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CCP-HSP-010

Revision 5

CCP
Nondestructive Assay System Health and Safety Plan

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PRINTED NAME

APPROVED FOR USE

RECORD OF REVISION

Revision Number	Date Approved	Description of Revision
0	01/09/2004	Initial Issue.
1	02/27/2004	Revision in response to findings at the LLNL Contractor ORR.
2	05/28/2004	Revised in response to the DOE ORR post start finding concerning the flow down of requirements prohibiting welding, cutting, etc., in the characterization units during waste analysis activities.
3	02/26/2005	Revised to change LLNL to INL and add the TGS.
4	11/27/2006	Revised to include SuperHENC.
5	12/29/2010	Minor revision to update references to the *Waste Isolation Pilot Plant Hazardous Waste Facility Permit.*

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1.0 PURPOSE

1.1 Scope

This plan is a discussion of the health and safety considerations that apply to Central Characterization Project (CCP) nondestructive assay (NDA) systems and may supplement or be superseded by site specific health and safety requirements.

2.0 REQUIREMENTS

2.1 References

Baseline Documents

- *Hazardous Waste Facility Permit*, issued to the Waste Isolation Pilot Plant, Identification No. NM4890139088-TSDF, by the New Mexico Environment Department, October 27, 1999, Attachment C, *Waste Analysis Plan* (WAP)
- DOE/CBFO-94-1012, *US Department of Energy Carlsbad Field Office Quality Assurance Program Document* (QAPD)
- CCP-PO-001, *CCP Transuranic Waste Characterization Quality Assurance Project Plan*
- CCP-PO-002, *CCP Transuranic Waste Certification Plan*
- CCP-PO-005, *CCP Conduct of Operations*
- CCP-PO-024, *CCP/INL Interface Document*

Referenced Documents

- NFPA 70, *National Electrical Code*
- NFPA 72-2001, *National Fire Alarm Code*
- CCP-QP-002, *CCP Training and Qualification Plan*
- CCP-TP- 068, *CCP Container Management at INL*
- CCP-TP-097, *Operating the CCP Tomographic Gamma Scanner (TGS)*

- CCP-TP-107, *Operating the CCP High Efficiency Neutron Counter*
- CCP-TP-108, *Calibrating the CCP High Efficiency Neutron Counter*
- CCP-TP-110, *Setup and Calibration of the CCP Tomographic Gamma Scanner*
- CCP-TP- 146, *CCP SuperHENC Operating Procedure*
- CCP-TP-170, *CCP SuperHENC Calibration Procedure*

2.2 Training Requirements

2.2.1 Personnel utilizing this plan will be qualified according to CCP-QP-002, *CCP Training and Qualification Plan.*

2.2.2 Personnel operating CCP NDA systems shall have documented evidence, as part of his/her training record, that they have read and understand the site interface document and this plan.

2.2.3 Personnel operating CCP NDA systems shall have Radiation Worker I or II training as required by the Host site.

2.2.4 Personnel operating CCP NDA systems shall have Hazardous Waste Operations and Emergency Response (HAZWOPER) and cryogenic training.

2.2.5 Supervisory personnel, for the CCP NDA systems, shall have Lockout/Tagout (LO/TO) training as required by the Host site.

2.2.6 Personnel operating CCP NDA systems shall have completed all Host site specific required health and safety training and facility access training.

2.2.7 Personnel handling liquid nitrogen must be trained in cryogenic material handling.

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3.0 RESPONSIBILITIES

3.1 Host Site Support

3.1.1 Provide Radiation Control and Health Physics support as defined in the site interface document.

3.1.2 Provide material movement and material scheduling support as defined in the site interface document.

[A] Site personnel will move, stage, load, and unload waste containers scheduled for characterization by NDA system.

[B] Site personnel will be responsible for completing, maintaining, and submitting all site specific documentation for the movement and scheduling of waste containers for characterization by NDA system.

3.1.3 Provide facility engineering and facility maintenance support as defined in the site interface document.

3.2 Subcontract Technical Representative (STR)

3.2.1 Responsible for the safe performance of all NDA activities.

3.2.2 Assure that all NDA activities are performed in conformance with Host site health, safety, and environmental compliance requirements.

3.2.3 Coordinate all NDA activities to conform with or complement Host site health, safety, and environmental compliance requirements.

3.2.4 Report all unresolved health, safety, and environmental compliance issues to the responsible Host site representative.

