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LANL Meteorology Program Self-Assesment 2025 Update

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1.1 Overview of Historical External Site Assist Visits

The LANL Meteorological (Met) Program has been subject to several external reviews over the past 19 years. The DOE Meteorological Coordinating Council (DMCC) conducted an initial Met Program Site Assist Visit (SAV) in August 2006 (DMCC 2006). A follow-up SAV in August 2015 assessed progress (DMCC 2015), and in June 2023, the DOE Meteorological Subcommittee (DMSC), successor to the DMCC, conducted a second follow-up SAV (DMSC 2023), in which the Met Program was evaluated relative to the following 8 high-level questions:

- What is the state of the meteorological services provided to its customers?
- What is the quality of meteorological data provided to its customers and is it adequate and available to meet all customer needs?
- What is the quality of atmospheric transport and diffusion modeling provided to its customers and is it applicable to complex wind flow patterns at LANL?
- Are the current and future meteorological service customers being serviced appropriately?
- Are there adequate human resources to meet present and future program customer needs and are they being appropriately leveraged?
- Are existing instrumentation, facilities, and systems adequate to meet present and future customer needs?
- Are LANL meteorological services conducted in an efficient, cost-effective manner?
- Is meteorological data used to ensure safety & health of LANL personnel?

More specific evaluations were performed relative to 23 performance objectives extracted from the ANSI/ANS-3.11- 2024 national standard and 14 separate performance objectives associated with consequence assessment and atmospheric transport and diffusion modeling in the consequence assessment element of DOE G 151.1-1B.

In 2023, the DMSC SAV Team also reviewed the status of each of the 18 remaining recommendations from its 2015 SAV. Based on this review, DMSC stated in its Exit Briefing that the LANL meteorological program has gotten much stronger and more robust since 2015 and now represents one of the better managed programs within the DOE complex.

1.2 Cumulative DMSC Assist Visit Recommendations

The recommendations from the 2006, 2015, and 2023 SAVs were related to improving all aspects of the Met Program. Based on significant improvements in the Met Program since 2015, which included the addition of human resources, three new meteorological towers, two trailer meteorological towers, a radiometer, a Light Detection and Ranging (LIDAR) system, and additional meteorological monitoring capability, it was determined that it would be a best practice to perform self-assessments on an annual basis. The status of the program improvements to meet the intent of the combined DMCC SAV recommendations has been documented since 2019 in annual self-assessment reports. This report represents the 7th consecutive annual self-assessment which will serve to document the status of open external review recommendations from the 2015 and 2023 SAVs, as summarized in Table 1. The recommendations that were appropriately addressed are shown as closed.

Recommended LANL Meteorological Program Improvements

Table 1 Disposition of Assist Visit Recommendations

DMCC/DMSC Recommendation	Present Status
#15-03: Customer Identification on Weather Machine	Closed
#15-12: Develop and Implement Training Program	Open
#15-13: Perform a 10-Year Meteorological NPH Update Analysis	Closed
#15-15: Resolve SODAR Wind Speed Error	Closed
#15-16: Revise ABQ NWS Forecasts	Open
#15-18: Investigate NCEP prognostic wind field sources and link to CAPARS	Open
#23-01: Perform JTA to determine realistic manpower requirements	Closed
#23-02: Determine optimum locations of additional 10-meter meteorological towers and other vertical remote sensing devices	Open
#23-03: Evaluate methods to establish lightning protection for SODAR and LIDAR	Open
#23-04: Replace surface landscape pavers with more natural surface for snow cover	Closed
#23-05: Explore additional meteorological support to assist in wildland fire mitigation	Open
#23-06: Explore additional meteorological support to assist in high explosive testing	Open
#23-07: Develop formal agreement to provide additional forecasted information during severe weather events to help operations decision making	Open
#23-08: Implement a local WRF capability to interface with CAPARS	Closed
#23-09: Explore additional roles for the meteorologists to the EOC cadre	Open
#23-10: Assist emergency management to get RAWS tower sited and operational	Open
#23-11: Develop LIDAR and radiometer surveillance and calibration procedures	Open
#23-12: Develop further Weather Machine improvements	Open
#23-13: Involve meteorologists to provide support to CAPARS-based Safety Basis	Open

2 Summary of Current Program Improvements

This 2025 annual self-assessment was conducted to determine to what extent that the Met Program at LANL has addressed the 19 open recommendations from the 2015 and 2023 SAVs. It was noted during the 2023 DMSC SAV that LANL management has actively addressed many of the open recommendations in recognition that its implementation will improve the robustness of the overall Met Program. Accordingly, many program improvements have been implemented since 2006 and each success will continue to improve the level of support that the Met Program provides to its many LANL customers.

