ARGOS

September 18, 2019

Ms. Elizabeth Ulrich
U.S. Nuclear Regulatory Commission
Nuclear Materials Safety Region I
2100 Renaissance Boulevard
King of Prussia, PA 19406-2713

RE: Radioactive Materials License Number 47-11451-01
Docket Number: 030-06692
Control: 612632

Dear Ms. Ulrich:

This is in response to your electronic letter of September 4, 2019.

Our response is in the same numerical order as listed in your correspondence:

1. *"Your list of definitions does not include the term "source holder", which is used throughout the procedures for non-routine maintenance. Confirm if "source holder" refers to the gauges you are authorized to possess under the NRC license, or if it has a different meaning."*

   RESPONSE: This is to confirm that the term "source holder" refers to the gauges authorized under the license. A definition of source holder has been added to the submittal.

2. *"It is not sufficient to state that any "Advanced Authorized User" may perform non-routine duties, as stated under "Training Program," that persons will complete a 40-hour training course authorized by the Agency. There are no 40-hour training courses pre-approved by the NRC; nor do our regulations contain a list of subjects that should be covered in training courses. We review training on a case-by-case basis. In accordance with the NRC guidance in Appendix J of NUREG 1556, volume 4, Revision 1, please identify the individuals who will perform non-routine operations, and describe their training and experience. We need the names of the individual(s). For each, provide a training description that includes the course topics and duration of training, including hands-on training; and the description of experience should include the types of gauges and quantities of materials handled, as well as the length of experience and where the experience was gained. "*

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RESPONSE: The RSO obtained the generic 40-hour Advanced Authorized User and RSO Training from a reputable company. In addition, the RSO received an 8-hour Authorized User training which was specifically oriented to fixed industrial gauges. Copies of each syllabus are attached. Since the RSO has received minimal hands-on experience performing advanced activities, the RSO commits that this activity will only be performed when absolutely necessary, such as removal of a gauge from service when inoperable and the manufacturer is not immediately accessible.

If this scenario should occur, the company's radiation consultant, AEC , will come and mentor the RSO in the movement of the gauge to storage using the RWP. Attached is a copy of the AEC corporate resume'. The RSO, Andrew Frye, is the only person to initiate and directly supervise (and in the physical presence) of any non-routine activity.

3. *Please explain the purpose of the fifth paragraph under the heading "Gauge Instructions", which discusses the air gap. It is unclear what this information is to be used for.*

RESPONSE: The fifth paragraph is reworded to read:

The purpose of this procedure is to ensure that workers are not able to put their hands or parts of their bodies into a direct beam of the fixed gauge. So, the RSO shall ensure that *the air gap between the radiation source holder and detector of the gauging device is less than 45 centimeters (18 inches). And, the air gap of the device would not allow insertion of a 30 cm (12 inch) diameter sphere into the radiation beam of the device without removal of a barrier. And, the radiation dose rate in the radiation beam of the device at 45 cm (18 inches) from the radiation source with the device shutters in the open position does not exceed 100 mrem/hour.*

4. *The gauge instructions state that "calculated exposure shall be conducted...the AAU shall utilize the calculated exposure as the assigned dose for workers for that task." However, Appendix J of NUREG 1556, Vol 4, Rev 1 states that you should confirm that individuals performing non-routine activities will wear both a whole body and extremity dosimeters, OR perform a prospective evaluation demonstrating that unmonitored individuals are not likely to receive a dose in excess of the limits in 10 CFR 20.1502(a). Those limits in 1 year are, in part, 500 millirem to the whole body and 5 rem to the skin of the whole body or the extremities for adults; in addition, any individual entering a high or very high radiation area must be monitored. The prospective (calculated) doses must be added for each task performed throughout the year to obtain the total dose for the year. Confirm that whole body and extremity dosimetry will be issued to any individual performing non-routine activities, unless the prospective dose evaluation demonstrates that unmonitored individuals are unlikely to exceed the 20.1502(a) limits in 1 year.*

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RESPONSE: This is to confirm that in lieu of wearing personnel monitoring devices, the RSO shall use the Radiation Work Permit (RWP) as the checklist documentation to ensure that personnel do not exceed 500 mrem/year (whole body) or 5,000 mrem/year extremity dose. That is the purpose of the dual surveys on the RWP checklist: One at the surface of the gauge (extremity dose) and at one foot (whole body dose). Both are calculated and placed on an excel spreadsheet to account for all personnel doses who are working under a RWP. Only the RSO or another 40-hour trained person can initiate the RWP.

5. *The statement that the public dose limit is "2 mR/hr" is not quite correct. The public dose limit from external radiation sources is 2 millirem in any one hour, therefore higher doses at shorter durations could be possible. However, using 2 mR/hr as an internal criteria is conservative and therefore acceptable. Also, please note that the NRC regulations do not include a posting of "Radiation Hazard" as stated in the section "Postings" in your procedure, so only a "Caution – Radiation Area" sign is acceptable. Confirm that these items will be corrected.*

   RESPONSE: Your comment regarding the 2 mR/hour is understood. The purpose is to keep the information simple and easily understood by all radiation and non-radiation workers. In evaluating doses to Members of the Public, it is felt that those working in the close proximity of a gauge at or near the posting (2 mR/hour) for one hour a week (50 weeks in the year plus 2 vacation weeks), the 100 mrem/year will not be exceeded. The RSO and the radiation team have as its philosophy of ALARA to be watchful that this is not exceeded.

