



# Seismic Vulnerability Assessment Forms

## Form 3: Pipes and Pipeline Systems

**Note:** Liquid Natural Gas pipeline systems are addressed separately

### General Pipeline Systems Information

For each of the following seven questions, use the PIP number to ID the question, and use the facility's code for each pipeline to respond. For example, for pipeline issues, see Figures 6-14 to 6-17 in "*Guidelines for Seismic Evaluation and Design of Petrochemical Facilities*", ASCE, 3<sup>rd</sup> edition 2020.

1. Provide current P&IDs for all pipelines on the facility. Provide the jurisdictional limits of the facility pipelines **(PIP1)**
2. Provide for each pipeline: product, age, inspection history (internal and external) **(PIP2)**
3. Identify all pipelines that are buried with locations **(PIP3)**
4. Identify any pipelines that are on raised racks **(PIP4)**
5. Identify any and all pressure tests on pipelines (e.g. static liquid pressure tests, SLPT) **(PIP5)**
6. Are there any pipe flanges over water **(PIP6)**
7. Provide all pipeline stress analyses and dates **(PIP7)**

### Preliminary CalARP walk-down inspection (Ref. 1)

For each of the following questions, use the PIP number to ID the question, and respond with specific pipelines to answer the following 24 questions. For any of the following questions have a response for any pipeline, use the PIP number and then use the facility's ID for each specific pipeline that answers the question.

1. Any historical seismic anchor movement **(PIP8)**
2. Any interaction of the pipelines with adjacent elements, especially existing tanks, or berms **(PIP9)**
3. Corrosion **(PIP10)**
  - a. Extensive corrosion
  - b. Malfunction of cathodic protection systems for an extended period (buried pipes) (inspection reports for CP systems will be included in the submittals)
4. Are there any non-ductile materials (e.g. cast iron, fiberglass, etc.) **(PIP11)**
5. Any failures of pipeline support **(PIP12)**
6. Any evidence of settlement of supports/pipelines **(PIP13)**
7. For buried pipelines: **(PIP14)**
  - a. Possible liquefaction and lateral spreading
  - b. Seismic displacement
  - c. Surface faulting
  - d. Landslides
8. Long unsupported pipeline segments **(PIP15)**
9. Brittle elements **(PIP16)**
10. Threaded connections, flange joints and special fittings **(PIP17)**

#### Translation or other formats

[Español](#) | [한국어](#) | [繁體中文](#) | [Русский](#) | [Tiếng Việt](#) | [العربية](#)

800-452-4011 | TTY: 711 | [deqinfo@deq.oregon.gov](mailto:deqinfo@deq.oregon.gov)



11. Inadequate supports, where a portion of the pipeline may lose its primary support (PIP18)
12. Connections to components with high seismic displacements (PIP19)
13. Inadequate anchorage (PIP20)
14. Short/rigid spans that cannot accommodate relative displacements (PIP21)
15. Damaged supports, including corrosion (PIP22)
16. Long vertical runs with possible drift (PIP23)
17. Large unsupported masses (e.g. valves) attached to pipeline (PIP24)
18. Flanged/threaded connections in high stress locations (PIP24)
19. Leakage (flanges, valves, welds, etc.) (PIP26)
20. Significant external corrosion – or under insulation (Corrosion under Insulation, CUI) (PIP27)
21. Inadequate vertical supports or insufficient lateral restraints (PIP28)
22. Welded attachments to thin-walled pipes (PIP29)
23. Excessive seismic displacement of expansion joints (PIP30)
24. Sensitive equipment possible impact (e.g. control valves) (PIP31)

Item #	Question	Response	Rating 6-1
<b>General</b>			
(PIP32)	In addition to oil service pipelines, the review should document ethanol, waste oil, fire water, utility, and auxiliary pipelines. (Fill out Table below)		
(PIP33)	Are pipeline materials, seals, gaskets, and other elastomers compatible with products and product additives? [API 2610]		
(PIP34)	Is non-metallic piping used for any pipeline service? If yes, describe briefly.		
(PIP35)	Has an incident or accident involving pipelines occurred? If so, provide a brief description.		
(PIP36)	List all in-kind replacements and component modifications.		
(PIP37)	List all new replacements and component modifications not considered in-kind.		
(PIP38)	Have any new pipelines or components been placed in service? If so, please provide brief details.		
(PIP39)	Have any existing <i>Out of Service</i> (O-O-S) pipelines been placed back in-service? If so, please provide details.		
<b>Oil Piping and Pipeline System</b>			
(PIP40)	Are all piping/pipelines, including components, documented on a current P & ID? If so, please provide as report attachment.		

