February 28, 2019

Betsy Ullrich, Senior Health Physicist
Mail Control No. 610798
USNRC, Region I
Division of Nuclear Materials Safety
2100 Renaissance Boulevard
King of Prussia, PA 19406

SUBJECT: Response to Request for Additional Information Regarding Perma-Fix License Application

Dear Ms. Ullrich,

Please see below the responses to your request for additional information regarding the Perma-Fix service provider license application submitted on December 13, 2018. Documents that have not been revised have not been resubmitted with this RFI response.

Item 1.

Please revise your requested list of byproduct materials to include only those that are covered by the definition in 10 CFR 30.4. In addition, please note that the following license conditions are standard on licenses for site remediation services:

- The licensee does not take possession of the radioactive materials and/or sealed sources while at the customer's facility except for analytical samples.
- Except for calibration sources, reference standards, and radioactively contaminated equipment owned by the licensee, receipt, storage, and use incidental to any activity of licensed material at each temporary job site shall be limited to material originating from each site. This material must either be transferred to an authorized recipient or remain at the site after licensee activities are completed.

These conditions limit the site remediation licenses to the use of the radioactive materials for activities authorized on the license at temporary job sites only, and do not authorize possession of the material other than calibration and check sources, or analytical samples. Therefore you will not be required to provide financial assurance or emergency plans. Possession of the material remains under the financial assurance and other regulatory requirements of the site at which you are working. In addition, you committed in Section 5 to restrict quantities possessed below those limits requiring provision of financial assurance or an emergency plan. You should consider this when establishing the number of line items you are requesting for byproduct material and the quantities to be listed on the license for use.

Response:

In response to RFI Item 1 above, Perma-Fix has revised the Section 5, Table 1, Radioactive Material Quantity Limits as described above in the attached Revision 1 of NRC Service Provider License Application, Section 5 through 11. Perma-Fix also understands the standard license conditions described above for remediation service licensees. An exception for analytical samples was added to the first bullet.

The quantity limits requested will also reflect changes which take into account that financial assurance or emergency plans will not be required.

Item 2.

In Section 5, you stated that you wish to define "possession" as the point at which materials are physically removed from their existing state prior to your work under this license. Please explain this statement more clearly, perhaps using an example. Alternately, if the conditions and commitments discussed in item 1 above provide sufficient relief from this issue, you may retract the request for this definition.

Response:

The "possession" definition will be retracted as sufficient relief is gained from the conditions and commitments discussed in Item 1.

Item 3.

The materials and activities you requested fall into several fee categories. Confirm that you wish to be authorized for the following activities and materials, and understand that you will be assessed an annual fee in each of the fee categories, in addition to the application fees for each category.

a. Program code 03219 is for decontamination services, and falls into fee category 3.N. This program code applies only to byproduct material, which you requested in Table 1 in six different line items. Activities with source and special nuclear material will fall under separate program codes and fee categories.
b. The source material you requested in Table 1 falls under program code 11300, source material, other, more than 150 kilograms. This is in fee category 2. F.
c. The special nuclear material you requested could belong to several program codes: 22110, SNM-plutonium, unsealed, less than critical mass; 22111 SNM-uranium-235, unsealed, less than critical mass; 22120 SNM plutonium, sealed neutron sources less than 200 grams; SNM plutonium, sealed sources in devices; 22150 SNM plutonium, sealed sources less than critical mass; and 22151 SNM uranium 235, sealed sources less than critical mass. All of these program codes are in fee category 1.D and a single fee would be assessed.

Response:

Perma-Fix confirms the fee categories of 3.N, 2.F, and 1.D.

Item 4.

Section 5 of your application does not include information about calibration and check sources as described in Sections 9 and 10. NUREG-1556, Volume 18, Rev 1, "Consolidated Guidance About Materials Licenses Program-Specific Guidance About Service Provider Licenses," Section 8.5.1, states that you should identify each radionuclide that will be possessed in each sealed source or device, and specify the maximum activity per source. Also, you should specify the maximum number of sources or the total activity for each radionuclide. Identify the manufacturer or distributor and model number of each type of sealed source and device requested, or provide the Sealed Source and Device (SSD) registration certificate number. Confirm that each sealed source, device, and source and device combination is registered as an approved sealed source or device by the NRC or an Agreement State. Confirm that the activity per source

and maximum activity per device will not exceed the maximum activity listed on the approved certificate of registration issued by the NRC or by an Agreement State. Identify the special circumstances under which sealed sources and devices that are not registered by the NRC or an Agreement State may be possessed, used, or serviced. Alternately, you may provide information as described in 10 CFR 30.32(g)(4).

Response:

The Technical Services group within Perma-Fix does not use any sealed sources that require registration. All sealed sources used on a project site are exempt quantity and are only used for instrument response verifications. Field instrument calibrations are performed offsite. As Perma-Fix has many exempt quantity sealed sources, it is not feasible to identify each sealed source and device individually. Perma-Fix will revise Section 5, Table 1 of NRC Service Provider License Application, Section 5 through 11 to provide clarification to meet the intent of 10 CFR 30.34(g)(4).

Item 5.

Based on review of the application, we understand that you are not planning to perform activities with radioactive wastes other than those generated by your site remediation activities. If this is correct, please state, "We will limit waste handling activities to those wastes generate by remediation and decommissioning services we provide. We will NOT take possession of waste generated by the customer as would a commercial waste service provider, or handle wastes we did not generate."

Response:

Perma-Fix will revise its NRC Service Provider License Application, Section 5 through 11 submittal to state that we will limit waste handling activities to those wastes generated by remediation and decommissioning services relative to the specific project.

Item 6.

As a result of a review of all licenses and program codes over the past 2 years, the NRC identified that activities under program code 03219 may require that an environmental assessment be performed. Confirm that you understand that the issuance of your new license may be delayed until a determination is made regarding the need for an environmental assessment for these activities.

Response:

Perma-Fix understands that a decision within the NRC regarding environmental assessments has not been made at this time.

Item 7.

Please provide more specific information regarding the types of activities you expect to perform related to site characterization, decontamination and decommissioning of facilities. In particular,

a. specify if procedures will be limited to surveys and routine cleaning activities of indoor facilities and equipment, or if you expect to use aggressive methods that could include grinding, cutting, scabbling or other activities that could generate airborne radioactivity; chemical methods that could result in generation of mixed wastes; or other methods that could require use of specialized protective clothing or equipment such as respirators.

b. specify if the procedures you expect to perform in outdoor areas will be limited to surveys and limited soil sampling in the top 15 centimeters, or if you expect to perform activities such as core sampling, soil removal, sampling and remediation below 15 centimeters, ground water and surface water sampling, or other similar activities that may require additional radiation or other safety precautions.

Response:

Decontamination and decommissioning and/or remediation projects vary significantly; as such, each project has very specific planning. The project scope and the nature of the contamination drive methodologies used on a particular project. With respect to Items 7 a. and b., essentially any of the methods listed above could be applicable (chemical methods aside from basic cleaners are not commonly used, however).

This unknown and highly variable nature is why each project will have specific project plans to address detailed actions and concerns related to the specific project.

Project specific details will be provided as part of the 10 CFR 20 Appendix D submittals (also noted in Item 16 below). Additionally, language has been added to Section 6 of NRC Service Provider License Application, Section 5 through 11 to further describe typical project operations.

Item 8.

Section 7 of your application does not include information requested in NUREG-1556, Volume 18, Revision 1, Section 7, "Individuals Responsible for Radiation Safety Program and Their Training and Experience." In accordance with Section 8.7.1, provide the following:

a. Demonstrate that the RSO has sufficient independence and direct communication with responsible management officials by providing a copy of an organizational chart by position and demonstrating day-to-day oversight of the radiation safety activities;
b. Confirm that the RSO will be available for emergencies and can be on-site within 24-48 hours, if applicable;
c. Confirm that the duties of the RSO will include those described in Appendix C of NUREG-1556, Volume 18, Revision 1.

Response:

A copy of the Perma-Fix organization chart is provided to address Item 8 a.

The RSO will be available for any emergencies and can be on-site within 24-48 hours (Item 8 b.)

Perma-Fix has reviewed Appendix C of NUREG-1556, Volume 18, Revision 1 and confirms that the RSO's duties will include those listed in Appendix C.

Item 9.

Your procedure RP-115, "Radiation Worker Training," stated that training would be provided bi-annually. According to the dictionary definition, bi-annual means twice each year. Confirm if you intended to provide training twice each year (semi-annually or biannually), or once every two years (biennially). If the latter, please justify why refresher training is only needed every 2 years, given that NUREG-1556, Volume 18, Revision 1 states that annual refresher training should be provided.

Response:

Procedure RP-115 has been revised to reflect an annual frequency for Radiation Worker Training.

Item 10.

The Radiation Protection Program procedures submitted with your application do not include procedures for the various types of site remediation activities you intend to perform (see Item 7 above) other than surveys. Please submit operating and emergency procedures applicable to the decontamination and remediation activities you expect to perform.

Response:

As noted in Item 7, Perma-Fix develops project specific documents to address the more detailed operational and emergency response aspects of a particular project.

Project specific details will be provided as part of the 10 CFR 20 Appendix D submittals (as noted in Item 16 below).

Item 11.

Confirm that you will obtain agreements as described in the following license condition which is standard for site remediation licenses:

- This license does not authorize the use of licensed material at temporary job sites for uses already specifically authorized by a customer's license. If a customer also holds a license issued by the U.S. Nuclear Regulatory Commission or an Agreement State, the licensee shall establish a written agreement between the licensee and the customer specifying which licensee activities shall be performed under the customer's license and supervision, and which licensee activities shall be performed under the licensee's supervision pursuant to this license. The agreement shall include a commitment by the licensee and the customer to ensure safety, and any commitments by the licensee to help the customer clean up the temporary job site if there is an accident. A copy of this agreement shall be included in the notification required by license condition [insert number].

Response:

Perma-Fix confirms agreements as described above shall be obtained to delineate specific license responsibility in situations where the customer/client also holds a license at a project site.

