BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Develop a Risk-Based Decision-Making Framework to Evaluate Safety and Reliability Improvements and Revise the General Rate Case Plan for Energy Utilities	R.13-11-006 (Filed November 14, 2013)

PACIFIC GAS AND ELECTRIC COMPANY'S (U 39 M) RESPONSE TO THE FEBRUARY 20, 2014 STRAW PROPOSAL'S REQUEST FOR A CASE STUDY

STEVEN W. FRANK
J.MICHAEL REIDENBACH

Pacific Gas and Electric Company
77 Beale Street
San Francisco, CA 94105
Telephone: (415) 973-6976
Facsimile: (415) 973-0516
E-Mail: SWF5@pge.com

Attorneys for
PACIFIC GAS AND ELECTRIC COMPANY

Dated: March 11, 2014

On February 20, 2014, California Public Utilities Commission staff issued a Straw Proposal that requested that Pacific Gas and Electric Company (PG&E) prepare a hypothetical case study addressing certain elements of the new process described in the Straw Proposal. Accordingly, PG&E has attached a case study -- in the area of Electric Operations – that addresses "Contact with Primary Overhead Conductor."

PG&E looks forward to discussing this case study at the workshops scheduled to commence on March 19, 2014.

Respectfully Submitted,
STEVEN W. FRANK

By: */s/ Steven W. Frank*
STEVEN W. FRANK

Pacific Gas and Electric Company
77 Beale Street
San Francisco, CA 94105
Telephone: (415) 973-6976
Facsimile: (415) 973-0516
E-Mail: SWF5@pge.com

Attorneys for
PACIFIC GAS AND ELECTRIC COMPANY

Dated: March 11, 2014

Pacific Gas and Electric Company
Electric Operations
Contact with Primary Overhead Conductor
Risk Case Study

Rate Case Plan OIR (R. 13-11-006)
March 11, 2014

Introduction

- PG&E has developed this case study for discussion purposes only. Some elements of the study have been constructed solely for illustrative purposes. Other elements are based on actual data, but the data have not been validated and should not be relied upon.
- The level of detail in this presentation is not uniformly available, nor would this level of analysis be advisable for all risks from a cost-effectiveness standpoint. PG&E looks forward to working with the CPUC and parties to determine what level of analysis may reasonably be required, as well as what types of risks should be subject to such evaluation.
- Risk analysis and the underlying risks evolve over time. The long time frames envisioned by the CPUC's February 20 Straw Proposal exacerbate the potential for divergence between the initial identification of risks and the programs ultimately implemented by the utilities.
- This case study focuses on safety and reliability risk. PG&E reiterates the need to clarify risk terminology as this proceeding progresses.
- This effort to explicitly include safety and reliability risk in the GRC process should not neglect other important elements of utility service, e.g., customer service and compliance, that must be supported.

Purpose of Presentation

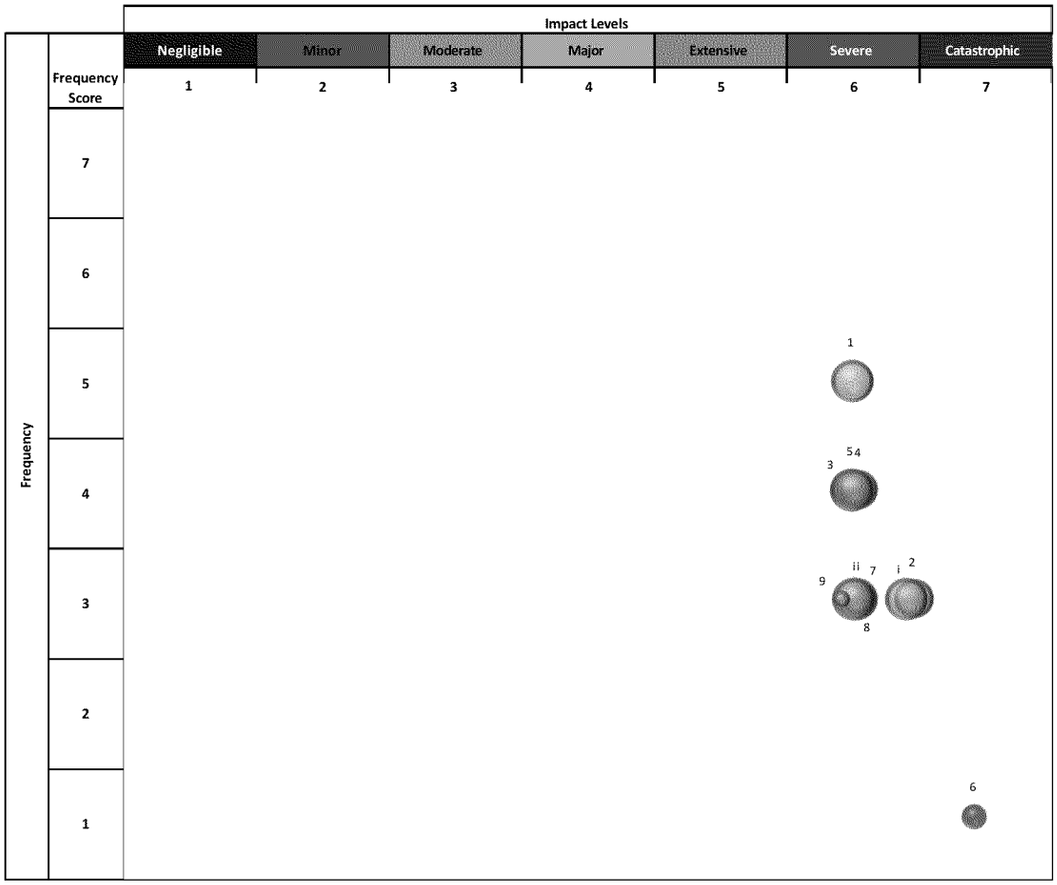
- This presentation addresses the following questions raised by the Straw Proposal with respect to *"Electric Operations – Contact with Primary Overhead Conductor Risk"*
  - Description of the utility asset needing replacement or upgrade. The estimated risk, the existing controls already in place to mitigate the risk, and the effect of not replacing or upgrading.
  - A description on the method used to estimate the risk. For instance, was the risk scored on a purely quantitative basis, a Subject Matter Expert (SME) basis, or a hybrid approach?
  - What alternative solutions are available to reduce or eliminate the risk?
  - The estimated risk reduction if the replacement is authorized or if the other alternatives are authorized.

