

**Idaho National Laboratory**

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier: AL-2100-OI-001
	Revision: 0
	Effective Date: 03/30/17 <span style="float: right;">Page: 1 of 16</span>

Materials and Fuels Complex	Laboratory Instruction	<b>USE TYPE 4</b>	eCR Number: 647223
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Manual: MFC Analytical Laboratory Manual

PROCEDURE REVIEW REQUIREMENTS PER SP-20.1.4			
DISCIPLINE	REVISION	DISCIPLINE	REVISION
ANALYTICAL RESEARCH LABORATORIES (AL, RCL)	X	MAINTENANCE	N/A
CHARACTERIZATION & ADVANCED PIE (EML, IMCL, SPL)	N/A	NUCLEAR SAFETY REVIEW	N/A
FUEL FABRICATION & NUCLEAR MATERIAL MANAGEMENT (EFF, FASB, FMF, ZPPR)	N/A	OUTSIDE REVIEW	N/A
POST-IRRADIATION EXAMINATION (HFEF, NRAD, MOCK-UP)	N/A	PACKAGING & TRANSPORTATION	N/A
PRODUCTION FACILITIES & INFRASTRUCTURE (BOP, FCF, RDF, INTEC, RSWF/TSDF, TREAT-WH)	N/A	QUALITY ASSURANCE	N/A
SPACE NUCLEAR POWER & ISOTOPE TECHNOLOGIES (SSPSF, 751, 772, 796, INTEC [RSTSF & 1634])	N/A	RADIOLOGICAL CONTROLS	*
CUI REVIEW	N/A	REMOTE-HANDLED LOW LEVEL WASTE (RH-LLW)	N/A
ENGINEERING	N/A	SAFEGUARDS & SECURITY	N/A
ENVIRONMENTAL	*	SAFETY & HEALTH (IH, IS)	*
FIRE PROTECTION	*	TRAINING	*
HOISTING AND RIGGING	N/A	WASTE GENERATOR SERVICES	*
INTER-FACILITY TRANSFERS	N/A		
*DOCUMENT OWNER OR QUALIFIED REVIEWER SHALL DETERMINE THE NEED FOR THESE REVIEWS BASED UPON THE SCOPE OF THE CHANGE AND THE HAZARDS IDENTIFIED			



<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier:	AL-2100-OI-001	
	Revision:	0	
	Effective Date:	03/30/17	Page: 3 of 16

## 1. PURPOSE/SCOPE/APPLICABILITY

This document supplies operating and maintenance instructions for the carbon, nitrogen, oxygen, hydrogen (CNOH) glovebox, located in Room B-141 of the Analytical Laboratory, Bldg. 752. It is used for contamination control during the operation of the two ELTRA solid sample analyzers located inside the glovebox. The ELTRA CS-800 is a carbon-sulfur analyzer, having a remote radio-frequency (rf) induction furnace. The ELTRA ONH-2000 is an oxygen-nitrogen-hydrogen analyzer, having a remote electrode furnace. The associated detectors, instrumentation, and controls are located inside the respective analyzer cabinets located under the glovebox. Analyzer operation will be performed under separate work control.

The CNOH glovebox is a single glovebox system with four 8-in Central Research Laboratory (CRL) gloveports. The south end of the glovebox is equipped with one 12-in. CRL bagout sleeve and a CRL rapid transfer port or French can. The north end of the glovebox is equipped with one 8-in. CRL sleeve and a small smear-counting port. Care should be used when using the smear port not to break or tear the Mylar window (which would break containment). The CNOH glovebox has a one-pass air atmosphere with intake and exhaust high efficiency particulate air (HEPA) filters. Waste removal, as well as glove changeouts, will be performed in accordance with AL-6000-MI-001, "Glove, Blank, and Bagout Sleeve Changeout, and Waste Removal-CRL Ports." All radiological-material transfers into and out of the glovebox shall be performed in accordance with AL-6000-OI-001, "Nuclear Material Handling."