3.3 Vendor Project Manager (VPM)

3.3.1 Responsible for on-site management of NDA field operation to assure safe performance of all NDA activities.

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3.3.2 Approve operational changes to the activities defined in the interface document.

[A] Document statement that operational changes do not significantly affect Host site health, safety, or environmental compliance requirements.

[B] Document specific changes to the activities defined in the interface document.

[C] Submit operational changes that constitute a change in hazard or safety scope to the STR for approval.

[D] Direct the revision of this plan to address any change in hazard or safety scope.

3.3.3 Assure that this plan is current and approved for use, the STR approves NDA operations, and NDA operations personnel are appropriately trained for NDA operations before such operations are initiated.

3.3.4 Shall be accessible when NDA operations are performed.

3.4 NDA System Operator

NOTE

All personnel have STOP WORK authority, at any time, if they feel an unsafe condition exits.

3.4.1 Shall be responsible for the safe conduct of operations within the NDA characterization unit.

3.4.2 Shall control access of all visitors and untrained personnel to the NDA characterization unit.

3.4.3 Shall report all unresolved health, safety, and environmental compliance issues to the VPM **AND** the Shift Supervisor (SS).

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3.5 NDA Technical Supervisor

3.5.1 Shall be responsible for the training and oversight of NDA operators with respect to safe conduct of operation within the NDA characterization unit.

3.5.2 Shall report all unresolved health, safety, and environmental compliance issues to the VPM and the SS.

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4.0 NDA SAFETY SYSTEMS, HAZARDS AND CONTROLS

4.1 On-board radiation safety systems

4.1.1 Radiological Hazards

[A] NDA systems use sample interrogation sources to establish matrix attenuation factors, Cf-252 for High-Efficiency Neutron Counter (HENC)/SuperHENC measurements, and Se-75 for TGS measurements.

[B] Waste containers, scheduled for characterization by NDA system, contain various radioactive isotopes of varying mass and concentration.

4.1.2 Radiological Controls

[A] The Cf-252 source is stored in a high density polyethylene (HDPE) storage unit that effectively shields personnel from source generated neutron activity.

[B] The Se-75 source is a system in situ source that resides in a single point aperture tungsten source assembly that itself resides in a single point aperture lead source holder that effectively shields personnel from source generated gamma activity.

NOTE

Initial setup and routine surveys are performed by Radiation Control personnel to ensure source shielding is effective. These surveys confirm that personnel radiation exposure, due to NDA system sources, remain as low as reasonably achievable (ALARA).

[C] The HENC/SuperHENC measurement chamber is designed to moderate and reflect sample and source generated neutrons and thereby serves as an effective personnel shield from both source and sample generated neutron activity.

[D] The HENC/SuperHENC measurement chamber doors are electronically interlocked to the Add-A-Source step controller and the programmed automated operation prohibits access to the assay chamber, the chamber doors will not open, unless the Add-A-Source is in the “home” (fully retracted to storage) position.

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[E] The TGS transmission source is redundantly shielded and the single point aperture, source of the gamma ray interrogation beam, is highly collimated while exposure of the source is controlled by a power failure safe shutter mechanism.

NOTE

The transmission source shutter mechanism will fall to a closed position if electrical power is removed or the system electrical power fails for the TGS unit.

[F] The NDA units are divided into two zones, an operator control room and an NDA equipment bay, by a wall and a personnel access door.

[G] Status lights indicate when the interrogation source is in use and when mechanical motion is imminent or occurring.

NOTE

Red or blue lamps are used to indicate source use.

[H] Appropriate radiation signs shall be posted inside or outside the NDA unit and in areas adjacent to the NDA unit as deemed necessary by site Radiation Control or Health Physics personnel.

[I] Dosimeters will be specified by Host site Radiological Work Permit (RWP).

[J] Radioactive sources will be handled in accordance with Host site requirements by a qualified source handler.

[K] Site Radiation Control Technicians (RCTs) perform routine contamination surveys of the NDA unit as specified by the Host site Radiological Controls.

[L] Routine personnel monitoring will be performed in accordance with Host site requirements.

[M] NDA operators will control personnel access to the NDA unit.

[N] Container surveys will be performed by RCT as required.

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[O] Limiting conditions will be identified in RWP.

[P] Area posting will be per Host site instructions.

4.2 On-board Fire Safety System

4.2.1 Hazards

[A] Combustibles (paper, office materials, etc.) are located inside the operator's control room.

[B] Combustibles located inside waste drums.

