



UR-ENERGY USA, INC.  
LOST CREEK ISR, LLC  
STANDARD OPERATING PROCEDURE



## **BREATHING ZONE AIR MONITORING**

**Edition:** 16July2013

**SOP Number:** SOP\_LC\_HP-017

**Author:** CJP

**Reviewed By:** MDG 4/11/2013; JWC 4/11/2013; CJP  
7/12/2013

**Final Approval:**

### **1.0 PURPOSE**

The purpose of this Standard Operating Procedure (SOP) is to provide the method for breathing zone air monitoring at the Lost Creek ISR (LC-ISR) site. A breathing zone (BZ) monitor is a personal monitoring device used primarily to determine the potential radiological internal dose due to inhalation for persons performing tasks associated with yellowcake drying and packaging. BZ sampling may be performed for other activities when it is believed airborne radionuclides might be generated. Other applications may be appropriate for the use of a personal monitor as directed by the Radiation Safety Officer (RSO) or Health Physics Technician (HPT).

### **2.0 RESPONSIBILITIES**



The RSO and Health Physics Staff are responsible for:

- Protecting workers from exposures due to air particulate radionuclides;
- Maintaining air sampling data and records for the life of the license;
- Providing training for the proper operation of breathing zone monitoring;
- Posting airborne radioactivity areas with conspicuous signage;
- Calibrating the air flow calibrators and associated radiation detection instruments;

### **3.0 PREREQUISITES AND TRAINING**

A BZ monitor that is properly maintained and calibrated according to the manufacturer's instruction shall be used.

Training includes reading and understanding this SOP and the manufacturer's recommended procedures with a practical demonstration of proper operation. Individuals should also have received radiation safety training according to the LC-ISR Radiation Protection Program (RPP).

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#### 4.0 DEFINITIONS

Airborne radioactivity area: A room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, may exist in concentrations:

- (1) In excess of the derived air concentrations (DACs) specified in appendix B, to §§20.1001–20.2401, or
- (2) To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC-hours.



Annual Limit on Intake (ALI): The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of 5 rem (0.05 Sv) or a committed dose equivalent of 50 rem (0.5 Sv) to any individual organ or tissue. (ALI values for intake by ingestion and by inhalation of selected radionuclides are given in table 1, columns 1 and 2, of appendix B to §§20.1001–20.2401).

Derived Air Concentration (DAC): The concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work (inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI. DAC values are given in table 1, column 3, of appendix B to §§20.1001–20.2401.

Derived Air Concentration-Hour (DAC-hour): The product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration for each radionuclide) and the time of exposure to that radionuclide, in hours. A licensee may take 2,000 DAC-hours to represent one ALI, equivalent to a committed effective dose equivalent of 5 rem (0.05 Sv).

#### 5.0 HAZARD ASSESSMENT AND PPE

Although there is no inherent hazard from wearing a breathing zone monitoring device, potential hazards may exist associated with yellowcake drying and packaging operations and are described in the associated SOPs:

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- SOP\_LC\_OPS-025: *Yellowcake Dryer Operations*
- SOP\_LC\_OPS-026: *Yellowcake Packaging*

Since BZ sampling may occur under a variety of circumstances the possible PPE requirements aren't enumerated here. If you are unsure of the PPE requirements please seek advice from your supervisor or EHS staff. When working in an airborne radiation area it will be necessary to wear a respirator.

## 6.0 PROCEDURE

BZ samplers will be worn in any area designated as Airborne Radioactivity Areas. The yellowcake dryer room is designated as an airborne radioactivity area until such time that the RSO designates otherwise. Data acquired from BZ monitoring is supplemental to area airborne particulate sampling. BZ samplers will also be worn when there is a change in operations or an upset condition that could create radioactive airborne particulates, as required by an RWP.

Sample analysis should be completed within 2 working days after sample collection to permit prompt corrective action if needed. Unusual results should be reported promptly to the RSO.

Before every use, BZ samplers must be calibrated for flow rate. Results of the calibration must be documented on the BZ calibration form (FORM\_LC\_HP-017A\_Breathing Zone Calibration Log). The electronic flow calibrator will be sent to the manufacturer (F & J Specialty) for calibration at least annually, and whenever repairs are necessary.

### 6.1 Calibration of BZ Sampler

1. Battery check – Ensure the battery is sufficient to supply power for the sampling duration. A full battery should last for longer than a typical dryer work shift.
2. Set up the digital calibration equipment, and connect the BZ sample pump to the calibrator using an in-line filter holder with a filter in it.
3. Turn on digital calibrator and BZ pump.
4. Set BZ pump to desired flow (7 L/min for dryer operations).
  - a. Push the down arrow until "Flow Mode" is selected.
  - b. Then hold down the "SET" button and use the up and down arrow buttons to change the desired flow rate.
  - c. Release "SET" button when finished.