Item 12.

In accordance with Section 8.10.2, confirm that a physical inventory will be conducted at intervals not to exceed 6 months, to account for all sealed sources and devices possessed at temporary job sites under the license; and records of the inventory will be maintained for a period of 5 years and will include the radionuclides, quantities, manufacturer's name and model numbers, and date of the inventory.

Response:

Perma-Fix will only use exempt quantity check sources at temporary job sites. Perma-Fix confirms that sealed sources used at temporary job sites will be inventoried and leak tested every six months and records will be maintained for a minimum of 5 years.

Item 13.

The quantities of special nuclear material (SNM) you requested to be authorized on the license could include SNM of low strategic significance and/or strategic SNM. Provide your procedure for determining if you will be working with SNM of strategic or low strategic significance, and implementing the physical protection requirements of 10 CFR Parts 73 and 74, if applicable.

Response:

While SNM of low strategic significance is possible under the requested possession limits (strategic or moderate strategic would not be possible), Perma-Fix has not encountered SNM at these enrichments historically. The potential does exist on former or current DOE sites (SLDA in Pennsylvania, for example), and a project that has this potential would require planning to address this possibility. Plans specific to addressing this would be part of the site specific documents described in Item 10 and submitted in advance of work per item 16.

Item 14.

Your procedures RP-104, "Radiological Surveys" and RP-105, "Unrestricted Release Requirements" contain the table "Acceptable Surface Contamination Levels". The levels listed are outdated with respect to release of facilities, and have not been used for release of facilities for unrestricted use in many years, following the issuance of 10 CFR 20, Subpart E, "Radiological Criteria for License Termination" in 1998. In addition, these limits do not address soil, water, etc. NUREG-1757, Volume 2, Revision 1, discusses how facilities can demonstrate they meet 10 CFR Part 20, Subpart E criteria for release of facilities for unrestricted use. The values in your Table 2 do not meet the criteria for Subpart E for alpha emitters, and may not meet the Subpart E criteria for some beta and gamma emitters. (We note, however, that your table is similar to Appendix L of NUREG- 1556, Volume 11, Revision 1 for acceptable contamination levels of items but not building surfaces.)

a. Please confirm your understanding that this table is to be used only for individual item release and not for release of facilities, and that you will revise your procedures to make this clear.
b. Confirm that your criteria for release of facilities under NRC jurisdiction will meet 10 CFR Part 20, Subpart E, "Radiological Criteria for License Termination", and that you will develop and implement appropriate release criteria, and site remediation and decommissioning activities, using guidance acceptable to the NRC. In addition, state, "We will conduct surveys and maintain contamination levels in accordance with the survey frequencies and contamination levels published in Section 8.10.4 of NUREG-1556, Volume 18, Revision 1, "Consolidated Guidance About Materials Licensees: Program-Specific Guidance about Service Provider Licenses."

Response:

Perma-Fix has revised RP-104 and RP-105 to clarify release of items and release of buildings and land areas. When unrestricted release is a goal of a project, actual site specific criteria that demonstrate compliance with 10 CFR 20, Subpart E are established and regulatory approval is obtained. The requested language will be added to the revised application and/or procedure where appropriate.

Item 15.

The procedures submitted do not address assessment of internal dose or conditions when external dosimetry would not be issued. In accordance with Section 8.10.6 of NUREG-1556, Volume 18, Revision 1, state "We will maintain, for inspection by the NRC, documentation demonstrating that unmonitored individuals are not likely to receive a radiation dose in excess of the limits in 10 CFR 20.1502." and "We will monitor individuals in accordance with the criteria in Section 8.10.6 'Radiation Safety Program - Occupational dose' in NUREG-1556, Volume 18, Revision 1, "Consolidated Guidance About Materials Licensees: Program-Specific Guidance about Service Provider Licenses."

Response:

Perma-Fix does have an internal dose procedure (RP-116), which is included with this response. Additional clarifying language has been added to RP-112 to address conditions in which project personnel may not be issued dosimetry. Both procedures are included as part of this response.

Item 16.

Confirm that you will abide by the following license conditions that are standard for site remediation service providers:

The licensee shall notify the U.S. Nuclear Regulatory Commission in accordance with Appendix D of 10 CFR Part 20, in writing at least 14 days before initiating activities under this license at a temporary job site, excluding routine packaging or repackaging for purposes of transporting and not requiring a job or site specific work package, and characterization and/or final surveys where radioactive materials and/or radiation are not likely to be detected. This notification shall include: (1) The estimated type, quantity, and physical/chemical forms of licensed material to be used, (2) The specific site location, (3) A description of planned activities including waste management and disposition, (4) The estimated start date and completion date for the job, and (5) The name and title of a point of contact for the job, including information on how to contact the individual.

- Within 30 days of completing activities at each job site location, the licensee shall notify the U.S. Nuclear Regulatory Commission in accordance with Appendix D of 10 CFR Part 20, in writing, of the temporary job site· status and the disposition of any licensed material used.
- The licensee shall maintain records of information important to decommissioning for each temporary job site pursuant to 10 CFR [30.35(g), 40.36(f), and 70.25(g)]. The records shall be made available to the customer upon request. At the completion of activities at a temporary job site, the licensee shall transfer these records to the customer for retention.
- If approved by a Radiation Safety Officer specifically identified in this license, the licensee may take reasonable action in an emergency that departs from conditions in this license when the action is immediately needed to protect public health and safety and no action consistent with all license conditions that can provide adequate or equivalent protection is immediately apparent. The licensee shall notify the U.S. Nuclear Regulatory Commission Headquarters Operations Center at 301-816-5100 and the U.S. Nuclear Regulatory Commission Regional contact before, if practicable, and in any case immediately after taking such emergency action using the reporting procedure specified in Appendix D of 10 CFR Part 20.

Response:

Perma-Fix understands the requirements above and will provide the required information and documentation according to the timelines described above.

Thank you for your time and consideration of the submitted responses. Please let us know if you have any questions regarding the responses or need additional information.

Best Regards,

Andrew J. Lombardo, CHP
Senior Vice President, Nuclear Services

Attachments

- Revision 1 to *NRC Service Provider License Application, Section 5 through 11*
- Organization Chart for Perma-Fix
- Revised Procedure RP-104
- Revised Procedure RP-105
- Revised Procedure RP-112
- Revised Procedure RP-115
- Procedure RP-116

NRC Service Provider License Application, Section 5 Through 11

February 2019, Revision 1

Submitted To:

NRC Region I
2100 Renaissance Blvd.
Suite 100
King of Prussia, PA 19406-2713

Submitted By:

Perma-Fix Environmental Services, Inc.
1093 Commerce Park, Suite 300
Oak Ridge, TN 37830

Introduction

The Perma-Fix Environmental Services, Inc. (Perma-Fix) performs field radioactive material management services throughout the U.S. as well as in Canada as well as waste treatment services at several fixed facilities throughout the U.S. Field services include site characterization, decontamination, remediation, waste management, and site final status survey for unrestricted release.

Perma-Fix currently holds eight state radioactive material licenses in six different states. Four of the licenses are for fixed facilities, one is for an instrument lab, and three are for radiological field services related work.

Perma-Fix believes an expansion of field service licensing authorization through the acquisition of an NRC field service license will be a benefit to the organization and is therefore made a decision to apply for such.

This document provides information required for NRC license application sections 5 through 11.

Section 5. Radioactive Material

Table 1 below lists the requested quantity limits for this service provider application.

Table 1. Radioactive Material Quantity Limits

Nuclide	Chemical Form	Quantity
Any radioactive material subject to NRC licensing, except tritium, source material, special nuclear material, and sealed sources	Any, as potentially contaminated materials	10 Ci
H-3 (tritium)	Any, as potentially contaminated materials	100 Ci
Source Material	Any, as potentially contaminated materials	Not to exceed 10,000 kg
Special Nuclear Material (SNM)	Any, as potentially contaminated materials	350 grams uranium-235, 200 grams Uranium-233, or 200 grams plutonium; or any combination of these provided the sum of the rations of the quantities does not exceed unity
Sr/Y-90, Cs-137, Co-60, Am-241, Tc-99, U-238, Ra-226 (as sealed sources)	Solid sealed source	No single source to exceed 10 microcuries
Th-230, Pu-239 (as sealed sources)	Solid sealed source	No single source to exceed 1 microcurie, total not to exceed 5 microcuries

Perma-Fix will track radionuclide quantities in possession for each specific project. Records related to radioactive material inventories will be maintained at the job site during project execution and transferred to the corporate operations office for archival after each project completion. Additionally, records will be available to the NRC electronically upon request.

Section 6. Purposes for Which Licensed Material Will Be Used

Radioactive materials associated with the implementation of this license will typically be in the form of contamination that requires some level of remediation or at a minimum, some level of characterization to determine if and/or where remediation is necessary.

For projects that include remediation, radioactive materials exceeding remediation threshold levels will be dispositioned at an appropriately licensed and permitted disposal facility either directly or through an appropriately licensed and permitted processing facility.

Remediation criteria will vary from site to site and will be dependent on the individual project specifics. Most often, the goal is free release of the site but not always.

Remediation and decontamination activities will vary from one project to another, depending on the project scope and the nature of the contamination. Projects typically begin with characterization activities which include surveys for dose rate (or gamma emission rate) and contamination (for items and building surfaces). A gamma scan with GPS mapping is often used for potentially impacted land areas (this can be either a walk-over scan or a vehicle based scan, and often both). Sampling methods are determined by the nature of the contaminates. Surface samples (0-6 inches) are used when there is only a surface concern. Core samples are used when contamination is potentially at some depth below the surface. For items and buildings, direct surface measurements and wipe samples are used. Building materials may be sampled as well. In-situ gamma spectroscopy may be employed if necessary.