6. *The statement that "work conducted in an area where the exposure rates are less than defined as 'Radiation Area' does not require personnel monitoring" is not quite correct. The duration of work in that area could result in doses that exceed the requirements for monitoring as described in Item 4 above, For example, if an area had a reading of 2 millirem per hour, a worker spending 250 hours in that area during a year would reach 500 millirem, above which monitoring is required. A "Radiation Area" is defined as an area that could result in an individual receiving 5 millirem in 1 hour at 30 centimeters (12 inches) from the radiation source; at that dose rate, monitoring would be required if the individual worked more than 100 hours in that area in a year. Please revise this section of your Gauge Procedures.*

   RESPONSE: Changes to that procedure that been made. Please see the attached editions to the "INFORMATION NEEDED TO SUPPORT APPLICANT'S REQUEST TO PERFORM NON-ROUTINE OPERATIONS ON FIXED NUCLEAR DEVICES (OTHER THAN CF-252)"

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7. *The following refers to the "Radioactive Materials Management Audit Checklist":*

   a. *Item 5 asks if each source has been tested for leakage at intervals not to exceed 6 to 36 months, depending on the radioisotope. Please note that the leak test interval is specified in the Sealed Source and Device Registry Certificate, and depends on the device and its use, not the radioisotope.*
   b. *Fixed gauges are required to be labeled "Caution – Radioactive Materials" not "Caution Radiation" as stated in Item 14. Most also are required to have a metal tag identifying the radionuclide, quantity as of a specified date, and serial number.*
   c. *The checklist refers to "sources" rather than gauges or source holders; is this intended? Also, the audit checklist does not address the following items that likely would be reviewed during an NRC inspection:*
      i. Completion of requirements for shutter and indicator testing of the fixed gauges, and the results of testing;
      ii. review of gauges that are in storage;
      iii. confirmation that gauges removed from service were transferred or disposed of properly;
      iv. completion of the annual program review required to 20.1101(c);
      v. availability and completeness of records required to be maintained.

RESPONSE: Please see the attached ALARA checklist (revision 2).

If you have any additional questions, please contact our consultant, Ben Warren of Applied Environmental Consulting, Inc. at (352) 215-1231 or me. Thank you for your attention to this matter.

Sincerely,

Andrew Frye,
Radiation Safety Officer

Enc. Procedures performing non-routine activities with fixed gauges (Rev. Sep 2019)
Revised annual ALARA checklist (Rev. 9/19)
Applied Environmental Consulting, Inc. corporate resume'
Syllabus of 40-hour and 8-hour training courses for RSO

C: Ben Warren, AEC

INFORMATION NEEDED TO SUPPORT APPLICANT'S REQUEST TO PERFORM NON-ROUTINE OPERATIONS ON FIXED NUCLEAR DEVICES (OTHER THAN CF-252)

(Revised September 2019)

This is to confirm that the elements of Appendix J of NUREG 1556 have been reviewed. This information is to support a request to perform this work by company personnel after approval by the Agency.

DEFINITIONS:

ADVANCED ACTIVITES or NON-ROUTINE ACTIVITIES include gauge installations, non-routine maintenance or service, relocations, and removal from service and placed in storage. Only the manufacturer, representatives of the manufacturer, persons specifically authorized to do so, or company AAUs, or workers under the direct supervision and in their physical presence of the AAU, are authorized to perform advanced activities. **NOTE: Gauge maintenance or repair that requires removal of the source from the source holder is prohibited.**

ADVANCED AUTHORIZED USER (AAU) is an employee who can do all the duties of the AU as defined below, plus issue the Radiation Work Permit (RWP) and directly supervise (in the physical presence of) the installation, relocation (removal from the pipe or tank), maintenance and repair of devices. This person must have satisfactorily completed a minimum of a 40-hour Advanced Radiation Training acceptable by the Agency or an Agreement State.

(NOTE: No person can remove the source from the source holder)

ALARA (acronym for "as low as reasonably achievable") means making every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other social and socioeconomic considerations, and in relation to utilization of nuclear energy and license materials in the public interest. Annually, the Company is required to perform a review of the program to assure that the procedures and tasks are keeping doses to the workers and public ALARA. This report can be performed by the RSO or a qualified expert who is assisting the radiation protection program. After completion of the report, it is to be reviewed and signed by the RSO.

ANCILLARY WORKER is a non-occupational worker but able to assist with the permitted activity outside the radiation area boundary (e.g., crane or hoisting operator, welder or helper), shall be authorized by the AAU and be given an orientation as the radiation hazards commensurate with the job. The anciillary personnel cannot use a survey meter or make any decisions regarding dose levels. This worker's exposure rate is limited to 2 mR/hour and an annual whole body dose of 100 mrem.

NOTE: Central Shipping & Receiving personnel are typically ancillary workers. However, they cannot sign shipping documents (incoming or outgoing) of hazardous materials unless they are trained in the hazard according to 49 CFR Subpart H. These personnel are typically AUs to be qualified to survey the package to ensure the proper Transport Index and sign shipping documents involving radioactive materials.

AUTHORIZED USER (AU) is able to perform all the basic activities regarding the handling of the source holders except be the supervisor of installing, relocating, maintenance and repair of a gauge. The AU can do the following: Perform an inventory, perform a leak test using an approved leak test kit, use a survey meter, perform basic repair and maintenance without removing the gauge from the pipe or tank, open and close the shutter, lock out a shutter, follow an RWP, sign as a shipper of radioactive materials (USDOT HAZMAT training every 3 years) and secure the source holder in storage.

RADIATION SAFETY OFFICER (RSO) is designated on the Company radioactive materials license as being responsible for managing nuclear sources and ensuring that those devices are used at the facility in compliance with applicable governmental regulations. The Radiation Safety Officer (RSO) must have received training to meet the U.S. Nuclear Regulatory Commission licensing requirements.

RADIATION WORK PERMIT (RWP) is a form which, when approved by the RSO or AAU, authorizes specific personnel to do specified work, to enter an area that requires special conditions and precautions and to minimize a radiological hazard. The RWP normally specifies authorized personnel, description of task to be performed and protective measures. The RWP is normally used only under special conditions, such as relocating devices and must be directly supervised by an Advanced Authorized User or RSO. However, it can be used if personnel are working for extended periods in the immediate "proximity" of a device that has been locked out. In this case, the AAU performs the calculation on the RWP and assigns the appropriate dose for the workers on that project. The RWP will be marked as a "PROXIMITY" RWP. (See RWP form).

SOURCE HOLDER is the shielding device that holds the radioactive source and usually possesses a shuttering mechanism. When used in conjunction with a mounted detector, it becomes a gauging device. The terminology may be different between manufacturers. Therefore, it is important to possess the Sealed Source & Device Registry sheet indicating that the source holder with the source has been evaluated by the USNRC or an Agreement State. This SSDR provides the details of source holder to include, but not limited to: Maintenance to be performed, leak test frequency, nomenclature of the unit assembly, limited purpose and use of the device, dimensions and isodose curves (anticipated radiation levels) at the surface and respective distances. At no times is the company to remove the radiation source from the source holder.

