DEFENSE NUCLEAR FACILITIES SAFETY BOARD

May 6, 2022

TO: Christopher J. Roscetti, Technical Director
FROM: Brandon Weathers, Resident Inspector
SUBJECT: Oak Ridge Activity Report for Week Ending May 6, 2022

Nuclear Criticality Safety: During a recent special nuclear material inventory period, CNS performed non-destructive assay measurements to obtain a quantitative fissile mass estimate for a portion of exhaust ductwork in Building 9212. The resulting mass estimate, when including uncertainty, violated a nuclear criticality safety control that established a maximum mass for that portion of the exhaust ductwork. The mass estimate was 7.5% above the nuclear criticality safety control limit. CNS established a fifteen-foot administrative boundary around the equipment that connects to this portion of the exhaust ductwork. That boundary was subsequently collapsed to the impacted equipment and remains in effect to prevent further introduction of fissile material into the exhaust. The location of the elevated mass estimate corresponds to a Uranium Holdup Survey Program measurement point that was created in 2021. A non-destructive assay subject matter expert considered this location to be an area in need of a new measurement point based on quantitative measurements of the system that were taken in 2020. In 2021, CNS performed a major update to the applicable criticality safety evaluation that went into effect on March 30, 2022. This update brought the evaluation into compliance with the expectations of DOE Standard 3007-2017, *Preparing Criticality Safety Evaluations at Department of Energy Nonreactor Nuclear Facilities*, and the current CNS criticality safety evaluation writer's guide. A specific focus of the update was the development of zones within the system that were assigned maximum fissile mass limits. In collaboration with nuclear criticality safety personnel, the non-destructive assay subject matter expert developed two new Uranium Holdup Survey Program measurement points to qualitatively monitor trends of the uranium that was expected to deposit in those locations. Because of concerns for uranium accumulation within portions of the exhaust ductwork, CNS revised the Uranium Holdup Survey Program measurement frequency for most of the pre-existing measurement points from six months to two months in 2021. The two newly created measurement points were also measured bi-monthly, with the first measurements of those points occurring in October 2021. CNS held a fact finding meeting this week to develop the initial timeline and will reconvene the fact finding next week.

Separately, CNS developed a new procedure that implements nuclear criticality safety controls to allow chemical operators to recontainerize several non-compliant containers in Building 9212 (see 10/1/22 report). Nuclear criticality safety engineers developed a supplement to the applicable criticality safety evaluation for this activity that resulted in seven new requirements. In addition to the discrepancy between the assigned and actual material form, the original shipping paperwork did not account for the inner polyethylene containers being constructed of hydrogenous material. The erroneous information on the shipping paperwork was non-conservative from a nuclear criticality perspective since hydrogenous material acts as a moderator and lowers the critical mass. The fuel elements that will be recontainerized may consist of some broken fuel elements and powders. The procedure requires that the supervisor notify fire protection engineering prior to beginning the work activity. In the event of pyrophoric reactions during the process, personnel may cover the material with coke (carbon microspheres).