After characterization, a plan is developed for remediation. Again, the nature of the contaminates will drive the methods used. Soil remediation may be as simple as hand tools removing identified discrete areas of contamination. A large area of impact will likely have heavy equipment involved. Removal of underground utilities is not uncommon, and may involve soil remediation as well. This requires that appropriate measures are taken to ensure safety (for example the use of trench boxes or shoring). For large volumes, soil segregation methods may be used to separate impacted soils from clean soils. Building surfaces typically move from the least aggressive methods to the most aggressive (for example, simple cleaning of the surface with a common household cleaner advancing up to complete demolition and removal if decontamination is not feasible). All methods are vetted for risk (personnel, contamination, and environmental concerns) and appropriate controls are developed for the tasks to minimize any risks.

Also, it is not uncommon that adjustments have to be made after work begins due to a more thorough understanding of the remediation challenges.

Section 7. Individual(s) Responsible For Radiation Safety Program and Their Training and Experience

The RSO for this license will be S. Eric Miller, CHP. Mr. Miller has more than 25 years of experience in the field of health physics and has been designated as RSO (or responsible party) on several radioactive material licenses issued by both agreement states and by the NRC. See Figures 1 and 2 below for *Certification by the American Board of Health Physicists*.

Figure 1. Certification by the American Board of Health Physicists

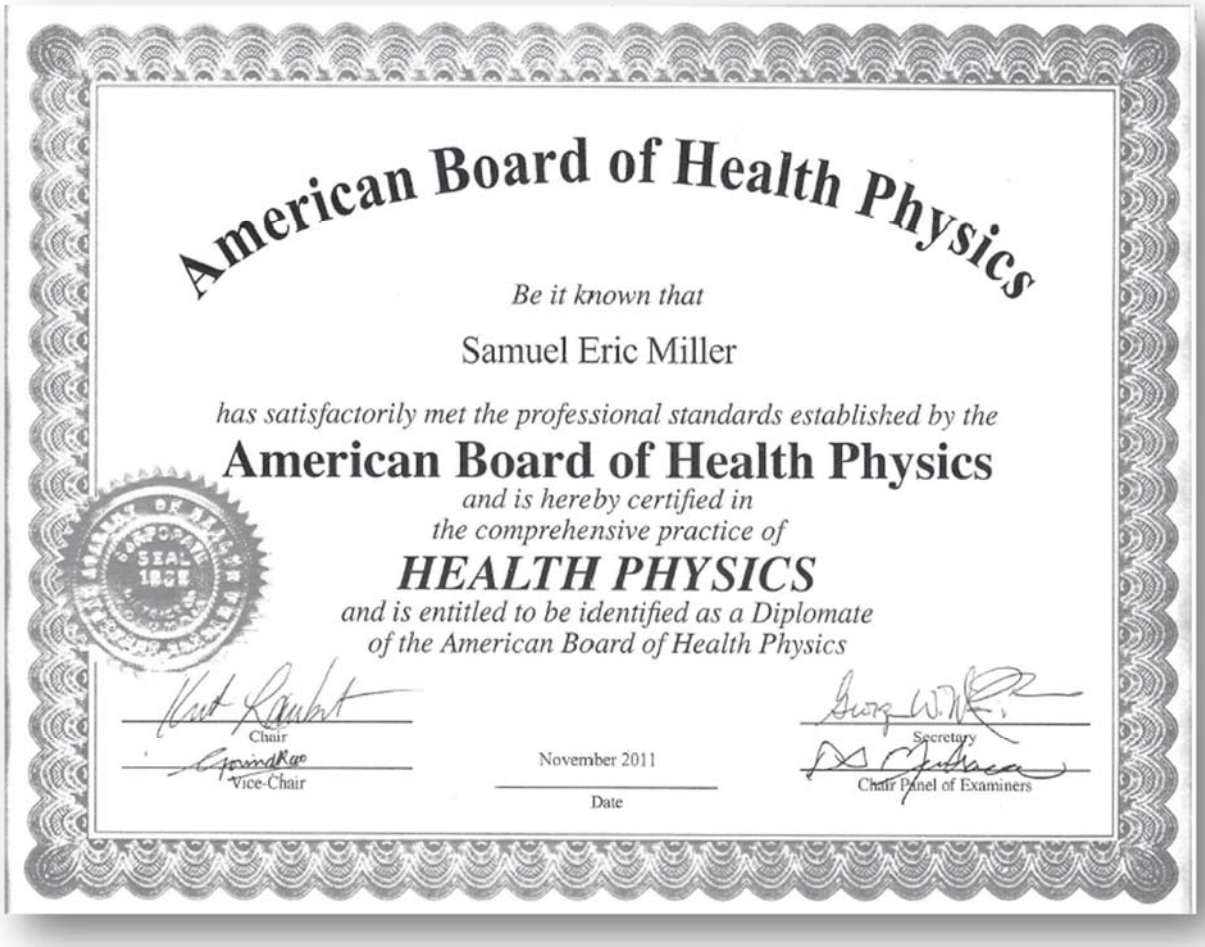


Figure 2. Certification Renewal Letter Through 2019

AAHP

AMERICAN ACADEMY OF HEALTH PHYSICS eMail: AAHP@BurkInc.com
1313 Dolley Madison Blvd. ■ Suite 402 ■ McLean, VA 22101 ■ (703) 790-1745
FAX: (703) 790-2672

August 20, 2015

Samuel Miller
PO Box 69
Mars, PA 16046

Dear CHP:

It is a pleasure to inform you that your application for renewal of certification by the American Board of Health Physics has been approved and your certification thereby renewed. Enclosed is a seal which you may affix to your certificate to show that you are meeting the obligations of an active Certified Health Physicist.

As a result of this action, you will remain on the roster of active Certified Health Physicists (unless you request a change) until December 31, 2019. During this period, you should take the necessary steps to continue your certification, assuming that you remain active as a health physicist. Many CHPs have found it convenient to set up a file to keep track of the functions they are attending that count toward the Continuing Education requirements. This helps avoid problems at the last minute.

In applying for renewal, you acknowledged your commitment to remain active in the field of health physics and acquainted with scientific, technical, and regulatory developments. Should changing circumstances make it impossible or impractical for you to continue this commitment, please advise the Board so that you may be transferred to the Inactive or Emeritus class as appropriate.

The Continuing Certification Program of the American Board is intended to serve the needs of Certified Health Physicists. If you have any suggestions or comments concerning this program, I would appreciate hearing from you.

Congratulations on your successful application for renewal!

Sincerely,

Nancy K. Johnson
Executive Secretary & Program Director

Enclosure: Renewal Seal

AMERICAN BOARD OF HEALTH PHYSICS
RECERTIFIED THRU 2019

Section 8. Training For Individuals Working In or Frequenting Restricted Areas

Authorized Users and radiation workers shall have adequate training and experience to use, possess, or provide services involving licensed materials.

The following individuals are the proposed Authorized Users for this license.

- Andrew Lombardo, CHP
- Eric Laning
- Jason Hubler
- Javid Kelley, CHP
- Jeff Knight
- Alejandro Lopez, CHP
- Darin McEleney
- Brian Miller
- Scott Walnicki, CHP
- Christopher Wedderman

Curriculum Vitae for the above individuals is provided on the following pages.

Before using licensed material, authorized users not listed above will receive the training described in Appendix D in NUREG–1556, Volume 18, Revision 1, 'Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Service Provider Licenses. Specific credentials for the proposed Authorized Users are provided in the following pages.

Before working in the vicinity of licensed materials, personnel will have successfully completed training commensurate with assigned duties.

Section 9. Facilities and Equipment

All jobsites associated with this license will be temporary jobsites. Facilities used and equipment deployed will be highly variable and dependent on the specifics of the project and site.

Typically, small projects may have basic temporary infrastructure such as a small mobile trailer or two to serve various functions. Larger, long duration projects may have a more permanent infrastructure deployed such as mobile office trailers with smaller support structures at control points. Existing structures may be used, if appropriate.

Equipment will vary depending on scope of work. Characterizations primarily use field instruments to collect data. Mobile gamma spectroscopy is deployed when needed. Gamma scanning can use all-terrain vehicles as well. If core sampling is needed, subcontractors specializing in that field are brought in (they are trained to the level required for the areas they will work in; this is the same for any subcontractor brought on site). The same would be true if monitoring wells are necessary (specialized subcontractors).

Remediation equipment on large projects would resemble typical demolition and earth moving equipment, however the process is under much more control and much more methodical than a typical demolition would be. Also, large volume soil projects could may have a soil segregation system deployed.

Section 10. Radiation Safety Program

The Perma-Fix Radiation Protection Program is comprised of several documents, with a master program overview document which is further detailed with operational procedures. Additional procedures may be developed due to specific project considerations.

The Radiation Protection (Safety) Program for Perma-Fix consists of the following documents:

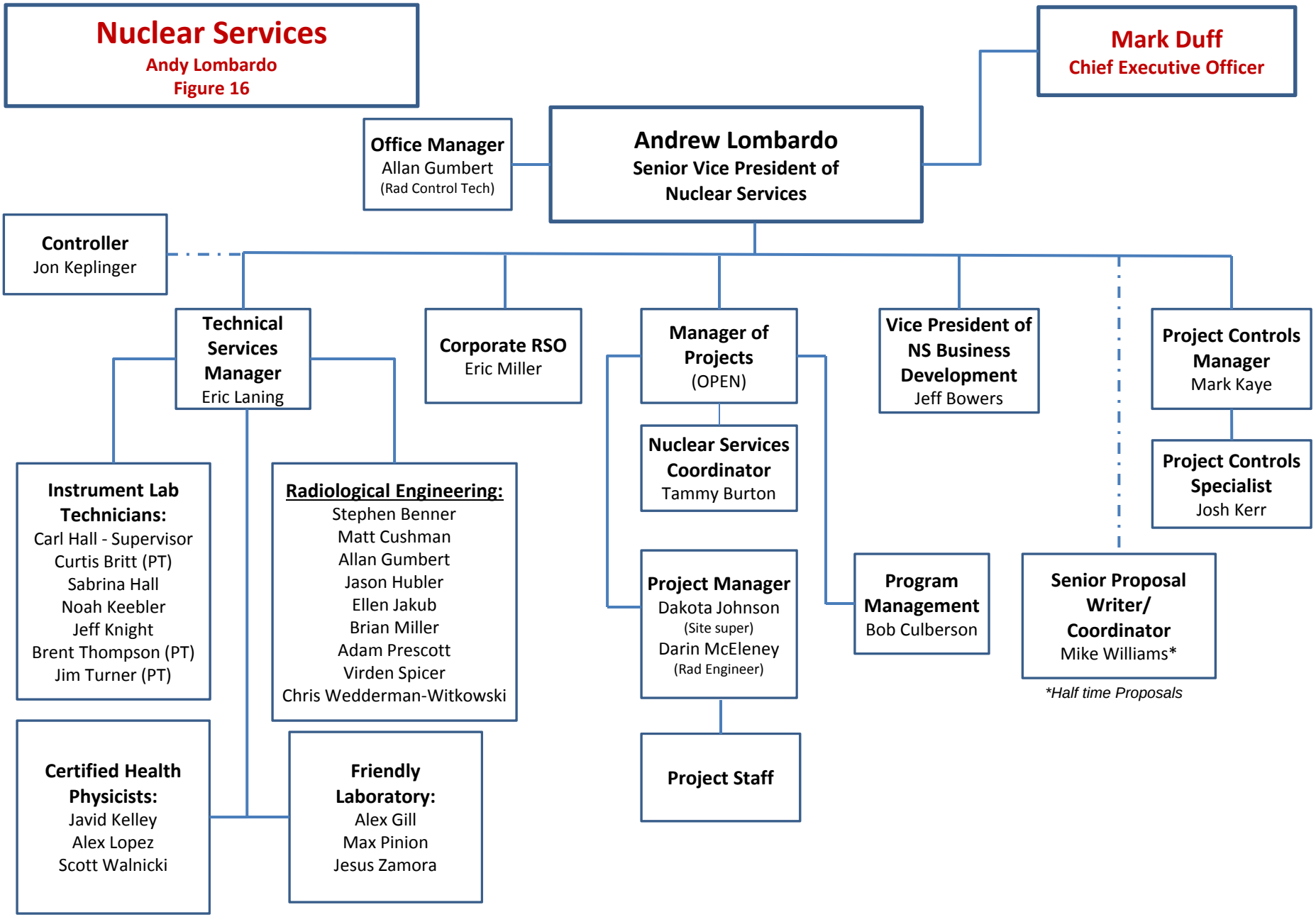
- RP-100, Radiation Protection Program
- RP-101, Access Control
- RP-102, Radiological Postings
- RP-103, Radiation Work Permits
- RP-104, Radiological Surveys
- RP-105, Unrestricted Release Requirements
- RP-106, Survey Documentation and Review
- RP-107, Measurement of Airborne Radioactivity
- RP-108, Count Rate Instruments
- RP-109, Dose Rate Instruments
- RP-110, Operation of Low Volume Air Samplers
- RP-111, Radioactive Materials Control and Waste Management Program
- RP-112, Dosimetry Issue
- RP-113, Embryo-Fetus Program
- RP-114, Control of Radiation Protection Records
- RP-115, Radiation Worker Training
- RP-120, Personnel Survey and Decontamination
- RP-116, Internal Dosimetry

Section 11. Waste Management

Waste Management is a component of the Radiation Protection Program (RP-111, specifically). The general disposition of waste materials will be 'transfer to an authorized recipient'. Additionally, Perma-Fix will limit waste handling activities to those wastes generate by remediation and decommissioning services that are provided. Perma-Fix will NOT take possession of waste generated by the customer as would a commercial waste service provider, or handle wastes Perma-Fix did not generate as a result of decontamination/decommissioning activities.

Nuclear Services

Andy Lombardo
Figure 16



Technical Services Operational Procedure

Radiological Surveys

RP-104

Issue Date: February 21, 2019

Revision Number: 2

Approvals

Eric J. Laning **Technical Services Manager**	02/21/2019 **Date**
Samuel E. Miller, CHP **Corporate Certified Health Physicist**	02/21/2019 **Date**

Revision Log

Item	Section	Revision
Initial Issue	n/a	0
Format update, minor edits	Throughout	1
Revised Section 1, added references (Section 3), added NRC language to Section 10, and updated Attachment 1	1, 3, 10, and 11	2

1.0 Purpose

This procedure establishes consistent methodology for performing radiation and contamination surveys at Perma-Fix Environmental Services (PESI) facilities and projects. Radiological surveys are performed to detect and assess radiological conditions, which may be encountered at PESI or on PESI projects.

This procedure is specific to operations and is applicable to radiological control areas and for release of items and/or equipment that has the potential for contamination.

Release of facilities and/or land areas are not covered by this procedure. Release of facilities and/or land areas must meet the criteria of 10 CFR 20, Subpart E. Specific release criteria based on the guidance of NUREG 1575 (MARSSIM) and NUREG 1757, Volume 2 shall be established for each project to demonstrate compliance with Subpart E.

2.0 Applicability

This procedure is applicable to all personnel trained and qualified to perform radiation and contamination surveys at PESI.

3.0 Reference

- PESI "Radiation Protection Plan (RPP)
- RP-101, "Access Control."
- RP-105, "Unrestricted Release of Requirements."
- RP-106, "Survey Documentation and Review"
- NUREG 1556, Volumes 11 and 18

4.0 Acronyms and Definitions

Contact Dose Rate: A radiation dose rate as measured at contact or within 1/2 inch of the surface being measured.

CPM: Counts per minute

Dose Rate: The quantity of absorbed dose delivered per unit of time.

DPM: Disintegrations per minute

General Area Dose Rate (GA Dose Rate): The highest radiation dose rate accessible to any portion of the whole body measured at a distance of 30 cm (12 inches) from a significant radiation source or combination of sources.

LAW: Large area Wipe (i.e., Masslinn)

MDA: Minimum Detectable Activity

Survey: An evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of ionizing radiation under a specific set of conditions.

5.0 Responsibilities

5.1 Radiation Safety Officer (RSO)

- Implementation of this procedure.
- Ensuring appropriate radiation surveys are performed to measure and document radiation levels.
- Ensuring all completed surveys are adequately reviewed.
- Providing technical direction to the RPTs.

5.2 Radiation Protection Technician (RPT)

- Conducting and documenting radiation surveys.
- Performing all necessary pre / post use operability checks.
- Creating neat, legible, and concise records.

6.0 Prerequisites

Prior to performing a radiation survey, personnel should review previous survey data and familiarize themselves with possible radiological hazards.

7.0 Precautions and Limitations

Personal Protective Equipment (PPE) should be appropriate for the level of contamination expected and shall be in compliance with Site Safety & Health Plan (SSHP), Radiation Work Permits (RWPs), or other work specific controlling documents. At a minimum, gloves or tweezers should be used when handling swipes.

Direct probe surveys may be used to demonstrate compliance with removable limits given in Attachment 1 (Acceptable Surface Contamination Levels), and discussed in RPP-105, "Unrestricted Release of Requirements." When instrumentation is used in this manner it should be capable of achieving the removable minimum detectable count (MDC) requirements.

Instruments used in surveys should be capable of achieving a Minimum Detectable Activity (MDA) that is less than the applicable release limits.

In high background areas it may not be possible to achieve the required survey MDAs for beta / gamma instruments.

8.0 Apparatus

- Radiation and contamination survey instruments

- Smears
- Masslinn
- Personal Protection Equipment

9.0 Records

Survey documentation to be completed per RPP-106, “Survey Documentation and Review.”

Survey forms shall be completed in entirety. This includes attaching printouts, diagrams, or other supporting documentation, appending sequential page and survey tracking numbers, a review for completeness and accuracy, and appending the appropriate signatures of personnel performing the survey and / or analyzing samples.

Once complete, the survey package shall be submitted to the RSO or designee, for final review and approval signature.

Survey documentation shall be maintained according to established RP document control and retention requirements.

10.0 Procedure

10.1 General Instructions

1. Select the survey instrument based on the anticipated hazards and dose rates as determined by a review of previous survey data and ongoing work activities.
2. Perform pre-operational and response checks in accordance with the operating procedures for the instrument.
3. Remove any defective instrument from service.
4. Obtain survey forms and any other material required to document survey results.
5. Contamination Surveys are normally done for alpha emitting constituents. In certain circumstances the RSO can dictate that a survey be performed for both alpha and beta emitting constituents.

10.2 Routine Survey Frequencies

1. Surveys will be conducted and contamination levels will be maintained in accordance with the survey frequencies and contamination levels published in Section 8.10.4 of NUREG-1556, Volume 18, Revision 1, "Consolidated Guidance About Materials Licensees: Program-Specific Guidance about Service Provider Licenses."
2. The RSO shall specify areas for routine monitoring surveys and the frequency of such surveys in accordance with 10.2.1 above. The RSO should maintain a routine survey frequency schedule. The schedule is NOT considered a record, and does not need to be retained.
3. The following areas should be considered for a routine survey on a DAILY basis:

- Access Control Points.
- Designated eating, drinking, and smoking areas within Restricted Areas.
- Radiological Counting Labs and sample prep areas.
- Occupied areas within the Radioactive Materials Area that could be a source of personnel contamination or an intake of radioactive materials (e.g., equipment storage areas).
- Highly occupied areas within the Radioactive Materials Area that could be a source of personnel contamination or an intake of radioactive materials (e.g., the boot change area, equipment floorboards, and workshops).
- Any other area specified by the RSO.

4. The following areas should be considered for a routine survey on a WEEKLY basis:
   - High Traffic areas on the PESI Site.
   - Operating high-efficiency particulate air (HEPA) exhaust areas.
5. The following areas and equipment should be considered for a routine survey on a MONTHLY basis:
   - Occupied offices.
   - Storage areas.
6. The following should be done on an as-needed basis:
   - Incoming Surveys

The RSO can direct that incoming surveys be performed on equipment and materials arriving onto the site. The purpose of an incoming survey is to protect the client from financial liability associated with decontaminating equipment that arrived on the site with existing contamination. The degree of thoroughness of the survey and the requisite cleanliness of the equipment is at the discretion of the RSO.

