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2022 Climate Change Vulnerability Assessment and Resilience Plan Summary

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2022 Climate Change Vulnerability Assessment and Resilience Plan Summary

Los Alamos National Laboratory (LANL, or the Laboratory) produced a Vulnerability Assessment and Resilience Plan (VARP) following Department of Energy (DOE) Guidance to assess and manage climate change related risks to the Laboratory's assets and operations. This is a condensed summary of the Laboratory's 2022 VARP – the full version of the document is not publicly available at this time.

The VARP was led by the Pollution Prevention (P2) Program in the Environmental Protection and Compliance Division (EPC-DO) and covers the entirety of the 36-square-mile LANL site in Los Alamos, New Mexico. A Steering Committee, composed of representatives from the three main Laboratory Directorates and the Los Alamos Field Office, identified real property Critical Assets based on their Mission Dependency Index (MDI) scores. LANL used MDI scores of 70 and above, which are considered Mission-Critical, to generate a list of 141 Critical Asset facilities.

Vulnerability Assessment

Climate related hazards were determined through a combination of a review of historical records, including LANL-specific sources, and a review of the literature. The Risk Assessment Tool, developed by DOE, was used to score hazard vulnerabilities for each Critical Asset. Those hazards projected to have high impacts to three or more Critical Asset types were characterized as High Impact Hazards. Five High Impact Hazards were identified for LANL: Increased frequency and intensity of extreme heat events; increased frequency, intensity, and duration of extreme precipitation events; increased thunderstorms (combined precipitation, wind, and lightning); increased flooding and erosion events; and increased wildfire frequency.

Using the calculations provided in the DOE Risk Assessment Tool, LANL created a VARP Risk Matrix to help visualize the vulnerabilities of Critical Assets against climate change hazards. Since there were 141 Critical Assets and ten (10) climate change hazards, the Risk Assessment Tool produced 1,410 individual VARP Risk Scores. LANL created a Summary Risk Matrix for High Impact Hazards showing average risk by Asset Type, vs. by individual asset. The color key is shown in Table 1 and the Summary Risk Matrix is shown in Table 2. Many of the risk scores appear in red, or the High Risk category. This is likely a function of the algorithms that were part of the Risk Assessment Tool. There was general agreement within the LANL VARP Planning Team that this did not mean that the Laboratory was in great danger from the hazards related to climate change. Rather, these high scores indicated which hazards warranted the greatest degree of mitigation and which assets needed the most protection.

VARP Risk Scores consider the Criticality Score of each critical asset, the projected likelihood of climate change hazards, the Impact Score for each climate change hazard on each critical asset, and the Vulnerability Score of each critical asset to each climate change hazard. Equations 1-3 show the calculations used in the Risk Assessment Tool.

$$\text{Risk} = \text{Criticality} \times \text{Hazard Likelihood} \times \text{Impact} \times \text{Vulnerability} \quad (\text{Eq. 1})$$

$$\text{VARP Risk Score} = \text{Log}_{10}(\text{Risk}) + 3.5 \quad (\text{Eq. 2})$$

$$\text{Average VARP Risk Score by Asset Type} = \text{Log}_{10}(\text{Average Risk}) + 3.5 \quad (\text{Eq. 3})$$

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Table 1. VARP Risk Score and Color Key.

VARP Risk Score and Color Key	
High	>7
Medium	3.5 - 7
Low	<3.5
No	Zero Calculated Risk

Table 2. LANL Summary Risk Matrix of Average VARP Risk Scores for High Impact Hazards across Asset Type.

Asset Type	Hazards				
	Increased Extreme Heat Events	Increased Extreme Precipitation Events	Increased Thunderstorms	Increased Flooding Events	Increased Wildfire Frequency
Specialized or mission-critical equipment	8.5	8.8	8.4	7.7	8.4
Energy Generation and Distribution Systems	7.5	7.5	7.5	7.5	7.8
Onsite Waste Processing	8.6	8.0	7.8	7.6	8.1
Site Buildings	7.2	8.2	7.8	7.4	7.7
Water and Wastewater Systems	6.4	7.9	7.9	6.8	7.6
IT and Telecommunication Systems	7.2	7.2	4.7	6.7	7.7

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Resilience Planning

In developing resilience solutions, the VARP Planning Team focused primarily on the critical assets that were shown to be potentially vulnerable to climate change hazards, receiving a VARP Risk Score in the High Risk range. The Team focused on identifying resilience solutions that can protect site critical assets from increased extreme heat events, increased extreme precipitation events, increased thunderstorms, and increased wildfire frequency because these hazards pose the highest overall risk to the Laboratory.

The team solicited ideas for Resilience Solutions from personnel across the Laboratory. A total of 48 projects were proposed for consideration. Each solution was evaluated against the hazard(s) which it addressed, expected effectiveness, feasibility, cost and funding type, and the timeline for the proposed project. The VARP team recommended nineteen (19) Resilience Solution projects for inclusion and annual tracking in the DOE Sustainability Dashboard. The final portfolio of recommended Resilience Solutions addresses vulnerability mitigations for all asset types and climate change hazards with a VARP Risk Score of Medium or High. Types of resilience solutions that LANL plans to implement include increasing energy redundancy and support, telework support, nature-based solutions, water efficiency, and employee information availability.

VARP data and processes will be revisited every four (4) years.