Table 2 shows the 19 open recommendations and how the present implementation has improved the Met Program's capacity to meet the program improvement goals. The table provides discussion on the present implementation status and identifies improvements and future initiatives.

Table 2 Present Implementation of Assist Visit Open Recommendations and Future Initiatives

DMSC Recommendation	Present LANL Met Program Implementation Status	Present Improvements and Future Initiatives
#15-03: Institute a system on the Weather Machine where LANL employees or offsite entities must identify themselves before being allowed to download meteorological. A brief questionnaire that would require the name and contact information of the user and the intended use of the data would provide more information to determine the customer base.	An extensive upgrade to the Weather Machine was completed in 2024 that is available to internal and external customers. **This recommendation is closed.**	In collaboration with Communications and External Affairs Communications Arts and Services (CEA-CAS), the Weather Machine will continue to undergo enhancements to improve the user experience, considering feedback from its customer base.
#15-12: Continue developing and implementing a procedure and training program on accessing and applying meteorological data and products.	There is not a current procedure and training program.	The procedure and training program was not developed in FY25. However, it is expected that resources will be applied to develop a procedure and training program in FY26.

Summary of Current Program Improvements

DMSC Recommendation	Present LANL Met Program Implementation Status	Present Improvements and Future Initiatives
#15-13: Perform a 10-year NPH update analysis for extreme straight-line winds, tornadoes, and extreme precipitation, and develop a 48-hour PWMP for the 2,500-year and 6,250-year return periods.	The 10-year NPH update data was submitted to Engineering Services in January 2025. The meteorologists contributed to the extreme winds, floods, and extreme precipitation sections. **This recommendation is closed.**	The Met Program will continue to provide rainfall, snowfall, and wind speed data that will be used for the next 10-year NPH update.
#15-15: If this SODAR wind speed error persists, request support from the manufacturer to troubleshoot problems and then make the appropriate repairs.	The SODAR wind speed error has been resolved. In discussions with the SODAR manufacturer (Scintec) in 2016, the wind speed error was assumed to be a result of the infrequent sampling period of the SODAR (i.e., 1 measurement every 11 minutes) compared to the more frequent tower sampling (i.e., 1 measurement every 3 seconds). **This recommendation is closed.**	The Met Program will continue to monitor the SODAR data to ensure its fidelity.
#15-16: The meteorologists should revise the ABQ NWS forecasts to account for local effects and provide more customized forecasts to each technical area.	In 2019, the Met Program concurred that the ABQ NWS forecasts do not properly represent the complex terrain of Los Alamos based on informal observations. Other available fine- scale forecast models (e.g., NAM- 3 km, HRRR, and WRF) are used to improve forecasting of wind shifts, rainfall, and snowfall amounts. ABQ NWS forecasts of wind shifts, and snowfall amounts have been improved using National Centers for Environmental Prediction (NCEP) products including NAM-3, HRRR, and WRF.	Although local forecasting has been improved over the past few years, further improvement is needed since the available WRF data are produced from external sources, which does not allow the model to be configured to account for the local complex terrain. The Met Program will continue to develop its own local WRF in FY26 that will provide the needed resolution to account for LANL mesa-valley flow phenomena.

Summary of Current Program Improvements

DMSC Recommendation	Present LANL Met Program Implementation Status	Present Improvements and Future Initiatives
#15-18: Investigate NCEP prognostic wind field sources and link to CAPARS.	Informal observations of NCEP prognostic wind field sources have been used to improve ABQ NWS wind forecasts (e.g., NAM-3, HRRR, and WRF). Wind profilers from the Rapid Update Cycle (RUC) forecast model provides semi-prognostic wind fields to CAPARS, but higher temporal and spatial resolution forecast modeling is needed.	The development of a local WRF would improve the prognostic wind fields for future implementation into CAPARS.
#23-01: Perform a Job Task Analysis (JTA) of the meteorological program and determine realistic manpower requirements, accounting for program upgrades, to meet all customer needs. It is a good practice to perform JTAs on an annual basis to assess human resources against workload. Consider hiring an additional meteorologist, and an additional instrumentation technician to meet the identified human resource requirements.	The Met Program has two meteorologists, two instrumentation technicians, and a data steward. A Roles, Responsibilities, Authorities, and Accountabilities (R2A2) document was developed this FY to indicate specific tasks required under the Met Program. **This recommendation is closed.**	Although this recommendation is closed, the R2A2 will be further developed in FY26 to balance R2A2 to account for new workload requirements.
#23-02: Using prior wind field studies in the Los Alamos-White Rock area, which are documented in the Atmospheric Dispersion Modeling Protocol, determine optimum locations of additional 10- meter meteorological towers and other vertical remote sensing devices to supplement the wind field and enhance three-dimensional transport and diffusion model results.	The Met Program has not investigated optimum locations for potential new stations. The current array of meteorological towers generally provide representative meteorological data for LANL customer needs.	The Met Program will evaluate the need for additional monitoring, pending emerging customer needs and available funding.