Item #	Question	Response	Rating 6-1
(PIP41)	Verify that P&ID depicts out-of-service pipelines. Also, are removed pipelines either designated as such or no longer shown on P&ID?		
(PIP42)	Identify vulnerable areas where pipelines are not protected from vehicle or vessel impact. [API 2610]		
(PIP43)	Is any pipeline or valve susceptible to vandalism? [API 2610]. If so, describe briefly.		
(PIP44)	Have the removed portions of replaced pipelines been studied for internal corrosion or other pipe wall anomalies? What are the results of this study?		
(PIP45)	Does the facility have piping flow diagrams indicating all major valves and flow directions for normal conditions as well as upset conditions? Provide as report attachment. [API 2610]		
(PIP46)	Does either configuration or routing of piping or pipelines obstruct access to or removal of other components? If so, describe briefly.		
(PIP47)	Is plastic piping used for hydrocarbon services? If so, have manufacturer specifications been verified that it is rated for oil service?		
(PIP48)	Does a flange connection exist within 20 pipe diameters from the end of any replaced section? If so, identify and document the location.		
(PIP49)	Are there dead legs in the pipelines? If so, identify location(s). [API 2610]		
(PIP50)	Identify all pipelines that do not have a valid SLPT (Static Liquid Pressure Tests) certificate.		
(PIP51)	Have any piping or pipelines not been used for transferring oil in the last three years? If so, are these designated and/or marked "Out of Service," gas-freed, and physically isolated from oil sources?		
(PIP52)	For each identified O-O-S pipeline, specify whether it's above ground, over water, submerged, or buried.		
(PIP53)	Have buried or submerged O-O-S pipelines been filled with inert gas or corrosion inhibitors? If so, describe briefly.		
(PIP54)	Is there any plan(s) to physically remove any O-O-S pipeline? Indicate which pipelines and the associated schedule for removal.		

Item #	Question	Response	Rating 6-1
<b>Pipeline Stress Analysis</b>			
<b>(PIP55)</b>	Do above ground pipelines have enough flexibility for movement (seismic and thermal) in all directions? [API 2610]		
<b>(PIP56)</b>	<p>Has a pipeline stress analysis (PSA) for oil and fire water service pipelines been performed for:</p> <p>a) New piping and pipelines.</p> <p>b) Significant routing/relocation of piping.</p> <p>c) Any replacement of “not-in-kind” piping.</p> <p>d) Any significant rearrangement or replacement of “not-in-kind” anchors and/or supports.</p> <p>Significant seismic displacements calculated from the structural assessment.</p>	<p>a)</p> <p>b)</p> <p>c)</p> <p>d)</p> <p>e)</p>	
<b>(PIP56)</b>	Does the completed PSA represent and reflect current conditions and configurations?		
<b>(PIP57)</b>	What are the maximum transverse and longitudinal seismic displacements used in the PSA?		
<b>(PIP58)</b>	Have all PSAs been performed in accordance with ANSI/ASME B31E or B31.4, as appropriate?		
<b>(PIP59)</b>	Has a pipeline flexibility analysis been performed in accordance with ASME B31.4?		
<b>(PIP60)</b>	Has the largest temperature differential considered all thermal load cases (startup, shutdown, normal and abnormal) have been used in the flexibility analysis?		
<b>(PIP61)</b>	Are there large unsupported masses (e.g. valves) included in the analysis?		
<b>(PIP62)</b>	Are buried pipelines evaluated to withstand the dynamic forces exerted by anticipated traffic loads? [49CFR195]		
<b>(PIP63)</b>	Has the piping system been evaluated for seismic interaction with other elements (equipment, falling objects, other pipelines, etc.)?		

Item #	Question	Response	Rating 6-1
(PIP64)	During a seismic event, is there a possibility of the pipeline(s) impacting safety-sensitive equipment?		
(PIP65)	Are flanged and threaded connections present in high-stress locations? If yes, provide recommendations.		
(PIP66)	Are flanged or threaded connection locations susceptible to high moment loads? If so, are they checked for leakage?		
(PIP67)	Are there adequate expansion loops or joints in the pipeline? If not, provide recommendations.		
<b>Valves and Fittings</b>			
(PIP68)	Are check valves relied on for positive shut off in the reverse direction? [API 2610]		
(PIP69)	Are non-ductile materials, iron, cast iron or low melting temperature materials used in hydrocarbon service valves? If so, describe. [API 2610]		
(PIP70)	Are any cast iron or brass fittings used in hydrocarbon service? [API 2610]		
(PIP71)	Is there a documented testing program for all pressure relief valves and are these valves tested on a regular schedule? Provide date(s) of last test(s). [API 2610]		
(PIP72)	Is all piping with blocked sections containing stagnant oil, provided with a relief valve to mitigate pressure build-up due to temperature increase? [API 2610]		
(PIP73)	Identify any information labels on valves that are: Illegible, painted over, damaged, or missing. [API 2610]		
(PIP74)	Are valves susceptible to damage and tampering, protected? [49CFR195]		
(PIP75)	Is access to valves and important appurtenances inhibited during emergencies? [API 2610]		
(PIP76)	Are valve stems oriented in a way that doesn't pose a hazard in operation or maintenance?		