DUTIES OF THE RADIATION SAFETY OFFICER

Radiation Safety Officer

1. Ensure that licensed material possessed by the licensee is limited to the kinds and quantities of radioactive material listed on the license.

2. Ensure that the source holders are used only by individuals authorized by the license.

3. Ensure that individuals using source holders are properly trained in accordance with section 6 of this Manual; are designated by the RSO and receive refresher training.

4. If used, ensure that personnel monitoring devices are used correctly and reports of personnel exposure are reviewed in a timely manner and to alert the radiation worker in the event of a high or unusual exposure, to notify the Agency as required of the high or unusual exposure, and to investigate all such unusual exposures and take any necessary corrective action to prevent these incidents from occurring again.

5. Ensure that the source holders are properly secured against unauthorized removal when not in use.

6. Ensure that proper authorities are notified in case of accident, damage to source holders, fire or theft.

7. Ensure that audits are performed at least annually to ensure that (a) the licensee is abiding by the Agency's regulations and the terms and conditions of the license (e.g. periodic leak tests, inventories, use limited to trained, approved users), (b) the licensee's radiation protection program content and implementation achieve occupational doses and doses to members of the public that are ALARA, and (c) the licensee maintains required records with all required information (e.g. records of personnel exposure; receipt, transfer and disposal of licensed material, leak testing, inventories and training) sufficient to comply with the Agency's requirements. (See attached Checklist)

8. Ensure that all incidents, accidents and personnel exposure to radiation in excess of U.S. NRC regulations are investigated and reported to the Agency and other authorities, as appropriate, within the required time limits.

9. Ensure that licensed material is transported in accordance with all applicable USDOT requirements.

10. Ensure that licensed material is disposed of properly.

11. Ensure that the licensee has up-to-date copies of the Agency regulations, reviews new or amended Agency regulations and revises licensee procedures, as needed, to comply with Agency regulations.

12. Ensure that the license is amended whenever there are changes in licensed activities, responsible individuals, or information or commitments provided to the Agency in the licensing process.

13. Ensure that Authorized Users who have received greater than 100 mrem in a calendar year receive written notice of that dose. The RSO is to maintain a record that the employee received the notice.

14. Identify an Alternate RSO that has been trained and authorized to fulfill the responsibilities in the RSO's absence.

GAUGE INSTRUCTIONS

All gauge-related operations, including routine cleaning and maintenance, must be in accordance with the gauge manufacturer's instructions and recommendations as outlined in the SSDR for that particular device.

Personnel are prohibited from entering any hopper, vessel, conveyor system, or other area where radiation levels exceed 2 mR/hour or during periods when a portion of any individual's body may be subject to the direct radiation beam until the source holder has been locked out in accordance with the gauge lock-out/tag-out procedure. The Company will review and modify, as appropriate, the "lock out/tag out" procedure whenever a new device is obtained in order to incorporate the device manufacturer's recommendations as outlined on the Sealed Source & Device Registry for that device.

Opening or removing a source from its housing is prohibited.

The RSO, AAUs, AUs and company personnel shall take all appropriate actions to ensure that unauthorized personnel do not have access to the radiation sources at the plant.

The purpose of this procedure is to ensure that workers are not able to put their hands or parts of their bodies into a direct beam of the fixed gauge. So, the RSO shall ensure that the air gap between the radiation source holder and detector of the gauging device is less than 45 centimeters (18 inches). And, the air gap of the device would not allow insertion of a 30 cm (12 inch) diameter sphere into the radiation beam of the device without removal of a barrier. And, the radiation dose rate in the radiation beam of the device at 45 cm (18 inches) from the radiation source with the device shutters in the open position does not exceed 100 mrem/hour.

Prior to conducting any of the non-routine activities, an AAU is to initiate a RWP. As

such, the AAU will perform a survey to assure that the shutter or closing mechanisms are functioning properly and are closed, where applicable. A record of the completion of this survey shall be made on the RWP. After the removal, relocation, maintenance or repair and the device is reinstalled, a final survey shall be performed with a record of the completion of the survey kept on the RWP.

Gauge installations and relocations will include radiation surveys. Surveys will be taken at 1 foot around the sources and at the surface of the source holder to verify that the source is property shielded and aligned with the detector. The highest radiation level at the SURFACE is to determine dose rates for the EXTREMITY and the highest radiation level at one foot is to determine the dose rates for the WHOLE BODY. Measurements will also be performed to establish the 5 mR/hour boundary (to determine if "Caution – Radiation Area" signs must be posted). A copy of the appropriate manufacturer's operation manual or Sealed Source and Device Evaluation from the Sealed Source & Device Registry (SSDR) must be available with applicable instructions.

The Radiation Work Permit (RWP) as attached must be used for Advanced Services. An RWP is a written document remaining on-site until completion of the task. Completed copies shall be maintained for inspection by the Department.

The RWP shall:

Authorize specific individuals to enter and work;
Establish "Lock-Out" procedures for each device;
Outline the specific job to be done;
Outline instructions on the safe and correct handling procedure prior to work commencing;
Outline survey results;
Outline a specific time period that a given worker may conduct activities based on proximity to the source; and,
Be placed in a plastic cover hanging on the Radiation Area Caution tape or as otherwise providing it being obviously displayed.

The RSO shall approve and document by means of a RWP the installation, relocation, or movement to storage, of devices containing radioactive materials. This documentation shall include:

Radioactive Material (element and mass number)
Manufacturer & model number of the sealed source & device
Previous location (building number, name, site in building)
New location (building no., location in bldg) - facility address
Survey of the source holder to assure the shutter is closed. Indicate maximum survey readings taken at directional points of the device (top, bottom, etc.) both at the surface and at a distance of one foot.
The model and serial number and calibration date of the survey instrument used.
During the survey, a reading of greater than 5 mR/hour at 30 cm from the

source shall required posting as a radiation area.
For movement to storage, the device is to be surveyed collectively with the other sources in storage to assure that the radiation levels are within a Radiation Area level.
Serial number of the source holder
Date performed
Transportation documentation, if necessary
Persons involved in the transfer

The AAU shall inspect the site of the gauge to be removed and any area for storage of the removed gauge before the permit is issued to determine which gauge is to be handled, that the sites are safe, that safety equipment is in place, and that established safety precautions have been taken. The AAU shall assure that access to the Radiation Areas are restricted using physical barriers or having personnel immediately present to monitor ingress and egress of other personnel.