Summary of Current Program Improvements

DMSC Recommendation	Present LANL Met Program Implementation Status	Present Improvements and Future Initiatives
#23-03: The SODAR and LIDAR at TA-6 and the radiometer at TA-53 provide an impressive amount of important remote-sensing data which will have many applications at LANL. However, these systems are prone to possible lightning damage and should be protected.	Lightning protection has been added to the radiometer, but the LIDAR is still subject to lightning risks.	Since the LIDAR is connected to utility power, an engineering evaluation is required for lightning protection. In FY26, the Met Program will continue to collaborate with Engineering Services to add lightning protection to the LIDAR, pending available funding.
#23-04: Replace the surface landscape pavers with a more natural surface of flattened soil with weed control since the current pavers may cause snow melt from reradiating heat from prior absorbed sunlight.	The pavers have been replaced with a white painted board based on recommendations from the National Weather Service. **This recommendation is closed.**	The Met Program will ensure that weathering and debris does not alter the color of the white painted board. Clean and/or replace, as appropriate.
#23-05: Explore additional meteorological support that could be provided to assist in LANL wildland fire mitigation efforts. Including specialized weather and wind forecasts.	The Met Program added fuel moisture measurements to the Weather Machine this FY to allow the Wildland Fire team to access the data anytime.	The Met Program is available to provide additional data upon request and to support meteorological data needs for any emergency response.
#23-06: Explore additional meteorological support that could be provided to assist LANL high explosive testing organization including consultation on their models.	There has not been further support provided to the Explosive Applications and Special Projects (M-6) group.	The Met Program will work on providing LIDAR data to M-6 in FY26, pending available funding.
#23-07: Develop a formal agreement to provide additional forecasted information during severe weather events and additional data to help operations decision making in severe weather conditions.	There is not a formal agreement currently.	The Met Program will complete this agreement and provide support, pending available funding.

DMSC Recommendation	Present LANL Met Program Implementation Status	Present Improvements and Future Initiatives
#23-08: Continue implementing a local Weather Research & Forecasting (WRF) capability to interface with CAPARS to permit longer-range consequence assessments and improve LANL weather forecasting. A TEAMS task group has been established and should have frequent meetings.	The LANL Numerical Weather Forecasting System Teams group has been formed, and it includes LANL staff from Safeguards Planning and Analysis, Earth and Environmental Sciences, Information Services and Modeling, Safety Basis, and Emergency Management. This group meets to define the specific needs of these LANL organizations. **This recommendation is closed.**	Although this recommendation has been satisfied, the Met Program will continue to support this effort. The LANL Numerical Weather Forecasting System Teams group is considering the cost benefits of running WRF locally or externally and plans to be active in FY26 and beyond.
#23-09: Explore additional roles for the meteorologists such as consultation with respect to evacuation/shelter-in- place decisions and providing timely meteorological consultation to the EOC cadre.	The meteorologists have not yet been requested to take on additional roles for the EOC.	The Met Program will respond to EOC requests for additional roles, pending available funding.
#23-10: The meteorologists should assist the emergency management organization to get the RAWS tower sited, tested, and operational.	Since the RAWS tower is being stored in LANL facilities until the SAFE contract with RAWS is finalized, there has been no activity required of the Met Program.	The Met Program will assist SAFE with getting the tower operational after the RAWS contract is finalized in FY26.
#23-11: Complete and issue LIDAR and radiometer surveillance and calibration procedures and bring LIDAR to an operational status.	The LIDAR and radiometer are functioning and being tested. Once fully operational, surveillance and calibration procedures will be issued.	The Met Program is working on getting the LIDAR and radiometer data on the Weather Machine.
#23-12: Develop further Weather Machine improvements. Develop additional concepts to effectively interact with the LANL customer base.	The Met Program continues to collaborate with CEA-CAS on further improvements to the Weather Machine.	Upgrades to the Weather Machine will continue in FY26 to address emerging customer needs.
#23-13: Once SB identifies how CAPARS can support DSAs, involve the meteorologists to provide technical support**.**	The meteorologists have not yet been involved in the development of DSAs.	The Met Program will provide technical support to CAPARS use in DSAs in FY26, pending available funding.