Item #	Question	Response	Rating 6-1
(PIP77)	Are swing check valves installed in vertical down-flow piping? If so, describe briefly		
(PIP78)	Are pressure safety valves (PSVs) set to equal or higher than the maximum allowable working pressure of the protected tank, pipeline, or system?		
(PIP79)	Is discharge from PSVs directed into lower-pressure piping for recycling and proper disposal? If not, what are the discharge areas?		
(PIP80)	Are double-block and bleed valves used for manifold valves?		
(PIP81)	Are all the oil transfer system valves included in a periodic maintenance program? Describe briefly.		
(PIP82)	Are all fire water system valves maintained, inspected, and tested per NFPA-25?		
(PIP83)	Do all SIV and ESD valves conform to MOTEMS requirements? [MOTEMS 3108F.3.2.1 and 3108F.3.2.2]		
<b>Valve Actuators</b>			
(PIP84)	Do valve actuators have a readily accessible manually operated overriding device to enable operation during a power loss?		
(PIP85)	Are torque switches set to stop the motor opening operation at a specified limit switch setting?		
(PIP86)	Is thermal insulation for critical valves inspected and maintained at periodic intervals? How frequent? Are the records kept for at least six years? Are they available?		
(PIP87)	At what interval has the electrical insulation for critical valves been measured for resistance following installation? Are the past records for the six years available?		
<b>Utility and Auxiliary Piping and Pipeline Systems</b>			
(PIP88)	Are utility and auxiliary pipelines included on P&IDs? Are P&IDs current? Attach the report.		

Item #	Question	Response	Rating 6-1
(PIP89)	What is the design standard(s) for stripping and sampling lines, compressed air, nitrogen, or natural gas pipelines? If so, describe the design standard for each.		
(PIP90)	Are there any buried utility/auxiliary pipelines? If so, briefly describe service, location, and corrosion protection.		
(PIP91)	Does vapor collection piping provide proper slope toward condensation collection points?		
<b>Fire Piping and Piping Systems</b>			
(PIP92)	Are firewater and AFFF pipelines included on P&IDs? Are P&IDs current? Please attach the report.		
(PIP93)	Is carbon steel used for all fire main piping? If not, describe construction material and location.		
(PIP94)	Are any portion(s) of fire water pipelines buried? Are they cathodically protected? What was the date of last inspection?		
(PIP95)	Are all fire water and foam pipelines color-coded per local jurisdiction requirements or ASME A13.1?		

Table 1: List of Pipelines

Pipeline Service Description	ID#	Diameter	Installation year of oldest section	Design standard	Operating Pressure



**Table 2: Pressure Relief Valves**

System	PSV Identification Number	Design Pressure (PSI)	Set pressure (PSI)	Equipment Protected	Remarks

**Table 3: Emergency Shutdown Valves and Shore Isolation Valves**

SIV OR ESD	Pipeline	Manual or Motor Controlled	If motor controlled Failsafe or fail last	P&ID No.	Remarks

## References

1. Guidance for California Accidental Release Prevention (CalARP) Program Seismic Assessments, 19 CalARP S.G.C. (2019).
2. PIANC MarCom Working Group 153B. (2022). *Recommendations for the design and assessment of marine oil, gas and petrochemical terminals*.
3. MOTEMS Chapter 31F, 3109 (2013). <https://www.slc.ca.gov/wp-content/uploads/2018/10/2013Chap31F.pdf> Guidelines for Seismic Evaluation and Design of Petrochemical Facilities, ASCE, 3<sup>rd</sup> edition. 2020.
4. American Society of Mechanical Engineers, ASME Pressure Vessels and Piping Division, & American National Standards Institute. (1998). *Process piping: ASME Code for Pressure Piping, B31.4*. American Society of Mechanical Engineers.
5. American Society of Mechanical Engineers, ASME Pressure Vessels and Piping Division, & American National Standards Institute. (1998). ASME B31.4, Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids, New York.
6. American Society of Mechanical Engineers (ASME), 1998, ASME B31.3, Process Piping, New York.
7. 33 CFR 154.808 – Vapor Control Systems, General (Title 33, Code of Federal Regulations (CFR), Section 154.808).
8. American Society of Mechanical Engineers (ASME), 1996, ASME B16.5, "Pipe Flanges and Flanged Fittings," New York
9. American Petroleum Institute (API) API Standard 2010 "Design, Construction, Operation, Maintenance and Inspection of Terminal and Tank Facilities", Washington, D.C.

## Contact

Program contact: [Killian Stoltenburg](#)

DEQ Seismic Stability Program Administrative Coordinator

971-295-8734

## Non-discrimination statement

DEQ does not discriminate on the basis of race, color, national origin, disability, age or sex in administration of its programs or activities. Visit DEQ's [Civil Rights and Environmental Justice page](#).