	11.00	11.40	11.65	12.00	12.35
2700	6.40	6.75	7.10	7.50	7.95	8.20	8.55	9.00	9.40	9.55	10.00	10.40	10.60	11.00	11.40	11.65	12.00	12.35
2800	6.40	6.75	7.10	7.50	7.95	8.20	8.55	9.00	9.40	9.55	10.00	10.40	10.60	11.00	11.40	11.65	12.00	12.35
2900	6.40	6.75	7.10	7.50	7.95	8.20	8.55	9.00	9.40	9.55	10.00	10.40	10.60	11.00	11.40	11.65	12.00	12.35
3000	7.45	7.95	8.30	8.60	8.90	9.20	9.50	9.90	10.10	10.40	10.80	11.10	11.40	11.70	12.00	12.35	12.50	12.90

Volumetric Expansion Coefficient Table of Water as a Function of Pressure and Temperature

Appendix C-2 – Standard Formulas used for Pressure / Temperature Calculations

Name of Range: Expand

	Temperature																	
Pressure	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
14.70	11.45	11.80	12.25	12.50	12.90	13.00	13.60	13.90	14.20	14.50	14.70	15.00	15.40	15.60	15.90	16.20	16.55	16.80
100	11.45	11.80	12.25	12.50	12.90	13.00	13.60	13.90	14.20	14.50	14.70	15.00	15.40	15.60	15.90	16.20	16.55	16.80
200	11.45	11.80	12.25	12.50	12.90	13.00	13.60	13.90	14.20	14.50	14.70	15.00	15.40	15.60	15.90	16.20	16.55	16.80
300	11.45	11.80	12.25	12.50	12.90	13.00	13.60	13.90	14.20	14.50	14.70	15.00	15.40	15.60	15.90	16.20	16.55	16.80
400	11.45	11.80	12.25	12.50	12.90	13.00	13.60	13.90	14.20	14.50	14.70	15.00	15.40	15.60	15.90	16.20	16.55	16.80
500	11.45	11.80	12.25	12.50	12.90	13.00	13.60	13.90	14.20	14.50	14.70	15.00	15.40	15.60	15.90	16.20	16.55	16.80
600	11.45	11.80	12.25	12.50	12.90	13.00	13.60	13.90	14.20	14.50	14.70	15.00	15.40	15.60	15.90	16.20	16.55	16.80
700	11.45	11.80	12.25	12.50	12.90	13.00	13.60	13.90	14.20	14.50	14.70	15.00	15.40	15.60	15.90	16.20	16.55	16.80
800	11.45	11.80	12.25	12.50	12.90	13.00	13.60	13.90	14.20	14.50	14.70	15.00	15.40	15.60	15.90	16.20	16.55	16.80
900	11.45	11.80	12.25	12.50	12.90	13.00	13.60	13.90	14.20	14.50	14.70	15.00	15.40	15.60	15.90	16.20	16.55	16.80
1000	12.00	12.30	12.65	13.00	13.40	13.70	14.00	14.30	14.60	14.80	15.00	15.40	15.60	15.90	16.20	16.50	16.75	17.00
1100	12.00	12.30	12.65	13.00	13.40	13.70	14.00	14.30	14.60	14.80	15.00	15.40	15.60	15.90	16.20	16.50	16.75	17.00
1200	12.00	12.30	12.65	13.00	13.40	13.70	14.00	14.30	14.60	14.80	15.00	15.40	15.60	15.90	16.20	16.50	16.75	17.00
1300	12.00	12.30	12.65	13.00	13.40	13.70	14.00	14.30	14.60	14.80	15.00	15.40	15.60	15.90	16.20	16.50	16.75	17.00
1400	12.00	12.30	12.65	13.00	13.40	13.70	14.00	14.30	14.60	14.80	15.00	15.40	15.60	15.90	16.20	16.50	16.75	17.00
1500	12.00	12.30	12.65	13.00	13.40	13.70	14.00	14.30	14.60	14.80	15.00	15.40	15.60	15.90	16.20	16.50	16.75	17.00
1600	12.00	12.30	12.65	13.00	13.40	13.70	14.00	14.30	14.60	14.80	15.00	15.40	15.60	15.90	16.20	16.50	16.75	17.00
1700	12.00	12.30	12.65	13.00	13.40	13.70	14.00	14.30	14.60	14.80	15.00	15.40	15.60	15.90	16.20	16.50	16.75	17.00
1800	12.00	12.30	12.65	13.00	13.40	13.70	14.00	14.30	14.60	14.80	15.00	15.40	15.60	15.90	16.20	16.50	16.75	17.00
1900	12.00	12.30	12.65	13.00	13.40	13.70	14.00	14.30	14.60	14.80	15.00	15.40	15.60	15.90	16.20	16.50	16.75	17.00
2000	12.50	12.90	13.30	13.60	13.90	14.20	14.50	14.70	14.90	15.10	15.50	15.70	16.00	16.40	16.60	16.80	17.10	17.50
2100	12.50	12.90	13.30	13.60	13.90	14.20	14.50	14.70	14.90	15.10	15.50	15.70	16.00	16.40	16.60	16.80	17.10	17.50
2200	12.50	12.90	13.30	13.60	13.90	14.20	14.50	14.70	14.90	15.10	15.50	15.70	16.00	16.40	16.60	16.80	17.10	17.50
2300	12.50	12.90	13.30	13.60	13.90	14.20	14.50	14.70	14.90	15.10	15.50	15.70	16.00	16.40	16.60	16.80	17.10	17.50
2400	12.50	12.90	13.30	13.60	13.90	14.20	14.50	14.70	14.90	15.10	15.50	15.70	16.00	16.40	16.60	16.80	17.10	17.50
2500	12.50	12.90	13.30	13.60	13.90	14.20	14.50	14.70	14.90	15.10	15.50	15.70	16.00	16.40	16.60	16.80	17.10	17.50
2600	12.50	12.90	13.30	13.60	13.90	14.20	14.50	14.70	14.90	15.10	15.50	15.70	16.00	16.40	16.60	16.80	17.10	17.50
2700	12.50	12.90	13.30	13.60	13.90	14.20	14.50	14.70	14.90	15.10	15.50	15.70	16.00	16.40	16.60	16.80	17.10	17.50
2800	12.50	12.90	13.30	13.60	13.90	14.20	14.50	14.70	14.90	15.10	15.50	15.70	16.00	16.40	16.60	16.80	17.10	17.50
2900	12.50	12.90	13.30	13.60	13.90	14.20	14.50	14.70	14.90	15.10	15.50	15.70	16.00	16.40	16.60	16.80	17.10	17.50
3000	13.10	13.50	13.80	14.05	14.40	14.60	14.80	14.90	15.20	15.50	15.75	16.00	16.40	16.60	16.80	17.00	17.40	17.60