  Source "Staff Straw Proposal R. 13-11-006," issued February 20, 2014, p. 2
- This presentation provides:
  - Illustrative information PG&E would expect to provide to address the content of the Straw Proposal questions in a GRC
  - Appendix A – Background on PG&E's Risk Evaluation Tool and risk scoring approach

PG&E anticipates providing:

- Enterprise and Top Operational safety, reliability and environmental risks for each core line of business (LOB) – Electric Operations, Gas Operations and Energy Supply
  - Enterprise Risks – Risks that could threaten the viability of the enterprise
  - Top Operational Risks – Risks that result from the execution of the Company's business functions, arising from the people, assets, technology and processes within the LOBs and which require a coordinated mitigation approach
- A prioritized list of proposed risk mitigation projects for the top risks for each LOB
- Key project descriptions for *new or incremental projects* will include:
  - the risk being mitigated
  - the recommended mitigation measures
  - the cost of the mitigations
  - alternatives considered

GRC Illustrative Showing
Electric Operations Enterprise and Operational Risks Heat Map



Risk #	Risk Name
i	Enterprise Risk
ii	Enterprise Risk
1	Distribution Overhead Conductor (Primary Voltage)
2	Electric Operations Risk
3	Electric Operations Risk
4	Electric Operations Risk
5	Electric Operations Risk
6	Electric Operations Risk
7	Electric Operations Risk
8	Electric Operations Risk
9	Electric Operations Risk