This procedure is performed by personnel qualified to work in the Analytical Laboratory (AL) per Section 2.1.

The activities directed by this procedure have been designated Quality Level 3 per Quality Level Determination MFC-000093.

## Idaho National Laboratory

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier: AL-2100-OI-001
	Revision: 0
	Effective Date: 03/30/17 <span style="float: right;">Page: 4 of 16</span>

**2. RISKS AND CONTROLS**

Table 1. Hazards.

Sequence of Basic Activities	Potential Hazard	Hazard Control
1. Working with furnaces inside a glovebox.	1a. Fire (due to presence of furnaces).	1a. 1) Maintain combustible supplies inside glovebox at minimum quantity. 2) Limit flammable/combustible liquids to only the amount required for daily operation. 3) Solid samples containing metallic fuel shall be placed in metal containers until they are transferred out of the glovebox area. 4) Ensure that the area around heat producing appliances (e.g. furnace) is clear of combustibles. 5) Ensure heat producing appliances are equipped with a manual reset over-temperature shutoff switch. 6) Notify the AL SS if equipment is operating unattended on back shifts. 7) Glovebox gloves must be restrained to the outside of the glovebox when unattended. Use care not to allow gloves to come in contact with hot surfaces when in use.
	1b. Thermal burn or glove breach	1b. Thermal protective outer gloves shall be worn when contacting objects >50°C.

## Idaho National Laboratory

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier: AL-2100-OI-001
	Revision: 0
	Effective Date: 03/30/17 <span style="float: right;">Page: 5 of 16</span>

Sequence of Basic Activities	Potential Hazard	Hazard Control
2. Working with radioactive materials.	2. Radiation exposure and personnel contamination.	2. 1) Per RWP. 2) Posted survey requirements. 3) “Clean as you go” philosophy as work is being performed, in order to maintain low contamination levels in the glovebox. 4) Expected radiological conditions (for example: expected neutron exposure, high radiological exposure, total activity of the sample) received from AL HP supervisor prior to working with new radiological material. 5) HPT monitoring for all transfers into or out of the radiochemistry glovebox. 6) In case of a glovebox breach (e.g., a cut glove), secure the area in accordance with the INL Radiological Glovebox Training (QNGLVACT) and notify the HPT, AL SS, and AL NFM. 7) PPE as specified in the RWP. 8) Shielding to maintain personnel dose ALARA. Staging of materials in a lower radiation field to minimize dose. 9) Periodic surveys of the glovebox gloves performed during operations with results given to operator of the glovebox.

## Idaho National Laboratory

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier: AL-2100-OI-001
	Revision: 0
	Effective Date: 03/30/17 <span style="float: right;">Page: 6 of 16</span>

Sequence of Basic Activities	Potential Hazard	Hazard Control
3. Working in a CA, HCA, or ARA.	3. Exposure to contamination and/or airborne radioactivity.	3. 1) Limiting potential for contamination spread whenever possible. 2) Requirements of the applicable RWP. 3) Reduction of airborne radioactivity levels using localized ventilation (HEPA vacuum), applying liquids (e.g., water), catch drapes, tacky cloth, etc. as needed, within the affected work areas.
4. Working in a known or suspected RA, or HRA.	4. Radiation exposure.	4. 1) Based on survey results, use of ALARA shielding or temporary shielding to maintain personnel dose ALARA. 2) Requirements of the applicable RWP. 3) Tools, parts, materials, etc., staged prior to entering a RA (or HRA, if applicable) to reduce time personnel are in the area.
5. Electrical activities.	5a. Potential electrical shock.	5a. 1) Use of equipment limited to 220-V (or less) consumer electrical devices approved by UL or other electrical equipment regulator. 2) Cords inspected prior to use. 3) CS-800 radio frequency (rf) generator has 7000 V potential; energized work requires consultation with Electrical/I&C technicians.
6. Repetitive motions while working in glovebox.	6. Injuries caused by repetitive motion and/or fatigue.	6. Appropriate tools and work techniques to minimize musculoskeletal stress and repetitive body motions; frequent breaks and stretching to combat fatigue.

