# PACIFIC GAS AND ELECTRIC COMPANY

ENGINEERING & OPERATIONS
GAS TRANSMISSION AND DISTRIBUTION
GAS ENGINEERING
GAS SYSTEM INTEGRITY
Risk Management

## Procedure for Risk Management

Procedure No. RMP-04
Rev. 5
Ground Movement and Natural Forces Threat Algorithm

Prepared By: [redacted] Date: 11/19/01

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Manager, System Integrity [redacted]

| | | | | | Approved |
|---|---|---|---|---|---|
| Rev. No. | Date | Description | Prepared By | Approved By | Director of Integrity Management and Technical Support |
| 0 | 11/24/01 | Initial Issue | [redacted] | | |
| 1 | 6/11/04 | Revised as Shown | | | |
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| 4 | 12/27/08 | Added Section 6.2-Distribution Algorithm & other minor changes | [redacted] | | RPF2 |
| 5 | 10/09/09 | Revised as Shown | | | |

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## 1.0 PURPOSE

The purpose of this procedure is to provide a guideline for determining the Ground Movement and Natural Forces Threats Algorithm for the determination of Likelihood of Failure and Risk for PG&E's Gas Transmission and Distribution's Risk Management Programs (RMP) and Integrity Management Programs. 5

## 2.0 SCOPE

This guideline is applicable to all of PG&E's gas transmission pipeline and distribution facilities and is to be used in conjunction with RMP Procedure 01. The algorithm provided in this procedure is for Natural Gas Pipelines. It is not applicable to regulator, compressor, or underground storage station facilities.

The Integrity Management Group is responsible for managing risk within the scope of this procedure. The Integrity Management Group shall establish and manage the risk of each pipeline facility by utilizing industry and regulatory accepted methodologies appropriate for PG&E's transmission and distribution facilities and shall be in conformance with this procedure. The Integrity Management Program Manager shall be responsible for compliance with this procedure.

## 3.0 INTRODUCTION

Gas Transmission: The risk management process is a process of integrating data to calculate risk, developing risk mitigation plans to bring and maintain risk within an acceptable risk profile, and monitoring risk to accommodate changes in the factors which affect risk. The Transmission Integrity Management Program (TIMP) is a program established by PG&E to address the integrity management rules in 49 CFR Part 192 Subpart O. (Procedure RMP-01 provides a procedure for the Risk Management Process.) Procedure RMP-06 provides procedures for compliance with the Transmission Integrity Management Program. This procedure supports the calculation of risk, required by Procedure RMP-01, due to one of the basic threats imposed on gas pipelines, Ground Movement (GM).

As described in RMP-01, Risk is defined as the product of the Likelihood of Failure (LOF) and the Consequence of Failure (COF). [Risk = LOF X COF] A relative risk calculation methodology is used to establish risk for all pipeline segments within the scope of RMP-01. The method used to calculate risk is based on an index model and qualitative scoring approach. Likelihood Of Failure (LOF) is defined as the sum of the following threat categories: External Corrosion (EC), Third Party (TP), Ground Movement (GM) and Design/Materials (DM).

Each threat category is weighted in proportion to PG&E and industry failure experience. GM is weighted at 20%. The weightings on the threat categories will be reviewed and approved annually by the Consequence Steering Committee. For each threat category, the appropriate steering committee will identify the significant factors that influence the threat's likelihood of failure. For each factor, a percentage weighting will be established to identify the factor's relative significance in determining the threat's likelihood of failure within the threat algorithm. Points will be established based on criteria that the

committee feels is significant to determining the threat's likelihood of failure due to each factor and the relative severity of failure (leak-before-break vs. rupture). (Negative points may be assigned where current assessments have been made to confirm pipeline integrity and/or mitigation efforts have eliminated or lowered susceptible to a threat.) Generally, the summation of the percentage weightings for all of the factors within each threat will be 100%. (There may be exceptions to permit the consideration of very unusual conditions.)

For the threat of GM, the scoring is based on direction from the GM Steering Committee. The GM Steering Committee shall meet once each calendar year and shall review this procedure per the requirements of RMP-01.

