

# CCP-HSP-009

Revision 5

## CCP RTR Health and Safety Plan

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APPROVED FOR USE

RECORD OF REVISION

Revision Number	Date Approved	Description of Revision
0	01/09/2004	Initial Revision.
1	05/28/2004	Revised to respond to DOE ORR post start finding concerning the flow down of requirements prohibiting welding, cutting, etc., in the characterization units during waste analysis activities.
2	03/20/2005	Revised to incorporate changes to support the RTR unit at INL.
3	08/08/2005	Revised to incorporate RTR #5 at INL.
4	11/18/2008	Revised in response to CAR-CCP-0008-07, to remove Real-Time Radiography (RTR) #2 and to make applicable to all Central Characterization Project (CCP) RTR units.
5	10/26/2009	Revised for consistency with conditions found at Savannah River Site (SRS) during MA-CCP-0001-09.

TABLE OF CONTENTS

1.0	PURPOSE.....	4
1.1	Scope.....	4
2.0	REQUIREMENTS.....	5
2.1	References .....	5
2.2	Training Requirements.....	6
2.3	RTR Systems.....	7
3.0	RESPONSIBILITIES.....	8
3.1	Host Site .....	8
3.2	Project Managers (PM).....	8
3.3	Vendor Project Manager (VPM).....	8
3.4	RTR System Operators.....	10
4.0	HAZARDS AND CONTROLS.....	13
4.1	Ionizing Radiation .....	13
4.2	Fire.....	14
4.3	Electricity .....	15
4.4	Powered Mechanical Systems.....	15
4.5	Material Handling.....	16
4.6	Lead.....	16
5.0	RECORDS.....	17
	Attachment 1 – Personal Protective Equipment Requirements.....	18

## 1.0 PURPOSE

This document is intended to identify the general hazards associated with operation of Real-Time Radiography (RTR) units and the responsibilities and type of minimum controls to assure the safety of RTR operators, trainees, visitors, surrounding workers, and the protection of the RTR equipment. RTR for waste characterization shall incorporate safety systems designed to protect its operators, nearby workers (such as forklift operators), visitors, and to protect the RTR equipment and any facility where the RTR system is located. RTR units pose radiation, fire, mechanical movement, electrical hazards and potential hazards from exposed lead, falling waste containers, personnel falls, coolant oil, and the small quantities of hazardous chemicals used to clean the RTR units.

### 1.1 Scope

This Health and Safety Plan (HSP) applies to RTR units used within the Central Characterization Project (CCP). This plan may be supplemented by vendor and Host site-specific health and safety requirements. Host site-specific Safety Basis document requirements, where available, are prerequisite and supersede the provisions of this Plan.

RTR is a non-intrusive characterization process that consists of performing X-ray imaging of waste containers to identify material contents. The containers are not opened during this process.

## 2.0 REQUIREMENTS

### 2.1 References

#### Baseline Documents

- 29 Code of Federal Regulations (CFR), *Occupational Safety and Health Standards*, Part 1910, General, Subpart 212(a), Machine and Machine Guarding
- CCP-CM-001, *CCP Equipment Change Authorization and Documentation*
- CCP-CM-018, *CCP Real-Time Radiography MCS Unit #3 LANL Unit #2 (RTR #2) (Equipment # NDE-RTR-03/LANL-RTR-02) Equipment Description*
- CCP-CM-019, *CCP Real-Time Radiography MCS Unit #4 (RTR-4) (Equipment # NDE-RTR-04) Equipment Description*
- CCP-CM-020 *Real-Time Radiography Unit #5 (RTR-5) Equipment Description*
- CCP-CM-021 *Real-Time Radiography Unit #6 (RTR-6) Equipment Description*
- CCP-CM-028, *Real-Time Radiography LANL Unit #1 (Equipment # LANL-RTR-01) Equipment Description*
- CCP-HSP-014, *Health and Safety Program Implementation for CCP*
- 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-026, *CCP Configuration Management Plan*
- CCP-TP-028, *CCP Radiographic Test and Training Drum Requirements*
- CCP-TP-066, *CCP Radiography Screening Procedure for Prohibited Items*