Analysis in progress, status unknown or under evaluation

Current controls are not adequate

Controls are being strengthened

Current controls are adequate

Funding needs unknown

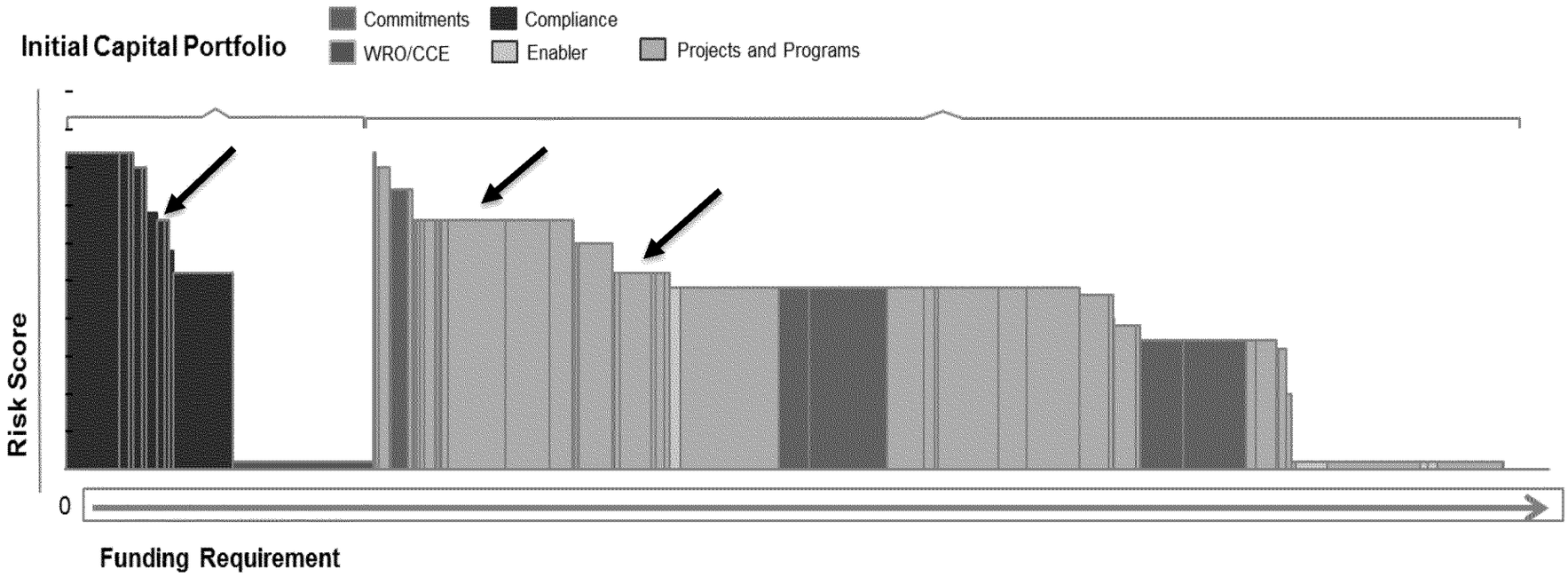
Additional funding may be needed

Additional funding not anticipated.

Bubble size is based on seven levels of the Safety impact

Contents may include hypothetical or illustrative data

GRC Illustrative Showing (cont.)
Prioritized List of Proposed Mitigation Measures



The arrows illustrate how different primary overhead conductor mitigation measures may be risk-ranked

Contents may include hypothetical or illustrative data

Line of Business – Electric Operations

Risk – Contact with Primary Overhead Conductor

Risk Definition

Failure of or contact with energized electric distribution primary overhead (OH) conductor – either "intact" or "wire down" - which could result in public or employee safety issues, significant environmental damage, prolonged outages, or significant property damage.

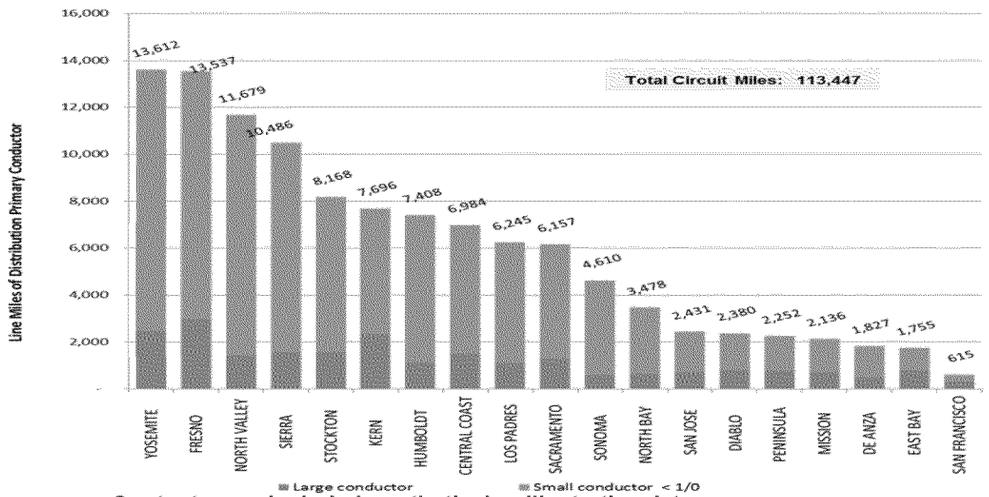
Asset Description

All 2.4kv to 21kv distribution OH conductor including splices, connectors and jumpers. Includes 113,000 OH circuit miles comprised of: Aluminum conductor, steel reinforced (ACSR) – 53%; Copper – 31%; and Aluminum – 13%

Over 80% of conductor< 1/0; 27% of conductor > 50 years

Conductor Size (small to large)	Number of Circuit Miles	Percent of Total
6 Cu	22,157	20%
4 Cu	6,310	6%
4 ACSR	47,555	42%
2 ACSR	9,836	9%
2 Cu	3,826	3%
1/0 ACSR	1,791	2%
1/0 Cu	2,105	2%
4/0 Al	5,081	4%
397 Al	5,435	5%
715 Al	4,970	4%
Other Sizes	4,381	4%
Total	**113,447**	**100%**

The majority of primary OH conductor is outside major urban areas



Contents may include hypothetical or illustrative data

Existing Controls

PG&E has a variety of controls in place to address the risks of contact with primary OH conductor.

