Southern California Edison
Risk Model Working Group – RMWG

DATA REQUEST SET O E I S - M i t i g a t i o n S e l e c t i o n - S C E - 0 0 1

To: Energy Safety
Prepared by: Yoshinori Goya
Job Title: Senior Advisor
Received Date: 11/7/2024

Response Date: 12/9/2024

Question 01:
Regarding the cost of mitigations:

a. SCE discusses the following mitigation activities in its 2023-2025 WMP:
i. Covered Conductor
ii. Undergrounding
iii. Branch Line Protection
iv. Distribution pole replacements and reinforcements
v. Distribution traditional hardening
vi. Transmission pole/tower replacements and reinforcements
vii. Transmission traditional hardening
viii. Microgrids, including Remote Grids
ix. Remote Automatic Recloser Setting Updates
x. Circuit Breaker Fast Curve Hardware
xi. Transmission Open Phase Detection
xii. Tree Attachment Remediation
xiii. Long Span Initiative
xiv. Vertical Switch Replacement
xv. Vibration Damper Retrofits
xvi. Fire Resistant Wrap Retrofits
xvii. Rapid Earth Fault Current Limiter (REFCL)
xviii. High Impedance relays
xix. Transmission Open Phase Detection (OPD)
xx. Distribution open phase detection (OPD)
xxi. Early Fault Detection (EFD)

For each of the above activities, provide:

(1) The projected average capital cost per circuit mile1 of projects2 expected to be completed3 in 2025.

(2) The average capital cost per circuit mile of projects completed from Jan 1, 2021, to Jun 30, 2024.

(3) The average operation and maintenance cost per circuit mile per year4 of projects completed from Jan 1, 2021, to Jun 30, 2024.

(4) A discussion of factors that have resulted in projects completed from Jan 1, 2021, to Jun 30, 2024, with a capital cost per circuit mile 20 percent more than the average cost per circuit mile from Jan 1, 2021, to Jun 30, 2024, for that given activity. List the factors and discuss how each impacts the cost.

(5) A discussion of factors that have resulted in projects completed from Jan 1, 2021, to Jun

30, 2024, with a capital cost per circuit mile 20 percent less than the average cost per circuit mile from Jan 1, 2021, to Jun 30, 2024, for that given activity. List the factors and discuss how each impacts the cost.

(6) Complete the following table for the 10 projects with the highest capital cost per circuit mile and 10 projects with the lowest capital cost per circuit mile completed in 2023. If less than 20 projects were completed in 2023, complete the table for all projects completed in 2023.

Mitigation Activity					
Project ID	Location	Project length (circuit miles)	Project Capital Cost	Project Duration[5] (days)	Capital Cost per circuit mile

[1] Cost per circuit mile in this Data Request refers to the cost per circuit mile of risk mitigated by the given activity, i.e. the number of circuit miles covered by a mitigation being implemented

[2] The average capital cost provided should be the average of all projects expected to be completed in 2025 and not a separate average capital cost per circuit mile for each project.

[3] A project is considered complete when it is operationalized.

[4] The average operation and maintenance (O&M) cost provided should be the average O&M cost per circuit mile per year of all projects expected to be completed for the years between 2021 and 2023, and not a separate O&M cost for each project.

[5] Project duration refers to the number of days from the beginning of the design phase to electrification.

Response to Question 01:

(1) The projected average capital cost per circuit mile of projects expected to be completed in 2025.

SCE objects to this request as overbroad and unduly burdensome. Subject to these objections, SCE responds as follows:

From the list of mitigation activities provided in the question, only covered conductor and targeted undergrounding are executed on a per circuit mile basis and lend themselves to meaningful calculations of cost per circuit mile. Given the framing of this question, SCE has therefore only populated data in the attached spreadsheet (tab title "Q1Q2" of "OEIS-Mitigation Selection-SCE-001_Response.xlsx") for details concerning average capital cost (constant $s) per circuit mile for covered conductor and targeted undergrounding projects.

(2) The average capital cost per circuit mile of projects completed from Jan 1, 2021, to Jun 30, 2024.