Gas Distribution: Gas Distribution Integrity Management Plan (DIMP) is a maturing program which will be adjusted to meet the requirements of the recently issued subpart P of 49 CFR 192. Currently it uses a Subject Matter Expert approach to identify and prioritize risks. That process is detailed in Section 6.2 of this document.

## 4.0 Roles and Responsibility

Specific responsibilities for ensuring compliance with this procedure are as follows:

| Title | Reports to: | Responsibilities |
|---|---|---|
| Integrity Management Program Manager | Manager of Integrity Management | • Supervise completion of work (schedule/quality)<br>• Monitor compliance to procedure – take corrective actions as necessary.<br>• Assign qualified individuals<br>• Ensure Training of assigned individuals<br>• Assign Steering Committee Chairman, and ensure that meetings are held once each calendar year. |
| Steering Committee Chairman (Risk Management Engineers) | Integrity Management Program Manager | • Arrange meetings.<br>• Review procedure with committee per RMP-01<br>• Provides meeting minutes<br>• Ensures action items are completed. |
| Steering Committee Members (Subject Matter Experts) | Various | • Attend meetings as requested by Steering Committee Chairman.<br>• Provide review and direction to procedure. |
| Risk Management Engineers | Integrity Management Program Manager | • Perform calculations per procedure. |

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## 5.0 Training and Qualifications

See RMP-06 for qualification requirements. Specific training to ensure compliance with this procedure is as follows:

| Position | Type of Training: | How Often |
|---|---|---|
| Integrity Management Program Manager | Procedure review of RMP-01 and RMP-04 | • Upon initial assignment<br>• Once each calendar year. |
| Steering Committee Chairman | Procedure review of RMP-01 and RMP-04 | • Upon initial assignment<br>• Once each calendar year.<br>• As changes are made to the procedure. |
| Steering Committee Members (Subject Matter Experts) | RMP-04 and Steering Committee requirements of RMP-01 | • Once each calendar year at the time of the steering committee meeting. |
| Risk Management Engineers | Per RMP-06 Integrity Management Program | • Upon initial assignment<br>• Once each calendar year.<br>• As changes are made to the procedure. |

## 6.0 GROUND MOVEMENT THREAT ALGORITHM

**6.1 Gas Transmission:** Ground Movement (GM) algorithm shall be calculated per the direction of the GM Steering Committee. The committee has determined that the factors in A through H of this section are significant to estimate the Likelihood of Failure (LOF) of a gas pipeline due to *ground movement* damage. The GM contribution to LOF shall be the summation of assigned points times the assigned weighting for the following factors:

A) Crossings* (30% Weighting): Points will be awarded as follows:

| Criteria | Points | Contrib. |
|---|---|---|
| Major Water Crossing Present** | 40 | 12 |
| Seismic Fault Crossing Present *** | A | B |
| No Major Water or Fault Not Present | 0 | 0 |

* Points for each factor are additive.

** A Major Water Crossing is defined as waterway identified by the Office of Pipeline Safety (OPS) as being a Commercially Navigable Waterway".

*** Seismic Fault Crossings as defined in Attachment 1. A=300*PR (Prob. of Rupture in Attachment 1, the number, 300, is a non-dimensional multiplier used to appropriately weight fault crossings as agreed by the GM Committee), for example: Hayward Fault, PR = 31%, A= (300*0.31) = 93 and B=(0.3*A)=27.9.

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B) Unstable Soil (Susceptibility to either slope instability or liquefaction) (15% Weighting): Points will be awarded as follows:

| Criteria | Points | Contrib. |
|---|---|---|
| Known Soil Instability or Landslide | 120 | 18 |
| Moderate-High Slope Instability | 100 | 15 |
| Liquefaction* | 100 | 15 |
| None | 0 | 0 |

* Liquefaction shall be considered for areas defined as Moderate-High or Known Liquefaction within GIS and pipelines installed prior to 1947.

C) Seismic Area* (15% Weighting): Points awarded as follows:

| Criteria | Points | Contrib. |
|---|---|---|
| Seismic Ground Acceleration** ≥ 0.5g | 150 | 22.5 |
| Seismic Ground Acceleration ≥ 0.2g to 0.49g | 100 | 15 |
| Seismic Ground Acceleration < 0.2g | 0 | 0 |

* Seismic Area shall be considered only if it is in an area of unstable soil. For the purpose of this factor, unstable soil shall be defined as an area of Moderate-High Soil Instability within GIS or areas of Moderate-High or Known Liquefaction within GIS.

