Application of Advanced Handling Techniques to Transportation Cask Design[1]

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Sandia National Laboratories supports the U.S. Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM) applying technology to the safe transport of nuclear waste. Part of that development effort includes investigation of advanced handling technologies for automation of cask operations at nuclear waste receiving facilities. Although low radiation levels are expected near transport cask surfaces, cumulative occupational exposure at a receiving facility can be significant. Remote automated cask handling has the potential to reduce both the occupational exposure and the time necessary to process a cask. Thus, automated handling is consistent with DOE efforts to reduce the lifecycle costs of the waste disposal system and to maintain public and occupational radiological risks as low as reasonably achievable .

This paper describes the development of advanced handling laboratory mock-ups and demonstrations for spent fuel casks. Utilizing the control enhancements described below, demonstrations have been carried out including cask location and identification, contact and non-contact surveys, impact limiter removal, tiedown release, uprighting, swing-free movement, gas sampling, and lid removal operations. Manually controlled movement around a cask under off-normal conditions has also been demonstrated

Advanced techniques are described that have been developed for the control of robotic equipment which enhance commercial robots capabilities, improve suitability for nuclear facility application, and reduce constraints on cask designers due to automated equipment limitations. Computer models of casks and facilities are accessed by the supervisory control system to automatically program robotic motion, eliminating manual point-to-point teaching. Multiple sensors have been integrated into the control system to constantly verify the expected real-world conditions, preventing collision and damage. Animated graphical programming has also been integrated into the control system, offering options to pre-program and preview anticipated movement, move the robots telerobotically using the collision prevention features of the graphics, or view automatic motion from any desired perspective. The pre-programming feature has been used to help determine compatibility of new cask designs with automated equipment.

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