Calculated exposure shall be conducted as part of the RWP. The AAU shall utilize the calculated exposure as the assigned dose for the workers for that task. The AAU shall inspect the site before the permit is issued to close or have closed and locked the source shutter, where applicable, and survey the area with a calibrated survey meter. Based on the survey result, time restrictions must be calculated to establish time limits for work tasks based on proximity of a radiation worker to the source, thereby limiting occupational worker (AU) exposure to no more than 2 mR/hr or 125 mrem/quarter dose. This is the administrative control to assure that radiation workers will not exceed 10% of the allowable annual dose for an occupational worker.

Ancilliary personnel who help with the permitted activity beyond the radiation area boundary (e.g., crane or hoisting operator, welder or helper) shall be authorized by the AAU and be given an orientation as the radiation hazards commensurate with the job. The ancillary personnel cannot use a survey meter or make any decisions regarding dose levels. Based on the survey result, time restrictions must be calculated to establish time limits for work tasks based on proximity of a ancillary worker to the source, thereby limiting individual exposure to no more than 2 mR/hr and 100 mrem/year dose. This is the regulatory limit for members of the public.

A barrier, rope, sign, or other indicator of a permit work area may be around the work area, as necessary, to advise other personnel of the restricted access area. The barrier shall be posted, "CAUTION: RADIATION AREA."

Following completion of all work and the return-to-service of the gauge, the RWP must be signed by the RSO. The completed permit then will be forwarded to the RSO's office to be filed.

Work conducted in an area where the exposure rates are less than defined as a "Radiation Area" does not require personnel monitoring **as long as the total radiation dose does not exceed 125 mrem/qtr.** This provision of the procedures is conditional that the

calculated quarterly dose for a Radiation Worker does not exceed 125 mrem per quarter; or, 10% of the quarterly dose for an occupational worker. The exception would be in the event of an emergency, such as fire or source displacement from its shielded position. **Personnel working in the immediate proximity of a source holder that is posted, are to notify the RSO and a "Proximity" RWP will be initiated. The RSO determine the radiation level the individual is being exposed and limit the amount of time of working, if appropriate. At the completion of the task, the RSO will calculate the amount of dose received by that worker(s) and record.**

"Lock-out" procedures specific to radioactive materials as addressed in these procedures shall be observed for each device to prevent inadvertent opening by the shutter and unwanted exposure to the employees. As a minimum, these procedures shall include:

1. Review of the shutter operation to understand the shutter mechanism fully, if applicable;

2. Means to ensure the source holder is locked in the "OFF" position during maintenance, repair, relocation or other work in, on, or around the bin, tank, hopper, belt or pipe on which the device is mounted.

3. These lock-out procedures are not applicable for Low Activity Sources (LASs) with microcurie sources that do not have shutter mechanisms (per Sealed Source and Device Registry documentation). Manufacturer-supplied shipping cover will be put into shipping position for storage or transfer of these units.

4. Lockout procedures shall be posted as part of the radiation work permit.

5. Prior to return-to-service following movement of any gauge, appropriate radiation signs shall have been installed and the gauge secured in its installed location. A survey is required following installation or relocation activities. If necessary, a leak test will be performed to be in accordance with procedures outlined in the leak test procedures.

6. Conditions requiring Lock-Out
   A. Prior to any work being performed in the immediate vicinity of a gauge radiation beam when a distance or gap exists between a gauge's radioactive source and the radiation detector that permits entry of all or a portion of a person's body into the primary radiation beam;
   B. During any manipulation of a gauge, including the source holder or the detector, which involves physical movement of the device or separation from a pipe,

vessel, etc. including installation, relocation or storage;

C. When individuals are working on or adjacent to a gauge during periods of shutdown;

D. Whenever an individual enters a vessel in which such a gauge is located; and,

E. Whenever a vessel with such a gauge is empty and an individual is working around the exterior of the device.

F. Whenever performing routine activities around the gauge as defined by the manufacturer's instructions and recommendations as described in the SSDR.

7. Lock-out/Tag-out specifications

A. Lockout devices will consist of either a key or combination lock capable of holding the gauge in the safe (closed) position such that the gauge cannot operate until the lock-out device is removed. Lock-out devices will be substantial enough to prevent removal without the use of excessive force or unusual techniques.

B. Tag-out devices will consist of a durable tag and a means of attachment that can be securely fastened to the gauge to indicate that the gauge may not be operated until the tag-out device is removed. Tag-out devices will be substantial enough to prevent inadvertent or accidental removal, and able to withstand the ambient environment for the maximum period of time that exposure is expected. Tag-out device attachments will be of the non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds, with the general design and basic characteristics at least equivalent to a one-piece, all-environment-tolerant nylon cable tie. Tag-out devices will warn against hazardous conditions if the gauge is operated and must include a legend such as Do Not Open or Do Not Operate. Tags shall be legible and understandable to all personnel who may be in the area.

C. Lock-out and/or tag-out devices will indicate the identity of the individual applying the device(s). Lock-out and/or tag-out devices will be standardized in at least one of the following criteria: color; shape; or size, and the print and format of tag-out devices will be standardized.

SURVEY METER USAGE.

The RSO has the responsibility to ensure that proper instrumentation is on site for performing surveys of the gauges. The instruments shall be calibrated yearly. Training in proper usage is required prior to usage. The manufacturer's manual will be the guide for proper usage. Care and maintenance of the instrument will be in accordance with the manufacturer's instructions. Prior to usage, the instrument will be turned on, allowed to warm up, battery checked, calibration checked, response checked, then used and stored. If not usable or out of calibration, the instrument will be tagged out of service. Instrumentation performing advanced activities shall be able to measure up to 200 mR/hour.

Each radiation survey meter will be calibrated by the manufacturer or other person authorized by the USNRC or an Agreement State to perform radiation survey meter calibrations.

The Company will use radiation survey instruments that meet the criteria in Section 8.10.2, "Radiation Monitoring Instruments", in NUREG-1556, Volume 4, Revision 1, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Fixed Gauge Licenses.