** Seismic Ground Acceleration is the peak ground acceleration values to 10% probability of exceedance in 50 years (or 475-year return period).

D) Erosion Area* (10% Weighting): Points awarded as follows:

| Criteria | Points | Contrib. |
|---|---|---|
| Pipe segment within 100 meters of identified erosion area | 100 | 10 |
| Not in erosion area | 0 | 0 |

* Erosion Area's are reported by the Gas Transmission Erosion Project Manager and also include levee crossings per Pipeline Levee Crossings in the Delta list from the enterprise risk management (ERM) study (Attachment 2) that are susceptible to failure are recorded into GIS on an ongoing basis.

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E) Ground Movement Mitigation (5% Weighting): Points awarded as follows:

| Criteria | Points | Contrib. |
|---|---|---|
| Full Ground Movement mitigation* of Known Landslide performed | -360 | -18 |
| Partial Ground Movement Mitigation** of Known Landslide performed | -240 | -12 |
| Full Ground Movement mitigation* of Known Erosion performed | -200 | -10 |
| Partial Ground Movement Mitigation** of Known Erosion performed | -140 | -7 |
| Fault Crossing Mitigation*** | -6*A | -B |
| None | 0 | 0 |

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* "Full Ground Movement Mitigation" efforts are projects whose scope substantially removed the ground movement threat of pipeline failure. This information is reported to the RMP on a case-by-case basis by the appropriate Pipeline Engineer and is documented in the RMP files.

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** "Partial Ground Movement Mitigation" efforts are projects whose scope removed some, but not all of the ground movement issues related to a threat to the pipeline. This information is reported to the RMP on a case-by-case basis by the appropriate Pipeline Engineer and is documented in the RMP files.

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*** "Fault Crossing Mitigation" is pipeline fault crossing segment that has been evaluated/mitigated per seismic fitness-for-service(F-F-S) (see Attachment 1) and the "Crossing Points" awarded will be removed.

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F) Girth Weld Condition (20% Weighting): Points awarded as follows:

| Criteria | Points | Contrib. |
|---|---|---|
| Pre 1947 Girth Welds within area of ground acceleration ≥ 0.5g | 120 | 24 |
| Pre 1947 Girth Welds within area of ground acceleration ≥ 0.2g to < 0.5g | 80 | 16 |
| All Other | 0 | 0 |

## 6.2 Gas Distribution:

PG&E's Distribution Integrity Management Plan (DIMP) (RMP-15) addresses each of the GPTC Appendix G-192-8 guide's seven major components. These components are as follows:

A. Knowledge of the distribution system – design, maintenance and operation
B. Threat Identification process
C. Risk evaluation and ranking of threats
D. Implement measures to manage risks
E. Measure and monitor results
F. Periodic evaluation of program for improvements

G. Reports to government agencies

Ground Movement (GM) (i.e. Natural Forces) threat algorithms for Gas Distribution are developed following the guidelines in RMP-15 and they are described as follows:

A) Knowledge of the system – PG&E's records and data bases that define the distribution system and what type of information they provide are described in Table 1.3 of RMP-15.

B) How Threats are identified – The GM threats to the distribution system are identified by Subject Matter Experts (SME). The pool used to select the members will include Gas Engineers at PG&E, Gas Planners at PG&E, experts from the PG&E Geosciences Department, members of the PG&E System Integrity Group and other industry experts inside and outside of PG&E.

C) Risk Evaluation and ranking of threats – Identification is performed by the SME team who then rank the Likelihood and Consequence of each threat with H, M or L. A value is then assigned to each of the ranks such as: H = 3, M = 2 and L = 1. The value of the Likelihood (L) X Consequence (C) of each SME's judgment will be calculated and then the average of all SMEs' risk values will be calculated as the relative risk value, R.

The relative risk values of the threat, $R = 1/n \left(\sum (Li \times Ci)\right)$ $(i = 1 \text{ to } n)$

n: Total number of SMEs.

In the table below, the consequence of the threat is that it will not be able to safely and reliably perform its intended function. For example, in the event of an earthquake, a higher ranking indicates a concern that activating a shutdown zone will limit the damage and loss of service to that zone.

