DEFENSE NUCLEAR FACILITIES SAFETY BOARD

May 3, 2024

TO: Timothy J. Dwyer, Technical Director
FROM: Sonia G. Thangavelu, Ph.D., Cognizant Engineer
SUBJECT: Nevada National Security Site (NNSS) Report for April 2024

DNFSB Staff Activity: During the weeks of April 8 and 15, 2024, the Board's cognizant engineer for NNSS conducted routine oversight at NNSS and participated in discussions with Nevada Field Office (NFO) leadership regarding subcritical experiment operations at the Device Assembly Facility and Principal Underground Laboratory for Subcritical Experimentation (PULSE). Mission Support and Test Services, LLC (MSTS) and Lawrence Livermore National Laboratory staff continue to perform activities for a planned subcritical experiment (SCE).

Potential Inadequacy in the Safety Analysis (PISA) for Zero Room Pressure Evaluation at PULSE. The zero room structure is a safety significant component credited to reduce the release of radiological material to surrounding areas within PULSE. The Cygnus zero room containment plugs form engineered closures for the zero room and are relied upon to provide a containment barrier if the credited vessel confinement system (VCS) failed to contain radiological material. The safety basis states the containment plugs are designed to withstand up to 1 psig pressure based on a loss of the VCS during experiment execution and post execution conditions. During review of the Cygnus zero room overpressure analysis, MSTS staff raised a concern related to the assumption that the vessel and zero room absorb excess heat of post detonation gasses inside the VCS and that the gasses cool to a defined temperature prior to breaching the VCS. MSTS also discovered this assumption was not made for the overpressure analysis used to determine the design criteria for the new Scorpius and Z-Pinch Experimental Underground System zero room structures. Therefore, MSTS concluded the differential pressure inside the Cygnus zero room could be greater than assumed in the analysis.

MSTS submitted a request for information (RFI) to the design laboratories to determine the post detonation zero room test pressure for a 3-foot and 6-foot vessel breach in the Cygnus zero room. The RFI included the design laboratories' gas expansion methodology to simulate a VCS breach, and the safety basis high explosive loading quantities used for both vessels. The design laboratories provided the information to MSTS and stated the differential pressure from a 3-foot vessel breach is high when post detonation gas heat transfer is considered but less than the zero room design criteria and the test pressure value protected by a surveillance requirement. However, the differential pressure from a 6-foot vessel breach exceeds the zero room design parameters and protected test pressure value when post detonation gas heat transfer is considered. MSTS entered the PISA process, declared a positive unreviewed safety question determination, and issued a timely order to prohibit 6-foot vessel experiments in the Cygnus zero room. On March 21, 2024, MSTS submitted the evaluation of the safety of the situation (ESS) to NFO for approval. The ESS contained compensatory measures to revise the overpressure analysis to evaluate a 6-foot vessel breach in the Cygnus zero room, update the safety basis with additional controls if identified from the revised analysis, and keep the timely order in place until the safety basis change is implemented. MSTS anticipates completion of the analysis and an update to the safety basis this summer, yet the design laboratories expect schedule impacts for future SCEs planned at PULSE. NFO is currently developing the safety evaluation report.