POSTINGS

Radiation areas, such as hoppers, are required to have the following posting:

CAUTION - RADIATION AREA

Storage Areas

Each area or room where radioactive materials are used or stored shall be conspicuously posted with a sign bearing the radiation caution symbol and the words:

CAUTION - RADIOACTIVE MATERIAL

Storage areas may also require the "Caution-Radiation Area" posting. These areas shall be secured with the key under jurisdiction of the RSO, AAUs, and/or AUs. These postings shall be inspected during the gauge inventory periods to

ensure that they are visible and legible,

TRAINING PROGRAM

Radiological Protection Training

40-Hour Advanced Authorized User (AAU) Training

Advanced Authorized User training authorizes a user to conduct installation, relocation, removal of the source holder, not involving the installation, replacement or disposal of the sealed sources containing radioactive materials used in the devices. The persons performing these functions will complete a 40–hour training course authorized by the Agency. Successful completion of the course requires obtaining a score of at least 70 percent on a closed-book test consisting of at least 50 questions that have not been provided to the students before the test. Documentation of compliance with this part of the regulation will be maintained for inspection by the Agency.

8-Hour Authorized User (AU) Training

Basic Authorized User Training: A fixed gauge Authorized User (AU) is an individual qualified to perform (and supervise the performance of) general tasks involving a gauge that presents minimal health and safety risks (lock-outs, inspections, surveys, shutter checks, leak tests, security, care & cleaning, minor repairs not involving removal of source holder). This includes the performance of repair of the electronic detector (not the source holder), cleaning the unit, replacing a radiation symbol metal plate, or other minor repairs performed in place. AUs may participate in "advanced" activities (gauge installations, relocations, maintenance, and repair of the gauge off the pipe) only in the direct supervision of and in the physical presence of an Advanced Authorized User (AAU). These advanced activities present an increased risk of radiation exposure requiring the presence of more highly trained individuals, such as the manufacturer's representative or a 40-hour trained person.

A minimum of 8 hours of formal training provided by a training program covering the subjects listed in Agency regulations is required to qualify as a fixed gauge AU. Training will be performed by a third party knowledgeable in fixed gauge usage. If appropriate, the third party may be approved by the Agency or an Agreement State. In addition, instructions will include Operating and Emergency procedures and supervised hands-on training. Documentation of compliance with this part of the regulation will be maintained for inspection by the Agency. Successful completion of the course requires obtaining a score of at least 70 percent on a closed-book test consisting of at least 20 questions that have not been provided to the students before the test.

Refresher Training

Refresher training will be provided by the RSO, AAU or radiation consultant biennially. The refresher training will include participating in "dry runs" of the emergency procedures and reviewing (1) operating and emergency procedures, including lock-out/tag-out procedures as appropriate, (2) changes in applicable regulations or license conditions, and (3) deficiencies identified during the performance of annual audits or Agency inspections of the radiation protection program. Refresher training may also include review of applicable Agency's Information Notices and Bulletins and update of HAZMAT Transportation of industrial gauges for the Authorized Users assisting with incoming or outgoing shipments. Typical refresher training will last 2-4 hours. Records will be kept of employees' satisfactory completion of refresher training.

Ancillary Workers

Ancillary personnel who help with the permitted activity (e.g., crane or hoisting operator, welder or helper) shall be authorized by the AAU and be given an orientation as the radiation hazards commensurate with the job. The ancillary worker cannot use a survey meter or make any decisions regarding dose levels. When evaluating the exposure rate from the locked out gauge, the AAU will calculate the amount of time to limit the worker so as to prevent the worker from exceeding 2 mrem/hour dose. (See the RWP checklist for details)

This is confirmation that the Company has reviewed NUREG 1556 which discusses, in general, licensee responsibilities before any non-routine activity is performed. Non-routine operations, which require specific authorization by the U.S. Nuclear Regulatory Commission (NRC) or an Agreement State, include gauge installation; initial radiation survey; repair and maintenance of radiological safety components; gauge relocation; replacement and disposal of sealed sources; gauge alignment; or removal of a gauge from service were also reviewed.

APPENDIX B

RADIOACTIVE MATERIALS MANAGEMENT AUDIT CHECKLIST
ALARA PROGRAM
(revised 9/19)

FACILITY: _____ **DATE:** _____
COMPLETED BY: _____ **SIGNATURE:** _____

PLEASE CHECK CORRECT ANSWER

				On Hand?	
1.	Facility Radioactive Materials License Number & amendments	Yes ☐	No ☐	GL ☐	
2.	Is the license correspondence available?	Yes ☐	No ☐	GL ☐	
3.	Are copies of the following available at the facility?	Yes ☐	No ☐		
	• USNRC Regulations.?	Yes ☐	No ☐		
	• Operating & emergency procedures for all sources?	Yes ☐	No ☐		
4.	Has the facility received any radioactive sources (in source holders) in the last year? If yes, attach receipt.	Yes ☐	No ☐	GL ☐	
5.	Has each Cs-137, Co-60 and Cf-252 source been tested for leakage and/or contamination at intervals not to exceed 6 to 36 months, as stated on the SSDR? If not, state discrepancy.	Yes ☐	No ☐	N/A ☐	
	a. Has the RSO signed the leak test results page?	Yes ☐	No ☐	N/A ☐	
	b. Do any of the tests reveal contamination of 0.005 microcuries or more?	Yes ☐	No ☐	N/A ☐	
6.	Leak Test kit supplier _____				
7.	Fixed gauge installation, relocation, maintenance, repair or initial radiation survey was performed in last 12 months?	Yes ☐	No ☐	N/A ☐	
	If yes, RWP completed for each?	Yes ☐	No ☐	N/A ☐	
8.	Is an inventory of all source holders located at the facility performed within six (6) months interval?	Yes ☐	No ☐	N/A ☐	
	Dates of inventories: _____				
9.	Any other inventories performed?	Yes ☐	No ☐	N/A ☐	
10.	Are any sources received/ shipped this year? Any sources removed from service? Were they disposed of properly? If so, provide details.				

