1.0 Purpose

This standard is intended to ensure regulatory compliance with applicable state and federal regulations pertaining to sealed source devices. This standard is also intended to ensure compliance with state requirements for X-ray tube devices.

2.0 Applicability

This standard applies to all sealed source devices, and x-ray tube devices which are owned and operated on MPC property. All MPC employees and contractors are required to comply with personal safety and security requirements of this standard.

3.0 Procedure

3.1 Contact List

Thermo Scientific – www.thermofisher.com

VEGA Americas – www.vega.com

US Nuclear Regulatory Commission – www.nrc.gov
US Nuclear Regulatory Commission Operations Center – (301) 816-5100

Michigan Department of Community Health – www.michigan.gov

Michigan Radiation Safety Section – (313) 456-4660

Radiation Safety Officer – Mandy Styes – (313) 297-6041

Alternate RSO – Al Morales

HESS Duty Phone – (313) 843-HESS

3.2 Licensing Requirements

MRD maintains a General License as well as a Specific License. Many of the requirements of those documents can be found in this written procedure. Specific License 21-32842-01 or General License GL-705285-21 can be referenced for additional requirements.

3.3 Inventory of Radioactive Sources

MRD uses stationary sealed-source nuclear devices in processing operations as well as X-ray portable devices for inspection and testing purposes. The detailed inventory of all radioactive sources at MRD can be found in Attachment A – Radioactive Source Inventory.

The Radiation Safety Officer will perform a physical inventory at 6-month intervals per license requirements. The inventories shall be maintained for 5 years from the date of each inventory, and shall include the radionuclides, quantities, manufacturer's name and model numbers as well as the date of the inventory. The RSO will immediately contact the NRC if a source is missing.

3.4 ALARA Principle

ALARA is an acronym for "as low as (is) reasonably achievable," which means making every reasonable effort to maintain exposures to ionizing radiation as far below the dose limits as practical, taking into account the state of technology, the economics of improvements in relation to state of technology, and the economics of improvements in relation to benefits to the public health and safety.

While MRD personnel are working on or around sealed source devices, they must follow the ALARA principle. Use the following work practices to comply with ALARA:

Time – Reducing the time of exposure will directly reduce radiation dose. If you are required to work on or near a sealed source, use pre-planning to identify challenges that may add time to your task. Consider splitting different parts of the task up amongst multiple employees.

Distance – Increasing the distance between you and the radiation source will reduce exposure by the square of the distance. Doubling the distance between your body and the radiation source will divide the radiation exposure by a factor of 4. If you are required to work on or near a sealed source, consider stepping away from the source of radiation whenever possible.

Shielding – Lead, cast iron and steel shielding for X-rays and gamma rays is an effective way to reduce radiation exposure. When working in radiation areas it is important to use shielding whenever possible. Shielding has been installed at the CCR reduction zone to help reduce radiation dose.

PPE – Proper PPE must be utilized to reduce exposure to airborne particulates. Alpha and Beta particle exposure can be prevented using particulate filter respirator and a Tyvek suit.

3.5 Gauge Maintenance

3.5.1 Leak Tests

The Radiation Safety Officer will test sealed sources for leakage and/or contamination at intervals not to exceed 36 months. This requirement is established in the Sealed Source Devices Registry. Devices in storage are not required to be leak tested.

In the absence of a certificate from a transferor indicating that a leak test has been made within the 36-month interval prior to the transfer, the sealed source received shall not be put into use until tested and the test results received.

Records of leak tests results shall be kept in units of microcuries and shall be maintained for 6 years.

Following an emergency where damage to a source holder could be reasonably expected, the RSO will ensure that a leak test is performed. A calibrated survey meter can be used to determine if damage is reasonably expected.

If any leak test indicates greater than 0.005 microcuries of removable contamination from a single source, the RSO will have the source withdrawn from service within 24 hours for repair, decontamination, or disposal.

The RSO will notify the NRC within five days of learning of the excessive leakage (leakage greater than 0.005 microcuries of removable contamination). The report will specify the source involved, the test results, and the corrective action taken.

3.5.2 Shutter Checks

The Radiation Safety Officer will check each gauge for the proper operation of the 'ON-OFF' mechanism (shutter) and indicator (if applicable) at 6-month intervals.

This requirement does not apply to gauges that are in storage or not being used and have the shutter locked in the 'OFF' position.

3.5.3 Radiation Survey

Prior to initial use and after installation, relocation, dismantling, alignment, or any other activity involving the source or removal of shielding, a radiological survey must be performed to determine radiation levels in accessible areas around, above and below the gauge with the shutter open.

The survey will generally be conducted by the manufacturer who must be present to perform any of the servicing previously mentioned in this section. The RSO and the manufacturer should make this determination prior to servicing any gauge.

The radiation survey must be performed with a survey meter that is calibrated annually and current with its calibration.