Volumetric Expansion Coefficient Table of Water as a Function of Pressure and Temperature

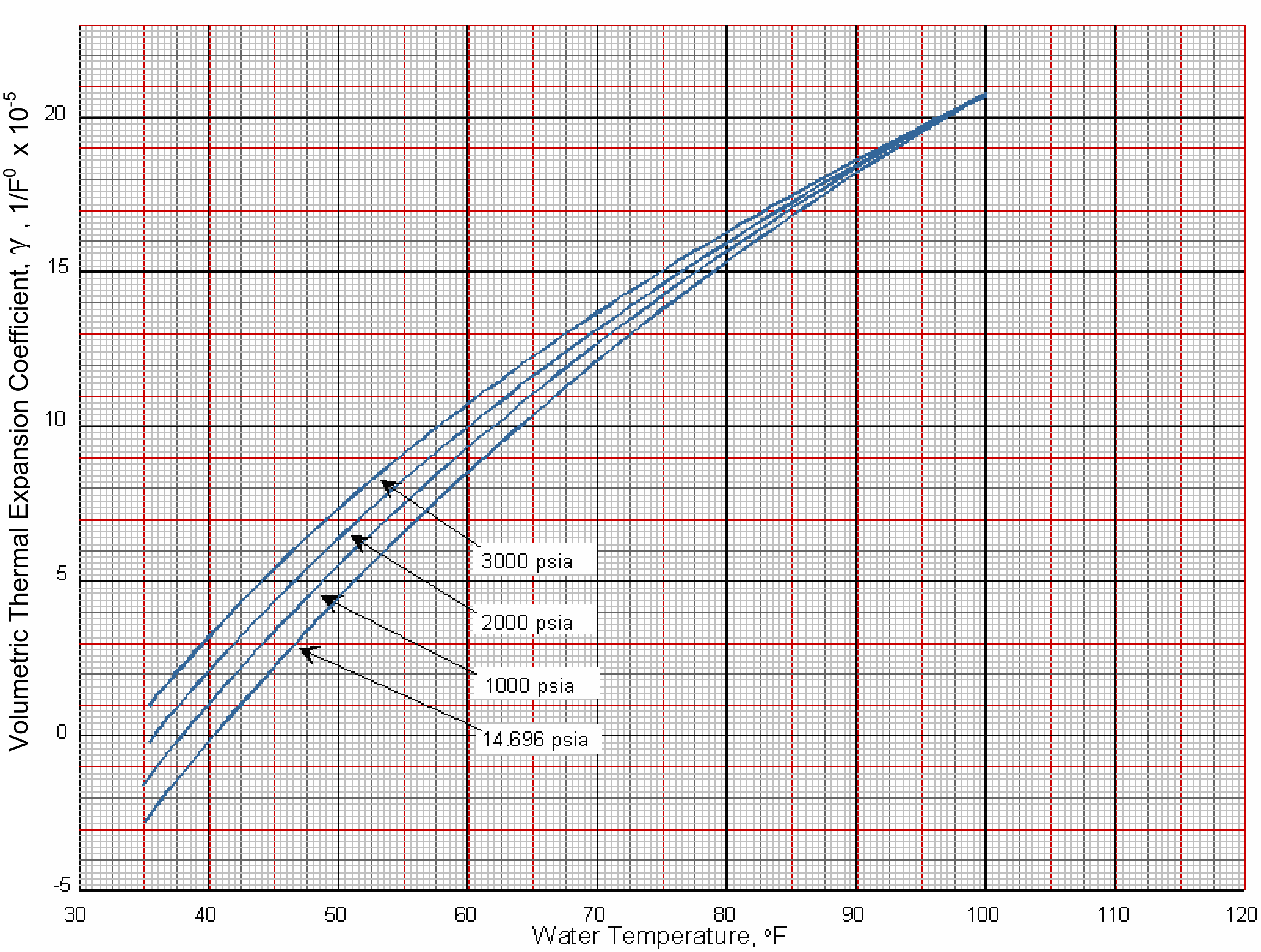
Appendix C-2 – Standard Formulas used for Pressure / Temperature Calculations

