

AN INTEGRATED SYSTEMS MODEL FOR PERFORMANCE ASSESSMENT OF A LOW-LEVEL RADIOACTIVE WASTE DISPOSAL SITE

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Texas Commission on Environmental Quality has approved licenses for four landfills at the Waste Control Specialists (WCS) site located in Andrews County, West Texas. The site includes a hazardous waste landfill and three landfills for radioactive waste. An updated performance assessment is necessary prior to acceptance of waste at the landfills. The updated performance assessment a) provides for more realistic and flexible dose modeling capabilities, b) addresses all plausible release and accident scenarios as they relate to the performance objectives, c) includes impact of climate and hydrologic scenarios that may impact long-term performance of the landfill, d) addresses impact of cover naturalization and degradation on the landfill, and e) incorporates uncertainty and sensitivity analysis for critical parameters.

For the updated performance assessment, WCS has developed an integrated systems level performance assessment model using the GoldSim platform. GoldSim serves as a model for integrating all of the major components of a performance assessment, which include the radionuclide source term, facility design, environmental transport pathways, exposure scenarios, and radiological doses. Unlike many computer models that are based on first principles, GoldSim is a systems level model that can be used to integrate and abstract more complex sub-models into one system. This can then be used to assess the results into a unified model of the disposal system and environment.

In this particular application, the GoldSim model consists of a) hydrogeologic model that simulates flow and transport through the Dockum geologic unit that underlies all of the waste facilities, b) waste cells that represent the containment unit and simulate degradation of waste forms, radionuclide leaching, and partitioning into the liquid and vapor phase within the waste unit, c) a cover system model that simulates upward diffusive transport from the underground repository to the atmosphere. In addition modules are included for human intrusion scenarios. Inputs and parameters for the hydrogeologic model are developed from a more detailed, numerical, vadose zone model (implemented in HYDRUS 2D). The Vadose zone model calculates fluxes through the waste under various climatic and cover-degradation scenarios. Uncertainty related to model parameters and boundary/initial conditions is also incorporated in the flux distribution through sensitivity analyses in the vadose zone model.

Doses are calculated for onsite and offsite receptors through ingestion, inhalation, and external exposure, for comparison with regulatory dose standards. This modeling is part of an ongoing licensing effort to demonstrate compliance with low-level waste site performance objectives.