Summary Table of Relative Risk Value (R) Per SMEs ballot results (Reviewed and Revised by the Committee in 2009 – see Attachment 3.)

| Consequence / *Threat* | Shutdown Zones | Steel Pipe | Plastic Pipe | Cast Iron Pipe | Dist. Reg. Station | Customer Meter Set | Connection - Fittings | House Lines |
|---|---|---|---|---|---|---|---|---|
| *Landslides* | 6.6** | 3.9 | 4.3 | 5.0 | 3.0 | 1.9 | 3.4 | 2.0 |
| *Liquefaction* | 6.6** | 2.1 | 2.8 | 5.6 | 2.6 | 3.3 | 2.5 | 3.1 |
| *Fault Crossing* | 6.6** | 6.1 | 5.0 | 6.0 | 6.9 | 4.3 | 4.6 | 3.9 |
| *Shaking* | 6.6** | 2.3 | 2.3 | 4.5 | 4.3 | 4.6 | 3.9 | 4.1 |
| *Erosion* | NA* | 1.8 | 1.7 | 2.1 | 1.7 | 1.2 | 1.2 | 1.7 |
| *Flood* | 1.1 | 1.5 | 1.0 | 2.9 | 2.3 | 2.4 | 1.1 | 1.0 |
| *Fire Storm* | 2.2 | 0.9 | 1.5 | 0.9 | 3.0 | 2.9 | 0.9 | 1.4 |
| *Levee Crossings* | NA* | 1.5 | 1.5 | 1.5 | NA* | NA* | NA* | NA* |

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* The item was reviewed and determined to have little or no impact by the threat.
** Shutdown Zones are considered for all hazards (landslides, liquefaction, fault crossings and shaking); therefore, the risk values are the same. 5

D) Implement Measure to Manage Risk – These risk rankings will be used to identify and implement measures to manage the risk.

**Attachment 1:** FaultCrossings_2009.xls

**Attachment 2:** LeveeCrossingsDelta2009.xls 5

**Attachment 3:** DistIM Natural Forces SME 2009 Final.xls

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Threats to the distribution System

| | | | | | | | Likelihood | | | | | | | | Consequence | | | | | | | | Likelihood | | | | | | | | Risk Calculation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Sub1 | Sub2 | Threat | Date Received | Threat Info Source | SME ID Seq | [redacted]<br>(sme1 - | [redacted]<br>(sme2) | [redacted]<br>(SME3) | [redacted]<br>(sme4) | [redacted]<br>(sme5) | [redacted]<br>(sme6) | [redacted]<br>(sme7) | [redacted]<br>(sme8) | [redacted]<br>(sme1) | [redacted]<br>(sme2) | [redacted]<br>(sme3) | [redacted]<br>(sme4) | [redacted]<br>(sme5) | [redacted]<br>(sme6) | [redacted]<br>(sme7) | [redacted]<br>(sme8) | [redacted]<br>x1 | [redacted]<br>x2 | [redacted]<br>x3 | [redacted]<br>x4 | [redacted]<br>x5 | [redacted]<br>x6 | [redacted]<br>x7 | [redacted]<br>x8 | SME Count | Ave Risk Rank | [illegible] | | |
| Natural Forces | Earthquake | Landslides, Liquefaction, Fault Crossing and Shaking | Distribution stabilization zones may not be sized for effective emergency response to a geo hazard. Specifically, large numbers of customers within each shutdown zone create a greater burden on relight and restoration. | 4/13/2009 | [redacted] | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Landslides | Steel Pipe - A pipe failure in a landslide event. May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Landslides | Plastic Pipe - A pipe failure in a landslide event. May include a pipe break, release of gas, or restricted supply to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Landslides | Cast Iron Pipe - A pipe failure in a landslide event. May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Landslides | District Reg Stations - A reg station failure in a landslide event. May include a pipe breaks at station, release of gas, loss of pressure control or accessibility (Station is buried by landslide). | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Landslides | Customer Meter Sets - A customer meter set failure in a landslide event. May include loss of meter function, release of gas and inability to control gas release due to failure below stop cock. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Landslides | Connections - fittings - Fittings on the gas supply system up to the customer piping. Failure in a landslide event causing uncontrolled release of gas. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Landslides | House lines - Customer piping failure in a landslide event. Includes release of gas and/or plugging of lines within buildings and underground as is the case with curb meters. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Liquefaction | Steel Pipe - A pipe failure in a Liquefaction event. May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Liquefaction | Plastic Pipe - A pipe failure in a landslide event. May include a pipe break, release of gas, or restricted supply to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Liquefaction | Cast Iron Pipe - A pipe failure in a landslide event. May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Liquefaction | District Reg Stations - A reg station failure in a liquefaction event. May include a pipe breaks at station, release of gas, loss of pressure control or accessibility. Includes above and below ground stations. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Liquefaction | Customer Meter Sets - A customer meter set failure in a liquefaction event. May include loss of meter function, release of gas and inability to control gas release due to failure below stop cock. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Liquefaction | Connections - fittings - Fittings on the gas supply system up to the customer piping. Failure in a liquefaction event causing uncontrolled release of gas. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Liquefaction | House lines - Customer piping failure in a liquefaction event. Includes release of gas and/or plugging of lines within buildings and underground as is the case with curb meters. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Fault Crossings | Steel Pipe - A pipe failure in at a fault crossing in an earthquake event. May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Fault Crossings | Plastic Pipe - A pipe failure at a fault crossing in an earthquake event. May include a pipe break, release of gas, or restricted supply to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Fault Crossings | Cast Iron Pipe - A pipe failure at a fault crossing in an earthquake event. May include a pipe break, release of gas, or restricted supply to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Fault Crossings | District Reg Stations - A reg station failure at a fault crossing in an earthquake event. May include a pipe breaks at station, release of gas, loss of pressure control or accessibility. Includes above and below ground stations. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Fault Crossings | Customer Meter Sets - A customer meter set failure at a fault crossing in an earthquake event. May include loss of meter function, release of gas and inability to control gas release due to failure below stop cock. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |

| Threats to the distribution System | | | | | | | Likelihood | | | | | | | | Consequence | | | | | | | | Likelihood | | | | | | | | Risk Calculation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Category | Sub1 | Sub2 | Threat | Date Received | Threat Info Source | SME ID Seq | [redacted] (sme1) | [redacted] (sme2) | [redacted] (SME3) | [redacted] (sme4) | [redacted] (sme5) | [redacted] (sme6) | [redacted] (sme7) | [redacted] (sme8) | [redacted] (sme1) | [redacted] (sme2) | [redacted] (sme3) | [redacted] (sme4) | [redacted] (sme5) | [redacted] (sme6) | [redacted] (sme7) | [redacted] (sme8) | SME #1 | SME #2 | SME #3 | SME #4 | SME #5 | SME #6 | SME #7 | SME #8 | SME Count | Ave Risk Rank | [illegible] | | |
| Natural Forces | Earthquake | Fault Crossings | Connections - fittings - Fittings on the gas supply system up to the customer piping. Failure at a fault crossing in an earthquake event causing uncontrolled release of gas. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Fault Crossings | House lines - Customer piping failure at a fault crossing in an earthquake event. Includes release of gas and/or plugging of lines within buildings and underground as is the case with curb meters. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Shaking | Steel Pipe - A pipe failure due to shaking in an earthquake event. May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Shaking | Plastic Pipe - A pipe failure due to shaking in an earthquake event. May include a pipe break, release of gas, or restricted supply to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Shaking | Cast Iron Pipe - A pipe failure due to shaking in an earthquake event. May include a pipe break, release of gas, or restricted supply to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Shaking | District Reg Stations - A reg station failure due to shaking in an earthquake event. May include a pipe break at station, release of gas, loss of pressure control or accessibility. Includes above or below ground stations. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Shaking | Customer Meter Sets - A customer meter set failure due to shaking in an earthquake event. May include loss of meter function, release of gas and inability to control gas release due to failure below stop cock. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Shaking | Connections - fittings - Fittings on the gas supply system up to the customer piping. Failure due to shaking in an earthquake event causing uncontrolled release of gas. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Earthquake | Shaking | House lines - Customer piping failure due to shaking in an earthquake event. Includes release of gas and/or plugging of lines within buildings and underground as is the case with curb meters. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Levee Crossings | All Pipe - A pipe failure during the failure of a levee. May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. May also include inaccessibility due to inundation and flooding. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Flood | Small-sized shutdown zones may not be sized for effective emergency response to a flood. Sometimes large numbers of customers within each shutdown zone create a greater burden on relight and restoration. | [illegible] | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Flood | Steel Pipe - A pipe failure due to flood. Flood failures can result from loss of cover or failure of supporting structure (bridges and spans). May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Flood | Plastic Pipe - A pipe failure due to flood. Flood failures can result from loss of cover or failure of supporting structure (bridges and spans). May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Flood | Cast Iron Pipe - A pipe failure due to flood. Flood failures can result from loss of cover or failure of supporting structure (bridges and spans). May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Flood | District Reg Stations - A reg station failure due to flood. May include a pipe break at station, release of gas, loss of pressure control or accessibility. Includes above or below ground stations. | [illegible] | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Flood | Customer Meter Sets - A meter set failure due to flood. Flood failures can result from failure of supporting structure. May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Flood | Connections - fittings - Fittings on the gas supply system up to the customer piping. Flood failures can result from failure of supporting structure. May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. | [illegible] | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Flood | House lines - A house line failure due to flood. Flood failures can result from failure of supporting structure. May include a pipe break, release of gas, or restricted supply due to crush of pipe with no release. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Erosion | Steel Pipe - A pipe failure due to long term erosion of cover. May include pipe over stress from excessive span or a pipe break, with or without a release of gas. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Erosion | Plastic Pipe - A pipe failure due to long term erosion of cover. May include pipe over stress from excessive span or a pipe break, with or without a release of gas. | 4/13/2009 | SME | [redacted] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | | |

material redacted

**Threats to the distribution System**

| | | | | | | | Likelihood | | | | | | | | Consequence | | | | | | | | Likelihood | | | | | | | | Risk Calculation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | [redacted] | [redacted] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Category | Sub1 | Sub2 | Threat | Date Received | Threat Info Source | SME ID Seq | sme1 | (sme2) | (SME3) | (sme4) | (sme5) | (sme6) | (sme7) | (sme8) | (sme1) | (sme2) | (sme3) | (sme4) | (sme5) | (sme6) | (sme7) | (sme8) | SME #1 | SME #2 | SME #3 | SME #4 | SME #5 | SME #6 | SME #7 | SME #8 | SME Count | Avg Risk Rank | Risk Event Likelihood | | |
| Natural Forces | Natural Processes | Erosion | Cast Iron Pipe – A pipe failure due to long term erosion of cover. May include pipe over stress from excessive span to a pipe break, with or without a release of gas. | 4/15/2008 | SME | [redacted] | M | M | L | M | H | H | L | M | M | M | L | L | L | L | H | H | 2 | 2 | 1 | 2 | 3 | 3 | 1 | 2 | 8 | 2.4 | 2.1 | | |
| Natural Forces | Natural Processes | Erosion | Steel Pipe – A pipe failure due to long term erosion of cover. May include pipe over stress from excessive span to a pipe break, with or without a release of gas. | [illegible] | SME | [redacted] | L | L | L | L | L | L | L | M | L | M | L | M | M | L | L | M | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Erosion | Customer Meter Sets – A pipe failure due to long term erosion of cover. May include pipe over stress from excessive span to a pipe break, with or without a release of gas. | [illegible] | SME | [redacted] | L | L | L | L | L | L | L | M | L | L | M | M | L | L | L | M | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | [illegible] | [illegible] | 1.2 | | |
| Natural Forces | Natural Processes | Erosion | Connections – fittings – Fittings on the gas supply system up to the customer piping. A failure due to long term erosion of cover. May include pipe over stress from excessive span to a pipe break, with or without a release of gas. | [illegible] | SME | [redacted] | L | M | M | L | L | L | L | M | L | L | L | L | L | L | L | H | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | [illegible] | [illegible] | 1.2 | | |
| Natural Forces | Natural Processes | Erosion | House lines – Customer piping failure due to long term erosion of cover. May include pipe over stress from excessive span to a pipe break, with or without a release of gas. | [illegible] | SME | [redacted] | L | L | L | L | L | L | L | M | L | L | M | L | L | L | L | M | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | [illegible] | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Fire Storm | Distribution shutdown zones may not be sized for effective emergency response to a fire storm. Excessively large numbers of customers within each shutdown zone create a greater burden on recovery/restoration. | [illegible] | SME | [redacted] | M | M | H | M | M | M | L | M | H | M | L | H | H | H | H | H | 3 | 2 | 2 | 3 | 3 | 2 | 1 | 2 | [illegible] | [illegible] | 2.2 | | |
| Natural Forces | Natural Processes | Fire Storm | Steel Pipe – A pipe failure causing the release of gas due to excessive heat or mechanical damage from falling debris. | 4/15/2008 | SME | [redacted] | L | L | L | L | L | L | L | M | M | L | L | L | L | L | L | H | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 8 | 1.5 | [illegible] | | |