- Surveys of Materials Vehicles, and Personnel leaving Restricted Areas

All materials, vehicles, and personnel shall perform surveys upon leaving Restricted Areas that have a potential for spread of contamination. The RSO or designee can direct that additional surveys be performed as needed to monitor for spread of contamination.

10.3 Direct Total Contamination Surveys

1. All items being surveyed should appear to be clean prior to being surveyed. To the extent possible, all interior and exterior surfaces should be free from oil and visible dirt. The RSO may dictate the required degree of cleanliness, based on the purpose of the survey and the history of the item being surveyed.
2. Obtain proper instrumentation for the survey. Ensure that the instruments are currently calibrated and have been performance checked prior to the survey.
3. Determine and record the background count in the area to be surveyed. Ensure that the background is representative of the measurement to be taken. Calculate and

record the MDA on the appropriate survey form. Verify the MDA has been calculated for the background at the point of use and is less than the applicable site release criteria. In no case shall the background count time be less than the sample count time.

4. Perform a scanning survey of the item. Concentrate survey measurements on areas most likely to be contaminated. The fraction of the total area scanned is subjective, based on technician experience, an item's use history, and RSO guidance. Typically, the scan frequency is a minimum of 10% of accessible surface areas.
5. Obtain static measurements at locations with the highest potential for contamination. The number of survey points selected is subjective, based on technician experience, an item's use history, and RSO guidance. The count time should be consistent with the MDA calculation. A typical count times is one minute for digital scalers and until the meter reading stabilizes for analog ratemeters.
6. Record and identify all locations surveyed on the appropriate survey form(s). The use of diagrams or sketches is recommended.
   - Beta-Gamma Probe - In high background areas it may not be possible to achieve the required survey MDAs. This should be noted on the survey cover sheet, and should be brought to the attention of the RSO.
   - Alpha Probe - The performance check background may be used in place of background count in the area to be surveyed. A good practice is to check the probe for light leaks or for faulty cables if positive results begin appearing.
7. All measurements shall be reported in units of "dpm" unless otherwise directed by the RSO. Examples include "dpm/100 cm^2," and "dpm/probe."
8. Direct non-smearable hot spots may be averaged over 1 square meter to determine compliance with release levels. If the entire item is less than 1 square meter in area, the entire surface area may be averaged. Bolt on parts of a vehicle should not be considered separate items.
   - The method for determining an average activity is to mark a 1 square meter area on the piece to be surveyed that is roughly centered on the hot spot. Take 1 measurement at the highest activity point of the hot spot. Take 4 (or more) other measurements within the square meter at locations representative of the whole square meter. Record count-rate of each individual measurement. Calculate the activity of all measurements being averaged, including those that are less than the MDA and those with a calculated activity less than zero. Calculate the average of all measurements and record on the survey form.
9. Complete the appropriate survey form.

10.4 Removable Contamination

With RSO approval, removable contamination surveys may be disregarded, provided that direct survey measurements and instrument MDAs are below site removable contamination limits for release.

1. All items being surveyed shall be clean prior to being surveyed. All interior and exterior surfaces should be free from oil and visible dirt. The RSO may dictate the required degree of cleanliness, based on the purpose of the survey and the history of the item being surveyed.
2. Wipe each location of interest with moderate pressure area using a standard 1 ¾-inch swipe. The area wiped should be approximately 100 cm^2. Larger areas may be wiped. It can be inferred that if the wipe meets the required limit for 100 cm^2 when it was actually taken from a larger area, the object will pass the 100 cm^2 criteria. No special documentation is required if the wiped area exceeds 100 cm^2. If the object is smaller than 100 cm^2, the area of the entire object should be wiped.
3. Large area wipes (LAW), also commonly referred to by the trade name "Masslinn" may be used to supplement smear surveys for removable contamination. The use of LAWs should be documented on the survey form with the notation "LAW," or equivalent.
4. Ensure each used swipe (i.e., smear or large area wipe) is handled, stored, and transferred in such a fashion as to prevent to loss of sampled material or cross-contamination with other personnel and other swipe samples.
5. Record the location of each wipe on the appropriate survey form. It is preferable to record the location by circling the sequential number location on a survey map where the wipe was taken.

10.5 Analyzing Swipes

1. Smear samples should be counted using available scintillation or gas-flow proportional laboratory counters, when practicable. Field instruments may be used for smear counting at the discretion of the RSO.
2. LAW samples may be counted using field instruments. The use of laboratory counters is inappropriate.
3. Determine and record the background count-rate. Calculate and record the MDA on the appropriate survey form. Verify the MDA has been calculated for the background at the point of use and is less than the applicable site release criteria. In no case shall the background count time be less than the sample count time.
4. Remove each swipe from the paper backing, as needed. The use of tweezers is recommended.
5. Place the swipe in the counter and close.

6. Count for the designated counting time.
7. Record the gross result under cpm in the appropriate column (either alpha or beta-gamma) of the survey form.
8. Calculate and record the activity. Removable contamination survey results shall be reported in units of "dpm" unless otherwise directed by the RSO. Examples include "dpm/100 cm2" and "dpm/LAW."

10.6 Gamma Surveys

1. Routine gamma surveys may be used to detect the gradual buildup of gamma emitting contaminated materials in soils. This may occur at heavy equipment, heavy traffic, or egress points from contaminated areas. Normal uncontaminated trash should be gamma surveyed prior to leaving the site.
2. Obtain proper instrumentation for the survey. Ensure that the instruments are currently calibrated and have been performance checked prior to the survey.
3. Perform the survey with the appropriate detector using techniques specified by the RSO.
4. Complete the appropriate survey form.

10.7 Gamma Dose Rate Surveys

1. Obtain proper instrumentation. Ensure that the instrument is currently calibrated and has been performance checked prior to the survey.
2. When entering areas with known radiation levels, select the appropriate scale.
   - Observe the meters as you enter the area. If necessary, change scales to maintain on-scale reading.
3. Perform gamma dose rate surveys as follows:
   - Monitor dose rates from the lower thighs to head level, recording the highest level as General Area Dose Rate.
   - Monitor dose rates 30 cm (12 inches) from a significant radiation source recording the highest level as General Area Dose Rate.
   - Additional measurements are necessary to determine Transport Index for shipping per procedure PP-8-810, "Conveyance Survey."
   - If dose rate sources are predominantly from overhead, then denote on survey.
   - Perform contact gamma dose rate measurements with the detector within ½-inch of the surface to be surveyed.
   - Additional measurement locations should be clearly identified in survey documentation.
   - Record all survey results on the appropriate survey form.

10.8 Calculations

Sample activity

$$DPM = \frac{\left(\frac{TotalSampleCounts}{SampleCountTime}\right) - \left(\frac{TotalBkgCounts}{BkgCountTime}\right)}{(E)\,(A)}$$

where

E = Instrument Efficiency
A = Area correction factor, if applicable

Minimum Detectable Activity (MDA)

The following MDA equation is to be used for a background count time equal to the sample count time.

$$MDA = \left(\frac{(3 + 4.65\sqrt{B})}{(E)(A)(T_S)}\right)$$

where:

Ts = Sample count time
E = Instrument efficiency
A = Area correction factor, if applicable
B = Background cpm

The following equation is to be used for a background count time equal to 5 or more times the sample count time:

$$MDA = \left(\frac{(3 + 3.29\sqrt{B})}{(E)(A)(T_S)}\right)$$

11.0 Attachments

- Attachment 1, Acceptable Surface Contamination Levels for Items and Equipment

Attachment 1

Acceptable Surface Contamination Levels for Items and Equipment

Nuclide[1]	Average[2, 3]	Maximum[2, 4]	Removable[2, 5]
U-nat, U-235, U-238, and associated decay products	83.3 Bq/100 cm^2 (5,000 dpm/100 cm^2)	250 Bq/100 cm^2 (15,000 dpm /100 cm^2)	16.7 Bq/100 cm^2 (1,000 dpm/100 cm^2)
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	1.7 Bq/100 cm^2 (100 dpm/100 cm^2)	5.0 Bq/100 cm^2 (300 dpm/100 cm^2)	0.3 Bq/100 cm^2 (20 dpm/100 cm^2)
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	16.7 Bq/100 cm^2 (1,000 dpm/100 cm^2)	50.0 Bq/100 cm^2 (3,000 dpm/100 cm^2)	3.3 Bq/100 cm^2 (200 dpm/100 cm^2)
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	83.3 Bq/100 cm^2 (5,000 dpm/100 cm^2)	250 Bq/100 cm^2 (15,000 dpm /100 cm^2)	16.7 Bq/100 cm^2 (1,000 dpm/100 cm^2)

[1]Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.
[2]As used in this table, disintegrations per minute (dpm) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
[3]Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.
[4]The maximum contamination level applies to an area of not more than 100 square centimeters (cm^2).
[5]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

**Source: NUREG 1556, Volume 11, Appendix L, 2017.*

Note: The acceptable surface contamination levels for Th-nat will be used unless subsequent sampling indicate the presence Ra-226, Ra-228, Th-230, Pa-231, or Ac-227 in concentrations greater than that of the parent nuclide. The RSO will determine if contamination limits should be modified for a specific activity or location based on available data.

Technical Services Operational Procedure

Unrestricted Release Requirements for Items and Equipment

RP-105

Issue Date: February 22, 2019

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Approvals

Eric J. Laning **Technical Services Manager**	02/22/2019 **Date**
Samuel E. Miller, CHP **Corporate Certified Health Physicist**	02/22/2019 **Date**

Revision Log

Item	Section	Revision
Initial Issue	n/a	0
Format update, minor edits	Throughout	1
Added clarifying language in 2, corrected references in 10, and removed redundant table from 11.	2, 10, and 11	2

1.0 Purpose

This project procedure describes the method of surveying equipment, materials, or vehicles for release for unrestricted use at Perma-Fix Environmental Services (PESI) facilities and projects.