4.2.2 Controls

[A] Storage and accumulation of combustible materials and maintenance debris shall be restricted and excess materials shall be removed from the NDA unit and its vicinity as soon as possible.

NOTE

The nominal ambient temperature operation range for the Clean Agent Fire Suppression System is 32 °F to 130 °F. For optimal performance, the dispersion area for the Clean Agent should be restricted to the mobile unit equipment bay and control room. When the unit fire alarm annunciates, the operator shall immediately exit the NDA unit, manually close all NDA unit doors and conveyor rollup doors, if they consider it safe to do so, and follow Host site fire evacuation and notification protocols.

[B] Clean Agent Fire Suppression System with Scorpio Fire Control Panel, which complies with National Fire Protection Association (NFPA) 72-2001 is installed in the NDA unit.

[C] Smoke detectors with audible and visual alarms are positioned in the control room and equipment bay of the NDA unit.

[D] NDA unit fire alarms are wired to the Host site building alarm system as required by the Host site.

[E] The Clean Agent Fire Suppression system automatically discharges, with a pre-programmed delay, into the control room and equipment bay of the NDA unit upon activation of the smoke alarms (manual discharge is also possible).

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[F] The SuperHENC Fire Suppression system is a wet pipe sprinkler system. This sprinkler system employs automatic sprinkler heads attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers when the thermo link is opened by heat from a fire. Each sprinkler head is activated individually when it is heated to its design temperature. Most sprinklers discharge approximately 20-25 gallons per minute (gpm), depending on the system design.

[G] There are two zones to the SuperHENC fire suppression system the operator control area (one sprinkler head coverage) and the equipment bay (four sprinkler head coverage).

[H] Upon activation of the fire suppression system, the operator shall immediately exit the NDA unit, manually close all NDA unit doors (Gamma turntable entrance doors and neutron system cart rollup doors), if the operator considers it safe to do so, and follow Host site fire evacuation and notification protocols.

[I] The SuperHENC fire alarms and pull station (located in the equipment bay) are wired to the Host site building alarm system as required by the Host site.

[J] Hand-held ABC type fire extinguishers are located in the NDA unit.

NOTE

Personnel with appropriate site fire safety training may perform emergency fire protection activities if they feel it is safe to do so.

[K] NDA operation personnel shall complete fire safety and fire extinguisher use training, as required.

[L] Control room and equipment bay door exits are clearly marked with lighted exit signs and emergency lighting over each exit door.

[M] Tables, desks, and floors shall be constructed of predominantly non-flammable materials that contribute to a low combustible environment.

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[N] No spark producing or open flame operations (welding, grinding, cutting, etc.) shall be allowed with waste containers in the NDA unit. Repairs requiring the use of spark producing or open flame operations must be approved by the STR, VPM, and authorities for the Host site health, safety, or environmental compliance requirements.

4.3 On-board Electrical Safety System

4.3.1 Hazards

[A] Electrical hazards including severe shock could occur while performing repair work on the NDA unit electrical equipment or computers.

4.3.2 Controls

[A] Electrical components and installation meet NFPA 70, National Electrical Code (NEC).

[B] NDA unit electrical supplies are labeled.

[C] Conduit inside the NDA unit is Electro Mechanical Tubing (EMT) except where mechanical motion or vibration suggest the use of flexible conduit and Rigid Metallic conduit is employed on the exterior of the NDA unit.

[D] NDA unit is wired to earth ground.

[E] De-energized equipment maintenance and repair work shall be performed only by qualified personnel as designated by the VPM and STR.

[F] Energized equipment maintenance and repair work shall be performed only by qualified personnel utilizing appropriate LO/TO protocol approved by the VPM and STR.

[G] Technical Supervisors shall have completed site acceptable LO/TO training.

[H] Ground fault circuit interrupter (GFI)-protected outlets are provided in each NDA unit.

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4.4 On-board Mechanical Safety System

4.4.1 Hazards

[A] The NDA unit utilizes electrically powered chain driven conveyors to automatically move waste containers to and from the NDA assay platform.

[B] The HENC employs an additional drawbridge conveyor to automatically load the waste container onto the assay platform, then upon completion of measurement unload the waste container from the assay platform. The drawbridge extends when the assay chamber door is open and retracts when the assay chamber door is closed.

[C] The SuperHENC employs a Load/Unload Cart Platform to load the waste container into the neutron assay chamber, then upon completion of measurement, unload the waste container from the assay platform.

[D] HENC assay chamber doors automatically open and close through a defined analysis protocol.