- CCP-TP-119, *CCP Operating the Real-Time Radiography (RTR) System #5*
- CCP-TP-121, *CCP RTR #1 Operating Procedure*
- CCP-TP-122, *CCP RTR #2 Operating Procedure*
- CCP-TP-145, *CCP RTR #4 Operating Procedure*
- CCP-TP-165, *CCP Real Time Radiography #6 Operating Procedure*
- CCP-TP-508, *CCP RH Standard Real-Time Radiography Inspection Procedure*
- CCP-TP-510, *CCP Remote-Handled Radiography Test and Training Drum Requirements*

#### Referenced Documents

- CCP-QP-002, *CCP Training and Qualification Plan*
- CCP-TP-053, *CCP Standard Real-Time Radiography Inspection Procedure*
- CCP-TP-140, *CCP Equipment Maintenance*
- ANSI N43.3-1993, *General Radiation Safety-Installations Using Non-Medical X-Ray and Sealed Gamma-Ray Sources, Energies up to 10 MeV*

## 2.2 Training Requirements

- 2.2.1 Personnel operating RTR systems shall have documented evidence as part of their training that they have read and understand this document, the operating procedure for the applicable RTR unit, and have complied with the requirements of CCP-QP-002, *CCP Training and Qualification Plan*.
- 2.2.2 Personnel operating RTR systems shall have Radiological Worker II, Host site facility access training, and any other required Host site training needed to install, start-up, test, maintain, inspect, and operate RTR characterization systems.

## 2.3 RTR Systems

- 2.3.1 RTR systems can be fixed or mobile units setup inside or outside of a building with various levels of utility support.
- 2.3.2 Power requirements for each RTR unit are provided in the applicable equipment description. Generally, 120 V AC 20 amp service is necessary for lighting and controls in the control room, and higher voltage power is needed for the x-ray units.
- 2.3.3 Safe operation of an RTR system requires a system which has a control room shielded from the X-ray system, interlocks on vault access doors which cut off x-ray unit electrical power, start-up warning alarms, including the time delay warning prior to system startup per American National Standards Institute (ANSI) N43.3, *General Radiation Safety-Installations Using Non-Medical X-Ray and Sealed Gamma-Ray Sources, Energies up to 10 MeV*, emergency stop buttons and interlocks for eliminating power to mechanical and electrical systems, and appropriate radiation area postings and warning lights.
- 2.3.4 Shielding is also required to protect surrounding workers and the public from the x-rays. Additionally, warning alarms (audible or visible) and postings are required to indicate the potential hazard associated with the use of x-rays.
- 2.3.5 Control Room operators generally require telephones and/or communication radios, a local area network (LAN) Internet connection, fire detection and suppression equipment, a public address system or other means of receiving host site announcements, chairs, surveillance cameras, recording devices, lights/emergency lighting, safe entry/ exit doors with appropriate access platforms and stairs, heating and cooling, computers, printers, tables/desks, cabinets, thermoluminescent dosimeters (TLDs), and a posting of emergency telephone numbers/radio frequencies.

### 3.0 RESPONSIBILITIES

#### 3.1 Host Site

3.1.1 Generally the Host site where the RTR system is located will provide Radiological Control services including issuing TLDs, performing radiation safety surveys, and providing appropriate radiation hazard postings.

3.1.2 Host site personnel also provide work control package reviews, authorizations, and scheduling, documented safety analyses, technical safety requirements, industrial hygiene and industrial safety services, access control, security, and emergency services in accordance with the respective site Interface Agreement with CCP.

3.1.3 Generally Host sites will move, stage, load, and unload waste containers scheduled for characterization by RTR systems.

3.1.4 Host site personnel also provide facility engineering and maintenance support where the work affects Host site facilities, utilities, and/or union work agreements.

#### 3.2 Project Managers (PM)

3.2.1 Assures that all RTR activities are performed in conformance with Host site and CCP health, safety, and environmental compliance requirements including the Host site's environmental permits, safety programs, and authorization basis.

3.2.2 Reports all unresolved health, safety, and environmental compliance issues to the responsible Host site and CCP professionals for resolution as appropriate.

3.2.3 Assures that appropriate engineering and safety reviews are performed on design changes, procedural changes, and equipment changes.

