Nuclear Security Training Opportunities at Los Alamos

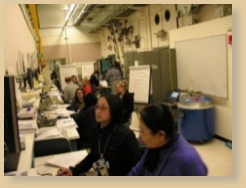
Background and Motivation

- LANL expertise and capabilities in multidisciplinary science, technology, and engineering supporting stockpile stewardship serve as the foundation for global security mission, including training and demonstrations in all aspects of nuclear security and nonproliferation.
- LANL subject matter experts have in-depth practical technical experience in radiation detection and measurements, Nuclear Material Accounting and Control (NMAC), nuclear forensics, physical protection systems, insider threat mitigation, cyber and information security, and export controls.
- LANL offers one-of-a-kind fully operational nuclear facilities equipped for a variety of hands-on, immersive nuclear security exercises in realistic training environments, using a wide range of nuclear materials and equipment.

Nuclear Security Training Facilities

- **TA-66 – National Security and Nonproliferation Center** offers class room space and laboratories for a wide range of nuclear security training and exercises with radiological and nuclear materials, including uranium- and plutonium-bearing items, at the Security CAT III level. All nuclear material is contained in intrinsically sealed containers resulting in a safe environment with quick and easy access.
- **TA-35 Bldg 2 laboratories** are a security CAT IV facility, initially built and intended to house a fast breeder reactor, that presents an opportunity for training in a realistic facility for NMAC and other nuclear security practices, and is used in practical safeguards training and exercises in conjunction with TA-66.
- **Clean Labs** facility is part of the IAEA Network of Analytical Laboratories (NWAL) environmental safeguards program, and serves as one of the analytical laboratories providing routine fission/activation product and actinide isotopic and concentration measurements. Additionally, Los Alamos NWAL experts provide radiochronometry (age determination) and trace element analysis services.
- **Tactical Training Facilities** include a state-of-the-art indoor live fire shooting range and force-on-force spaces that mimic realistic tactical environments.

Curriculum



Nuclear Material Accounting & Control
- System design and implementation
- Gap assessments

Physical Security
- Access controls
- Vulnerability analysis program

Nuclear Safeguards
- Nondestructive assay
- Advanced safeguards concepts

Nuclear Forensics
- Material out of regulatory control
- Forensic analysis

Radiological Security
- Compliant and secure radioactive material transportation
- Lost or orphaned sealed source management

Border Monitoring Systems
- Radiation detection capabilities

Personnel Security
- Insider threat mitigation
- Human reliability program

Export Controls & Compliance
- Commodity identification
- Regulatory framework

Information, Knowledge, Cyber Security
- Incident coordination
- Forensic analysis
- Good practices to prevent inadvertent releases

Nuclear Fuel Cycle
- Expert broad overview

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Nuclear Security Training Opportunities at Los Alamos cont.

Relevant Technical Tours

- **TA-55** is the only fully operational, full-capability plutonium science and manufacturing facility in the nation. TA-55 supports a wide range of national security programs that involve stockpile stewardship, plutonium processing, nuclear materials stabilization, materials disposition, nuclear forensics, nuclear counter-terrorism, and nuclear energy.

- The **Dual-Axis Radiographic Hydrodynamic Test** Facility (DARHT) is the world's most powerful x-ray machine built to analyze the three-dimensional implosion of mock nuclear weapons primaries. DARHT supports LANL's primary mission to ensure safety, security, and effectiveness of nuclear weapons in our nation's stockpile.

- The **Strategic Computing Complex (SCC)** is a secured supercomputing facility that supports the calculation, modeling, simulation, and visualization of complex nuclear weapons data in support of Stockpile Stewardship. Characteristics of weapons simulations, such as fluid dynamics, impact analysis, shock physics, and thermal exchange, are also applied to open science and national security simulations, such as climate modeling.

- **Sigma** Complex focuses on prototype fabrication and materials research, including metallurgy and ceramics. Sigma capabilities have been applied to a variety of weapons activities, including life extension programs for the W76 and B61.

- Through experimental work carried out at **High Explosive (HE) Laboratories and Firing Sites** LANL maintains world-class research and development capabilities in HE science supporting the stockpile stewardship and global security.

- The **Chemistry and Metallurgy Research and Radiological Laboratory/Utility/Office Building** jointly house key capabilities for analytical chemistry, uranium processing, destructive and nondestructive analysis of nuclear materials, and actinide research, processing, and metallography. These capabilities support nonproliferation and nuclear safeguards, counter-proliferation, stockpile surveillance, nuclear materials technologies, and waste treatment and minimization efforts.

