Sandia National Laboratories

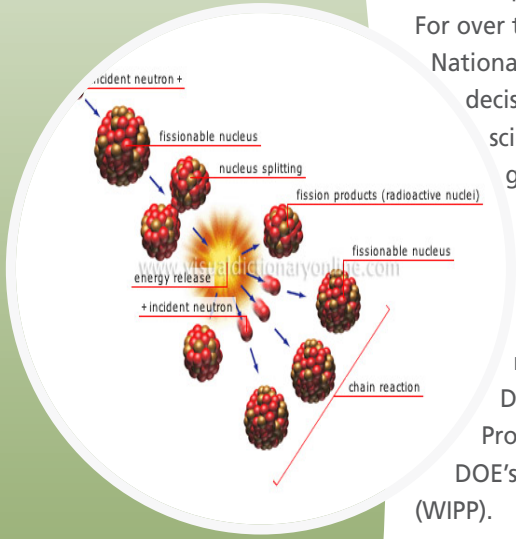
Energy, Climate, & Infrastructure Security

Weighing the Alternatives

Sandia National Laboratories has assisted decision makers by offering expert, scientific advice to those tasked with nuclear materials management.

Introduction

From their creation, during their utilization and with their disposal, nuclear materials present significant management challenges for those responsible for making decisions that may have impacts on the public and/or the environment. For over thirty years, researchers at Sandia National Laboratories have assisted these decision makers by offering expert, scientific advice when those in our government tasked with nuclear materials management weigh alternatives. The expertise that Sandia National Laboratories developed over time is maintained within Sandia's Defense Waste Management Programs, the science advisor for DOE's Waste Isolation Pilot Plant (WIPP).



Depiction of Nuclear Fission Reaction

What is an Acceptable Clean-up Goal for Remediation of a Contaminated Site?

By illustrating the effects of various action levels and risk tolerances on the ultimate remediation cost for a site contaminated with lead, researchers from Sandia National Laboratories were able to build consensus among stakeholders, regulators and implementers and develop a defensible remediation plan for this contaminated site. It was noted that a remediation plan that over-estimates the degree of cleanup required to satisfy the action level results in an unnecessary expense. A plan that underestimates the degree of clean needed may fail to achieve regulatory compliance, leading to fines, penalties and more remedial actions. Our scientists produced four probability maps to help understand how a lower action level (400 ppm vs. 2,000 ppm) and higher tolerance for risk (5% vs. 1%) affected the amount of soil to be removed (and the cost). The results showed that a remediation plan based on 5% probability of leaving soil that exceeded an action level of 2,000 ppm could save $6.5 million dollars over a plan with a 5% probability of exceeding the 400 ppm action level. The tools used and expertise developed in this application can be used in any application when stakeholders, regulators and implementers must agree on a clean-up goal and the level of risk to accept in deciding on a remediation plan.

Stakeholder Interactions at the ETEC Site

How Can Transuranic Waste Be Safely Shipped to the WIPP?

Because defense-related transuranic waste contains cellulosic, rubber and plastic materials as well as alpha-emitting radionuclides, hydrogen gas is formed through radiolysis and emitted from the waste form. In a closed container, hydrogen

First Shipment of TRU Waste at the WIPP Site

U.S. DEPARTMENT OF ENERGY

gas can build up quickly and become an explosion hazard, even in the short time period required to ship the waste to WIPP. Sandia's Defense Waste Management Programs worked with DOE to evaluate proposed technical mitigation strategies for reducing the potential for explosions while transuranic waste is transported to WIPP. The team employed a decision analysis technique, developing a decision tree that incorporated uncertainties and produced the likelihood for success, for each mitigation strategy. With this information, the DOE was able to choose a mitigation strategy using hydrogen getters that was both dependable and cost effective.

What is the Best Disposal Option for Radioactive Sources that Could Be Used in Dirty Bombs?

A specific category of waste, called Greater-than-Class-C (GTCC) waste, contains radioactive sources. If these radioactive sources were to fall into the hands of a terrorist, they could be used for dirty bombs. This is the driver for finding a permanent disposal location for GTCC waste. Sandia's Defense Waste Management Programs collaborated with researchers at Argonne National Laboratories (ANL) to develop an Environmental Impact Statement (EIS) that evaluates the environmental impacts of a number of alternatives for permanent disposal of Greater-than-Class-C waste. The EIS was developed to comply with the National Environmental Policy Act (NEPA) which requires that the environmental impacts of government actions must be vetted with the public and delineated in an EIS. The group developed the technical description for each alternative being considered while ANL assessed the environmental impacts. Sandia's Defense Waste Management Programs continues to provide council to DOE on the GTCC EIS as they move toward a record of decision for disposal of GTCC waste.

Radioactive Sources No Longer in Use and Destined for Disposal

What Research Should be Performed Before Choosing Remediation Approaches for a Contaminated Site?

Chemically hazardous and radioactive materials have been deposited on soils at DOE's ETEC site over a sixty-five year time frame starting in 1947. These soils must undergo remediation if DOE is to comply with a Consent Agreement they have with the State of California. Researchers at Sandia's Defense Waste Management Programs were able to build consensus among stakeholders, regulators and the DOE about research that is needed prior to implementing a soil remediation strategy at ETEC. This was accomplished using a decision analysis technique that examined the uncertainties related to soil remediation technologies and their application at ETEC. It was decided that research should be focused on resolving uncertainties associated with in-situ thermal treatment of mercury contaminated soils and phytoremediation of soils containing radionuclides and/or heavy metals. This work is documented at http://www.etec.energy.gov/Char_Cleanup/Soil_Treatability.html.

Soil Treatability Study
Energy Technology Engineering Center • U.S. Department of Energy

Publications

Plutonium-238 Transuranic Waste Decision Analysis. 1999. Sandia National Laboratories, Albuquerque, NM. SAND98-2629C.

Draft Environmental Impact Statement for the Disposal of Greater-than-Class C (GTCC) Low-level Radioactive Waste and GTCC-Like Waste (DOE/EIS-0375-D). 2011. U.S. Department of Energy, Washington, D.C.

For more information, please contact:

Christi Leigh
E-mail: cdleigh@sandia.gov
Phone: (505) 845-0407
Website: energy.sandia.gov

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