11. Shutter checks performed timely? Yes ☐ No ☐ N/A ☐

12. Any gauges in storage? If so, what is the status? Yes ☐ No ☐ N/A ☐

13. All records complete including the annual review? Yes ☐ No ☐

WALK THROUGH

14. Are the following forms posted?
    - Notices of violation? Yes ☐ No ☐ N/A ☐
    - Orders issued and responses to violations? Yes ☐ No ☐ N/A ☐
    - Notice to Employees posted? Yes ☐ No ☐
    - Does Form include a location where the operation documents can be examined? Yes ☐ No ☐
    - Yellow emergency sheet? Yes ☐ No ☐
    - Emergency Response document? Yes ☐ No ☐
    - Facility Lock Out Procedures for fixed gauges? Yes ☐ No ☐ N/A ☐

15. Are the following documents/labels attached to the incoming packages?
    - Proper labels? Yes ☐ No ☐
    - Bill of Lading? Yes ☐ No ☐
    - Other transmittal documents? Yes ☐ No ☐

16. Does the package have the correct marking and labels? Yes ☐ No ☐

17. Are the fixed source holders have **legible** "Caution Radioactive Materials" labels to include the element and mass number, activity, date of installation, serial number of the source holder. These labels are to be durable (usually metal) soldered to the source holder. Are they firmly affixed? Yes ☐ No ☐

18. Are the facility lock-out procedures available for fixed gauges? Yes ☐ No ☐

Comments: _____

RSO: _____

Applied Environmental Consulting, Inc.

Prospectus
(Revised 2018)

Applied Environmental Consulting, Inc. (AEC) was founded in 1992 by Bernhardt (Ben) C. Warren to provide health physics consulting services to the nuclear industry. The primary services are preparation of applications for the LICENSING of radioactive materials, TRAINING of the workers and oversee the regulatory requirements in the DECOMMISSIONING of industrial facilities. These services include providing general health physics consulting, dosimetry advise, dose assessments, preparing procedures and application documents, performing audits and assessment of licensed activities, exploring lost source concerns, evaluating potential doses to the public, providing a myriad of certified radiation protection training programs, surveying land areas to identify changes in background radiation and functioning as radiological consultant to sites being decommissioned.

MAIN BUSINESS FOCUS

Applied Environmental Consulting, Inc. focuses its expertise in the industrial sector providing the services to a myriad of industry groups. One common thread between several of the groups is the use of fixed industrial gauges that contain radioactive materials. Another commonality is that those clients that mine and technologically-enhance the naturally-occurring radioactive materials (TENORM) from the ground make the disposal of the equipment problematic and under regulatory oversight. For the fixed gauges, AEC provides certified training for the advanced authorized user and authorized user to include inventorying, gauge leak testing, relocation, surveying and all other regulatory requirements of possessing fixed industrial gauges. Those companies that enhance TENORM must undergo the decommissioning of their plants. This requires a complicated process under regulatory guidelines to complete.

In addition, many customers have industrial x-ray units for use in elemental analysis, microscopy, or radiographic operations. AEC provides the training for the workers, prepares Radiation Protection Programs and performs the required annual reviews of the program to ensure that the program is providing the program that keeps the doses to the employees as low as reasonably achievable.

FIXED GAUGES

AEC focuses on the health physics support for the industrial sector. One of the primary uses of fixed gauges is the non-tactile (touching) of the product while perform a density measurement. This technique assists the company in keeping the flow of materials moving through the plant. These gauges can be used in several methods, such as the mounting on pipes to monitor the flow of slurries carrying product, placing on conveyor belts to monitor the movement of solids, or placing on tanks or vessels to monitor the fill-level of liquids, slurries or solids. The use of fixed gauges assists the plant operator in

having many monitoring points in the plant that are electronically tied into the control system to quickly identify problems so they can be remedied before a major issue occurs. In addition, the gauges can be used to quantify the density or amount of product that is being moved through the plant. These gauges have discrete sealed sources that emit gamma radiation that is shielded in its source holder. As the shutter is opened, the radiation levels increase allowing the radiation to penetrate the target and reach a detector which quantifies the amount of radiation attenuated, thus automatically calculating the amount of product being measured. These sealed sources create a small risk of exposure and ultimate dose. Keeping these doses as low as reasonable is our goal.

The services provided by AEC include the training of the operators. This includes the 40-hour training course to certify Advanced Authorized Users that have the complete understanding of the radiological requirements of the plant. They are also qualified to be the site Radiation Safety Officers (RSOs). For those companies wanting a general RSO capability, a 24-hour RSO course is offered. Limited authorized user training in the form of an 8-hour training course is provided. In addition, AEC performs the USDOT HAZMAT training for the users at the facility to be able to ship the industrial gauges on the highway. And finally, customized refresher training is provided for the plant personnel as recommended by the RSO.

On-site services include conducting a radiological review of the radiation protection program to assure that the activities of the RSO and plant are maintaining exposures as low as reasonably achievable (ALARA) is performed by AEC annually of all its clients. Also, AEC field health physics technicians inventory the industrial gauges, perform leak testing services, clean and care for the gauge and verify the required posting as being accurate.

AEC's clients that possess fixed gauges are members of the following groups:

MINING GAUGE USERS:	Phosphate, Rare-earth, Kaolin and Silicon industries
NON-MINING GAUGE USERS:	Energy production, Cement and Pulp & Paper industries

Some of these industries are discussed in more detail below:

MINING

Those companies involved in mining have a unique function in that they are extracting naturally-occurring radioactive materials from the earth and concentrating it in their chemical processes when processing the ores.

Phosphate industry

AEC has been providing professional services to the phosphate industry since 1992. These companies are on annual contracts performing full-service health physics support. There are many services licensing and regulatory functions. AEC has continued to

provide on-site radiological support services for the radioactive materials, assisted in preparing and maintaining a broad industrial license and provided quarterly consulting services for the Radiation Safety Committee. One license has expanded from four to twelve sites under the broad license during the time of contractual relationship. The phosphate companies are authorized for the possession of fixed industrial gauges containing radioactive materials and enhanced naturally-occurring radioactive materials.

During this contracting history, the decommissioning of their uranium recovery operations was unique. Decommissioning is beyond the simple closing of the plant. The company is not released from the regulatory restrictions until the license is terminated by the regulatory agency. Uranium recovery is the licensing process that allows the phosphoric acid from the fertilizer production to be processed through a side-circuit to remove the uranium. Then, the uranium-depleted phosphoric acid is returned to the fertilizer production plant to continue the process to make fertilizer. The demolition and closing of these plants occurred when the price of uranium was no longer competitive. This activity included providing the pre-decommissioning survey and developing the decommissioning plan according to regulatory guidelines. The decommissioning plan included the scope and degree of demolition of the facilities by contractors decided by the clients, negotiating the conditions with the regulatory agency, assisting the companies in reviewing demolition contractors, providing training to the site demolition contractors, providing oversight of the procedures and releasable items, performing a post-survey, and preparing the final report. This was used to terminate the radioactive materials license and release any financial bonding required by the State of Florida.