## Idaho National Laboratory

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier: AL-2100-OI-001
	Revision: 0
	Effective Date: 03/30/17 <span style="float: right;">Page: 7 of 16</span>

Sequence of Basic Activities	Potential Hazard	Hazard Control
7. Use of sharp cutting tools and handling sharp items ("sharps").	7. Cut potential.	<p>7. 1) Only necessary blade section (as small as possible) left exposed (any excess edge covered with tape).</p> <p>2) Use scissors when possible instead of a knife.</p> <p>3) Cut resistant (level 4) gloves worn over the top of the glovebox gloves when handling sharp cutting tools or materials (e.g., razor blades, broken glass, etc.). Note: scissors with blunt/ rounded tip do not require the use of cut resistant gloves.</p> <p>3) Use puncture resistant gloves over the top of the glovebox gloves when a puncture hazard exists.</p> <p>4) If force must be applied when using pointed tools, puncture-resistant gloves to mitigate the puncture hazard.</p> <p>5) Leather gloves offer a small amount of unrated puncture resistance and may be worn if only a slight force is applied with pointed tools.</p> <p>6) Sharps (including broken glass, pipet tips, razor blades, pieces of wire, tweezers) placed in a closed, approved container.</p> <p>7) Sharp edges wrapped or padded or placed in secondary container (for example, can lids, etc.).</p> <p>8) In case of a glovebox breach (e.g., a cut glove), secure the area in accordance with the INL Radiological Glovebox Training (QNGLVACT) and notify the HPT, AL SS, and AL NFM.</p> <p>9) Sharp tools not in use protected or covered to prevent inadvertent glove breach.</p>

## Idaho National Laboratory

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier: AL-2100-OI-001
	Revision: 0
	Effective Date: 03/30/17 <span style="float: right;">Page: 8 of 16</span>

Sequence of Basic Activities	Potential Hazard	Hazard Control
8. Working in glovebox with items that present pinch points.	8. Pinching of hands and arms, and damage to glovebox gloves.	8. 1) Awareness of all possible pinch points (for example, transfer-port door hinges, handling sample containers, etc.). 2) Hands and glovebox gloves kept away from pinch points. 3) In case of a glovebox breach (e.g., a cut glove), secure the area in accordance with MFC-ONRI-0001 and notify the HPT, AL SS, and AL NFM.



## Idaho National Laboratory

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier: AL-2100-OI-001
	Revision: 0
	Effective Date: 03/30/17 <span style="float: right;">Page: 9 of 16</span>

**2.1 Certification/Qualification/Training Required****2.1.1 AL Lab Worker**

- RDLYMFNP01, AL Worker Job Code
- OJT AFAL0001, Analytical Laboratory General Checklist
- OJT AFAL0105, CNOH Glovebox Operations.

**2.1.2 AL Operator**

- AL Facility Operator 2 Qual, QNAL00P2

**2.1.3 Health Physics Technician**

- QNRCT001, Radiological Control Technician  
OR  
QNMFHPTS, MFC HPT Supervisor.
- QNGLVACT, INL Radiological Glovebox Training.

**2.2 Precautions and Limitations**

**NOTE:** *This section applies to risks not necessarily involving hazards to personnel.*

Table 2. Risks.