Risk Driver	Key Controls (Existing)	Is an additional mitigation needed?

Driver 1: Equipment Failure	• Conductor replacement programs
	  • Annealed/poor performing wire such as wires down, aluminum conductor steel reinforced (ACSR) in corrosion zones, small conductor with circuit breaker zone, and spanswith high splice count
	  • Targeted circuit enhancements
	  • Capacity upgrades
	  • Work requested by others
	• Infrared scan and inventory splices on OH line prioritized by potential impact of failure: OWF/Urban Wildfire, Targeted Circuits, High Customer Count, High Peak Load, Low Peak Load (aka remaining circuits)
	• Visual patrols and inspections to identify issues and initiate maintenance
		Yes

Driver 2: Third Party	• Inspections ensure proper clearance requirements are met to limit exposure • Wire down awareness campaign continues • Tree trimmers awareness program continues, including new videos • Line clearance requirements for vegetation • High voltage warning signs in place where required	**Yes**
Driver 3: Vegetation	• Routine trimming, pole clearing • Work at historic outage locations, including tree removal • Analyzing failure characteristics of otherwise healthy trees in wildfire areas • Wires Down site investigations	**Yes**
Driver 4: Animal	• Raptor-safe construction and wildlife protection standard issued 6/28/2013	**No**
Driver 5: PG&E Employee Work Procedure Error (WPE)	• Training and qualification programs coupled with work procedures prepare employees to work safely • Efforts to ensure Near Hits are reported and monitored for proactive actions	**Yes**

Methods Used to Estimate the Risk

A combination of quantitative and qualitative (subject matter expert/engineering judgment) information was used to assess the risk associated with contact with primary OH conductor

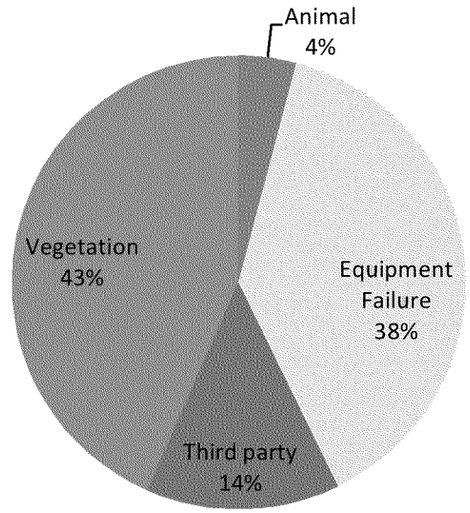
The following data were used:

1. Data on Fatality/Injury/Property damage related to primary OH conductor contact
2. Data on contact with "intact" energized primary conductor (2005-2012)
3. Data on Causes of Wire Down (2008 – 2012)
4. Data on assets (see Asset Description on Slide 6)

The following assessment approaches were used

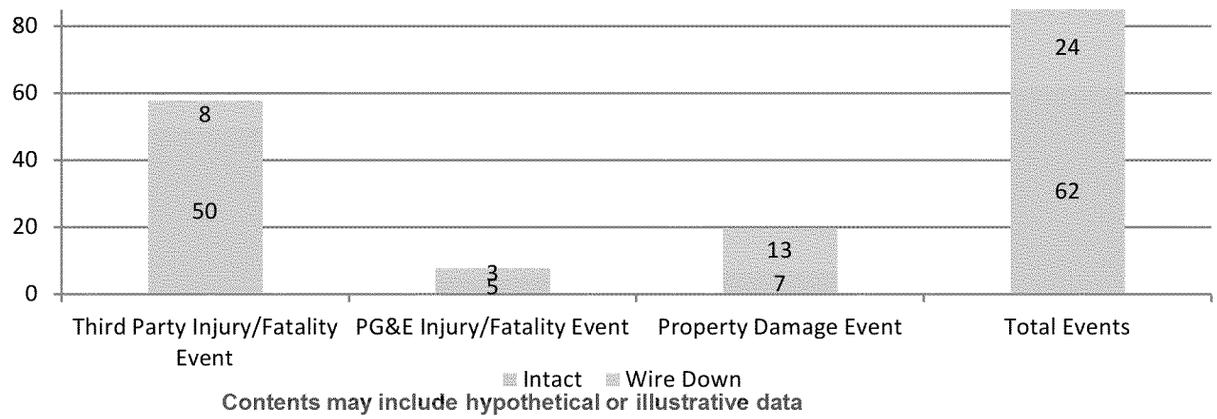
1. "Bow-Tie" Analysis of Drivers and Consequences that relies on both data and judgment (see Slide 19)
2. Company-wide Risk Evaluation Tool 2.0 to assign risk score using data and judgment (see Slide 12 and following)

