COVERSHEET
STANDARD OPERATING PROCEDURE

Operation Title: **SAFETY PROTOCOL FOR USE OF THE INNOV-X PORTABLE X-RAY FLUORESCENCE METALS ANALYZER**

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Standard Operating Procedure: **RWM-DR-024**
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Written by: **Jean Firth**
Reviewed by: **Gordon Fuller**

Five Year Review No Changes Needed:

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1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, Division of Remediation's (MEDEP/DR) safety protocol for use of the Innov-X x-ray fluorescence (XRF) metals analyzer.

2.0 APPLICABILITY

MEDEP/DR is responsible for the investigation and subsequent remediation of hazardous substance, petroleum, and landfill Sites throughout Maine. Part of the investigation of these Sites is analysis of samples for metals, the XRF is a useful tool in providing this analysis. This SOP applies to all staff who may use the XRF.

3.0 RESPONSIBILITIES

All MEDEP Staff must follow this procedure when operating the Innov-X XRF. All Managers and supervisors are responsible for ensuring that their staff are familiar with and adhere to this procedure. *Additionally, before any person is allowed to use the Innovex XRF they **MUST:** have completed a radiation training course (proof of completion must be submitted to the DR Site Assessment and Support Services Unit (SASS)), wear a radiation dosimeter badge and have 8 hours of supervised field use with the instrument by approved DR staff.*

The Radiation Safety Officer (RSO), the Oil and Hazardous Materials Specialist III in the Division of Remediation, will be responsible for proper storage, usage, training of authorized employees, distribution of dosimetry, maintenance of exposure records (including reporting of quarterly exposure records to the X-Ray Section of the State of Maine's Radiation Control Program), procedural compliance, and all other safety requirements regarding the unit. These duties may be delegated to other Oil and Hazardous Materials Specialists in the Division by the RSO as necessary.

4.0 INTRODUCTION

In the course of the investigation and subsequent remediation, samples must be collected and analyzed to determine the geographical extent, chemical characteristics, and relative levels of contaminants at and around each site. For this reason samples are collected for metals analysis. Use of an XRF can provide information on the level of contamination in real time. These results then can be used to make decisions about where to collect samples for laboratory analysis, determine the extent of contamination or confirm that all contaminated material was removed from a site.

5.0 GENERAL INFORMATION

The Innov-X XRF is a metals analyzer which is used to evaluate levels of metals in solid substances such as soil and waste materials as well as paint. This XRF does not contain a radioactive source, however, it does produce ionizing radiation. The instrument must be energized to produce radiation. This means that when the instrument does not have a battery installed, or it is not turned on with the hand held computer installed, radiation is not produced.

The Innov-X works by bombarding a sample with ionizing radiation which excites the electrons in the sample, causing them to leave their orbits. Electrons from other orbits fall in to fill the voids and in the process they fluoresce. A detector in the XRF then reads the energy levels of the fluorescence and reports the levels of certain metals in the sample on a hand held computer.

Because ionizing radiation is produced while operating the instrument, safety precautions must be taken so the operator or nearby workers are not exposed.

6.0 SAFETY REQUIREMENTS

6.1 TRAINING AND MONITORING REQUIREMENTS

1. Prior to using the Innov-X XRF staff must attend the manufacturers training for the instrument and have 8 hours of supervised field use by a trained Division of Remediation Oil and Hazardous Materials Specialist.
2. All operators must have certification that they attended a 40 hour OSHA HAZWOPER training and annual 8 hour safety refresher courses.
3. All users must be enrolled in the Division's health monitoring program.
4. All operators must wear a radiation dosimeter while using the Innov-X XRF.

6.2 INNOV-X SAFETY FEATURES:

1. Deadman trigger. When this is set on the instrument the trigger must be held for the duration of the test. This requires that a person is present for the duration of the test while x-rays are emitted. This feature should be used whenever practicable. If this feature is not on while using the instrument extra precautions must be taken to ensure that nearby workers are aware of the dangers posed by the XRF. The operator is responsible for insuring that no person enters within 5 feet of the x-ray path while the instrument is being used. This mode cannot be used when the instrument is used in the test stand.
2. Software trigger. When this is set the operator must tap on the lock icon located on the lower right hand corner of the handheld computer screen before the instrument will operate. The user will then have to confirm they want to unlock the trigger. When the instrument has not been used for at least 5 minutes this will reactivate. This will remain active at all times.
3. Software Proximity sensor. The software requires that a sample be present in front of the sample window. This prevents the accidental exposure of bystanders to an open beam. If the analyzer does not detect a sample it will abort the test and shut off the x-rays two seconds after the test is started. The operator must keep in mind the instrument is just looking for a solid object in front of the window. This means if a body part is in front of the window it will think it is a sample.

6.3 USE

1. Operators will visually inspect the instrument for damage prior to use. If there is damage the instrument will not be used until it has been inspected and repaired by the manufacturer. At no time will staff dismantle the instrument.

2. The instrument is not waterproof and should not be used in heavy rain. The instrument can be used in light rain inside a large ziplock bag to limit the exposure.
3. All users will take care while using the Innov-X XRF so that no one, including the operator, will be exposed to radiation. The instrument will not be pointed at any person at anytime. The user will take care to keep all of their body parts away from the sample window while analyzing samples. ALARA (as low as reasonably achievable) objectives for radiation exposure will be used by the operator when using the instrument.
4. Operators will use distance time and shielding principles when using the XRF. This includes minimizing time around the instrument when it's energized, maximizing the distance from the instrument window and shooting into high density materials whenever possible.
5. The instrument shall be used in accordance with the manufacturer's instructions provided in the training course and the user's manual.
6. When the instrument is set up in the test stand a controlled area will be established by posting signs indicating x-rays are being used. If the instrument is used on a site without the test stand only personnel who have 40 hour OSHA safety training will be allowed on the site while the instrument is in operation. The operator is responsible for controlling entry to an area while the instrument is in use. This means keeping people at least 5 feet from the instrument x-ray path while the instrument is in use.
7. The instrument will be stored and transported without the batteries or hand held computer installed.
8. When not in use the instrument will be stored at the Division's locked room at the warehouse and the hand held computer will be stored at the Ray Building. The instrument must be signed out through the assigned Division of Remediation OHMS.
9. If the instrument is left in a vehicle unattended for any period of time the vehicle must be locked. The instrument must not be left in a vehicle overnight.