Name of Range: Expand

	Temperature														
Pressure	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
14.70	17.10	17.50	17.75	18.00	18.25	18.60	18.80	19.20	19.40	19.60	19.70	20.00	20.30	20.50	20.80
100	17.10	17.50	17.75	18.00	18.25	18.60	18.80	19.20	19.40	19.60	19.70	20.00	20.30	20.50	20.80
200	17.10	17.50	17.75	18.00	18.25	18.60	18.80	19.20	19.40	19.60	19.70	20.00	20.30	20.50	20.80
300	17.10	17.50	17.75	18.00	18.25	18.60	18.80	19.20	19.40	19.60	19.70	20.00	20.30	20.50	20.80
400	17.10	17.50	17.75	18.00	18.25	18.60	18.80	19.20	19.40	19.60	19.70	20.00	20.30	20.50	20.80
500	17.10	17.50	17.75	18.00	18.25	18.60	18.80	19.20	19.40	19.60	19.70	20.00	20.30	20.50	20.80
600	17.10	17.50	17.75	18.00	18.25	18.60	18.80	19.20	19.40	19.60	19.70	20.00	20.30	20.50	20.80
700	17.10	17.50	17.75	18.00	18.25	18.60	18.80	19.20	19.40	19.60	19.70	20.00	20.30	20.50	20.80
800	17.10	17.50	17.75	18.00	18.25	18.60	18.80	19.20	19.40	19.60	19.70	20.00	20.30	20.50	20.80
900	17.10	17.50	17.75	18.00	18.25	18.60	18.80	19.20	19.40	19.60	19.70	20.00	20.30	20.50	20.80
1000	17.40	17.60	17.90	18.20	18.40	18.70	18.90	19.20	19.40	19.60	19.80	20.00	20.30	20.50	20.80
1100	17.40	17.60	17.90	18.20	18.40	18.70	18.90	19.20	19.40	19.60	19.80	20.00	20.30	20.50	20.80
1200	17.40	17.60	17.90	18.20	18.40	18.70	18.90	19.20	19.40	19.60	19.80	20.00	20.30	20.50	20.80
1300	17.40	17.60	17.90	18.20	18.40	18.70	18.90	19.20	19.40	19.60	19.80	20.00	20.30	20.50	20.80
1400	17.40	17.60	17.90	18.20	18.40	18.70	18.90	19.20	19.40	19.60	19.80	20.00	20.30	20.50	20.80
1500	17.40	17.60	17.90	18.20	18.40	18.70	18.90	19.20	19.40	19.60	19.80	20.00	20.30	20.50	20.80
1600	17.40	17.60	17.90	18.20	18.40	18.70	18.90	19.20	19.40	19.60	19.80	20.00	20.30	20.50	20.80
1700	17.40	17.60	17.90	18.20	18.40	18.70	18.90	19.20	19.40	19.60	19.80	20.00	20.30	20.50	20.80
1800	17.40	17.60	17.90	18.20	18.40	18.70	18.90	19.20	19.40	19.60	19.80	20.00	20.30	20.50	20.80
1900	17.40	17.60	17.90	18.20	18.40	18.70	18.90	19.20	19.40	19.60	19.80	20.00	20.30	20.50	20.80
2000	17.70	17.90	18.10	18.40	18.60	18.80	19.00	19.20	19.60	19.70	19.90	20.10	20.40	20.50	20.80
2100	17.70	17.90	18.10	18.40	18.60	18.80	19.00	19.20	19.60	19.70	19.90	20.10	20.40	20.50	20.80
2200	17.70	17.90	18.10	18.40	18.60	18.80	19.00	19.20	19.60	19.70	19.90	20.10	20.40	20.50	20.80
2300	17.70	17.90	18.10	18.40	18.60	18.80	19.00	19.20	19.60	19.70	19.90	20.10	20.40	20.50	20.80
2400	17.70	17.90	18.10	18.40	18.60	18.80	19.00	19.20	19.60	19.70	19.90	20.10	20.40	20.50	20.80
2500	17.70	17.90	18.10	18.40	18.60	18.80	19.00	19.20	19.60	19.70	19.90	20.10	20.40	20.50	20.80
2600	17.70	17.90	18.10	18.40	18.60	18.80	19.00	19.20	19.60	19.70	19.90	20.10	20.40	20.50	20.80
2700	17.70	17.90	18.10	18.40	18.60	18.80	19.00	19.20	19.60	19.70	19.90	20.10	20.40	20.50	20.80
2800	17.70	17.90	18.10	18.40	18.60	18.80	19.00	19.20	19.60	19.70	19.90	20.10	20.40	20.50	20.80
2900	17.70	17.90	18.10	18.40	18.60	18.80	19.00	19.20	19.60	19.70	19.90	20.10	20.40	20.50	20.80
3000	17.90	18.10	18.40	18.60	18.80	19.00	19.30	19.50	19.75	19.90	20.20	20.40	20.50	20.75	20.90