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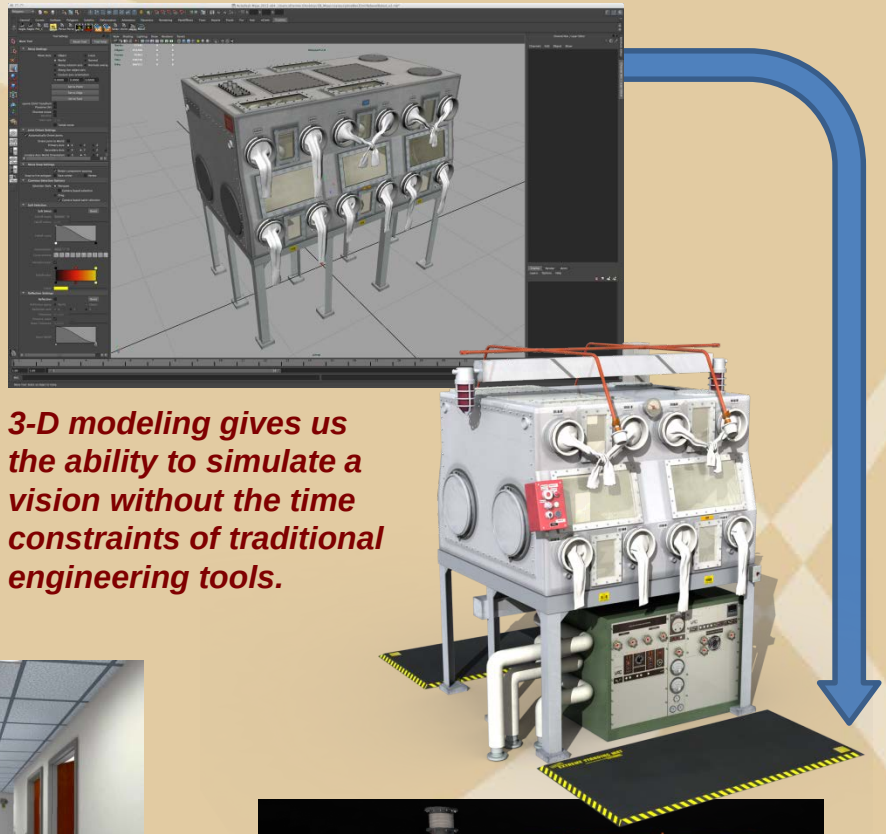
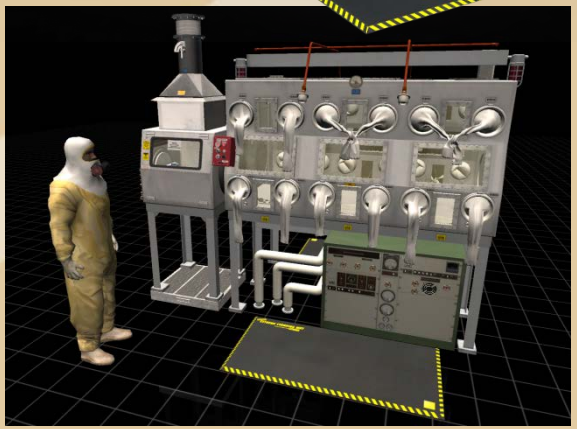
Interactive Visual Modeling at LANL — Safeguards and Security Capabilities and Training Applications

Description/Capabilities

- LANL develops interactive visual models in support of global security-related project and programs.
- Using virtual modeling to enhance the understanding of complex processes and automate critical procedure driven steps, LANL is augmenting real-world nuclear engineering scenarios and increasing available tools to which operators have access.
- Immersive three-dimensional models have changed the way training and nuclear facility operator aids are delivered and how projects and ideas become reality.
- Developed models are customized, license-free, and platform independent.
- The models are created using photos, engineering drawings, and subject matter expert knowledge, ensuring scientific accuracy.
- The implementation and integration are unique to nuclear facilities, and have multiple additional applications in treaty verification and nuclear safeguards context.



3-D modeling gives us the ability to simulate a vision without the time constraints of traditional engineering tools.