SCE incorporates by reference the objections noted in response to subpart 1. Subject to those objections, please see the attached spreadsheet (tab title "Q1Q2" of "OEIS-Mitigation Selection-SCE-001_Response.xlsx") for details concerning average capital cost per circuit mile for covered conductor and targeted undergrounding projects. Costs are based on information historically provided to Energy Safety.

(3) The average operation and maintenance cost per circuit mile per year of projects completed from Jan 1, 2021, to Jun 30, 2024.

SCE incorporates by reference the objections noted in response to subpart 1. Subject to those objections, SCE responds as follows: There are no O&M costs for the covered conductor or targeted undergrounding programs.

(4) A discussion of factors that have resulted in projects completed from Jan 1, 2021, to Jun 30, 2024, with a capital cost per circuit mile 20 percent more than the average cost per circuit mile from Jan 1, 2021, to Jun 30, 2024, for that given activity. List the factors and discuss how each impacts the cost.

SCE incorporates by reference the objections noted in response to subpart 1. Subject to those objections, SCE responds as follows:

The lists below represent the range of reasons that may impact individual projects.

The factors that have contributed to relatively higher capital costs for completion of covered conductor projects included:

- costs for helicopter resources to perform work in difficult terrain;
- contractor and material costs;
- project delays (due to environmental holds, processing easements and permitting) that led to higher costs associated with activities to overcome these delays. Such activities typically include performing additional environmental analyses and/or lengthy negotiations with external agencies for permits, for example; and
- design complexity.

The factors that have contributed to relatively higher capital costs for completion of undergrounding projects included:

- project delays (due to environmental holds, processing easements and permitting, and obtaining landowner permissions) that led to higher costs associated with activities to overcome these delays. Such activities typically include project redesign, performing additional environmental analyses, or lengthy negotiations with landowners and external agencies for land access and/or permissions to conduct outages to perform work;
- project cost was also affected by complexity and availability of resources and materials; and
- design complexity.

(5) A discussion of factors that have resulted in projects completed from Jan 1, 2021, to Jun 30, 2024, with a capital cost per circuit mile 20 percent less than the average cost per circuit mile from Jan 1, 2021, to Jun 30, 2024, for that given activity. List the factors and discuss how each impacts the cost.

The lists below represent the range of reasons that may impact individual projects. Completion of projects at relatively lower cost is often due to the absence of factors that drive higher cost.

The factors that have contributed to relatively lower capital costs for completion of covered conductor projects included:

- terrain that was easily accessible by ground crews;
- less material required to complete work;

- fewer costs associated with easements and permitting; and
- in some cases, projects with less complex designs may have also contributed to lower project costs.

The factors that have contributed to relatively lower capital costs for completion of undergrounding projects included:

- use of existing vaults for undergrounding work;
- fewer costs associated with easements and permitting; and
- in some cases, projects that had less complex designs may have also contributed to lower project costs.

(6) Complete the following table for the 10 projects with the highest capital cost per circuit mile and 10 projects with the lowest capital cost per circuit mile completed in 2023. If less than 20 projects were completed in 2023, complete the table for all projects completed in 2023.

SCE incorporates by reference the objections noted in response to subpart 1. Subject to those objections, SCE responds as follows:

Regarding covered conductor, the details for the top 10 highest and top 10 lowest capital costs per circuit mile are available in the tab titled "Q1a.6" of the attached spreadsheet entitled "OEIS-Mitigation Selection-SCE-001_Response.xlsx." Please note that the information in this tab is provided at the work order level (i.e., TD #) and may not reflect all the costs of a project, as a project may have more than one work order associated with it.

For targeted undergrounding, SCE used a total of 8 work orders in 2023. The details for these 8 work orders are available in the tables labeled "Undergrounding" under "2023 Top 10 Projects with Highest Capital Cost Per Circuit Mile (Q01.a.6)" and "2023 Top 10 Projects with Lowest Capital Cost Per Circuit Mile (Q01.a.6)."