<b>Applies</b>	<b>Activity/Task</b>	<b>Risk</b>	<b>Engineering Control</b>	<b>Administrative Control</b>
Yes	1. Sample Management	Conditions adverse to quality, incorrect categorization of waste or violation of a written requirement.	Sample containers/ cabinets/ locations.	MCP-3364
Yes	2. Generating Waste	Damage to the environment. Violation of a written requirement.	Waste containers/ cabinets/ locations.	MCP-3365

## Idaho National Laboratory

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier: AL-2100-OI-001
	Revision: 0
	Effective Date: 03/30/17

Page: 10 of 16

Yes	3. Generating Air Emissions	Air emissions above acceptable limits. Violation of a written requirement.	Facility ventilation system.	FRM-1048 Environmental Review on procedures creating air emissions (per LWP-21220)
No	4. Activities involving Quality	Inaccurate/unacceptable results, re-work, loss of unique samples. Violation of a written requirement.	Facility systems, SSCs, instruments, labware, chemicals, consumables,	PDD-13000
Yes	5. Performing Work	Incomplete or inadequate planning and execution of work, unforeseen hazards and risks. Violation of a written requirement.	NA	LWP-13850
Yes	6. Housekeeping	Fire hazard, contamination control, chemical control, radiological control.	Storage containers/ cabinets/locations	LWP-14620 LWP-9600
Yes	7. Radiological Work	Inadequate surveys or postings. Violation of a written requirement.	Radiological instruments	FRM-441.49 and -49A MCP-139 MCP-187
No	8. Work that impacts a SAR/TSR-401 requirement	SAR/TSR violation	Safety-Significant SSCs, engineered systems.	TSR-, SAR- Procedures, facility access training. QFMH Training SP-20.1.4

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier: AL-2100-OI-001
	Revision: 0
	Effective Date: 03/30/17 <span style="float: right;">Page: 11 of 16</span>

### **2.3 General Glovebox Operations**

- 2.3.1 In the event that operations are not ongoing, smears will be taken inside the glovebox at least twice a year.
- 2.3.2 A full decontamination of the glovebox will be performed, and smears of the glovebox interior taken, at the end of each campaign (at a minimum this will occur once a year). Acceptable contamination levels should average <1,000,000 dpm/100 cm<sup>2</sup> alpha and <1,000,000 dpm/100cm<sup>2</sup> beta-gamma over the entire glovebox. If that level is unattainable, facility management, radiological engineering, the health physics (HP) supervisor, and the glovebox subject-matter expert (SME) will determine the future course of action.

## **3. PREREQUISITES**

### **3.1 Notifications**

- 3.1.1 Notify affected organizations (Waste Generator Services (WGS), Environmental, Quality, Life Safety, etc.) as applicable.

### **3.2 Radiological Conditions**

- 3.2.1 Ensure the appropriate radiological work permit (RWP) has been completed and is available prior to start of work per MCP-15009, "Radiological Work Permit Preparation."

### **3.3 Briefing**

- 3.3.1 Conduct Briefing in accordance with LWP-9201, 'Briefings.'
- 3.3.2 Discuss expected radiological conditions (for example; expected neutron exposure, high radiological exposure, total activity of the sample) with the AL radiological engineer prior to working with new radiological material.

### **3.4 Staging Activities**

- 3.4.1 Ensure the appropriate materials for the activity to be performed are identified, available and staged as necessary.

## **4. FACILITY CONDITIONS**

- 4.1 The appropriate radiological monitoring equipment and Na/NDA wing ventilation system are operational.

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier:	AL-2100-OI-001	
	Revision:	0	
	Effective Date:	03/30/17	Page: 12 of 16

## 5. INSTRUCTIONS

### WARNING

**The glovebox gloves are susceptible to heat. Direct contact with hot surfaces must be avoided to prevent the chance of melting the glove, which could result in personal contamination.**

**NOTE 1:** *Maintenance performed on the CNOH glovebox must be documented in the CNOH Glovebox Logbook.*

**NOTE 2:** *The CNOH Glovebox Logbook is used to track items transferred into and out of the glovebox.*

**NOTE 3:** *In addition to the surveys required by this procedure, the health physics technician (HPT) may perform radiation, contamination, and airborne radioactivity surveys throughout these activities as appropriate.*

### 5.1 Routing Table

- 5.1.1 IF any of the activities listed below need to be performed, THEN GO TO the associated subsection and perform as directed; AND return to this table.