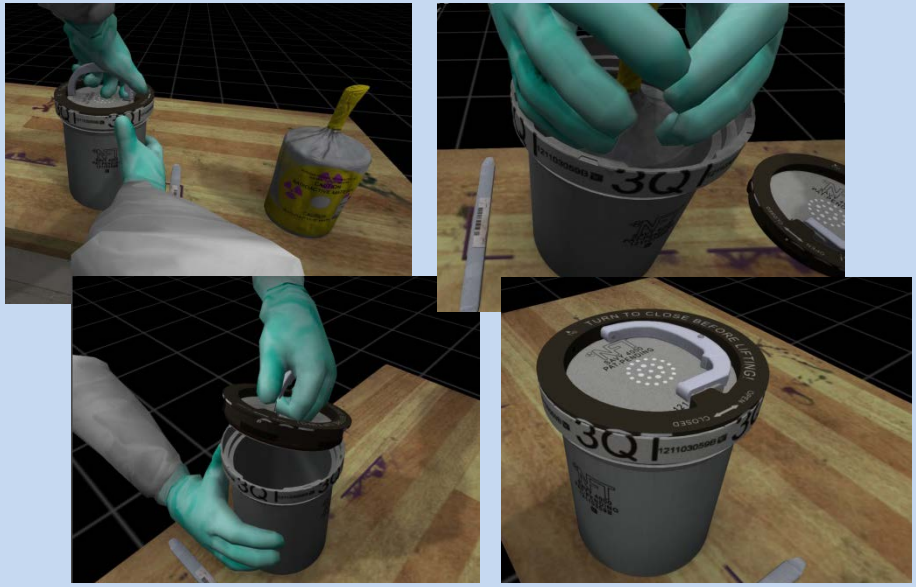
The Benefits of Virtual Facility Models

Interactive visual models can be used to access controlled areas, highly radioactive areas, and specialized training areas that generally require time and effort preparing paperwork to gain access, as well as overcoming the security hurdles to enter the facility. These facilities are prime examples for developing these models, as they allow sponsors and emergency response teams to become familiar with a facility without having to physically visit.

Interactive Visual Modeling at LANL — Safeguards and Security Capabilities and Training Applications

Training Applications

- The newest and fastest growing application for the modeling tool has been in training and testing simulations.
- Training procedures can be incorporated and provide users with step-by-step visual aids as preparation for training or real-life activities.
- By incorporating procedures, we begin to bridge the gap between the training materials and traditional on-the-job training.
- The model can also be created to test the users on correct steps. If users make a wrong scenario decision, the model will not allow them to move forward.
- This process forces users to interact with the procedures, while seeing the desired result and ultimately learning the correct process.
- Supervisors can also receive notice as to when and how often employees interact with the model, thus giving the supervisor a greater sense of confidence in the workers' understanding of training plans.



Through the development of a user-friendly interface, LANL 3-D training tools reach a new set of users not familiar with interactive virtual reality.

Virtual model of a Los Alamos training facility

3-D Modeling Strengths

- *Virtual Scientific Data Immersion and Visualization*
- *Conceptualized Design*
- *UET (Use-Every-Time) Procedures*
- *Process Troubleshooting/Diagnostic*
- *Physical Space Optimization*
- *Interactive Procedures*
- *Scenario Driven Testing Training*

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Lost or Orphaned Sealed Source Management — LANL Capabilities and Training Applications

Description/Capabilities

Instruction can be tailored to managers, as well as scientists, technicians, and first responders, who may be required to identify and manage radioactive sources.

Topics that can be covered by LANL subject matter experts include:

- Identification of different types of radioactive sources, their activities, and isotopes
- General introduction to and best practices for transport of radioactive materials meeting or exceeding that of USDOT 49CFR, USNRC 10CFR Part 61, and IAEA SSR-6
- Identification of appropriate and compliant packages (Type A and Type B)
- Identification/interpretation of package labeling (may vary locally)
- Introduction to the basics of transportation, and transportation security
- Identification of potential outlets for management and disposal of orphaned/recovered radioactive sources

Instruction is delivered in the form of classroom lectures, discussions, group exercises, case studies, and demonstrations. Hands-on demonstration and examples of devices, sources, and containers are available.