#### 3.3 Vendor Project Manager (VPM)

3.3.1 Responsible for the on-site management of RTR field operations to assure safe performance of all RTR activities.

- 3.3.2 Responsible for assuring that appropriate Host site interface occurs for installation, testing, operation, inspection, and maintenance of the RTR systems in accordance with the Interface Agreement between the Host site and CCP.
- 3.3.3 Submits operational and engineering changes to the PM or equivalent for appropriate CCP and Host site review and approval.
- 3.3.4 Assures that RTR operators are appropriately trained for RTR operations before such operations are initiated, and maintains a list of qualified RTR operators.
- 3.3.5 Ensure that operators have access to and read current job hazard analyses for the RTR system being operated.
- 3.3.6 Shall be accessible when RTR operations are performed.
- 3.3.7 Shall periodically perform a walkdown of the RTR units to assure that they are receiving appropriate Host site support, that communication systems are operational, exit pathways are clear, postings make sense and are legible, that traffic controls are appropriate, and to identify any possible hazards which require review and/or mitigation.
- 3.3.8 Assure that Lockout/Tag outs are performed only by personnel who are qualified by the Host site to perform Lockout/Tagouts. Ensure that Lockout/Tag outs are performed when required by the Host site for maintenance on RTR systems.
- 3.3.9 Assure that maintenance work on RTR systems is performed by qualified and knowledgeable personnel in accordance with CCP-TP-140, *CCP Equipment Maintenance*.
- 3.3.10 Assure that walking and working surfaces and stairs/railings are clean and undamaged.
- 3.3.11 Assure that all accidents and injuries are reported promptly to Host site and CCP personnel including the WTS Safety and Health Department.
- 3.3.12 Assure that appropriate guards are in place and are functional where rail systems are used to move waste containers into and out of RTR systems, and where rotating parts and moving chains exist.
- 3.3.13 Assure that conveyors are posted with warning signs, emergency stop buttons are present and routinely tested, maintenance power

tools used by CCP workers are appropriately guarded, and electrical equipment is properly grounded.

3.3.14 Assure that hazards near the RTR systems are identified and mitigated to minimize impact to RTR operators and equipment.

3.3.15 Assure the Host site emergency response procedures are understood by RTR operators and that RTR operators participate in Host site emergency response exercises.

### 3.4 RTR System Operators

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#### **NOTE**

All personnel have STOP WORK authority, at any time, if they believe an unsafe or abnormal condition exists, AND shall notify the VPM and Lead RTR operator if a STOP WORK is initiated.

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3.4.1 Responsible for the safe conduct of operations within the RTR systems.

3.4.2 Controls, authorizes, escorts, and limits access of visitors and untrained personnel to the RTR system.

3.4.3 Assure that **NO** person is inside the vault prior to or during start-up of the x-ray unit.

3.4.4 Assure that only authorized personnel are inside the RTR control room during operation of the RTR system.

3.4.5 Brief all visitors regarding the hazards of RTR systems and their safe standing or sitting locations within the RTR system.

3.4.6 Assure that visitors wear the personnel protective equipment (PPE) required for the RTR system and the place in which the system is located.

3.4.7 Report all accidents, injuries and unresolved health, safety, and environmental compliance issues to the VPM.

3.4.8 Maintain qualifications and fulfill training requirements appropriate to the location of assigned work.

3.4.9 Work toward a comprehensive resolution of health, safety, and environmental compliance issues and hazards.

- 3.4.10 Responsible for the safety of trainees and each other.
- 3.4.11 Maintain inside the control room and follow current RTR system operating, inspection, and applicable maintenance procedures.
- 3.4.12 Maintain Material Safety Data Sheets (MSDSs) for all chemicals and oils used on the RTR systems.
- 3.4.13 Wear assigned TLDs, review and sign applicable radiation work permits; obey all work permit requirements, postings, barriers, and warning devices.
- 3.4.14 Maintain and/or verify that operators have access to and read current job hazard analyses for the RTR system being operated.
- 3.4.15 **DO NOT** stand beneath suspended loads or climb on equipment that is energized.
- 3.4.16 **DO NOT** sit, stand, climb, or walk on conveyor system or equipment in the x-ray vault.
- 3.4.17 **IF** a waste container is suspected to be damaged or breached, **THEN STOP WORK**, warn others, leave the area, **AND** notify the VPM and Radiological Control personnel.
- 3.4.18 Wear the required PPE for the area in which the RTR system resides and for the work that is to be performed on RTR system (see Attachment 1, Personal Protective Equipment Requirements).
- 3.4.19 Assure that associated safety systems are operational, hazard postings (e.g., radiation area, high voltage, hot surfaces, rotating parts, pinch points, etc.) are present, alarms (visual and audible including the time delay warning prior to system startup per ANSI N43.3) and emergency stop features are functional, and that shielding is in place and not damaged prior to operating the RTR system.
- 3.4.20 RTR system operators **SHALL NOT** work alone unless they can communicate with, and be heard or seen by others.
- 3.4.21 Shall be accessible when RTR operations are performed; assure that waste containers admitted into the RTR system have a documented surface radiation dose measurement.
- 3.4.22 Utilize control key capture/possession for applicable operations where the control panel power key is in the physical possession of

