

PACIFIC GAS AND ELECTRIC COMPANY

CALIFORNIA GAS TRANSMISSION
GAS SYSTEM MAINTENANCE & TECHNICAL SUPPORT
SYSTEM INTEGRITY SECTION
Risk Management



Procedure for Risk Management Procedure No. RMP-04 Rev. 0 Ground Movement Threat Algorithm

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1.0 PURPOSE

The purpose of this procedure is to provide a guideline for determining the Ground Movement Threat Algorithm for the determination of Likelihood of Failure and Risk for California Gas Transmission's (CGT) Risk Management Program (RMP).

2.0 SCOPE

This guideline is applicable to all of CGT's gas transmission pipeline 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 RMP is responsible for managing risk within the scope of this procedure. The RMP shall establish and manage the risk of each pipeline facility by utilizing industry and regulatory accepted methodologies appropriate for PG&E's CGT facilities and shall be in conformance with this procedure. The Lead Risk Management Engineer shall be responsible for compliance with this procedure.

3.0 INTRODUCTION

The RMP 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. (Procedure RMP-01 provides guidelines for the Risk Management Process.) 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.

4.0 GROUND MOVEMENT THREAT ALGORITHM

Ground Movement (GM) 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 Line Present***	60	24
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 Waterway¹.

*** Seismic Fault Line Present is defined as either a Historic or Holocene type fault crossing.

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

Criteria	Points	Contrib.
Slope Instability*	100	15
Liquefaction**	100	15
None	0	0

* Slope Instability shall be considered for the area defined as Moderate-High Soil Instability within GIS.

** 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 \geq 0.5g	150	22.5
Seismic Ground Acceleration \geq 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.

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 CGT Erosion Project Manager and are recorded into GIS on an ongoing basis.

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

Criteria	Points	Contrib.
EXTENSIVE Ground Movement mitigation performed*	-360	-18
None	0	0

* "Extensive 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.

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

Criteria	Points	Contrib.
Some Ground Movement Mitigation	-240	-12
None	0	0

* "Some 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.

G) 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 0.49g	80	16
All Other	0	0