US and International Laws and Standards

Discussion on US and international laws and standards for safety and secure transport of radioactive materials

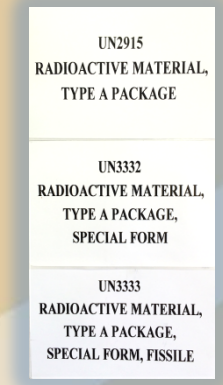
Type A

Type AF

Type B

Shipping Containers

Several categories of shipping containers may be used with different requirements depending on isotope and activity



Appropriate/Compliant labeling dependent on activity, Type/Form of material, and container dose rate

Lost or Orphaned Sealed Source Management — LANL Capabilities and Training Applications

Source Identification

- *Visual identification of radioactive sealed sources and devices*
- *Introduction to common radioactive sealed sources and their use*
- *Isotopes and chemical form and relationship to dose and contamination*

Medical and Industrial Sealed Sources

Appropriate Packaging

- *Familiarization with USDOT and NRC regulations*
- *Identification of compliant shipping configurations*
- *Familiarization and interpretation with labeling requirements*

Basic Transportation Requirement

- *Familiarization with USDOT and NRC regulations*
- *Appropriate modes of transport*
- *Transportation vehicle markings and labeling*
- *Driver requirements*

Source Collection and Threat Reduction Program
SCATR

Disposal Options

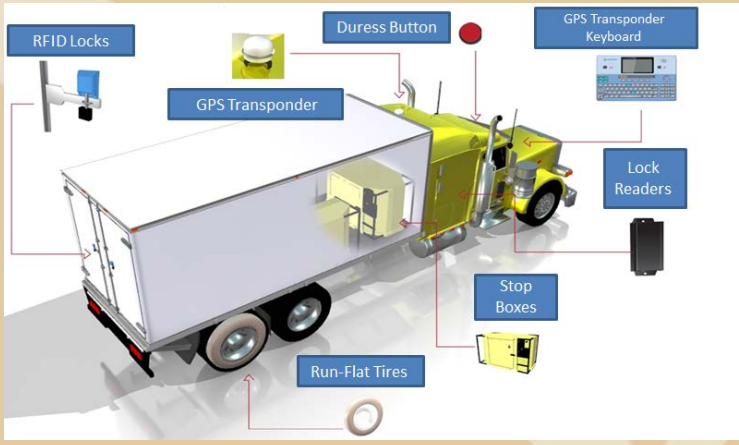
- *Current outlets for federal and commercial disposal*
- *Basic requirements for disposal depending on facility*

LA-UR-16-25661

Secure Radioactive Material Packaging and Transportation — LANL Capabilities and Training Applications

Description/Capabilities

- Provides instruction and best practices on secure transport of radioactive materials meeting or exceeding that of USDOT 49CFR, USNRC 10CFR Part 61, and IAEA SSR-6.
- Provides tailored modules for managers, as well as for scientists, technicians, and engineers, who work with packaging and transporting radioactive materials around the globe.
- Provides structured analysis approach. Participants will be able to:
  - Understand various transportation security measures
    - GPS Tracking
    - Tamper Indicating Devices (Passive/Active)
    - Vehicle Security Features
    - Carrier/Driver Security
  - Identify appropriate and compliant packages (Type A and Type B)
  - Identify proper package labeling (may vary locally)
  - Understand the basics of a transportation security plan
  - Understand the process of alerts and notifications upon incident while in transport.
- Provides instruction in the form of classroom lectures, discussions, group exercises, case studies, and demonstrations.



Increased Physical Security for Transport

Passive vs Active
Tamper Indicating Devices

Basic Elements of a Transportation Security Plan

- *Material to be Shipped*
- *Consigner/Consignee Information*
- *Route Plans*
- *Communication Routes*
- *Driver/Carrier Information*
- *Procedural Notifications*
- *Emergency Notifications*
- *Transportation Security Equipment Procedures*

Secure Radioactive Material Packaging and Transportation — LANL Capabilities and Training Applications

Los Alamos NATIONAL LABORATORY EST. 1943

Stolen/Lost Material Case Studies

Texas, September 2012 – Cat3 Am241 well-logging source lost

Mexico, December 2013 – Cat1 Co60 irradiator stolen in transit.

Oklahoma, July 2015 – Cat 2 Ir192 radiography truck stolen.

UN2915
RADIOACTIVE MATERIAL, TYPE A PACKAGE

UN3332
RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM

UN3333
RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, FISSILE

Cargo Labeling

Appropriate/Compliant labeling dependent on activity, Type/Form of material, and container dose rate.

US and International Laws and Standards

Course includes in-depth discussion on US and international laws and standards for safety and secure transport of radioactive materials.

Increased Transport Security Measures

- *Physical Security Measures*
- *Transportation Security Plan*
- *Driver/Consignee Background Checks*
- *Local Government/Law Enforcement Notifications*

Shipping Containers

Several categories of shipping containers may be used with different requirements depending on isotope and activity.