3.5.4 Servicing Gauge Detectors

If the scope of work requires a person to pass any part of their body in front of a source shutter, the shutter must be locked in the 'off' position.

Anyone who manipulates a source housing (open-close a shutter) must notify the RSO before doing so. Only employees who have received training may manipulate a source housing.

3.6 Confined Space Entry

Confined space entry into vessels with fixed source is permitted following the refineries confined space entry procedure. As part of the preparation for entry the RSO will lock the source shutter in the 'off' position.

As part of the energy isolation process it will be necessary to verify energy isolation using a calibrated survey meter. Confined space entry may be necessary to perform this survey.

After verifying the isolation is effective, the RSO will update the Isolation List, place the keys for the source(s) in the lockbox for the job and place a lock on the lockbox.

If the source shutter becomes stuck in the 'ON' position or if the survey indicates an exposure above 2 millirems in any one hour, the source is not isolated. Entry is prohibited if the source is not isolated. Contact the manufacturer for guidance if the source shutter does not move to the 'OFF' position.

3.7 Gauge Installation, Commission, and/or Relocation

Refinery personnel may place a gauge onto its mounting bracket if the shutter is locked in the 'OFF' position but may not place the device into service for the first time. Only a representative from the manufacturer may commission a source.
The gauge may only be mounted in accordance with written instructions provided by the manufacturer. The gauge must be mounted in a location compatible with "Conditions of Normal Use" found within the Sealed Source Device Registry. Additionally, the gauge must

be in good condition and shall not be modified to fit the proposed location.

Upon commissioning, the manufacturer must perform and document a radiation survey to determine radiation levels in accessible areas around, above, below the gauge with the shutter open. Upon completion of the survey, the survey documents will be turned into the RSO for record retention.

Refinery personnel are not permitted to move or relocate sources, even temporarily unless directly supervised by a representative of the manufacturer.

3.8 Portable Devices, Radiographers & Contractors

Industrial radiographers may be asked to provide the RSO with a copy of their federal or state license, operating and emergency procedures, training manuals, current leak tests, and list of qualified technicians.

Radiographers will obtain a safe work permit in accordance with the refineries safe work permitting procedure for each shift they anticipate using their nuclear or X-ray devices.

The FEO that issues a safe work permit to a radiographer must verbally notify the DCS Operator for the appropriate operating complex if the Vacuum, FCC, CCR, or Coker units are operating. This is to help raise the awareness of a potential false high-level indicator from their source detectors.

Radiographers must barricade their work area using rope or tape that is colored magenta and yellow and states “Caution – Radioactive Material”. A calibrated survey meter must be used to establish that barrier boundaries. The barrier will be established to reduce exposure to no more than 2 millirems in any one hour.

3.9 Regulatory Postings

Areas where nuclear gauges are in operation are marked with signage reading “Notice – Nuclear Gauging Devices Installed”.

Restricted areas are marked with signage reading “Caution – Radioactive Material Restricted Area”.

NRC Form 03 and 10 CFR 19.11 Notice to Workers are both posted inside all the control rooms for operating complexes with nuclear gauges.

MIOSHA-RSS-100 Notice to Employees and a copy of the current year Radiation Machine Registration Certificate is posted at or visible to all X-ray devices. The postings are kept in the case for portable devices.

During the 6-month inventory check, the RSO is responsible for evaluating the regulatory postings and making corrections if necessary.

3.10 Training

Operations, maintenance, ERT, and safety employees receive annual computer-based

training on the hazards and precautions of working with nuclear gauges.

Instrument mechanics receive additional training which qualifies them to be able to open and close shutters and work on the gauge detectors. This training is performed in collaboration with Suntrac Services.

Training records are maintained by the Training Department.

3.11 Radiation Dose Limits, Exposure Monitoring & Restricted Areas

3.11.1 Radiation Dose Limits

All MPC employees and directly supervised contractors are individual members of the public.

Individual members of the public are not permitted to receive a whole-body dose more than 100 millirems (1.0 millisievert, mSv) above background levels per calendar year.

Individual members of the public are not permitted to receive a whole-body dose more than 2 millirems (0.02 millisievert, mSv) in any one hour, 100 millirems in 7 days, or 5000 millirems in any one calendar year. Dose rates in unrestricted areas do not exceed 2 millirems (0.02 millisievert, mSv) in any one hour.

No fetus of a declared pregnant woman shall be exposed to a dose exceeding 500 millirems during its term due to exposure of the mother.

3.11.2 Restricted Areas

A restricted area is one in which access is controlled for the protection of individuals from exposure to radiation and radioactive materials. The restricted area is the maximum distance from the source holder where the dose rate equals or exceeds 2 millirems per any one hour, measured in any direction from any surface of the holder.

Where a dose comes from a fixed source, permanent barriers are in place to keep individual members of the public out of restricted areas. These restricted areas are marked with signage reading “Caution – Radioactive Material Restricted Area”.