2.0 Applicability

This project procedure applies to all site personnel responsible for the unrestricted release of equipment and materials used in a Restricted Area. This procedure is not used for vehicles that are transporting radioactive materials. Vehicles conveying radioactive materials also must follow USDOT Regulation 49 CFR Part 173. This procedure is not used for release of buildings or land areas. Release of buildings or land areas is project-specific and requires development of project-specific release criteria based on guidance from NUREG 1575 (MARSSIM) and NUREG 1757, Volume 2.

3.0 Reference

- PESI "Radiation Protection Plan (RPP)"
- RP-104, "Radiological Surveys"

4.0 Acronyms and Definitions

CPM: Counts per minute

DPM: Disintegrations per minute

Equipment and Material: Equipment and material refers to any item used in a Restricted Area to support work activities (i.e., hand tools, heavy equipment, plastic, etc.).

LAW: Large Area Wipe (i.e., Masslinn)

Unrestricted Release: Release of equipment and / or material to the general public

5.0 Responsibilities

5.1 Radiation Safety Officer (RSO)

- Ensuring adequate staffing, facilities, and equipment are available to perform the survey tasks assigned to Radiation Protection personnel.
- Approving purchase or acquisition of equipment necessary to perform surveys.
- Ensuring that surveys take place in appropriately posted areas.
- Reviewing results of survey data as required to determine acceptability for release of items.
- Dispositioning materials that cannot be released based on survey results.
- Investigating and initiating corrective actions for the improper release of radiologically contaminated material.

5.2 Radiation Protection Technician (RPT)

- Identify equipment and material to be surveyed for unrestricted release.
- Performing and documenting contamination surveys.
- Posting, securing and controlling radioactive material that cannot be released.
- Releasing material in accordance with this and implementing procedures.

5.3 Project Personnel

- Adhering to all policies, procedures and other instructions, verbal and written, regarding control and minimization of radioactive material and contaminated material.
- Reporting any concerns about the control and minimization of radioactive material and contaminated material to supervision.
- Maintaining good housekeeping at work sites and assisting in preventing the buildup and spread of contamination.

6.0 Prerequisites

Appropriately calibrated and responsed instrumentation is required.

7.0 Precautions and Limitations

The RSO or designee, shall review all survey data prior to the release from the Controlled Area.

8.0 Apparatus

- Alpha Detector
- Beta-Gamma Detector
- Portable Ratemeter / Scaler
- Scintillation or Gas-Flow Proportional Lab Alpha / Beta Counter
- Survey forms
- Cloth smears
- Masslinn™ type cloths

9.0 Records

Survey forms shall be completed in entirety. This includes attaching printouts, diagrams, or other supporting documentation, appending sequential page and survey tracking numbers, a review for completeness and accuracy, and appending the appropriate signatures of personnel performing the survey and / or analyzing samples.

Once complete, the survey package shall be submitted to the RSO or designee, for final review and approval signature.

Survey documentation shall be maintained according to established RP document control and retention requirements.

10.0 Procedure

10.1 General Instructions

Prior to conducting any surveys, ensure that all survey instrumentation has been response checked, is in operating within control limits and has not been removed from service. Response checks shall be performed daily.

Background measurements are to be taken prior to use at the point of use. The background count time shall be greater than or equal to the sample count time.

Verify that the MDA has been calculated for the background at the point of use and is less than the applicable site release criteria. Refer to RPP-104, "Radiological Surveys," for the MDA calculation.

Survey results are converted from counts per minute (cpm) to disintegrations per minute (dpm). A sample "cpm to dpm" calculation is attached for review and use at the end of this procedure.

10.2 Release of Items for Unrestricted Use

1. Surveys for both total and removable contamination shall be made in accordance with Sections 10.3 and 10.4 (below) on all equipment, materials or vehicles which have either been in a Restricted Area or which may be potentially contaminated.
2. With RSO approval, removable contamination surveys may be disregarded, provided that direct survey measurements and instrument MDAs are below site removable contamination limits for release.
3. RP personnel will determine which items located outside a Restricted Area may be potentially contaminated based on their use, site history, or previous survey data. The potential for these objects to have become contaminated by airborne radioactive materials must be considered. This could include items that are used to support site activities, such as office equipment, cleaning devices, furniture, trailers, etc., even though direct contact may not have occurred.
4. Items which have a potential for internal contamination of inaccessible surfaces shall be evaluated by the RSO or designee prior to release.
5. All items to be released shall be surveyed in such a manner as to fully demonstrate that accessible surfaces comply with the surface contamination release criteria specified in RP-104, "Radiological Surveys", Attachment 1.

6. Items that do not meet release criteria shall be decontaminated until release criteria is met or shall be disposed of as radiological waste.

7. Air intakes / filters on motorized equipment should be surveyed as an indicator of potential internal contamination. Notify the RSO or designee if air intake / filter surfaces indicate the presence of contamination. Contaminated air filters shall be removed and disposed of as radiological waste.

8. To the extent practicable, visible dirt and mud or other material shall be removed from surfaces prior to survey.

9. The RSO or designee, shall review all survey data prior to the release from the Controlled Area.

10.3 Direct Surveys Scans and Static Measurements

1. Surfaces shall be dry and cleaned, to the extent practicable prior to performing direct alpha measurements.

2. The RSO may authorize the short-term relocation or staging of equipment / vehicles for direct measurements in any portion of the Controlled Area. This is provided that the item has been verified to be clean of removable contamination prior to removal from a Restricted Area and fixed contamination producing general area dose rates greater than 0.2 mrem/hr is not anticipated.

3. Alpha detectors should be placed within ¼-inch of the surface to be surveyed. Beta detectors should be placed within ½-inch of the surface to be surveyed. Use caution to not contaminate or damage the detector surface.

4. Perform a scanning survey of the item. Concentrate survey measurements on areas most likely to be contaminated. The fraction of the total area scanned is subjective, based on technician experience, an item's use history, and RSO guidance. Typically, the scan frequency is a minimum of 10% of accessible surface areas.

5. Obtain static measurements at locations with the highest potential for contamination. The number of survey points selected is subjective, based on technician experience, an item's use history, and RSO guidance.

6. Static measurement count times shall be appropriate for desired MDAs. Typical count times are one minute for digital scalers and until the meter reading stabilizes for analog ratemeters.

7. Record and identify all locations surveyed on the appropriate survey form(s). The use of diagrams or sketches is recommended.

8. All measurements shall be reported in units of "dpm" unless otherwise directed by the RSO. Examples include "dpm/100 cm²" and "dpm/probe."

10.4 Removable Contamination Surveys

1. "Cloth" smears shall be used for smear surveys.
2. A notation (e.g., smear number, date, time, location, etc.) should be made on the smear envelopes to ensure proper smear tracking. Smears may also be numbered using a pen or marker prior to use.
3. Using moderate pressure, swipe an area of 100 cm² (4-inch square area or equivalent) of the surface at the selected location. Smear surveys should be performed at the same location that direct surveys were performed.
4. Large Area Wipes (LAW), also commonly referred to by the trade name "Masslinn," may be used to supplement smear surveys for removable contamination. The use of LAWs should be documented on the survey form with the notation "LAW" or equivalent.
5. Ensure each used swipe (i.e., smear or large area wipe) is handled, stored, and transferred in such a fashion as to prevent to loss of sampled material or cross-contamination with other personnel and other swipe samples.
6. Smear samples should be counted using available scintillation or gas-flow proportional laboratory counters, when practicable. Field instruments may be used for smear counting at the discretion of the RSO.
7. LAW samples may be counted using field instruments. The use of laboratory counters is inappropriate.
8. Removable contamination survey results shall be reported in units of "dpm" unless otherwise directed by the RSO. Examples include "dpm/100cm^2" and "dpm/LAW."
9. Ensure all results are documented on the appropriate survey form. Lab printouts may be attached and referenced on the survey form.

10.5 Calculations

MDA and Sample Activity formulas are located in RPP-104, "Radiological Surveys."

11.0 Attachment

None

Technical Services Operational Procedure

Dosimetry Issue

RP-112

Issue Date: February 28, 2019

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Approvals

Eric J. Laning **Technical Services Manager**	02/28/2019 **Date**
Samuel E. Miller, CHP **Corporate Certified Health Physicist**	02/28/2019 **Date**

Revision Log

Item	Section	Revision
Initial Issue	n/a	0
Format update, minor edits	Throughout	1
Added clarifying paragraph for dosimetry issue	1	2

1.0 Purpose

This procedure provides consistent methodology for the issuance of radiation monitoring dosimetry devices at Perma-Fix Environmental Services (PESI) facilities and projects.

This procedure describes the requirements for the issuance of standard dosimetry devices to visitors and radiation workers accessing restricted areas of the remediation project.

The Thermoluminescent Dosimeter (TLD) normally provides the dose of record, while the Self Reading Dosimeter (SRD) provides a means of deep dose tracking prior to TLD processing, as well as verifying the reasonableness of the results.

Certain workers on a project may not be required to wear dosimetry, based on their specific project responsibilities (clerical staff or other support staff not entering the controlled areas). RSO discretion will be used to determine dosimetry need for support staff not entering controlled areas.

2.0 Applicability

This procedure applies to all personnel issuing dosimetry devices.

3.0 Reference

- 10 CFR 20
- ANSI N13.15 1985
- PESI Radiation Protect Program (RPP)

4.0 Acronyms and Definitions

Radiation Worker: An individual who accesses any Radiological Area unescorted. Radiation Workers shall have successfully completed all requisite medical and training requirements for performing work in Radiological Areas.

Radiological Area: Any area within a Restricted Area which require posting as a Radiation Area, Contamination Area, Airborne Radioactivity Area, High Contamination Area, or High Radiation Area.

Restricted Area: An area to which access is limited to protect individuals against undue risks from exposure to radiation, radioactive materials, and chemical contaminants. All posted radiological or chemical areas are Restricted Areas.

Self-Reading Dosimeter (SRD): A radiation monitoring device (either electrostatic or electronic) that can be read by the wearer at any time and indicates total accumulated dose.