Volumetric Expansion Coefficient Table of Water as a Function of Pressure and Temperature

Appendix C-2 - Standard Formulas used for Pressure/Temperature Calculations



Volumetric Expansion Coefficient Table of Water as a Function of Pressure and Temperature

CALIFORNIA STATE FIRE MARSHAL
PIPELINE SAFETY DIVISION
HYDROSTATIC TEST RESULTS
PIPELINE DATA

Test Date	CSFM Test ID #
Pipeline Operator	Independent Testing Firm

Kind of Test [ ] Annual [ ] 2 Year [ ] 3 Year [ ] 5 Year [ ] 10 Year

Pipeline Identification (description, line number, name, pre-tested pipe, etc.)

[ ] Pre-tested pipe [ ] New [ ] Replacement or relocation [ ] Station piping

Pipeline Location (mile post, street, station, etc.)

CSFM #: 00000-0000	From: To:

Normal Product Transported

Test Medium [ ] Water [ ] Diesel [ ] Fuel Oil [ ] JP-5 [ ] Other

Location of Deadweight Tester	Elevation

Elevation of Pipeline - High Point Low Point

Maximum Operating Pressure (Based on 80% of Minimum Test Pressure)

PIPE DATA

Pipe O.D.	Wall Thickness	Specification & Grade (SYMS)	Length of Pipe Being tested (ft.)	Volume (Barrels)

TEST EQUIPMENT

Make of Deadweight Tester	Serial #	Date Last Calibrated
Make of Pressure Chart Recorder	Serial #	Date Last Calibrated
Make of Temperature Recorder	Serial #	Date Last Calibrated

COMMENTS (additional Information)

GPS LOCATIONS:

Beginning Location:	**Ending Location:**
Latitude:	Latitude:
Longitude:	Longitude:

TEST DATA					CSFM TEST ID #			
Date	**Time**	**Deadweight Pressure (psig)**	**Chart Pressure (psig)**	**Pipe Wall Temp**	**Ambient Temp**	**Medium Temp.**	**Test Medium Change (+) Added (-) Drained**	**Comments**
Net Change:								

LIST ALL LEAKS ON LINE PIPE RESULTING FROM UNSUCCESSFUL TEST ATTEMPTS	
LOCATION	CAUSE

CERTIFICATION	
Name of Company Conducting Test	
Name of Independent Testing Firm Witnessing Test	
Name of Certified Independent Witness on Site	Date
Pipeline Operator’s Representative on Site	Date
Name of Person Certifying Test Data for Witnessing Firm	Date

APPENDIX E

IMP Rule section §195.450 - (Appendix E)

This Appendix gives guidance to help an operator implement the requirements of the integrity management program rule in §195.450 and §195.452. Guidance is provided on:

(1) Information an operator may use to identify a high consequence area and factors an operator can use to consider the potential impacts of a release on an area;
(2) Risk factors an operator can use to determine an integrity assessment schedule;
(3) Safety risk indicator tables for leak history, volume or line size, age of pipeline, and product transported, an operator may use to determine if a pipeline segment falls into a high, medium or low risk category;
(4) Types of internal inspection tools an operator could use to find pipeline anomalies;

(5) Measures an operator could use to measure an integrity management program's performance; and
(6) Types of records an operator will have to maintain.
(7) Types of conditions that an integrity assessment may identify that an operator should include in its required schedule for evaluation and remediation.

I. Identifying a high consequence area and factors for considering a pipeline segment's potential impact on a high consequence area.