Example Data
2008-2012 Wire Down by Basic Cause



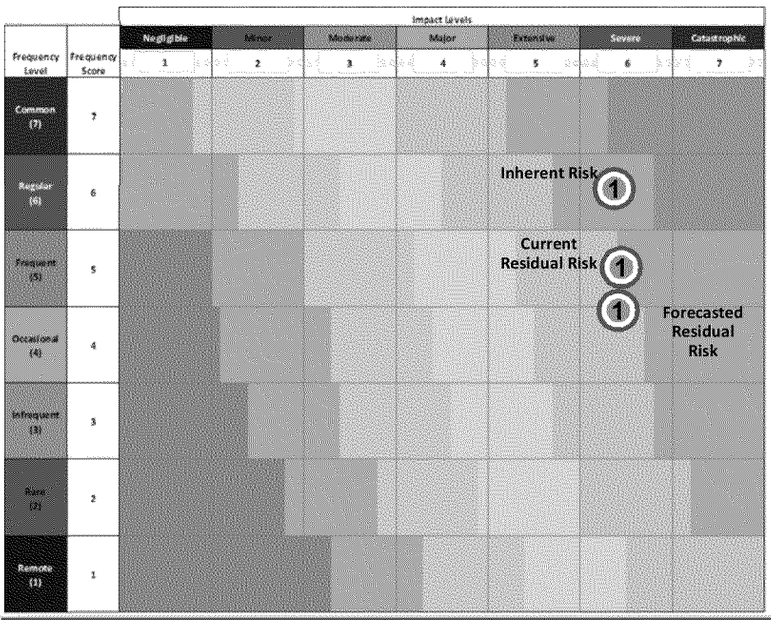
.

Example Data
Injury/Fatality and Third Party Property Damage OH Primary Conductor
2005 to 2012



Contents may include hypothetical or illustrative data

GRC Illustrative Showing (cont.)
Risk – Contact with Primary Overhead Conductor



Risk Score

The risk score reflects the severity and frequency of events. PG&E examines three types of risk: inherent risk (i.e., if no mitigations are in place), the current residual risk (i.e., with current controls); and the residual risk with proposed mitigations in place. The risk scores for primary OH conductor are as follows:

Inherent Risk - 980
Current Residual Risk Score - 408
Residual Risk Score with Proposed Mitigations – 310*

*assumes completion of all proposed multi-year mitigations

Proposed Additional/Enhanced Mitigation Items	Drivers Mitigated	Expected Investment	Percentage Complete as of 12/31/13	End Date
Mitigation 1: Interim STAR tool enhancement to provide identification of obsolete, poor performing conductor	Equipment Failure	$	**50%**	**06/30/2015**
Mitigation 2: Distribution Protection Practice Review and Recommendations	Equipment Failure	$$	**10%**	**09/30/2020**
Mitigation 3: Prioritize replacement of small ACSR conductor in corrosion zones, small conductor in circuit breaker zones, spans with high splice counts	Equipment Failure	$$	**10%**	**12/31/2019**
Mitigation 4: Improved wires down site visit data capture and analysis refinement	Equipment Failure	$	**70%**	**09/30/2015**
Mitigation 5: Improve Public Awareness Program tracking and reporting	Third Party	$	**10%**	**06/30/2014**
Mitigation 6: Continue enhanced Vegetation Management in historic outage locations	Vegetation	$$	**N/A**	**04/30/2016**
Mitigation 7: Ensure workplace environment encourages reporting and sharing of Near Hits	PG&E Employee WPE	$	**N/A**	**03/31/2015**

Alternatives Considered

In determining the recommended mitigations, PG&E considers a variety of factors including: cost, available resources, expected risk reduction. The following alternatives were considered and rejected.

- No change from current activities
- Infrared inspect all ED OH on a 2 year cycle
- Replace all small Cu wire over 5 years
- Special inspection to collect splice inventory and develop corrective maintenance
- Underground all distribution overhead lines
- Underground distribution in wildfire risk zones, urban areas, etc.
- Clear vegetation ground-to-sky
- Expand public safety outreach
- Focus vegetation management on areas with repeat wire down events

PG&E Risk Evaluation Tool 2.0

Illustrative Scoring Methodology for Mitigations

Contents may include hypothetical or illustrative data

PG&E's RET2 model approach is based on seven levels of impact and seven levels of frequency. Each risk event is measured against six (see "Objectives" below) impact groups by the seven levels of frequency and impact.

Every risk has an initial inherent and residual risk score. During the risk analysis and evaluation phase, a formal inherent and residual risk score is established. During the Response Phase, a forecasted residual risk score is established so that the risk mitigation efforts can be monitored to ensure results.