Thermoluminescent Dosimeter (TLD): An integrating detector where radiation energy is absorbed (trapped) and can be read out later by thermal excitation of the detector (ANSI N13.15 1985).

Visitor: An individual who accesses the project site for purposes other than working (e.g., tour the site or meet with an individual).

5.0 Responsibilities

5.1 Radiation Safety Officer (RSO)

- The RSO is responsible for implementing this procedure.

5.2 Radiation Protection Technicians (RPTs)

- RPTs are responsible for the performance of this procedure.

5.3 Project Personnel

- Provide the RP Dosimetry Group with required personal information to track and report radiation exposures (e.g., Social Security/ID Number, Address, Date of Birth, Exposure History from Other Sites, etc.)
- Complying with Radiation Protection Program (RPP) requirements, including dosimetry care & use requirements identified in Attachment 1.

6.0 Prerequisites

Individuals who are planning to visit other radiologically monitored facilities while being monitored at PESI shall notify RSO prior to going to the other monitored facility(s).

7.0 Precautions and Limitations

- The NRC Form-4 for individuals with current year recorded or estimated exposures from other site(s) shall be reviewed by the RSO prior to issuance of dosimetry. The purpose of this review is to ensure that individuals would not exceed the quarterly exposure limit of 1.25 rem, or the annual exposure limit of 5 rem Total Effective Dose Equivalent.
- Any individual entering a Restricted Area, or performing work under a Radiation Work Permit shall wear dosimetry.
- TLDs will be changed out on a quarterly basis.
- Employee personal information shall be accessible only to personnel authorized by the RSO, SSHO, or Project Manager.

8.0 Apparatus

- Self-Reading Dosimeters
- Thermoluminescent Dosimeters

9.0 Records

- Occupational External Radiation Exposure History (NRC Form-4)
- TLD Issue Form (e.g., TLD Processor Chain-of-Custody)
- TLD Use & Care Acknowledgement

10.0 Procedure

10.1 Dosimetry Issuance for Visitors

- Dosimetry is issued to escorted visitors accessing Restricted Areas, and as required by the RSO.

10.2 Dosimetry Issuance for Radiation Workers

1. Ensure that Radiation Worker Training has been successfully completed by the worker prior to dosimetry issue.
2. Ensure the individual has completed an NRC Form 4 "Occupational Radiation Exposure History."
3. Ensure the individual has completed the "TLD Use & Care Acknowledgement" form.
4. Ensure the worker understands the administrative dose limit and the fraction remaining (available dose) for the current year.
5. Review all other paperwork for completeness and legibility.
6. Issue a TLD to the individual by recording the pertinent information on the TLD Issue Form.

11.0 Attachment

Attachments may be revised without formal review of this procedure and are attached as examples only. Please contact the RSO for a current copy of these attachment(s).

- Attachment 1, Dosimetry Care & Use Acknowledgement Form

Attachment 1, Dosimetry Care & Use Acknowledgement Form

1. Use only dosimetry specifically issued to you.
2. Verify that you are wearing the appropriate dosimetry prior to entering Restricted Areas.
3. Unless otherwise directed by the RSO, Dosimetry shall be worn facing out, and attached to clothing/lanyard on the front of the upper torso. Do not attach dosimetry to waist belt loops, safety glasses, or hard hats.
4. Dosimetry shall be stored in the designated location during non-work periods.
5. Dosimetry shall not be worn off-site or to another radiological facility unless specifically authorized by RSO.
6. If dosimetry is misplaced or damaged, perform the following:

    a. Place work in a safe condition and exit the radiological area;
    b. Report the lost dosimeter to RP Personnel;
    c. RP shall initiate a Radiological Occurrence Report (ROR); and
    d. Obtain RSO authorization to issue replacement dosimetry.

7. Do not tamper with or expose dosimetry to excessive heat, security x-rays, or medical radiation sources. Report instances of tampering or unnecessary exposure to the RSO immediately.

Dosimetry is used to monitor your exposure as required by Federal Law and Company Policy. Failure to comply with these or other Radiation Protection Program requirements implemented for your safety, and for the protection of the public and environment may result in revocation of Radiation Worker Training credentials and Restricted Area access privileges.

I have read and understood the information presented and will comply with Radiation Protection Program requirements as established in the FMSS Site Safety & Health Plan.

_____ _____

Signature Date

Technical Services Operational Procedure

Radiation Worker Training

RP-115

Issue Date: February 6, 2019

Revision Number: 2

Approvals

Eric J. Laning **Technical Services Manager**	02/06/2019 **Date**
Samuel E. Miller, CHP **Corporate Certified Health Physicist**	02/06/2019 **Date**

Revision Log

Item	Section	Revision
Initial Issue	n/a	0
Format update, minor edits	Throughout	1
Updated refresher training frequency to annual	7.0	2

1.0 Purpose

The purpose of this procedure is to provide consistent methodology for implementing Radiation Worker Training (RWT) at Perma-Fix Environmental Services, Inc. (PESI) Sites.

Successful completion of the RWT will qualify employees for unescorted access into Restricted Areas, provided other access requirements are met as specified in procedure RP-101, "Access Control".

Qualified individuals with a demonstrated knowledge of radiological concepts should provide RWT instruction. The RSO approves RWT Instructors.

2.0 Applicability

RWT is applicable to ALL PESI employees and subcontractors who perform work within Restricted Areas.

3.0 Reference

- 10 CFR 20
- PESI Radiation Protection Program (RPP)
- RP-101, Access Control

4.0 Acronyms and Definitions

Controlled Area: An area under the control of PESI management area to which access is limited by Project Management.

Practical Factors: The "performance-based" portion of RWT that focuses on demonstration and evaluation of safe radiation worker practices. Particular emphasis is given to the donning and doffing of protective clothing and self-monitoring for radioactive contamination.

Radiation Worker: An individual who accesses any Restricted Area unescorted. Radiation Workers shall have successfully completed all requisite medical and training requirements for performing work in Restricted Areas as specified this procedure.

Restricted Area: An area to which access is limited to protect individuals against undue risks from exposure to radiation, radioactive materials, and chemical contaminants. All posted radiological or chemical areas are Restricted Areas.

5.0 Responsibilities

The RSO is responsible for implementation of this procedure and approval of course content and materials.

6.0 Prerequisites

Prior to obtaining RWT qualification, individuals shall have submitted evidence of completion of other medical / training requirements established in the PESI Site Safety & Health Plan.

7.0 Precautions and Limitations

- RWT shall be required on an annual basis. Active site personnel may be granted up to a 90-day extension beyond the RWT anniversary date, with RSO approval.
- Individuals must have documented evidence of completing both academic and Practical Factors objectives before being allowed to work unsupervised in a Restricted Area.
- Personnel may be allowed to challenge the academic examination portion of this training by passing the examination.
- Annual re-qualification of the Practical Factors portion of RWT may be by observation of actual work practices.
- A minimum passing score on the RWT exam and Practical Factors is 80%.
- Trained emergency response personnel (Fire Department, Ambulance/EMT, Law Enforcement) responding to on-site emergencies are exempt from this training.
- The RSO may waive the classroom portion of RWT provided the individual is able to show documented proof of successful completion of an equivalent level of training from another facility during the previous 12-month period.
- RP technicians are exempt from this training.

8.0 Apparatus

None

9.0 Records

The Site Safety & Health Group shall maintain a copy of the RWT certificate or attendance roster in each employee file.

10.0 Procedure

10.1 RWT Classroom Training

1. At a minimum, the following topics shall be discussed during RWT:
   - Fundamental of Radioactivity
   - Prenatal Exposure Risks
   - Shaw Group Radiation Protection Plan
   - Site Specific Radiological Hazards / contaminants
   - ALARA Concepts
   - Radiological Postings / Barriers
   - Emergency Response / Evacuation Routes

2. Provide the trainees with a copy of the course materials and all pertinent training forms.
3. Present the course material including overhead slides.
4. Lecture on the associated concepts.
5. Answer any questions the trainees may have.
6. Review the material with the trainees prior to administering the exam.
7. Administer the RWT exam.
8. The proctor will grade the test and review incorrect answers with the trainee.
9. Submit the completed exam to RP Document Control.

10.2 RWT Practical Factors Training

1. At a minimum, the following topics shall be discussed as part of Practical Factors training:
   - Proper PPE donning and doffing procedures
   - Use of RWP
   - Recognition of postings
   - Utilization of ALARA concepts (time, distance, shielding)
   - Use of frisking equipment and proper frisking techniques
2. Develop a mock-up area from which trainees may be evaluated. Include the following:
   - RWP
   - Radiological postings
   - Ropes / barriers
   - Radiological hazards
   - Whole body frisking instrument
   - In-use work areas may be used, with RSO approval, and provided that airborne generating activities are not underway.
3. Introduce the practical training by relating it back to the academics the trainees have just completed.
4. Explain what will be expected of each trainee.
5. Demonstrate how to perform the tasks, talk about good practices while doing so.
6. Allow the participants to practice as you coach.
7. Proceed to the Mock-Up area and begin Practical Factors evaluation.
8. Complete a Practical Factors Evaluation Form.
9. Review evaluation results with the trainee and forward form to RP Document Control.

11.0 Attachment

None

Technical Services Operational Procedure

Internal Dosimetry

RP-116

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Approvals

Eric J. Laning **Technical Services Manager**	02/28/2019 **Date**
Samuel E. Miller, CHP **Corporate Certified Health Physicist**	02/28/2019 **Date**

Revision Log

Item	Section	Revision
Initial Issue	n/a	0
Format update, minor edits	Throughout	1

1.0 Purpose

This procedure covers the processes for monitoring, assessing, and determining internal dose to Perma-Fix personnel using bioassay techniques. The term “bioassay” includes analysis of urine samples, and other means for detecting internalized radioactive material.

2.0 Applicability

The internal dosimetry program consists of three elements:

- An air-monitoring program, using portable and/or fixed devices.
- An individual monitoring program, using indirect bioassay, and personal breathing zone air monitoring, as appropriate.
- A dose evaluation program that evaluates the data collected by the air and individual monitoring programs to determine the magnitude of the individual doses.