[E] SuperHENC neutron assay chamber doors are manually controlled to open and close through a defined programmable logic controller (PLC) protocol.

[F] NDA units automatically manipulate the waste container while on the assay platform through low intensity rotation or translation movements.

[G] Rigid metal pedestals, frames, and extensions present potential tripping or bump hazards.

4.4.2 Controls

[A] Bump and tripping hazards are posted with warning labels and striped warning tape as required by Host site.

[B] Assay chamber doors are equipped with torque limiter switches and pressure sensitive bump pads that will immediately stop door movement for equipment and personnel safety.

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[C] Personnel shall not reach into, over, stand, walk, or otherwise break the plane of the NDA unit conveyor assembly while it is activated.

[D] Emergency stop buttons are available to de-activate the mechanical operation of the NDA unit.

NOTE

Red emergency stop buttons are strategically located at the conveyor assembly, the electronic control cabinet, and the remote operator computer terminal for the NDA unit.

[E] Physical warning barriers, (chains, ropes, tapes, etc.), are employed to indicate areas where access is restricted during NDA system operation.

[F] The operator shall control personnel access to the NDA unit during operation.

[G] All conveyor guards and emergency stop switches are in place when conveyor is operated.

4.5 Pressurized Gas or Cryogenics

4.5.1 Hazard

[A] NDA system germanium detectors must be operated at cryogenic temperatures, therefore liquid nitrogen is the optimal coolant for NDA system detectors.

NOTE

Evaporation of the cryogen (liquid nitrogen) will pressurize the transfer dewar, however the pressure does not exceed 25 pounds per square inch (psi). Liquid nitrogen can cause burns to exposed skin due to its extremely cold temperature.

4.5.2 Control

[A] NDA operations personnel shall have completed pressurized gas and cryogenic safety training as required by the Host site.

[B] Transfer dewar will be appropriately secured in a designated storage location.

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[C] Standard regulators are used to monitor transfer dewar vessel pressure.

[D] Use caution when filling dewars. Exposed metallic objects, such as watches and rings, should be removed before handling cryogenics.

[E] When handling cryogenic liquids, the following personal protective equipment (PPE) must be worn:

- safety glasses with side shields, chemical splash goggles, face shield
- loose fitting insulated gloves
- non-permeable high-topped shoes or boots that extend upward inside the legs of the trousers
- cuffless trousers
- long-sleeved heavy shirt or coat that affords coverage of the neck to above the bottom of the face shield

[F] The NDA unit shall not be left unattended while liquid nitrogen is transferred to the detector dewar.

[G] The NDA unit roll up doors shall be open during the transfer of liquid nitrogen to the detector dewar.

[H] The equipment bay should not be occupied while transferring liquid nitrogen from the transfer dewar to the detector dewar.

4.6 Material Handling

4.6.1 Hazards

[A] Personnel injury or equipment damage due to incorrect or improper movement of large, heavy, waste containers.

[B] Slips, trips, and falls.

[C] Caught between equipment moving waste containers.

4.6.2 Controls

[A] Personnel shall not individually lift items that exceed 50 pounds or one-third the individual's body weight, which ever is less.

[B] Material handling aids (crane, fork truck, drum lift, drum dolly, drum carrier, castor, ramp, or hoist) shall be employed whenever practical.

[C] Placement or removal of waste containers on the conveyor or assay platform, which require remote handling by any of the listed material handling aids will be coordinated by CCP personnel and performed by Host site personnel.

[D] Appropriate PPE to include protective footwear, eyewear, and heavy (leather) gloves shall be worn for waste container movement and material handling activities.

[E] Walking and work surfaces shall be maintained in a clean and undamaged condition so as not to impede waste container movement and material handling activities.

[F] Identify potential tripping hazards and mark where possible.

[G] All accidents or injuries will be reported to the VPM as soon as possible.

[H] Wear safety-toed footwear.

[I] Use safe method to ascend/descend trailers. Personnel must **NOT** jump off trailers.

[J] Maintain awareness of forklifts operating in the area **AND** be aware of alarms on heavy equipment/forklifts. Only qualified personnel shall operate equipment.

[K] Maintain body position awareness.

[L] Ensure loads are secure prior to movement **AND** no body parts are under suspended loads.

4.7 Emergency Response Plans and Procedures

4.7.1 NDA operations personnel shall be trained to required Host site identification of emergency signals and attendant Host site emergency response and safety protocols for the specific facility of operation.