To date AEC has directly coordinated the decommissioning of four uranium recovery plants.

The main phosphoric acid plants that transform the ore to fertilizer also go through decommissioning when their useful life is complete. Since the phosphoric acid plants chemically transform the ore, it enhances and concentrates the naturally-occurring radioactive materials in the ore on the surface of the tanks, pumps, piping and valves to a regulatory concentration called Technologically-Enhanced Naturally Occurring Radioactive Materials (TENORM). In order to obtain relief from the license, a decommissioning plan, similar to the uranium recovery decommissioning, must be completed. The dismantled equipment requires surveying by company personnel training by AEC prior to release for metals salvage. Much of the contaminated equipment is decontaminated on-site prior to obtain releasable status. There are several technologies to include water and grit blasting requiring personal protective equipment by the workers. All these activities required training, technical consulting and support provided by AEC. After demolition of the site, the site is surveyed, sampled and a report completed for the regulators to review and approve.

To date, AEC has been directly involved in the decommissioning of four phosphoric acid sites.

Rare-earth minerals

AEC provided professional services to the rare-earth industry since the mid-90s. Services included performing and assessing doses from the respective applications within a licensed mineral extraction (titanium) facility. This included performing a baseline assessment of the site, the potential exposure pathways using air sampling and area monitors, particle size assessment, worker interviews, and Time & Motion studies. Results were provided to the company's management as to their potential areas of concern and recommendations to minimize worker exposures using administrative and mechanical controls. Services also included performing the renewal of the radioactive materials license. Then began of the decommissioning process of performing a pre-demolition survey, preparing a decommissioning plan, surveying items to be released from the site and sampled the site after the facility was demolished. Final decommissioning approvals are pending.

Kaolin Mining

AEC has been providing professional services to the kaolin industry since 1992. The kaolin industry mines kaolinite clays for the production of a fine white substance used in many products, such as paint pigments, toothpaste and the white slickness in paper. These companies are on annual contracts in which AEC performs full-service health physics support. These clients are authorized for the possession of fixed industrial gauges containing radioactive materials and enhanced naturally-occurring radioactive materials.

When these plants come to the end of their useful life, decommissioning is required. Similar to the phosphate industry, these plants must go through the regulatory rigors of the decommissioning process.

The decommissioning of two sites in Georgia is pending and one is completed in the State of SC.

OTHER CLIENT GROUPS

In addition to the above gauges and TENORM clients, AEC consults the industry that possesses and uses radioactive materials in a myriad of methods. AEC has also provided research in the better understanding of the risk of handling the materials.

Research Companies

Clients use radioactive materials tagged to organic compounds which are used as tracers. The purpose is to identify the efficacy and tenaciousness of the research compound. For example, herbicides and pesticides need to be tested to assure that they are effective and do not linger in the environment to assure no more environmental problems, like DDT. After administration of the tracer to a plant or soil, samples are taken to identify the extent of uptake and persistence. These results are provided the product manufacturer who submits the report to the federal agencies to obtain permits for distribution to the

general public. The primary radioactive material is carbon-14 tagged to an organic compound.

To date decommissioning of plots where radioactive materials have been administered have been completed in Florida, Georgia, Texas, Illinois, Mississippi and California.

Department of Defense Contractors

AEC provides licensing and health physics support to several companies who are contractors to the Department of Defense. The use of radioactive materials is primarily the use of small amounts of discrete sources used in the tactical equipment used by the military.

Veterinary Hospitals

AEC provides licensing, radiation protection training and general health physics support to veterinary hospitals that treat cats with I-131. Cats with overactive thyroids are not very good pets as their metabolism is too high driven by an overactive thyroid. The injection of I-131in the cat allows the radioactive iodine to be concentrated in the thyroid and reduce the metabolism in the cat. The injection, care, handling of the kitty litter and related paraphernalia, monitoring doses to the workers, and contamination control of the laboratory until the cats are ultimately discharged are the primary issues that must be approved through a license prior to receiving radioactive materials.

GENERAL RADIATION SERVICES TO INDUSTRY

AEC has provided site assessment surveys of raw land to land reclaimed during the mining operations. The purpose is to identify the background levels and if there are any elevated levels potentially needing remediation prior to construction of major projects, such as golf courses and resorts.

AEC performed a dose reconstruction for workers in a salvage yard due to a source being "lost" from a licensee. Performed interviews with the potentially affected employees, performed Time & Motion studies to determine doses to all the handlers and drivers and provided a final report to the licensee.

AEC provided health physics services, licensing and As Low As Reasonably Achievable (ALARA) assessments to a company engaged in the manufacture and distribution of brachytherapy implants containing I-125 prostate seeds.

AEC provides licensing and health physics consulting services to a laboratory using krypton-85 (noble radioactive gas) in specialty lamps, including commercial aircraft. AEC assisted client obtain radioactive materials license and a federal exempt distribution license.

AEC obtained a license for a major metals smelting company after a cesium-137 industrial gauge was inadvertently smelted and contaminated the plant. After shutdown and decontamination with a cost of over $10MM, a license was required for the residual radioactivity that could not be removed.

AEC provides radon studies for plant having phosphogypsum stacks in the phosphate industry requiring closure and periodic radon testing. In addition, radon tests were performed to determine worker exposure in mining tunnels where background radiation is release and accumulates. AEC provided recommendations as to the mitigation of the air concentrations.

AEC provided radioactive waste management consulting to a large company with over 40,000 contaminated and rusted 55 gallon drums as to a viable and competitive disposal option.

AEC provides facility design, licensing and regulatory support for a company beginning a TENORM decontamination facility for the industry.

AEC has provided other site remediation and decommissioning projects. In addition to those described above, AEC has performed the decontamination and decommissioning of several sites with various types of radionuclides, to include: thorium oxide and tritium. This included remediation of laboratory facilities to the removal of soils and obtaining the final decommissioning approval. Of these clients (3) the decommissioning was completed in Florida.