Condition	Response
Operation Inspections	Subsection 5.2
Sample/Waste/Material Transfer Out of the Glovebox	Subsection 5.3
Using the Rapid Transfer Port (French Can)	Subsection 5.4
Replacing the Smear-port Window	Subsection 5.5

### 5.2 Operation Inspections

- 5.2.1 Check the differential pressure gauge to ensure the filter system is operating at -0.50 to -1.0 in. of H<sub>2</sub>O.
- 5.2.2 IF the differential pressure is not -0.50 to -1.0 in of H<sub>2</sub>O, THEN stop work and immediately notify the AL SS.
- 5.2.3 Ensure that the gloves have been changed annually and CRL blanks biennially (every 2 years) by checking the CNOH Glovebox Logbook and/or the date written on the glove ring or CRL blank.

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier: AL-2100-OI-001	
	Revision: 0	
	Effective Date: 03/30/17	Page: 13 of 16

- 5.2.4 Perform a survey of glovebox gloves prior to performing work inside the glovebox.
- 5.2.4.1 IF gloves are found to be >20 mrem/hr beta gamma, THEN contact facility management and the HP supervisor to evaluate whether gloves should be decontaminated or changed prior to continuing operations.
- 5.2.5 Prior to use, inspect each glove/blank for degraded conditions.
- 5.2.5.1 IF degraded conditions are found, THEN record the findings in the CNOH Glovebox Logbook, AND notify the AL SS.
- 5.2.5.1.1 Cover the port of the defective glove/blank to prevent further use.
- 5.2.5.1.2 Label each defective glove/blank as inoperable
- 5.2.5.2 Replace each defective glove/blank as soon as possible per AL-6000-MI-001.

### 5.3 Sample/Waste/Material Transfer Out of the Glovebox

**NOTE:** *All radiological material transfers must be performed per AL-6000-OI-001.*

- 5.3.1 Ensure applicable portions of AL-6000-OI-001 have been performed.
- 5.3.2 Perform bagout of the sample, waste, or material in accordance with AL-6000-MI-001, "Glovebox Glove, Blank and Bagout Sleeve Changeout and Material Removal."
- 5.3.3 IF a French Can will be used to transfer out of the glovebox, THEN go to subsection 5.4, "Using the Rapid Transfer Port (French Can)," AND perform the transfer out of the glovebox per AL-0730-LI-001, "Transfer of Material Using French Cans."
- 5.3.4 Record the information in the CNOH Glovebox Logbook.

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier:	AL-2100-OI-001	
	Revision:	0	
	Effective Date:	03/30/17	Page: 14 of 16

#### 5.4 Using the Rapid Transfer Port (French Can)

**NOTE:** *All radiological material transfers must be performed per AL-6000-OI-001.*

- 5.4.1 Ensure applicable portions of AL-6000-OI-001 have been performed.
- 5.4.2 Perform Rapid Transfer Port (French Can) activities, per AL-0730-LI-001.
- 5.4.3 Record the information in the CNOH Glovebox Logbook.

#### 5.5 Replacing the Smear-port Window

**NOTE:** *HPT coverage is required during the replacement of the smear-port window.*

- 5.5.1 Obtain a new mylar window.
- 5.5.2 Apply a light coating of vacuum grease to the O-ring on the new window.
- 5.5.3 Place new window into opening of housing with existing window.
- 5.5.4 While holding the new windows in place, remove clip from existing window and place on new window.
- 5.5.5 Use hand to push new window into housing, thereby expelling existing window into glovebox.