LA-UR-16-25661

Nonproliferation Fundamentals

Course Description

- This course provides a technical overview of nuclear weapons development through briefings and tours of weapons facilities.
  - Production of nuclear materials
  - Fundamentals of weapons physics
  - Testing and hydrotesting
  - History of the US weapons program
- Building on these fundamentals, the course gives an overview of the frameworks that seek to curb proliferation of weapons.
  - Nonproliferation Treaty and international safeguards
  - Strategic trade control and technology assessments
  - Bi-lateral and multi-lateral efforts to reduce nuclear weapons and counter weapons technology
- Course Length: 3 days
- Often taught in conjunction with tours and briefings at the Nevada National Security Site.

Learn the fundamentals of development and nonproliferation

Nuclear Weapons Fundamentals

- Learn the history of nuclear weapons development
- Understand the technical aspects of nuclear weapons
- Tour nuclear material production and testing facilities
- Learn about modern weapons technology

Nonproliferation Regime

- Learn the history of the Nonproliferation Regime
- Understand the technical aspects of curbing the spread of nuclear weapons
- Learn about the current technologies of proliferation concern

Understanding the current nonproliferation regime requires a broad understanding of weapons fundamentals and the historical development of nuclear weapons and weapons technology.

Objective

Understand the fundamentals of nuclear weapons design and development, as well as efforts to prevent the spread of weapons technologies.

Course History

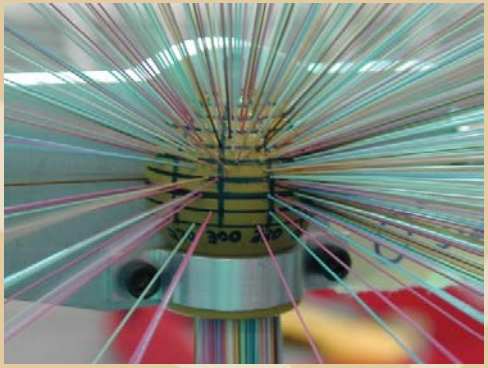
Versions of this course have been taught >135 times.

Nonproliferation Fundamentals

Tour Relevant Facilities

- Plutonium fabrication and casting*
- Uranium casting facility*
- Dual-Axis Radiographic Hydrodynamic Testing Facility
- Computer modelling visual demonstrations*
- Nuclear material measurement and detection labs
- Historical sites of the Manhattan Project
- Weapons concepts demonstrations*

**available as classified tours only*



Weapons Concepts

Supercomputing Facilities

LANL Plutonium Facility

Nondestructive Assay Expertise and Facilities

DARHT Facility

LA-UR-16-25661

LANL Nonproliferation and National Security Center

Overview

- LANL has developed a new training facility at Technical Area 66 (TA-66) that is focused on teaching nuclear material measurement techniques and technologies.
- The TA-66 facility replaces and augments older facilities that have been integral to LANL's 40+ years of offering training courses to US and international partners in Material Control and Accountability (MC&A), international safeguards, and related areas.

Description/Capabilities

- The TA-66 facility offers unclassified classroom space adjacent to laboratories that supports a wide range of activities with radiological and nuclear materials at the Security CAT III level.
- With on-site access to nuclear material, the training facility is uniquely suited to provide realistic demos and practical exercises on various material security and safeguards concepts and practices.
- The 8,600 square feet facility provides ample room for lectures and hands-on training, with three classrooms, laboratories, meeting rooms, and office space.
- In addition, LANL has configured other laboratory areas outside of TA-66 to mimic material and room configurations typically found in operating nuclear facilities. This ensures comprehensive training in environments similar to those where the nuclear security and safeguards approaches will actually be implemented.
- The pairing of modern classroom and laboratory facilities with venues that resemble real nuclear facilities yields an unparalleled teaching environment to provide safe, secure, flexible, and accurate training to a variety of domestic and international partners.

Example Course Offerings at New Facility

- *IAEA Inspector Training*
- *Fundamentals of Nondestructive Assay (NDA)*
- *Advanced Neutron NDA*
- *Advanced Gamma-ray NDA*
- *MC&A Accounting and Statistical Concepts*
- *First Responder Isotope ID*

Future Goals

- Creation of flexible classified boundaries that would encompass the classroom space, as well as the existing laboratory space
  - Once this process is in place, there will be the capability to hold classified classes at the S/RD level, including nuclear emergency response organizations
  - Use of classified training devices
  - The ability to "roll down" from this classified posture to teach IAEA and other international courses at the unclassified level will be retained

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