A. The rule defines a High Consequence Area as a high population area, an other populated area, an unusually sensitive area, or a commercially navigable waterway. The Office of Pipeline Safety (OPS) will map these areas on the National Pipeline Mapping System (NPMS). An operator, member of the public or other government agency may view and download the data from the NPMS home page http://www.npms.rspa.dot.gov. OPS will maintain the NPMS and update it periodically. However, it is an operator's responsibility to ensure that it has identified all high consequence areas that could be affected by a pipeline segment. An operator is also responsible for periodically evaluating its pipeline segments to look for population or environmental changes that may have occurred around the pipeline and to keep its program current with this information. (Refer to §195.452(d)(3).) For more information to help in identifying high consequence areas, an operator may refer to:

(1) Digital Data on populated areas available on U.S. Census Bureau maps.
(2) Geographic Database on the commercial navigable waterways available on http://www.bts.gov/gis/ntatlas/networks.html.
(3) The Bureau of Transportation Statistics database that includes commercially navigable waterways and non-commercially navigable waterways. The database can be downloaded from the BTS website at http://www.bts.gov/gis/ntatlas/networks.html.

B. The rule requires an operator to include a process in its program for identifying which pipeline segments could affect a high consequence area and to take measures to prevent and mitigate the consequences of a pipeline failure that could affect a high consequence area. (See §195.452 (f) and (i).)

Thus, an operator will need to consider how each pipeline segment could affect a high consequence area. The primary source for the listed risk factors is a US DOT study on instrumented Internal Inspection devices (November 1992). Other sources include the National Transportation Safety Board, the Environmental Protection Agency and the Technical Hazardous Liquid Pipeline Safety Standards Committee. The following list provides guidance to an operator on both the mandatory and additional factors:

(1) Terrain surrounding the pipeline. An operator should consider the contour of the land profile and if it could allow the liquid from a release to enter a high consequence area. An operator can get this information from topographical maps such as U.S. Geological Survey quadrangle maps.
(2) Drainage systems such as small streams and other smaller waterways that could serve as a conduit to a high consequence area.
(3) Crossing of farm tile fields. An operator should consider the possibility of a spillage in the field following the drain tile into a waterway.

(4) Crossing of roadways with ditches along the side. The ditches could carry a spillage to a waterway.
(5) The nature and characteristics of the product the pipeline is transporting (refined products, crude oils, highly volatile liquids, etc.) Highly volatile liquids become gaseous when exposed to the atmosphere. A spillage could create a vapor cloud that could settle into the lower elevation of the ground profile.
(6) Physical support of the pipeline segment such as by a cable suspension bridge. An operator should look for stress indicators on the pipeline (strained supports, inadequate support at towers), atmospheric corrosion, vandalism, and other obvious signs of improper maintenance.

(7) Operating conditions of the pipeline (pressure, flow rate, etc.). Exposure of the pipeline to an operating pressure exceeding the established maximum operating pressure.
(8) The hydraulic gradient of the pipeline.
(9) The diameter of the pipeline, the potential release volume, and the distance between the isolation points.
(10) Potential physical pathways between the pipeline and the high consequence area.

(11) Response capability (time to respond, nature of response).
(12) Potential natural forces inherent in the area (flood zones, earthquakes, subsidence areas, etc.)

II. Risk factors for establishing frequency of assessment.

A. By assigning weights or values to the risk factors, and using the risk indicator tables, an operator can determine the priority for assessing pipeline segments, beginning with those segments that are of highest risk, that have not previously been assessed. This list provides some guidance on some of the risk factors to consider (see §195.452 (e)).
An operator should also develop factors specific to each pipeline segment it is assessing, including:

(1) Populated areas, unusually sensitive environmental areas, National Fish Hatcheries, commercially navigable waters, areas where people congregate.
(2) Results from previous testing/inspection. (See §195.452(h).)
(3) Leak History. (See leak history risk table.)
(4) Known corrosion or condition of pipeline. (See §195.452 (g).)
(5) Cathodic protection history.
(6) Type and quality of pipe coating (disbonded coating results in corrosion).

(7) Age of pipe (older pipe shows more corrosion–may be uncoated or have an ineffective coating) and type of pipe seam. (See Age of Pipe risk table.)
(8) Product transported (highly volatile, highly flammable and toxic liquids present a greater threat for both people and the environment) (see Product transported risk table.)
(9) Pipe wall thickness (thicker walls give a better safety margin)
(10) Size of pipe (higher volume release if the pipe ruptures).
(11) Location related to potential ground movement (e.g., seismic faults, rock quarries, and coal mines); climatic (permafrost causes settlement–Alaska); geologic (landslides or subsidence).

(12) Security of throughput (effects on customers if there is failure requiring shutdown).
(13) Time since the last internal inspection/pressure testing.
(14) With respect to previously discovered defects/anomalies, the type, growth rate, and size.
(15) Operating stress levels in the pipeline.
(16) Location of the pipeline segment as it relates to the ability of the operator to detect and respond to a leak. (e.g., pipelines deep underground, or in locations that make leak detection difficult without specific sectional monitoring and/or significantly impede access for spill response or any other purpose).