### 6. POST-PERFORMANCE ACTIVITIES

- 6.1 Perform housekeeping and properly store chemicals and equipment not in use.
  - 6.1.1 Ensure the glovebox is as clean and uncluttered as possible.
  - 6.1.2 Ensure glovebox gloves are restrained on the outside of glovebox when the glovebox is unattended.
  - 6.1.3 Decontaminate the glovebox as needed.
  - 6.1.4 Obtain smears of the glovebox interior as needed.
- 6.2 Dispose of or store waste in accordance with MCP-3365, "Waste Management at the Analytical Laboratory."

## Idaho National Laboratory

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier: AL-2100-OI-001	
	Revision: 0	
	Effective Date: 03/30/17	Page: 15 of 16

6.3 Manage samples in accordance with MCP-3364, “Sample Management at the Analytical Laboratory.”

6.4 IF the activity required the use of forms and/or logs,  
THEN ensure the forms and/or logs are updated appropriately.

## 7. ABNORMAL OPERATIONS

7.1 IF abnormal conditions should arise during the performance of this procedure, THEN stop work, place the system in a safe configuration, as applicable, and immediately notify the AL shift supervisor.

7.2 IF necessary,  
THEN follow instructions in MFC-AOP-0001, “MFC All Facilities Response to Abnormal Operations”, MFC-ONRI-0001, “MFC All Facilities Response to MFC Anomalies”, or AL-ONRI-0001, “AL Response to Anomalies”, as applicable.

## 8. RECORDS

Executed copies of laboratory instructions.

Completed forms as a result of performing the procedure or laboratory instruction.

**NOTE:** [LWP-1202, “Records Management,”](#) the [INL Records Schedule Matrix](#), and associated [record types list\(s\)](#) provide current information on the retention, quality assurance, and/or destruction moratorium requirements for these records. Contact a [Records Coordinator](#) for assistance if needed.

## 9. REFERENCES

AL-0730-LI-001, “Transfer of Material Using French Cans”

AL-5000-LI-003, “Contact Handled Transuranic Waste Handling”

AL-6000-MI-001, “Glove, Blank, and Bagout Sleeve Changeout and Waste Removal-CRL Ports”

AL-6000-OI-001, “Radioactive and Nuclear Material Handling”

AL-ONRI-0001, “AL Response to Anomalies”

Form 435.42, “Radioactive Waste Inventory Sheet”

Form 441.49, “Radiological Work Permit”

FRM-952, “Analytical Laboratory Transfers”

**Idaho National Laboratory**

<b>OPERATION OF THE CNOH GLOVEBOX</b>	Identifier:	AL-2100-OI-001	
	Revision:	0	
	Effective Date:	03/30/17	Page: 16 of 16

FRM-1048, "Research Facilities NESHAP Data Tracking Sheet for Radiological Materials Heated to Greater than 100C"

FRM-1492, "AL Radiological Fume Hood/Glovebox Content Removal Sheet"

LRD-8000, "Environmental Requirements for Facilities, Processes, Materials and Equipment"

LWP-9201, "Briefings"

LWP-9600, "Conduct of Operations for the INL"

LWP-13850, "Processing Lessons Learned and Operating Experience"

LWP-14620, "Chemical Hygiene Plan"

LWP-21220, "Work Management"

MCP-139, "Radiological Surveys"

MCP-187, "Radiological Control Posting and Labeling"

MCP-2875, "Proper Use and Maintenance of Laboratory Notebooks"

MCP-3364, "Sample Management at the Analytical Laboratory"

MCP-3365, "Waste Management at the Analytical Laboratory"

MCP-15009, "Radiological Work Permit Preparation"

MFC-AOP-0001, "MFC All Facilities Response to Abnormal Operations"

MFC-ONRI-0001, "MFC All Facilities Response to MFC Anomalies"

PDD-13000, "Quality Assurance Program Description"

PLN-2224, "Records Management Plan for Nuclear Science and Technology"

SP-20.1.4, "MFC Document Management Supplement to LWP-1201 and LWP-21220"

## **10. APPENDIXES**

None.