SCE notes that the cost-per-mile calculation for certain individual projects in the attached spreadsheet is an extrapolated value using individual work orders (TD) to align with OEIS's requested metrics. A given hardening "project" may consist of multiple TDs. As such, TDs are not representative of actual realized costs per mile for the mitigation more broadly. For example, if a 0.1-mile TD with unique considerations had a cost of $1M, it would have an implied cost per mile of $10M. However, it would be inappropriate to draw broad conclusions based on extrapolated calculations for these TDs because they do not represent the project costs for the majority of project miles. This same logic also applies to TDs with relatively lower costs, which also should not necessarily be relied upon as representative of the majority of project miles. As noted above in response to Question 1, subpart 1, SCE's realized average capital cost per circuit mile for covered conductor was $649K from 2021 through 2024 Q2, and was $2.25M for targeted undergrounding during that same period.

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To: Energy Safety
Prepared by: Deanna Ellis
Job Title: Advisor
Received Date: 11/7/2024

Response Date: 12/9/2024

Question 02:
Regarding the deployment time of mitigation initiatives:

a. For each mitigation activity listed in Q01. a. i-xxii, provide:
i. The projected project duration (days/circuit mile)6 for projects expected to be completed in 2025.
ii. The average project duration (days/circuit mile) of projects completed from Jan 1, 2021, to Jun 30, 2024.
iii. A discussion of factors that have resulted in projects completed from Jan 1, 2021, to Jun 30, 2024, with a project duration (days/circuit mile) 20 percent more than the average project duration from Jan 1, 2021, to Jun 30, 2024, for that given activity. List the factors and discuss how each impacted the project duration.
iv. A discussion of factors that have resulted in projects completed from Jan 1, 2021, to Jun 30, 2024, with a project duration (days/circuit mile) 20 percent less than the average project duration from Jan 1, 2021, to Jun 30, 2024, for that given activity. List the factors and discuss how each impacted the project duration.
v. Complete the following table for the 10 projects with the longest duration per circuit mile and 10 projects with the lowest duration per circuit mile completed in 2023. If less than 20 projects were completed in 2023, complete the table for all projects completed in 2023.

Mitigation Activity					
Project ID	Location	Project length (circuit miles)	Project Capital Cost	Project Duration[7] (days)	Capital Cost per circuit mile

6 Duration per circuit mile in this question refers to the length of time required to mitigate one circuit mile of risk with the given activity.
7 Project duration refers to the number of days from the beginning of the design phase to electrification.
8 Compatible refers to mitigations that can physically exist in the same space.

Response to Question 02:
SCE incorporates by reference the objections noted in response to Question 1.

a. For each mitigation activity listed in Q01. a. i-xxii, provide

i. The projected project duration (days/circuit mile) for projects expected to be completed in 2025.

See the tab labeled "Q1Q2" in the spreadsheet entitled "OEIS-Mitigation Selection-SCE-001_Response.xlsx" that is attached to the response to Question 1 of this data request.

ii. The average project duration (days/circuit mile) of projects completed from Jan 1, 2021, to Jun 30, 2024.

See the tab labeled "Q1Q2" in the spreadsheet entitled "OEIS-Mitigation Selection-SCE-001_Response.xlsx" that is attached to the response to Question 1 of this data request.

iii. A discussion of factors that have resulted in projects completed from Jan 1, 2021, to Jun 30, 2024, with a project duration (days/circuit mile) 20 percent more than the average project duration from Jan 1, 2021, to Jun 30, 2024, for that given activity. List the factors and discuss how each impacted the project duration.

The lists below represent the range of reasons that may impact individual projects.

The factors that have contributed to relatively longer durations for completion of covered conductor projects included:

- bird nesting;
- weather conditions;
- coordinating scheduling of helicopter resources to perform work in difficult terrain;
- deployment of work crews in remote areas (which generally take longer than in urban areas); and
- additional time needed to process easements and permitting.

In addition, project length was affected by complexity and availability of resources and materials.

The factors that have contributed to relatively longer durations for completion of undergrounding projects included:

- additional time needed to process easements and permitting;
- challenges with obtaining landowner permissions; and
- delays due to customer outage fatigue.

Project length was also affected by complexity and availability of resources and materials.

iv. A discussion of factors that have resulted in projects completed from Jan 1, 2021, to Jun 30, 2024, with a project duration (days/circuit mile) 20 percent less than the average project duration from Jan 1, 2021, to Jun 30, 2024, for that given activity. List the factors and discuss how each impacted the project duration.