In the work planning process, the Radiation Protection (RP) Organization determines internal dosimetry program requirements necessary for the performance of radiological work. The internal dosimetry program requirements are included on the appropriate Radiological Work Permits (RWP). Individuals performing radiological work are required to comply with the requirements on the appropriate RWP (e.g., requirements for individuals can include lapel air sampling, confirmatory bioassay, and/or Dosimetry bioassay).

3.0 Reference

- NUREG 1556, Volume 18
- 10 CFR Part 20

4.0 Acronyms and Definitions

Confirmatory Bioassay: Routinely scheduled bioassays for individuals who perform activities that are not likely to result in internal exposures that exceed 50 mrem committed effective dose equivalent (CEDE). Confirmatory bioassays are performed on a representative number of individuals to validate the engineering controls and Radiation Protection that are implemented in the field.

Dosimetry Bioassay: Routinely scheduled bioassays for all individuals who perform activities that are likely to result in internal exposures that exceed 50 mrem CEDE.

Special Bioassay: Bioassay that is performed because field indicators identify an individual as meeting a monitoring trigger level.

5.0 Responsibilities

5.1 Radiation Safety Officer (RSO)

- Ensuring adequate staffing, facilities, and equipment are available to perform the tasks assigned to Radiation Protection personnel.
- Approving purchase or acquisition of equipment necessary to conduct required monitoring.
- Reviewing results of monitoring data as required.
- Determines bioassay requirements for radiological area.
- Ensures bioassay requirements are correctly documented on the appropriate RWP.
- Coordinates the scheduling of baseline, routine, follow-up, ending assignment, and termination bioassay samples with the worker.
- Provides advance notification for routine bioassay samples to an individual.
- Provides notification of a delinquent status for a bioassay schedule to an individual.
- Investigates potential internal exposures [e.g., incidents and Derived Air Concentration (DAC)-hour tracking].
- Establishes and informs the individual of any work restrictions imposed upon the individual during exposure evaluations or due to identified internal radioactive material depositions.
- Reviews and evaluates reports of bioassay and dose determinations.
- Inform affected individuals of bioassay results.

5.2 Radiation Protection Technician (RPT)

- Writes RWPs.
- Performs air sampling duties (collects samples, counts samples, reports results to RSO).

5.3 Project Personnel

- Adhering to all policies, procedures and other instructions, verbal and written, regarding control and minimization of radioactive material and contaminated material.
- Reporting any concerns about the control and minimization of radioactive material and contaminated material to supervision.
- Maintaining good housekeeping at work sites and assisting in preventing the buildup and spread of contamination.

6.0 Prerequisites

None

7.0 Precautions and Limitations

- Individuals entering a radiological area under an RWP are required to comply with the RWP bioassay requirements before entering the work area. Individuals attest their compliance by signing the RWP.
- A bioassay is considered complete when the individual submits the completed kit as instructed.
- If radiological area access restrictions are imposed due to potential or confirmed internal exposure, the restrictions shall remain in effect until the internal exposure has been quantified and the RSO has removed the restriction.
- Personnel dosimetry records and associated data are considered sensitive information and are not available to individuals who do not have a need to know.
- Bioassay requirements specified on the RWP are for general employees with Radiation (Rad) Worker training.
- Since the Dosimetry Bioassay requirement is more stringent than the Confirmatory Bioassay requirement, individuals who comply with a Dosimetry Bioassay schedule are considered to meet a Confirmatory Bioassay schedule of the same type.

8.0 Apparatus

None

9.0 Records

Records generated as a result of an internal exposure shall be maintained.

10.0 Procedure

10.1 Establishing Bioassay Schedules for Individuals

Project Supervisors are responsible for ensuring their personnel are qualified to enter radiological areas according to the applicable RWP. The RWP bioassay requirements are available from the following sources:

- The RWP,
- Project Management, and
- The Radiation Protection Organization (RPO).

10.2 Monitoring Personnel for Internal Exposure

10.2.1 The RSO shall schedule individuals for Baseline, Routine, Follow-up, Ending Assignment, and Termination measurements as necessary to maintain compliance with the individual's bioassay schedules.

10.2.2 Refer to Appendix A for a detailed description of the processes for obtaining bioassays, which are enumerated below:

a. The individual submits the requested bioassay.

b. The RSO informs individuals of scheduled bioassays that are not received.

c. The RSO evaluates the bioassay results.

d. The RSO notifies the individual that one of the following conditions applies:

1) The bioassay results do not warrant follow-up sampling.

2) The bioassay results warrant follow-up sampling.

10.3 Complying with a Bioassay Schedule

10.3.1 The RSO maintains the Database of bioassay schedules for PERMA-FIX personnel. The RSO periodically determines the status of active bioassay schedules by reviewing the schedules and sample data.

10.3.2 All routine bioassay samples are given a grace period. The grace period is a combination of a “due period” and a “probation period.”

a. The due period is the calendar month in which the routine sample is scheduled.

b. The probation period is the calendar month that immediately follows the due period.

10.3.3 The status of a bioassay schedule is one of the following:

a. A status is assigned to schedules where a bioassay sample was obtained and the criteria of Late or Delinquent is not met.

b. A late status is assigned to schedules where a bioassay sample was not obtained during the due period. Late bioassays warrant attention to make sure they are obtained during the probation period.

c. A delinquent status is assigned to schedules where a bioassay sample was not obtained during the probation period. Delinquent schedules result in a work restriction for the worker until the bioassay is obtained.

10.3.4 The RSO shall issue work restrictions for the individual whose bioassay schedule is in a delinquent status.

10.3.5 The RSO routinely issues reports that contain bioassay schedule information for personnel. The report is issued to Supervisors each quarter.

10.4 Investigation of Potential Intake of Radioactive Material

The RSO investigates potential intakes of radioactive material.

10.5 Setting/Removing Work Restrictions

10.5.1 The RSO shall set a work restriction for an individual who:

a. Is identified as being delinquent with his/her assigned bioassay schedule.

b. Is being evaluated for internal exposure because of an incident/event.

10.5.2 Immediate Supervisors limit the individual's access as described in the work restriction.

10.5.3 The RSO shall report the individual as delinquent until action to lift the work restriction has been completed.

10.5.4 The RSO shall track work restrictions with a log containing the individual's name, the date the work restriction was initiated, the work restriction, the action necessary to lift the work restriction, and the date the work restriction was lifted.

10.6 Dose Evaluation

The RSO shall evaluate internal exposure for an employee.

10.7 Consideration of Non-Occupational Dose

10.7.1 Employees shall notify the RSO when they are undergoing medical treatment/testing involving the administration of radioisotopes.

10.7.2 The RSO tracks identified medically administered radioisotopes.

10.7.3 The RSO obtains and logs the following information from the employee:

a. Date and time of the administration.

b. Specific radioisotopes administered.

c. Total activity of each radioisotope.

10.7.4 The RSO instructs the employee regarding the proper disposition of any assigned personnel dosimetry. If necessary, a work restriction shall be initiated.

10.7.5 The RSO shall identify and log a date at which the radioisotope should be decayed. The date will be identified to the employee.

11.0 Attachments

Attachment 1. Processes for Urinalysis Bioassay Samples

Attachment 2. Bioassay Sample Routing Log

Attachment 1. Process for Urinalysis Bioassay Samples

1.0 URINALYSIS BIOASSAY BASELINE SAMPLING PROCESS

- The RSO establishes a bioassay schedule for an individual (Step 5.0, 1).

Note: The RSO may use the Personal Radiation Exposure History form to document the initiation of a bioassay schedule for a newly hired individual.

- The RSO schedules the baseline sample in radiation exposure.
- The RSO coordinates delivery of the sample kit. The RSO may hand deliver the baseline sample kit to the individual/Immediate Supervisor, along with directions for returning the kit.
- The individual completes the sample kit according to the instructions provided with the sample kit and returns the kit to the RSO who sets it out for pick up. (If the kit was hand delivered, the individual will return the kit according to the directions provided at the time of delivery.)
- The RSO arranges the retrieval of the sample kit.

2.0 URINALYSIS BIOASSAY ROUTINE SAMPLING PROCESS

Follow the same procedure steps in Section 1.0 above.

3.0 URINALYSIS BIOASSAY FOLLOW-UP SAMPLING PROCESS

Follow the same procedure steps in Section 1.0 above.

4.0 URINALYSIS BIOASSAY ENDING ASSIGNMENT SAMPLING PROCESS

Follow the same procedure steps in Section 1.0 above.

5.0 URINALYSIS BIOASSAY TERMINATION SAMPLING PROCESS

1) The RSO identifies those individuals with active bioassay schedules who are terminated.
2) The RSO schedules the termination sample.
3) The RSO coordinates delivery of the sample kit. The RSO shall hand deliver the termination sample kit to the individual/supervisor along with directions for returning the kit.
4) The individual completes the sample kit according to the instructions provided with the sample kit and returns the kit to the RSO who sets it out for pick up. The individual shall be provided directions for returning the termination sample kit.
5) The RSO coordinates the retrieval of the sample kits.

Attachment 2. Bioassay Sample Routing Log

Perma-Fix Bioassay Sample Routing Log

Organization: Site Name/WBS:	Quantity Shipped:	Bottles	Project Number:
Date Shipped: Special Instructions: Analyze For:	CHAIN OF CUSTODY Reason:	Relinquished By:	Date/Time
		Received By:	
Name: Last First MI	Shipment:	Airborne	
Employee Social Security Number:			

Collection Date:	Collect Time:	Start	Stop	Analysis:

Analyses Required *	Sample Type**	Purpose***	U	R	Projected Lab No. Comp Date		

* Analyses	** Sample Type	*** Purpose
Tot U = Total Uranium	UR = Urine	IN = Initial
Iso Th = Th-230, Th-232	FE = Feces	FN = Final
HPGE = Gamma Spec.	NS = Nasal	RT = Routine
Ra-226 = Radium-226		RS = Resample
Pb-210 = Lead-210		SP = Special
Po-218 = Polonium-218		