Frequency	> 10 times per year	1 - 10 times per year	Once every 1 - 3 years	Once every 3 - 10 years	Once every 10 - 30 years	Once every 30 - 100 years	Once every 100 + years
	F = > 10	F = 1 - 10	F = 1 - 0.30	F = 0.20 - 0.10	F = 0.10 - 0.03	F = 0.03 - 0.01	F = <0.01
	Common	Regular	Frequent	Occasional	Infrequent	Rare	Remote
	(7)	(6)	(5)	(4)	(3)	(2)	(1)
Objectives	Safety						
	Environmental						
	Compliance						
	Reliability						
	Reputational						
	Financial						
Impact	Catastrophic	Severe	Extensive	Major	Moderate	Minor	Negligible
	(7)	(6)	(5)	(4)	(3)	(2)	(1)

Scoring a risk using the risk criteria will result in a total risk score that falls between 1 of 7 risk levels.

Pacific Gas & Electric

Risk Evaluation Tool (RET2.0) - Risk Scoring Matrix

					Impact Levels						
	Frequency Description	Frequency per Year	Frequency Level	Frequency Score	Negligible	Minor	Moderate	Major	Extensive	Severe	Catastrophic
					1	2	3	4	5	6	7
Frequency	> 10 times per year	f = > 10	Common (7)	7	10	32	100	316	1,000	3,162	10,000
	1 - 10 times per year	f = 1 - 10	Regular (6)	6	6	18	56	178	562	1,778	5,623
	Once every 1 - 3 years	f = 1 - 0.3	Frequent (5)	5	2	7	23	74	234	740	2,340
	Once every 3 - 10 years	f = 0.2 - 0.1	Occasional (4)	4	2	6	18	56	178	562	1,778
	Once every 10 - 30 years	f = 0.1 - 0.03	Infrequent (3)	3	1	5	15	47	150	473	1,495
	Once every 30 - 100 years	f = 0.03 - 0.01	Rare (2)	2	1	3	10	32	100	316	1,000
	Once every 100 + years	f = <0.01	Remote (1)	1	1	2	6	18	56	178	562

Total RS Levels				
Risk Level	Score Level	Min	Mid	Max
7	10,000	2,683	6,341	10,000
6	2,683	720	1,701	2,683
5	720	193	456	720
4	193	52	122	193
3	52	14	33	52
2	14	4	9	14
1	4	-	2	4

Contents may include hypothetical or illustrative data

Impact Level	Safety
Catastrophic (7)	o **Fatalities:** Many fatalities and life threatening injuries to the public or employees.
Severe (6)	o **Fatalities:** Few fatalities and life threatening injuries to the public or employees.
Extensive (5)	o **Permanent/Serious Injuries or Illnesses:** Many serious injuries or illnesses to the public or employees.
Major (4)	o **Permanent/Serious Injuries or Illnesses:** Few serious injuries or illnesses to the public or employees.
Moderate (3)	o **Minor Injuries or illnesses:** Minor injuries or illnesses to many public members or employees.
Minor (2)	o **Minor Injuries or illnesses:** Minor injuries or illnesses to few public members or employees.
Negligible (1)	o No injury or illness or up to an un-reported negligible injury.

Impact Level	Reliability
Catastrophic (7)	o **Location:** Impacts an entire metropolitan area, including critical customers, or is system-wide; and o **Duration:** Disruption of service of more than a year due to a permanent loss to a nuclear facility, hydro facility, critical gas or electric asset; or o **Customer Impact:** Unplanned outage (net of replacement) impacts more than 1 million customers; or EO: 50 million total customer hours, or more than 1 million mwh total load;
Severe (6)	o **Location:** Impacts multiple critical locations and critical customers; or o **Duration:** Substantial disruption of service greater than 100 days; or o **Customer Impact:** Unplanned outage (net of replacement) impacts more than 100k customers; or EO: 5 million total customer hours, or more than 100k mwh total load;
Extensive (5)	o **Location:** Impacts multiple critical location sor customers; or o **Duration:** Disruption of service greater than 10 days; or o **Customer Impact:** Unplanned outage (net of replacement) impacts more than 10k customers; or EO: 500k total customer hours, or more than 10k mwh total load;
Major (4)	o **Location:** Impacts a single critical location; or o **Duration:** Disruption of service greater than 1 day; or o **Customer Impact:** Unplanned outage (net of replacement) impacts more than 1k customers; or EO: 50k total customer hours, or more than 1k mwh total load;
Moderate (3)	o **Location:** Impacts a small area with no disruption of service to critical locations; or o **Duration:** Disruption of service of up to 1 full day; or o **Customer Impact:** Unplanned outage (net of replacement) impacts more than 100 customers; or EO: 5k total customer hours, or more than 100 mwh total load;
Minor (2)	o **Location:** Impacts a small localized area with no disruption of service to critical locations; or o **Duration:** Disruption of up to 3 hours; or o **Customer Impact:** Unplanned outage (net of replacement) impacts less than 100 customers; or EO: Less than 5k total customer hours, or less than 100 mwh total load;
Negligible (1)	o No reliability to negligible impacts.