AEC PERFORMING RESEARCH

Florida Institute of Phosphate Research

AEC conducted a multi-year research project to determine external and internal radiation doses to workers in the Florida phosphate industry due to Technologically-Enhanced Naturally-Occurring Radioactive Materials (TENORM). The study included a comparison of external dosimetry methods using pressurized ion chambers, scintillation survey meters, optically stimulated luminescent dosimeters, and lithium fluoride TLDs. Inhalation doses were estimated using air samplers in working zones and published dose conversion factors. Total effective dose equivalents were calculated using measured parameters and uncertainty analysis methods including Monte Carlo techniques to generate dose distributions. A formal document was published and is available under the Florida Institute of Phosphate Research - publication number 05-046-155.

In addition, AEC performed a study to provide information as to the characterization of objects contaminated with TENORM within the industry. Technical enhancement is the separation of the principal radionuclides, namely uranium and radium-226, with the resultant material not in equilibrium. TENORM is currently not officially defined by most of the regulatory agencies nor are compliance criteria established. Seven facilities participated in the study that lasted twelve months. Current practices at each site were

reviewed with results being anonymous. Each site maintained a "lay-down" area where items were collected, segregated and surveyed prior to determining the disposition. Samples were taken from debris, metals, and other items destined for landfills, salvers and phosphogypsum stacks. Collective sample analyses indicated the enhancement being 72% favoring uranium and 25% favoring radium. Thirty-five percent of the uranium samples had activity 10 times greater than the radium activity. Over 50% of the discarded items went to salvers, of which 66% had background radiation levels. One hundred tons of debris destined for off-site disposition consisted of approximately 4.5 millicuries of uranium and 8 millicuries of radium. One hundred thirty-six total samples were taken with detailed descriptions delineating identification, radiation levels, estimated mass and whether having fixed or removable contamination. A formal document was published and is available under the Florida Institute of Phosphate Research - publication number 05-059-191.

AEC's founder developed a 40-hour radiation protection training program for the Florida Institute of Phosphate Research to use in conjunction with their partner, the International Atomic Energy Agency (IAEA). The IAEA is offering this training program to their clients in the world-wide phosphate production arena and associated disciplines.

Applied Environmental Consulting, Inc.
8-Hour Radiation Protection Training
to qualify as an Authorized User
with fixed industrial gauges (including Cf-252)

Syllabus

INTRODUCTION

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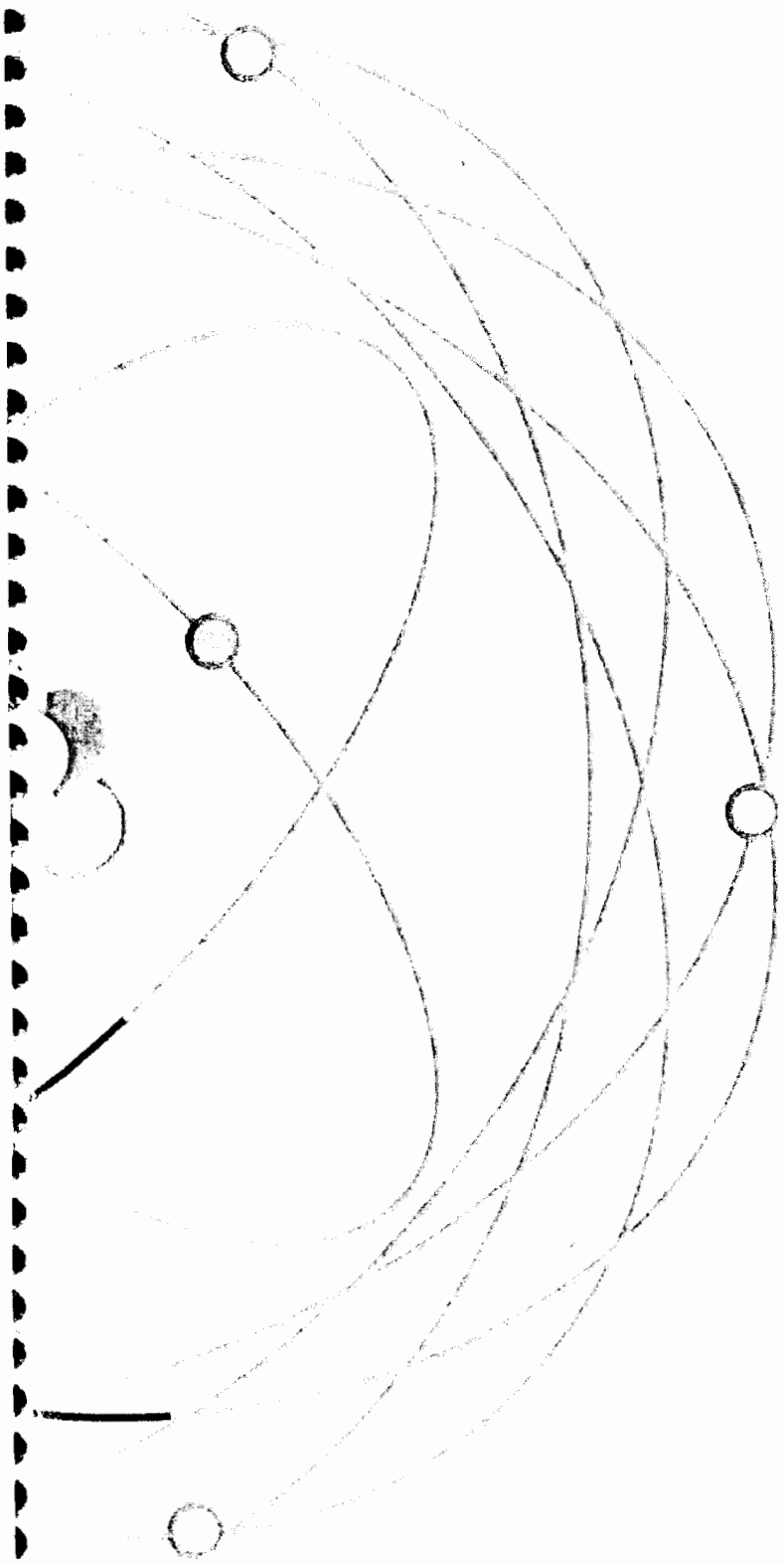

Radiation Safety Officer

Nevada Technical Associates

Radiation Safety Training

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