(17) Physical support of the segment such as by a cable suspension bridge.
(18) Non-standard or other than recognized industry practice on pipeline installation (e.g., horizontal directional drilling).

B. Example: This example illustrates a hypothetical model used to establish an integrity assessment schedule for a hypothetical pipeline segment. After we determine the risk factors applicable to the pipeline segment, we then assign values or numbers to each factor, such as, high (5), moderate (3), or low (1). We can determine an overall risk classification (A, B, C) for the segment using the risk tables and a sliding scale (values 5 to 1) for risk factors for which tables are not provided. We would classify a segment as C if it fell above 2/3 of maximum value (highest overall risk value for any one segment when compared with other segments of a pipeline), a segment as B if it fell between 1/3 to 2/3 of maximum value, and the remaining segments as A.

i. For the baseline assessment schedule, we would plan to assess 50% of all pipeline segments covered by the rule, beginning with the highest risk segments, within the first 3½ years and the remaining segments within the seven-year period. For the continuing integrity assessments, we would plan to assess the C segments within the first two (2) years of the schedule, the segments classified as moderate risk no later than year three or four and the remaining lowest risk segments no later than year five (5).

ii. For our hypothetical pipeline segment, we have chosen the following risk factors and obtained risk factor values from the appropriate table. The values assigned to the risk factors are for illustration only.

Age of pipeline: assume 30 years old (refer to "Age of Pipeline" risk table)–
Risk Value=5
Pressure tested: tested once during construction–
Risk Value=5
Coated: (yes/no)–yes
Coating Condition: Recent excavation of suspected areas showed holidays in coating (potential corrosion risk)–
Risk Value=5
Cathodically Protected: (yes/no)–yes–Risk Value=1

Date cathodic protection installed: five years after pipeline was constructed (Cathodic protection installed within one year of the pipeline's construction is generally considered low risk.)–Risk Value=3

Close interval survey: (yes/no)–no–Risk Value =5
Internal Inspection tool used: (yes/no)–yes. Date of pig run? In last five years–Risk Value=1
Anomalies found: (yes/no)–yes, but do not pose an immediate safety risk or environmental hazard–Risk Value=3
Leak History: yes, one spill in last 10 years. (Refer to "Leak History" risk table)–Risk Value=2
Product transported: Diesel fuel. Product low risk. (Refer to "Product" risk table)–Risk Value=1

Pipe size: 16 inches. Size presents moderate risk (refer to "Line Size" risk table)–Risk Value=3

iii. Overall risk value for this hypothetical segment of pipe is 34. Assume we have two other pipeline segments for which we conduct similar risk rankings. The second pipeline segment has an overall risk value of 20, and the third segment, 11. For the baseline assessment we would establish a schedule where we assess the first segment (highest risk segment) within two years, the second segment within five years and the third segment within seven years. Similarly, for the continuing integrity assessment, we could establish an assessment schedule where we assess the highest risk segment no later than the second year, the second segment no later than the third year, and the third segment no later than the fifth year.

III. Safety risk indicator tables for leak history, volume or line size, age of pipeline, and product transported.

LEAK HISTORY

Safety risk indicator	Leak history (Time-dependent defects)1
High	> 3 Spills in last 10 years
Low	< 3 Spills in last 10 years

1. Time-dependent defects are those that result in spills due to corrosion, gouges, or problems developed during manufacture, construction or operation, etc.

LINE SIZE OR VOLUME TRANSPORTED

Safety risk indicator	Line size
High	= 18"
Moderate	10"–16" nominal diameters
Low	= 8" nominal diameter

AGE OF PIPELINE

Safety risk indicator	Age Pipeline condition dependent1
High	> 25 years
Low	25 years

1 Depends on pipeline's coating & corrosion condition, and steel quality, toughness, welding.

PRODUCT TRANSPORTED

Safety risk indicator Considerations .... Product examples
High (Highly volatile and flammable)(Propane, butane, Natural Gas Liquid (NGL), ammonia).
Highly toxic (Benzene, high Hydrogen Sulfide content crude oils).
Medium Flammable-flashpoint <100F .... (Gasoline, JP4, low flashpoint crude oils).
Low Non-flammable–flashpoint 100+F ..(Diesel, fuel oil, kerosene, JP5, most crude oils).

1 The degree of acute and chronic toxicity to humans, wildlife, and aquatic life; reactivity; and, volatility, flammability, and water solubility determine the Product Indicator. Comprehensive Environmental Response, Compensation and Liability Act Reportable Quantity values may be used as an indication of chronic toxicity. National Fire Protection Association health factors may be used for rating acute hazards.