Radiographers may need to establish temporary regulated areas when using a nuclear source or X-ray device. These areas will be marked using rope or tape that is colored magenta and yellow and states “Caution – Radioactive Material”. A calibrated survey meter must be used to establish that barrier boundaries. The barrier will be established to reduce exposure to no more than 2 millirems in any one hour.

3.11.3 Exposure Monitoring

Radiographers will be responsible for their own exposure monitoring program.

If a direct reading dosimeter (Ludlum) indicates over 2 millirem per hour in the work area of the employee, personnel must barricade off the affected area and immediately notify the RSO.

3.12 Receiving & Storing Nuclear Sources

When a nuclear source is delivered to the warehouse, personnel will exercise the same

caution they do for any other type of hazardous material shipment. Once the order is confirmed to be complete, warehouse personnel will contact the RSO.

The RSO will obtain shipping papers, leak test certificates, and any other documentation for records retention. The RSO will then ensure the device is locked in the 'off' position and perform a survey.

The device cannot be moved to a storage area unless under the direct supervision of the manufacturer.

3.13 Packaging & Shipping Nuclear Sources

Reference NUREG-1556 Volume 4, Appendix K US Department of Transportation Regulations. Additional information on transportation requirements may be found at the DOT website: http://www.dot.gov. Any packaging and shipping of nuclear sources must be coordinated through the refinery DOT coordinator and the RSO.

3.14 Emergency Procedures

In the event of a fire or explosion near a source holder where damage is known or could be suspected, reference RSW-ERP-009-DT Fire Emergency.

If the gauge becomes damaged, dislodged, begins leaking, fails to function properly or any other emergency or unusual situation arises, do the following:

- Stop use of the gauge and immediately secure the area to keep people away until the situation is assessed, and radiation levels are known.
- Notify the RSO using the contact information found in Section 3.1 Contact List of this procedure. The RSO will conduct a radiation survey or contact the manufacturer to conduct a radiation survey.
- The RSO will make necessary notifications to local authorities as well as the NRC as required by 10 CFR 20 – Standards for Protection against Radiation. An information guide is available in NUREG-1556 Volume 4, Appendix L Incident Notifications and Reporting.

3.15 Disposal

The only method to dispose of a portable or sealed source is to transfer the source to a licensee specifically authorized to possess the radioactive material. Authorized recipients are the original supplier of the gauge, a commercial firm licensed to accept radioactive waste from other persons, or another licensee authorized to possess the licensed material.

3.16 Audits & Inspections

The RSO reviews this Radiation Control Program and completes the Fixed Gauge Audit Checklist on an annual basis. Inspections performed at routine intervals are detailed in Section 3.3 Inventory of Radioactive Sources and Section 3.5 Gauge Maintenance of this procedure.

3.15 Incident Notifications & Reporting

Incident notifications and reports shall be made in compliance with 10 CFR 20 – Standards for Protection against Radiation. An information guide is available in NUREG-1556 Volume 4, Appendix L Incident Notifications and Reporting.

An MRD employee who becomes aware of a loss, theft or damaged radioactive device must notify the RSO immediately. In the event of loss or theft, the RSO must also notify the Security Supervisor and HESS Manager.

3.17 Records Retention

Records will be maintained in accordance with applicable state and federal regulations. Additional records retention policies are mandated by our General and Specific License. In the case that the state and federal regulations do not support what is required by the license, the requirements of the license will be followed.

4.0 Definitions

5.0 References

10 CFR 20 Standards for Protection against Radiation

NUREG-1556, Volume 4, Rev 1 Consolidated Guidance about Materials Licenses

HLT-2016 Radiation Safety Management Program

MIOSHA Forms and Publicans for Radiation Safety

MISOHA Radiation Safety Section

6.0 Attachment

6.1 Attachment A – Radioactive Source Inventory

7.0 REVISION HISTORY

Revision number	Description of change	Written by	Checked by	Effective date
15	Annual review. Fixed broken links.	S. Kumpar	S. Kumpar	03/08/18
16	Removed LOTO requirements to work on detectors @ Slop Wax Line and CCR Reduction Zone. Removed all references to Gamma/Neutron RAEs.	S. Kumpar	S. Kumpar	11/14/18
17	Annual Review. No changes.	S. Kumpar	Al Morales	04/02/19
18	Annual Review. Updated RSO and Source Inventory	A. Styes	Al Morales	03/19/20
19	Removed personal dosimetry language to reflect discontinuance of dosimetry program.	A. Styes	Al Morales	06/04/2020

Attachment A

Radioactive Source Inventory

Attachment A – Radioactive Source Inventory.

The Radioactive Source Inventory contains the following documents:

- Physical Source Inventory
- X-Ray Devices
- Detection Devices & Survey Meters
- Shutter Check Form
- Field Survey Form
- NRC Fixed Gauge Audit