Impact Level	Environmental
Catastrophic (7)	o **Duration:** Permanent or long-term damage greater than 100 years; or o **Hazard Level/Toxicity:** Release of toxic material with immediate, acute and irreversible impacts to surrounding environment; or o **Location:** Event causes destruction of a place of international cultural significance; or o **Size:** Event results in extinction of a species.
Severe (6)	o **Duration:** Long-term damage between 11 years and 100 years; or o **Hazard Level/Toxicity:** Release of toxic material with acute and long-term impacts to surrounding environment; or o **Location:** Event causes destruction of a place of national cultural significance; or o **Size:** Event results in elimination of a significant population of a protected species.
Extensive (5)	o **Duration:** Medium-term damage between 2 and 10 years; or o **Hazard Level/Toxicity:** Release of toxic material with a significant threat to the environment and/or release with medium-term reversible impact; or o **Location:** Event causes destruction of a place of regional cultural significance; or o **Size:** Event results in harm to multiple individuals of a protected species.
Major (4)	o **Duration:** Short-term damage of up to 2 years; or o **Hazard Level/Toxicity:** Release of material with a significant threat to the environment and/or release with short-term reversible impact; or o **Location:** Event causes destruction of an individual cultural site; or o **Size:** Event results in harm to a single individual of a protected species.
Moderate (3)	o **Duration:** Short-term damage of a few months; or o **Hazard Level/Toxicity:** Release of material with a moderate threat to the environment and/or release with short-term reversible impact; or o **Location:** Event causes damage to an individual cultural site; or o **Size:** Event results in damage to the known habitat of a protected species.
Minor (2)	o **Duration:** Immediately correctable; or contained within a small area.
Negligible (1)	o Negligible to no damage to the environment.

Contact with Primary OH Conductor Risk
Illustrative Scoring of Proposed Mitigation

ILLUSTRATIVE

Safety / Reliability Project: Targeted Circuit Blitz

	Impact	Frequency
Safety	**4** ▪ Worst reasonable case is wire down event, the major contribution of this work is to mitigate this event	**1** ▪ Less than 1% probability that injury to the public will occur based on historical average of 3,000 wire down events per year and 1 injury per 1,000 events
Environ-mental	**3** ▪ Small localized grass fire, circuit is not designated as wild fire area	**1** ▪ Less than 1% chance of fire occurring
Reliability	**4** ▪ Average number of customers impacted on a mainline ~1,500	**6** ▪ We are reducing Customers Experiencing Sustained Outages (CESO) of ~1,500 in a year

202

i. Provide **context and rationale** for risk informed budgeting and **change management**

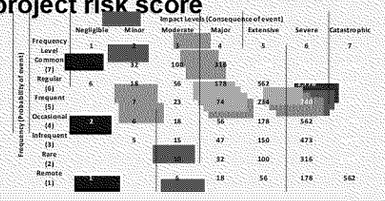
ii. Work with engineer to understand project and **rationale** - *why* are we doing this work? Is it to mitigate risk, or for another reason?

iii. Determine the **Worst Reasonable Direct Impact (WRDI)** that the project is expected to mitigate

iv. For safety, environmental and reliability, use the 1-7 scoring taxonomy to **determine the impact score for the WRDI**

v. Align with the engineer on the expected **frequency** of the WRDI in each risk area – how often could the adverse outcome occur?

vi. Enter all of the data into spreadsheet-based scoring tool, which will capture necessary details (including key flags), and **calculate the overall project risk score**



Contents may include hypothetical or illustrative data

Contact with Primary OH Conductor Risk
Illustrative Scoring of Proposed Mitigation

ILLUSTRATIVE

Safety / Environmental / Reliability Project: Annealed Conductor Replacement

	Impact		Frequency	
Safety	4	▪ Replacement of wire will prevent a live wire down event	1	▪ Less than 1% probability that injury to public will occur based on historical average of 3,000 wire down events per year 1 injury per 1,000 events
Environ-mental	6	▪ Small localized grass fire, circuit is designated as wild fire area	1	▪ Less than 1% chance of fire occurring
Reliability	2	▪ Average of 500 customers affected per wire down outage equates to 4,000 customer hours per event for average 8 hour outage	5	▪ Per engineer failure analysis, chance of failure reoccurring is 40%

203

i. Provide **context and rationale** for risk informed budgeting and **change management**

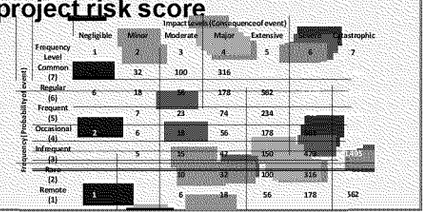
ii. Work with engineer to understand project and **rationale** - *why* are we doing this work? Is it to mitigate risk, or for another reason?