IV. Types of internal inspection tools to use.

An operator should consider at least two types of internal inspection tools for the integrity assessment from the following list. The type of tool or tools an operator selects will depend on the results from previous internal inspection runs, information analysis and risk factors specific to the pipeline segment:

(1) Geometry Internal inspection tools for detecting changes to ovality, e.g., bends, dents, buckles or wrinkles, due to construction flaws or soil movement, or other outside force damage;
(2) Metal Loss Tools (Ultrasonic and Magnetic Flux Leakage) for determining pipe wall anomalies, e.g., wall loss due to corrosion.
(3) Crack Detection Tools for detecting cracks and crack-like features, e.g., stress corrosion cracking (SCC), fatigue cracks, narrow axial corrosion, toe cracks, hook cracks, etc.

V. Methods to measure performance.

A. General.

(1) This guidance is to help an operator establish measures to evaluate the effectiveness of its integrity management program. The performance measures required will depend on the details of each integrity management program and will be based on an understanding and analysis of the failure mechanisms or threats to integrity of each pipeline segment.
(2) An operator should select a set of measurements to judge how well its program is performing. An operator's objectives for its program are to ensure public safety, prevent or minimize leaks and spills and prevent property and environmental damage. A typical integrity management program will be an ongoing program and it may contain many elements. Therefore, several performance measures are likely to be needed to measure the effectiveness of an ongoing program.

B. Performance measures. These measures show how a program to control risk on pipeline segments that could affect a high consequence area is progressing under the integrity management requirements. Performance measures generally fall into three categories:

(1) Selected Activity Measures–Measures that monitor the surveillance and preventive activities the operator has implemented. These measures indicate how well an operator is implementing the various elements of its integrity management program.
(2) Deterioration Measures–Operation and maintenance trends that indicate when the integrity of the system is weakening despite preventive measures. This category of performance measure may indicate that the system condition is deteriorating despite well executed preventive activities.

(3) Failure Measures–Leak History, incident response, product loss, etc. These measures will indicate progress towards fewer spills and less damage.

C. Internal vs. External Comparisons. These comparisons show how a pipeline segment that could affect a high consequence area is progressing in comparison to the operator's other pipeline segments that are not covered by the integrity management requirements and how that pipeline segment compares to other operators' pipeline segments.

(1) Internal–Comparing data from the pipeline segment that could affect the high consequence area with data from pipeline segments in other areas of the system may indicate the effects from the attention given to the high consequence area.
(2) External–Comparing data external to the pipeline segment (e.g., OPS incident data) may provide measures on the frequency and size of leaks in relation to other companies.

D. Examples. Some examples of performance measures an operator could use include–

(1) A performance measurement goal to reduce the total volume from unintended releases by -% (percent to be determined by operator) with an ultimate goal of zero.
(2) A performance measurement goal to reduce the total number of unintended releases (based on a threshold of 5 gallons) by ____-% (percent to be determined by operator) with an ultimate goal of zero.
(3) A performance measurement goal to document the percentage of integrity management activities completed during the calendar year.

(4) A performance measurement goal to track and evaluate the effectiveness of the operator's community outreach activities.
(5) A narrative description of pipeline system integrity, including a summary of performance improvements, both qualitative and quantitative, to an operator's integrity management program prepared periodically.
(6) A performance measure based on internal audits of the operator's pipeline system per 49 CFR Part §195.
(7) A performance measure based on external audits of the operator's pipeline system per 49 CFR Part §195.

(8) A performance measure based on operational events (for example: relief occurrences, unplanned valve closure, SCADA outages, etc.) that have the potential to adversely affect pipeline integrity.
(9) A performance measure to demonstrate that the operator's integrity management program reduces risk over time with a focus on high risk items.
(10) A performance measure to demonstrate that the operator's integrity management program for pipeline stations and terminals reduces risk over time with a focus on high risk items.

VI. Examples of types of records an operator must maintain.

The rule requires an operator to maintain certain records. (See §195.452(l)). This section provides examples of some records that an operator would have to maintain for inspection to comply with the requirement. This is not an exhaustive list.

(1) A process for identifying which pipelines could affect a high consequence area and a document identifying all pipeline segments that could affect a high consequence area;
(2) A plan for baseline assessment of the line pipe that includes each required plan element;
(3) Modifications to the baseline plan and reasons for the modification;
(4) Use of and support for an alternative practice;

(5) A framework addressing each required element of the integrity management program, updates and changes to the initial framework and eventual program;

(6) A process for identifying a new high consequence area and incorporating it into the baseline plan, particularly, a process for identifying population changes around a pipeline segment;
(7) An explanation of methods selected to assess the integrity of line pipe;
(8) A process for review of integrity assessment results and data analysis by a person qualified to evaluate the results and data;
(9) The process and risk factors for determining the baseline assessment interval;

(10) Results of the baseline integrity assessment;
(11) The process used for continual evaluation, and risk factors used for determining the frequency of evaluation;
(12) Process for integrating and analyzing information about the integrity of a pipeline, information and data used for the information analysis;
(13) Results of the information analyses and periodic evaluations;
(14) The process and risk factors for establishing continual re-assessment intervals;
(15) Justification to support any variance from the required re-assessment intervals;

(16) Integrity assessment results and anomalies found, process for evaluating and repairing anomalies, criteria for repair actions and actions taken to evaluate and repair the anomalies;
(17) Other remedial actions planned or taken;
(18) Schedule for evaluation and repair of anomalies, justification to support deviation from required repair times;
(19) Risk analysis used to identify additional preventive or mitigative measures, records of preventive and mitigative actions planned or taken;

(20) Criteria for determining EFRD installation;
(21) Criteria for evaluating and modifying leak detection capability;

(22) Methods used to measure the program's effectiveness.