| Natural Forces | Natural Processes | Fire Storm | Plastic Pipe – A pipe failure causing the release of gas due to excessive heat or mechanical damage from falling debris. | 4/15/2008 | SME | [redacted] | M | M | L | M | M | M | L | M | M | M | L | L | L | L | M | H | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 8 | 2.0 | 1.5 | | |
| Natural Forces | Natural Processes | Fire Storm | Cast Iron Pipe – A pipe failure causing the release of gas due to excessive heat or mechanical damage from falling debris. | 4/15/2008 | SME | [redacted] | L | L | L | L | L | L | L | M | M | L | L | L | L | L | L | H | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 8 | 1.4 | [illegible] | | |
| Natural Forces | Natural Processes | Fire Storm | District Reg Stations – A reg station failure causing the release of gas or lack of pressure control due to excessive heat or mechanical damage from falling debris in a fire storm event. | 4/15/2008 | SME | [redacted] | M | H | L | M | M | H | L | H | M | M | M | H | H | H | M | H | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 3 | 8 | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Fire Storm | Customer Meter Sets – A meter set failure causing the release of gas or lack of pressure control due to excessive heat or mechanical damage from falling debris in a fire storm event. | 4/15/2008 | SME | [redacted] | H | H | H | M | H | H | L | M | H | H | L | H | L | H | M | H | 2 | 2 | 3 | 2 | 3 | 4 | 1 | 2 | 8 | [illegible] | [illegible] | | |
| Natural Forces | Natural Processes | Fire Storm | Connections – fittings – A fitting failure causing the release of gas due to excessive heat or mechanical damage from falling debris in a fire storm event. | 4/15/2008 | SME | [redacted] | L | L | L | L | L | L | L | M | L | L | L | L | L | L | M | H | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 8 | 1.4 | [illegible] | | |
| Natural Forces | Natural Processes | Fire Storm | House lines – Customer piping failure due to excessive heat or mechanical damage from falling debris in a fire storm event. Includes release of gas [illegible] | [illegible] | SME | [redacted] | M | L | M | M | M | H | L | M | M | L | L | L | L | L | M | H | 2 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 8 | 2.5 | 1.5 | | |
| | | | **Event Likelihood** | | | [redacted] | [redacted] | | | | | | | | | | | | | | | | | | | | | | | | | | Sum | Normalized to Earthquake | Normalized to Flood (not used) |
| | Earthquake | | Includes Landslide, liquefaction, Fault crossings and Shaking | | | [redacted] | 5 | 6 | 10 | 7 | 8 | 6 | 5 | 7 | | | | | | | | | | | | | | | | | | | 9 | 1.00 | [illegible] |
| | Natural Processes | Levee Crossings | | | | [redacted] | 1 | 5 | 4 | 3 | 3 | 4 | 3 | 2 | | | | | | | | | | | | | | | | | | | [illegible] | 0.50 | [illegible] |
| | Natural Processes | Flood (Erosion) | | | | [redacted] | 7 | 6 | 7 | 7 | 7 | 7 | 8 | 5 | | | | | | | | | | | | | | | | | | | [illegible] | 0.72 | 1 |
| | Natural Processes | Fire Storm | | | | [redacted] | 5 | 6 | 5 | 3 | 5 | 6 | 3 | 4 | | | | | | | | | | | | | | | | | | | [illegible] | 0.58 | [illegible] |