The lists below represent the range of reasons that may impact individual projects. Completion of projects with relatively shorter duration is often due to the absence of factors that drive longer

duration.

The factors that have contributed to shorter durations for completion of covered conductor projects included:

- terrain that was easily accessible by ground crews; and/or
- fewer environmental holds, easements, and permitting.

In addition, project length was affected by weather conditions, project complexity, and availability of resources and materials.

The factors that have contributed to shorter durations for completion of undergrounding included:

- use of existing vaults for undergrounding work;
- little or no barriers to performing work (e.g., nesting, access challenges, weather); and/or
- shorter periods for processing permitting and rights checks.

Project length was also affected by complexity and availability of resources and materials.

v. Complete the following table for the 10 projects with the longest duration per circuit mile and 10 projects with the lowest duration per circuit mile completed in 2023. If less than 20 projects were completed in 2023, complete the table for all projects completed in 2023.

See the tab labeled "Q2.a.v" in the spreadsheet entitled "OEIS-Mitigation Selection-SCE-001_Response.xlsx" that is attached to the response to Question 1 of this data request.

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To: Energy Safety
Prepared by: Arianne Luy
Job Title: Manager
Received Date: 11/7/2024

Response Date: 12/9/2024

Question 03:
Regarding mitigation compatibility

a. For each mitigation activity listed in Q01. a. i-xxii:
i. List the constraints associated with each activity (e.g., cannot be deployed on 3 wire systems, in areas with frequent freeze/thaw cycles, requires communication network to function).
ii. Provide a completed compatibility table. Each cell must identify one of the following:
(1) Mitigations are compatible8 and the combination will further reduce wildfire risk.
(2) Mitigations are compatible, but combination will not further reduce wildfire risk.
(3) Mitigations are compatible, but it is unknown if combination will further reduce wildfire risk.
(4) Mitigations are not compatible/combination is impractical.
The utility must submit two separate tables, one for transmission specific initiatives and one for distribution specific initiatives, if the transmission and distribution tables are not identical.

Example Mitigation Initiative Compatibility Table:

Mitigation Activity	Covered Conductor Installation	Undergrounding	Branch line Protection	(Mitigation Activities continued…)
Covered Conductor Installation		Mitigations are not compatible/ combination is impractical	Mitigations are compatible and combination will reduce additional wildfire risk	
Undergrounding	Mitigations are not compatible/ combination is impractical		Mitigations are not compatible/ combination is impractical	
Branch Line Protection	Mitigations are compatible and combination will reduce additional wildfire risk	Mitigations are not compatible/ combination is impractical		
(Mitigation Activities continued…)				

Response to Question 03:

a. For each mitigation activity listed in Q01. a. i-xxii:
i. List the constraints associated with each activity (e.g., cannot be deployed on 3 wire systems, in areas with frequent freeze/thaw cycles, requires communication network to function).

See the tab labeled "Q3.a.i" in the file titled *OEIS-Mitigation Selection-SCE-001_Response* attached to the response to Question 1.

ii. Provide a completed compatibility table. Each cell must identify one of the following:
(1) Mitigations are compatible and the combination will further reduce wildfire risk.
(2) Mitigations are compatible, but combination will not further reduce wildfire risk.
(3) Mitigations are compatible, but it is unknown if combination will further reduce wildfire risk.
(4) Mitigations are not compatible/combination is impractical.
The utility must submit two separate tables, one for transmission specific initiatives and one for

distribution specific initiatives, if the transmission and distribution tables are not identical.

See the tabs labeled "Q3.a.i (D)" and "Q3.a.i (T)" in the file titled *OEIS-Mitigation Selection-SCE-001_Response* attached to the response to Question 1.

For reference, the numbers listed in the compatibility tables correspond to the following legend specified in the question:

1 - Mitigations are compatible and the combination will further reduce wildfire risk
2 - Mitigations are compatible, but the combination will not further reduce wildfire risk
3 - Mitigations are compatible, but it is unknown if the combination will further reduce wildfire risk
4 - Mitigations are not compatible/combination is impractical