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5. Push the power button to return to the main menu.
6. Start the pump (from the main menu push the up arrow).
7. Allow the pump to run for a couple minutes to warm up.
8. Ensure the flow measured by the calibrator is within 5% of the desired flow (between 6.65-7.35 L/min for dryer operations).
9. If the measured flow is not within 5%, change the pumps adjustment factor ("Adj Factor"):
  - a. From the main menu scroll through the menu with the down arrow until "Calibration Mode" is reached.
  - b. Press and hold the "Set" button and use the arrow buttons to change the "Adj Factor".
  - c. An increase in the "Adj Factor" will increase the flow rate of the pump. The pump will run while changing the adjustment factor. Read the electronic calibrator to get the correct flow rate.
10. Record results of calibration on the calibration form.
11. Reset the data on the pump before proceeding to sample collection.
  - a. Scroll down from the main menu to "Reset Mode".
  - b. Hold Select and press the up arrow twice to answer yes to both questions.

### **6.2 Sample Collection**

1. Don the BZ sampling gear (pump on belt, lapel sampler in breathing zone). Place the inlet to the BZ pump as close to your mouth as possible so the sample collected accurately represents the air being inhaled.
2. Record the BZ ID number, date and the start time on the filter envelope.
3. Just before entering the dryer room, start the BZ pump by pressing the up arrow from the main menu. Record the start time on the filter envelop.
4. Ensure that nothing obstructs the flow of the sampler by blocking the air inlet, or kinking the hosing.
5. As you are leaving the dryer room, turn off sampler and record the elapsed time and sample volume on the envelope.
6. Carefully remove filter with tweezers, use disposable gloves as necessary.
7. Place filter in envelope-don't fold, and give it to desinated member of the HP staff.



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8. The RSO or HPT will count the sample using the same method detailed in SOP\_LC\_HP-008: *Indoor Airborne Radionuclide Sampling*.
9. If the U-nat concentration is above the action limit (see table of action limits below) then an investigation should be performed to determine the cause, an appropriate response (e.g. bioassay), and corrective actions.

**Table: BZ Action Limits**

	without respirator (uCi/ml)	with respirator (uCi/ml)
U-nat	3.00E-10	1.50E-08
Ra-226	3.00E-10	1.50E-08

### 6.3 Quality Assurance/Quality Control

#### 6.3.1 Data Objectives



The BZ sampling pumps should be run at a rate to provide sufficient volume of air passing through the filter to meet MDC for radionuclides of interest. The desired MDC (3.00 E-11 uCi/ml) is 10% of the DAC for U-nat. The MDC is calculated by using the equations in SOP\_LC\_HP-004: *Radiation Detection Instrumentation*.

#### 6.3.2 Measurement Quality Control

The quality will be controlled by the routine calibrations of the air sampling pump, and the quality control of the associated radiation detection instruments. The dryer room, which is the most common BZ sampling location, will routinely be sampled using an area sampling device; the results from these two sampling methods can be used to confirm the measurements' validity. Calibration is described in Section 6.1 above.

#### 6.3.3 Data Verification and Validation

The person collecting the sample may not be the same person measuring the samples. Both individuals will be responsible for verification and validation. The person sampling shall include additional comments on the sample container if there is reason to believe

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something happened that will affect the sample results, such as a disconnected sample line. The person generating the results will review them for anomalies.

### 6.3.4 Audit/Corrective Actions/ALARA

Any anomalous results of sample measurements and radiation detection instrument function checks (described in SOP\_LC\_HP-004\_Radiation Detection Instrumentation) will be investigated and corrective actions proposed. Investigations will be provided in the annual Radiation Protection Program Report. Audits are also discussed in SOP\_LC\_AD-007: *Internal Audit and Corrective Action Program*.

## 7.0 DOCUMENTS AND RECORDS

Documents and records related to breathing zone monitoring may include:

- Instrument calibration records
- Sample information and analytical results
- Instrument Operator's Manual
- Annual RPP/ALARA Reports

## 8.0 REFERENCES

Code of Federal Regulation Title 10 Part 20: *Standards for Protection Against Radiation*  
NRC License Amendment, *Vacuum Dryer Amendment Supplement to the Lost Creek ISR, LLC Technical and Environmental Reports*, January 2012

NRC License Application Technical Report, Section 5.7.3: *In-Plant Airborne Radiation Monitoring Program*, April 2010

NRC, Regulatory Guide 8.25: *Air Sampling in the Workplace*, June 1992

NRC, Regulatory Guide 8.30: *Health Physics Surveys in Uranium Recovery Facilities*, May 2002

SOP\_LC\_AD-007: *Internal Audit and Corrective Action Program*

SOP\_LC\_HP-004: *Radiation Detection Instrumentation*

SOP\_LC\_HP-009: *Bioassay Monitoring*



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SOP\_LC\_HP-014: *Screening and Decontamination of Materials*

SOP\_LC\_HP-008: *Indoor Airborne Radionuclide Sampling*

SOP\_LC\_OPS-025: *Yellowcake Dryer Operations*

SOP\_LC\_OPS-026: *Yellowcake Packaging*