VII. Conditions that may impair a pipeline's integrity.

Section §195.452(h) requires an operator to evaluate and remediate all pipeline integrity issues raised by the integrity assessment or information analysis. An operator must develop a schedule that prioritizes conditions discovered on the pipeline for evaluation and remediation. The following are some examples of conditions that an operator should schedule for evaluation and remediation.

A. Any change since the previous assessment.
B. Mechanical damage that is located on the top side of the pipe.
C. An anomaly abrupt in nature.
D. An anomaly longitudinal in orientation.
E. An anomaly over a large area.
F. An anomaly located in or near a casing, a crossing of another pipeline, or an area with suspect cathodic protection.

[Amdt. 195-70, 65 FR 75378, Dec. 1, 2000; Amdt. 195-74, 67 FR 1650. Jan 14, 2002]

California Department of Forestry and Fire Protection
OFFICE OF THE STATE FIRE MARSHAL
PIPELINE SAFETY DIVISION

CSFM

INITIAL APPLICATION

Approval as an Independent Hydrostatic Testing Firm

INSTRUCTIONS:

1. Complete all sections of this form. Entries must be in ink or typed. If the submitted form is not legible it will be returned. Please note that this form must be notarized.

2. The completed form must be accompanied by the required fee of $1,500.00. Payment may be made by check or money order drawn on a United States bank. Checks/money orders drawn on foreign banks are not acceptable. The State Fire Marshal cannot accept credit cards or purchase orders as payment.

3. All data must be submitted to the address listed below:

   California State Fire Marshal
   Pipeline Safety Division
   PO Box 944246
   Sacramento, CA 94244-2460

4. Answers to questions regarding this application may be obtained by mail at the above address or by telephoning (916) 445-8477

1.	Name of Company:	
2.	Mailing Address:	
3.	Physical Location Address: *(do not use PO Box)*	
4.	Business Telephone:	( )
5.	Business Fax:	( )
6.	This application is made the firm Listed above doing business as *(check one)*	Sole Owner/Individual Corporation Partnership

7.	**Responsible Parties:** Identify all owners, partners, and/or officers of the company. If additional space is necessary, please attach a separate sheet.		
	SOLE OWNER	Print Name	
		Signature	
		Date	
	CORPORATION OFFICERS	Print Name	
		Signature	
		Date	
		Print Name	
		Signature	
		Date	
	ALL MEMBERS OF THE PARTNERSHIP	Print Name	
		Signature	
		Date	
		Print Name	
		Signature	
		Date	
		Print Name	
		Signature	
		Date	
8.	**Work History:** Attach three Hydrostatic Test Pressure Reports made within the past three years. All Hydrostatic Test Reports must comply with the California Government Code and Part 195.310, Title 49, Code of Federal Regulations.		
9.	**Character References:** Submit three letters attesting to the character, financial responsibility and integrity of administrative, managerial and supervisorial personnel. Letters must include the name and address of each reference AND must include the name of the applicant. These letters must be received by the California State Fire Marshal within 60 days of application submittal.		

10.	**Hydrostatic Testers:** Attach a completed Hydrostatic Testers form (Form #1-HYD). Provide the names of the persons who will be conducting hydrostatic testing in the name of your company. List all pertinent contractor licenses, professional degrees and other similar data. ***Please submit one form per person.***
11.	**Certification/Notarization:** I certify under penalty of perjury that the foregoing information is true. Print Name: ____________________ Title: ____________________ Signature: ____________________ Date: ____________________ Place: ____________________

NOTARY

California Department of Forestry and Fire Protection
OFFICE OF THE STATE FIRE MARSHAL
PIPELINE SAFETY DIVISION

CSFM

FORM #1-HYD

EMPLOYEES AUTHORIZED TO CONDUCT HYDROSTATIC TESTING

Name of Firm: ______________________________ Date: ____________

Employee Name: ______________________________
(one name per form)

This employee is authorized to perform the following in the name of the firm listed above:
Witness hydrostatic testing operations
Certify hydrostatic testing result

Authorized by: ______________________________
(signature of company officer)

License/Professional Degree	Date Issued

Pipeline, Petrochemical or Related Qualifying Experience

Return completed form to:

California State Fire Marshal
Pipeline Safety Division
PO Box 944246
Sacramento, CA 94244-246