the operator entering the vault. Most sites' RTR vault mechanical and electrical systems are not interlocked to the vault doors to ensure that they cannot be activated when the doors are open. Control key capture, in accordance with applicable procedures, must be used for systems that are not interlocked.

#### 4.0 HAZARDS AND CONTROLS

##### 4.1 Ionizing Radiation

- 4.1.1 Radiographic images are produced utilizing a radiation-generating device with a typical operating range of 20 kilovolt (kV) to 450kV. To keep personal exposure levels as low as reasonably achievable (ALARA), the RTR radiography system shall be designed, constructed, and operated in accordance with ANSI N43.3-1993.
- 4.1.2 The RTR unit shall have shielding sufficient to limit the radiation dose rate in the control room/operator's console, and immediately around the exterior of the RTR operations area to ALARA for the location in which the RTR unit is located.
- 4.1.3 The x-ray machine and the waste container being examined are located within a lead-shielded enclosure. The doors to this enclosure are remotely controlled and fitted with redundant electrical interlock switches such that x-ray generation is **NOT** possible unless all doors are securely closed.
- 4.1.4 The operator control station is fitted with closed-circuit cameras and monitors that allow constant visual surveillance of the shielded enclosure/vault and conveyor area.
- 4.1.5 Audible and visual alarms, including a time delay warning prior to system startup, are provided to warn personnel in the vicinity of impending and actual x-ray generation.
- 4.1.6 These and other safety systems are tested in accordance with the applicable operating procedures for each specific RTR system.
- 4.1.7 Radiation surveys shall be performed in accordance with Host site-specific safety basis requirements (e.g., Technical Safety Requirements), where available, to assure the integrity of the RTR system shielding. In the absence of Host site-specific safety basis requirements, radiation surveys shall be performed annually to assure the integrity of the RTR system shielding.
- 4.1.8 **IF** maintenance has been performed on shielding components, **THEN** a radiation survey/leak check shall be performed prior to operation of the RTR system.
- 4.1.9 Appropriate signs and posting shall be visible to warn personnel and visitors of the hazards of ionizing radiation, moving parts, pinch points, rotating parts, electrical hazards, fall hazards, and

emergency telephone numbers and contacts shall be posted within the control room.

#### 4.2 Fire

- 4.2.1 The oil-insulated high tension generators contain insulating oil. Oil is periodically changed and an MSDS shall be available in the work area for this oil.
- 4.2.2 Combustibles (e.g., paper, desk, etc.) are located inside the operator's control room and shall be kept to a minimum.
- 4.2.3 Combustibles brought into the RTR system shall be limited to procedures, print paper, logbook, tissues, and incidental materials including cleaning supplies necessary to support operations and operators.
- 4.2.4 A hand-held ABC fire extinguisher shall be accessible to people operating the RTR systems.
- 4.2.5 Exit doors shall be clearly marked and remain unobstructed.
- 4.2.6 Spark producing or open flame operations (e.g., welding, grinding, cutting) shall **NOT** be allowed when waste containers are in the RTR system.
- 4.2.7 Repairs requiring the use of spark producing or open flames (e.g., welder, grinder, cutting torch) shall have prior approval of the VPM and will require a Host site approved Hot Work Permit.
- 4.2.8 Personnel witnessing a fire or smoke in the RTR area, or hearing a fire alarm, shall immediately call for everyone to evacuate the RTR operations area. The operator shall quickly conduct a system shut-down **AND** close and secure the access-doors after all personnel have evacuated, providing it is safe to do so. Otherwise, activate the system e-stop and leave immediately.
- 4.2.9 When in a safe area away from the fire, emergency notifications shall be made in accordance with Host site requirements. In addition, the VPM and Lead Operator as a minimum shall be notified as immediately as possible.