iii. Determine the **Worst Reasonable Direct Impact (WRDI)** that the project is expected to mitigate

iv. For each of safety, environmental and reliability, use the 1-7 scoring taxonomy to **determine the impact score for the WRDI**

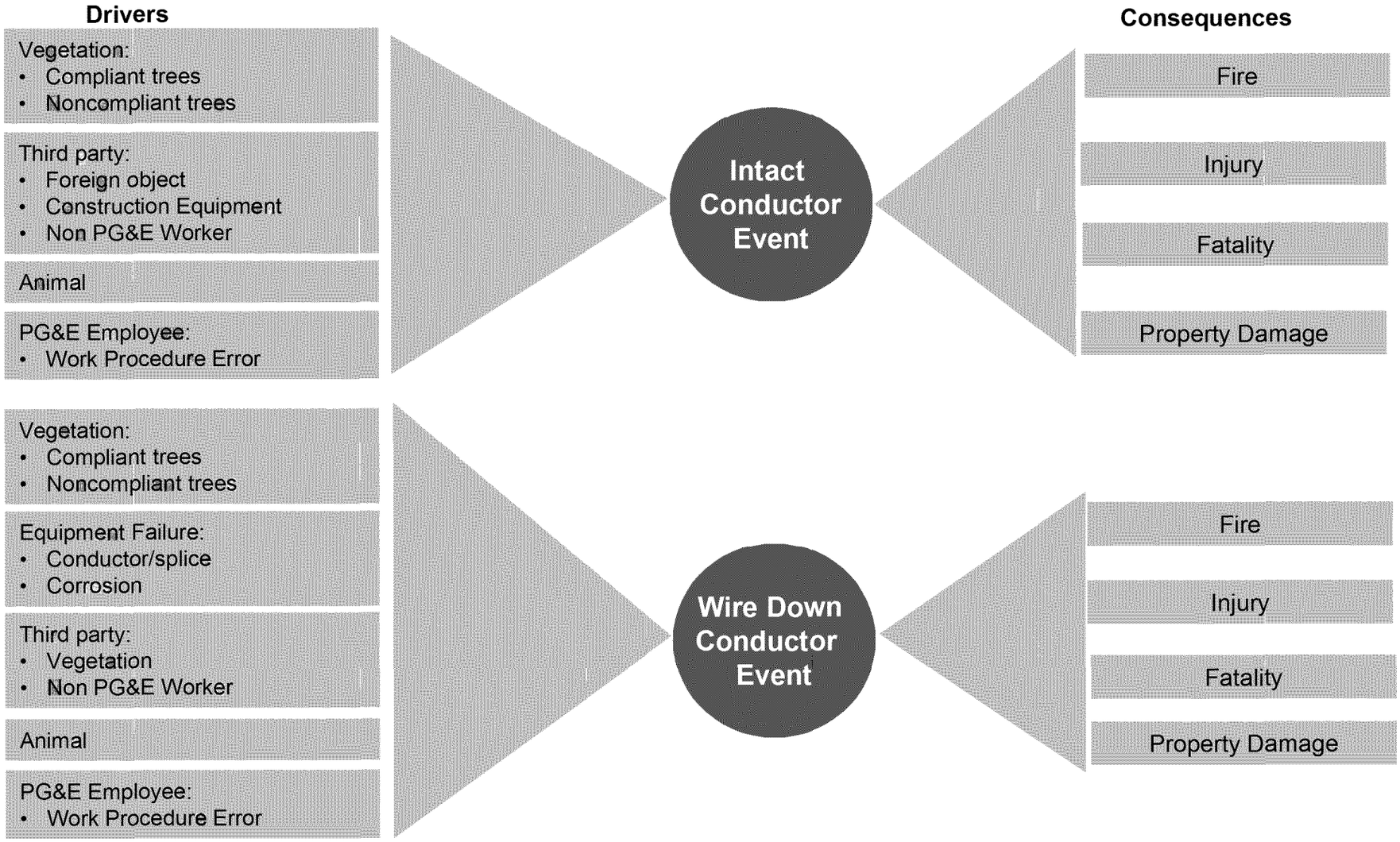
v. Align with the engineer on the expected **frequency** of the WRDI in each risk area – how often could the adverse outcome occur?

vi. Enter all of the data into spreadsheet-based scoring tool, which will capture necessary details (including key flags), and **calculate the overall project risk score**



Contents may include hypothetical or illustrative data

Risk of Contact with Primary OH Conductor
Risk Assessment - Bow Tie Analysis



Contents may include hypothetical or illustrative data