4.7.2 NDA operations personnel shall participate in Host site scheduled drills concerning recognition of site emergency notification and response to the stated emergency.

4.7.3 NDA personnel shall be trained to required Host site protocol to address emergency first aid responses and identification of site assistance programs (emergency responder telephone number, medical support location, etc.).

4.7.4 NDA personnel shall be knowledgeable of Host site specific evacuation and sheltering protocol for emergency or disaster conditions.

4.7.5 NDA personnel shall be knowledgeable of Host site specific inclement weather notification and protocols that address work shutdowns, weather protection, and snow or ice conditions.

4.7.6 NDA operations personnel shall perform systematic shutdown of NDA equipment, according to the appropriate operating procedure, during emergency conditions only if the personnel determine it is safe to do so.

4.7.7 If any unsafe condition is encountered during activities in WMF- 628, place equipment in safe condition, AND notify the SS.

[A] Additional actions must be performed as directed by the SS.

4.8 Other Operational Safety Requirements

4.8.1 If an operator suspects a drum has been damaged or breached they should stop work, warn others, isolate the spill, minimize the hazard, then notify the VPM and site RCT.

4.8.2 Telephone communication and emergency warning public address notification will be available in each NDA unit or, if not available, portable 2-way radios will be utilized.

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4.9 Waste Produced

4.9.1 Non-contaminated (non-radioactive) waste produced as a result of NDA characterization activities, such as packaging materials, waste paper, and spent office supplies shall be disposed of through normal Host site waste disposal processes.

4.9.2 Contaminated (radioactive) waste and secondary (job controlled) waste, generated by NDA characterization activities shall be collected, packaged and disposed of through a site assigned Waste Coordinator.

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5.0 RECORDS

5.1 No records are generated as a result of this Health and Safety Plan.

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Attachment 1 – Summary of Identified Hazards and Mitigating Controls

CCP Nondestructive Assay System Health and Safety Plan

Hazard Description	Controls
1. Radiation Safety a. System sources b. Waste containers	1. ALARA practices. 2. Site source handler training. 3. Source Isolation through engineered storage. 4. Visual indicators for source operation. 5. Appropriate TLD or required alternative dosimeter. 6. RCT monitoring as necessary. 7. PPE as required. 8. Knowledge of site specific emergency notification, emergency response, and evacuation protocol.
2. Fire Safety a. Paper and office supplies b. Waste containers	1. Good housekeeping practices. 2. Integrated fire suppression system (Clean Agent or Wet Pipe Deluge). 3. Smoke detector with audio/visual alarms. 4. Integrated to site fire protection services. 5. Hand held fire extinguishers. 6. Emergency exit lighting. 7. Administrative control of open flame operations. 8. Knowledge of site specific emergency notification, emergency response, and evacuation protocol.

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Attachment 1 – Summary of Identified Hazards and Mitigating Controls - continued

3. Electrical Safety a. Shock hazard	1. Electrical components designed to meet NFPA 70, NEC. 2. Electrical supplies labeled. 3. Wiring encased in conduit. 4. Cabinets and components wired to earth ground. 5. GFI protected outlets available. 6. LO/TO training required for NDA Technical Supervisor. 7. Administrative oversight, VPM or STR for electrical work. 8. Knowledge of site specific emergency notification, emergency response, and evacuation protocol.
4. Mechanical Safety a. Chain driven conveyors b. Drum platforms c. Rigid frames (bump) d. Frames and cables (trip)	1. Remote operator location. 2. Posted warning labels. 3. Personnel safety bumpers (interrupt mechanical motion). 4. Emergency stop buttons. 5. Warning light indicating imminent mechanical motion. 6. Operator control of personnel access. 7. Knowledge of site specific emergency notification, emergency response, and evacuation protocol.
5. Pressurized or Cryogenic Gases a. Liquid Nitrogen	1. Appropriate storage (fasteners and straps). 2. Appropriate PPE. 3. Attended use. 4. Personnel trained in site required pressurized or cryogenic gases training. 5. Knowledge of site specific emergency notification, emergency response, and evacuation protocol.
6. Material Handling Safety a. Lifting hazard	1. Use material handling aids. 2. Drum movement performed by site personnel using appropriate handling aids. 3. Appropriate PPE. 4. Practice good housekeeping. 5. General awareness of workspace limitations (low overhead, trip potential, restricted movement, etc.). 6. Knowledge of site specific emergency notification, emergency response, and evacuation protocol.