3 Conclusions

This self-assessment, as documented in Table 2, has shown that significant progress has been achieved in meeting the intent of the remaining 13 open recommendations from the last two DMSC SAVs. After each SAV, the LANL Met Program has shown continuous improvement within its budget constraints, by addressing the recommendations in each prior SAV report. The LANL Met Program management will continue to apply its resources to acquire additional human capital and physical resources to meet the dynamic needs of its growing site wide customer base. This includes additional upgrading of the hardware and software elements of the Met Program and implementation of its operational procedures and the QAPP to ensure it will consistently meet important present program requirements, as well as anticipated future requirements. These improvements have been summarized in the "present improvements and future initiatives" column in Table 2.

The DOE Meteorological Program Guide (MPG) provides guidance on establishing an effective meteorological program and as a tool for the DOE field offices and national laboratories to determine the size and scope of its programs. The MPG provides worksheets to help scale a meteorological program based on 10 different functions and capabilities. Table 3 shows the evaluation for the LANL Met Program with a score of 27, which represents the high end of a moderate-sized program that can be staffed with at least one onsite meteorologist, but preferably two meteorologists. This is consistent with the current staffing level. Should the Met program growth continue its upward trajectory, it is likely additional staffing will be needed.

Table 3 LANL Meteorological Program Scoring

If your Field Element needs these Meteorological Program Capabilities	What Degree of Scope does your Field Element Need?					
Access to Local Area Weather Data	0	1	2	**3**	4	5
Onsite Instrumented Meteorological Tower(s)	0	1	2	**3**	4	5
Upper Air Data Collection	0	1	2	3	4	**5**
Other Necessary Weather Data Collection	0	**1**	2	3	4	5
Local or NWS Forecast Model Products	0	1	**2**	3	4	5
Dispersion Model(s)	0	**1**	2	3	4	5
Dispersion Modeler(s)	0	**1**	2	3	4	5
Weather Forecaster	0	1	2	3	**4**	5
IT Infrastructure	0	1	2	**3**	4	5
Meteorological Support Staff	0	1	2	3	**4**	5
	TOTAL			**27**		

Conclusions

In no specific order, it is recommended that LANL management focus on the following tasks in FY26 and beyond, and prioritize its implementation based on current and other resources it may receive from its LANL customers:

1. Develop a procedure and training program on accessing and applying meteorological data and products.
2. Bring LIDAR to an operational state, integrate it into the Met Program network, and collaborate with Engineering Services to add lightning protection.
3. Provide atmospheric dispersion modeling services, upon request.
4. Continue implementing a local WRF capability to improve LANL weather forecasting services to account for LANL mesa-valley flow phenomena.
5. Continue Weather Machine improvements in collaboration with CEA-CAS.
6. Continue Supporting the LANL Numerical Weather Forecasting System Teams working group.
7. Develop additional concepts to effectively interact with the LANL customer base.
8. Acquire new NCEP data sources to assist the emergency management organization.

4 References

ANSI/ANS 3.11-2024, Determining Meteorological Information for Nuclear Facilities, American Nuclear Society, 2024

DMCC Assist Visit Report on the LANL Meteorological Program, August 2006

DMCC Assist Visit Report on the LANL Meteorological Program, August 2015

DMSC Assist Visit Report on the LANL Meteorological Program, November 2023

DOE G 151.1-1C, Comprehensive Emergency Management System Guide, 2024

5 Acronyms and Abbreviations

Acronym	Definition
ABQ	Albuquerque
ANS	American Nuclear Society
ANSI	American National Standards Institute
ASME	American Society for Mechanical Engineers
CAPARS	Computer Assisted Protective Action Recommendation System
CEA-CAS	Communications and External Affairs Communications Arts and Services
DMCC	DOE Meteorological Coordinating Council
DMSC	DOE Meteorological Sub Committee
DOE	Department of Energy
DSA	Documented Safety Analysis
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
EPC	Environmental Protection and Compliance
FTE	Full Time Equivalent
FY	Fiscal Year
G	Guide
HRRR	High-Resolution Rapid Refresh
JTA	Job Task Analysis
LANL	Los Alamos National Laboratory
LA-UR	Los Alamos – Unclassified Report
LIDAR	Light Detection and Ranging
M-6	Explosive Applications and Special Projects
MAQ	Meteorology Air Quality
MPG	Meteorology Program Guide
NAM	North American Mesoscale Forecast System
NARAC	National Atmospheric Release Advisory Center
NCEP	National Centers for Environmental Prediction
NPH	Natural Phenomena Hazard
NWS	National Weather Service
O	Order
PWMP	Probable Winter Maximum Precipitation
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
RAWS	Remote Automated Weather System
R2A2	Roles, Responsibilities, Authorities, and Accountabilities
RUC	Rapid Update Cycle
SAV	Site Assist Visit
SB	Safety Basis
SODAR	Sound Detection and Ranging

Acronyms and Abbreviations

Acronym	Definition
STD	Standard
TA	Technical Area
WRF	Weather Research and Forecasting Model