### 4.3 Electricity

- 4.3.1 Electrical systems shall be provided with appropriate safety enclosures.
- 4.3.2 Conduit runs shall be liquid-tight.
- 4.3.3 The RTR system shall be wired to a ground.
- 4.3.4 Routine maintenance work shall be performed on confirmed de-energized equipment, including de-energized mechanical systems whose stored energy has been released. Maintenance work, including troubleshooting, that requires energized equipment, shall be performed in accordance with a Job Hazard Analysis and Work Plan in accordance with the Host site's requirements.
- 4.3.5 High-voltage warning labels shall be posted/visible near the high-voltage equipment.
- 4.3.6 Interlocks which cut off power to the electrical system of the x-ray generating equipment shall be used on each vault access door.

### 4.4 Powered Mechanical Systems

- 4.4.1 RTR operators, trainees, and visitors, if present, shall remain in the control room during the operation of the RTR system.
- 4.4.2 Wheels and chains with potential to move shall be guarded, and conveyors shall have warning signs on or near them.
- 4.4.3 Emergency stop buttons for mechanical and electrical systems shall be present and available to personnel inside and/or outside of the RTR system and in the control room.
- 4.4.4 An enclosure shall be used around rotating waste containers which meets the requirements of 29 CFR, *Occupational Safety and Health Standards*, Part 1910, General, Subpart 212(a), Machine and Machine Guarding, (4) which states: "Barrels, containers, and drums. Revolving drums, barrels, and containers shall be guarded by an enclosure which is interlocked with the drive mechanism, so that the barrel, drum, or container cannot revolve unless the guard enclosure is in place."
- 4.4.5 Safety shoes shall be worn by all personnel who work in or around RTR systems (See Attachment 1.)

4.4.6 Pinch points shall be identified by warning signs.

4.4.7 Video surveillance cameras shall allow for visual monitoring of the areas of the RTR system which contain powered mechanical equipment.

4.4.8 Inspect moving parts when de-energized to assure that they are clear of foreign objects.

#### 4.5 Material Handling

4.5.1 Due to the large size and weight of the waste containers and lead shielding, a potential for personnel injury and/or equipment damage exists.

4.5.2 Personnel shall not individually lift items that exceed 50 pounds or one-third the individual's body weight, whichever is less.

4.5.3 Material handling aids (e.g., cranes, fork trucks, drum lifts, drum carriers, casters, ramps, or hoists) shall be employed whenever practical. Material handling practices shall conform to the requirements of the Host site related to health and safety for both material handling and forklift safety.

4.5.4 All movement and handling of waste containers requiring the use of forklift or cranes will be performed by qualified personnel. Compliance with the Host Site's requirements for a second person as a safety observer is required.

4.5.5 Appropriate PPE as described in Attachment 1, shall be worn by personnel accessing the RTR unit.

#### 4.6 Lead

4.6.1 Lead shielding is not generally considered a hazard unless it is machined, flakes off, or can fall on someone.

4.6.2 Lead shielding shall be encapsulated (painted as a minimum) to prevent wear and flaking.

4.6.3 Host site radiological control surveys shall be performed on operating RTR units after installation at the host site to confirm that the lead shielding is sufficient to meet host site dose rate limitations.

4.6.4 Handling of lead shall be minimized and limited to installation and repair, and shall follow Host site safety requirements.

5.0 RECORDS

5.1 No records are generated as a result of this HSP.

Attachment 1 – Personal Protective Equipment Requirements

Operation/Condition	Respiratory Protection	Protective Equipment (in addition to Host site requirements)	Dosimetry
Drum and Box Handling	N/A	Leather gloves, safety glasses, and safety shoes. (Note – do not wear gloves around rotating devices unless they are completely de-energized.)	TLD and other supplemental dosimetry as specified in the governing Radiological Work Permit (RWP).
Lead Handling	Determined by Host Site Industrial Hygiene.	Leather gloves and work clothes. Notify Host site Industrial Hygiene before handling exposed lead.	As directed by Host site industrial hygiene professional.
RTR equipment operation, maintenance and inspection	N/A	Safety shoes and appropriate industrial work attire per Host site requirements.	TLD and other supplemental dosimetry as specified in the governing RWP.