DEFENSE NUCLEAR FACILITIES SAFETY BOARD

February 24, 2012

MEMORANDUM FOR: T. J. Dwyer, Technical Director
FROM: B.P. Broderick and R.T. Davis
SUBJECT: Los Alamos Report for Week Ending February 24, 2012

Plutonium Facility: The approved, but not yet implemented, 2011 annual update to the Plutonium Facility DSA asserts the mitigated offsite dose for the bounding postulated facility accident involving a seismically-induced fire is 23 rem, a value just below the DOE Evaluation Guideline. The 2011 DSA relies on two key elements to support this significant reduction of consequences compared to previous safety analyses: (1) an assumption that all structural features of the safety class building that could fail in an evaluation-basis earthquake and cause facility collapse or loss of confinement will be identified and fixed prior to implementation of the 2011 DSA, and (2) refined assumptions and analysis associated with the seismically-induced fire scenario that reduce the material at risk (factor of ~2), the airborne release fractions and respirable fractions of materials (factor of ~30), and the leak path factor (factor of ~2).

Laboratory personnel are in the process of performing an important static non-linear analysis scheduled to complete in June that will determine whether additional structural vulnerabilities exist that could lead to facility collapse or loss of radiological confinement. In parallel, LANL and NNSA have aggressively pursued and completed upgrades to repair known structural vulnerabilities. These upgrades include plenum room beam-to-column connections (complete July 2011), glovebox exhaust fan pads (complete October 2011), plenum room captured columns (complete August 2011), concrete shield wall connections (complete November 2011), roof drag strut (complete November 2011), laboratory ceiling beams (complete December 2011), and mezzanine upgrades. Last week, Plutonium Facility personnel finished field work on the last of five mezzanines that required modifications. This marked physical completion of all currently planned facility upgrades pending results of the static non-linear analysis.

Analytically, the 2011 DSA reduced the material at risk by imposing more stringent limits on the amount of inventory allowed on the facility's laboratory floor. Dispersibility parameters were reduced by disaggregating the material at risk and analyzing the dispersibility characteristics of each specific form of material (e.g. metals, oxides, and solutions). The leak path factor was reduced based on revised fire analysis that concludes a seismic event will cause a number of individual lab room fires rather than a large floor-wide fire, as previously assumed. Smaller fires with lower overall thermal output contribute less motive force to drive aerosolized material out of the building and result in a reduced leak path factor.

The revised fire analysis concludes that the new seismically-induced fire scenario should assume one "probabilistic fire" and three "deterministic fires." The probabilistic fire is based on statistical analysis of 80 years of seismically-induced fire ignition data from Alaska and California for all structures in the "generally built environment," that is, all residential, commercial, and industrial structures. The deterministic fires are postulated to occur in lab rooms that operate high temperature furnaces that intentionally take plutonium metal to a molten state. Last week, LANL management submitted a DSA revision for NNSA review and approval that includes additional technical discussion of the revised fire analysis and how it was used in developing the new seismically-induced fire scenario in the DSA. The DSA revision provides new justification to support the assumption that only furnaces that produce molten plutonium metal, rather than all high temperature furnaces, present an increased probability of seismically-induced fire ignition in relation to the generally-built environment. The DSA revision also provides a technical argument that the new leak path factor analysis is conservative because its final calculated value assumes four lab room fires in each half of the building for a total of eight room fires.