RADIATION SAFETY PLAN

TNT SITE WALKOVER
AT
LAKE ONTARIO ORDNANCE WORKS
LEWISTON, NEW YORK

Prepared By:

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Sevenson Environmental Services, Inc

USACE TNT SITE

Radiation Safety Office

Approval Sheet

Radiation Safety Plan

Rev. 0

	Name	Title	Signature	Date
Approved	Paul Jung, RRPT	Sevenson Radiation Safety Officer		
Approved	Bill Thomas, CHP	IEM CHP		

Record of Changes

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Appendix A

Acronyms

"	Alpha
$	Beta
cc	Cubic centimeter
CIH	Certified Industrial Hygienist
CHP	Certified Health Physicist
cm^2	Centimeter squared
cpm	counts per minute
cpm_{net}	net counts per minute
DAC	Derived Air Concentration
DOD	Department of Defense
DOE	Department of Energy
dpm	disintegrations per minute
(	Gamma
≥	greater than or equal to
IEM	Integrated Environmental Management, Inc.
LOOW	Lake Ontario Ordinance Works
:	micro
NRC	Nuclear Regulatory Commission
NVLAP	National Voluntary Lab Accreditation Program
PPE	Personal Protective Equipment
RRPT	Register Radiation Protection Technician
RSO-TNT	Radiation Safety Office-TNT Site- Standard Operating Procedures
SES	Sevenson Environmental Services, Inc.
SRSO	Site Radiation Safety Officer
SSHP	Site Safety and Health Plan
TBD	To Be Determined
TLD	Thermoluminescent Dosimeter
TNT	2,4,6-Trinitrotoluene
USACE	United States Army Corps of Engineers

1.0 Purpose

This Radiological Monitoring Plan is to be used in conjunction with the Site Safety and Health Plan (SSHP) for the United States Army Corps of Engineer's (USACE) TNT Site Walkover at the Lake Ontario Ordnance Works (LOOW) located in Lewiston, New York. This plan will describe and outline the potential radiological hazards associated with the LOOW site and how materials and activities will be monitored for such hazards.

This Radiological Monitoring Plan has been prepared in order to provide protection to workers, visitors, the public, and the environment from exposure to radioactive materials. It has been written to comply with requirements and guidance in accordance with:

- 29 CFR 1910.120 – Hazardous Waste and Emergency Response Standard
- 29 CFR 1926 – Safety and Health Regulations for Construction
- USACE Safety and Health Requirements Manual EM 385-1-1
- USACE Buffalo District Radiation Protection Program CELRB EM 385-1-1 Appendix Z
- USACE Radiation Protection Manual EM 385-1-80
- Nuclear Regulatory Commission (NRC) Regulations and Regulatory Guides

2.0 Site Description

The former LOOW is located within the Town of Lewiston and the Town of Porter in Niagara County, New York. A site location map is located in the SSHP as Figure 1-1.

The original site encompassed approximately 7,500 acres with actual United States Department of Defense (DOD) activities having occurred on 2,500 acres. During the early 1940s, the LOOW site was used as a manufacturing plant producing TNT for use in World War II. Once completed, the complex contained a power plant, hospital, fire department, a water supply system adequate for a population of 100,000, and water supply and waste water treatment system of underground water, sewage, acid, and TNT pipelines.

The manufacturing portion of the plant was situated in the central southwest section of the LOOW site, south of Balmer Road. Waste water from the TNT manufacturing operation, as well as storm water and sanitary sewage, was transferred through an underground sewer network to a waste water treatment plant located in the western portion of the TNT plant. The TNT pipelines ran as one pair of east-west trending lines across the TNT production area before being routed south to the waste waster treatment plant at the west end of the production line.

An overestimation by the Army of the need for TNT during World War II resulted in the closure of the TNT plant in July 1943, after only nine months of operation. Following the decommissioning of the TNT plant, the majority of the LOOW facility was sold to private citizens with the government retaining the former active 2,500 acre portion of the site. Portions of the LOOW site have since been used by several branches of the DOD and the United States Department of Energy (DOE) for various manufacturing and storage activities.

The Niagara Falls Storage Site and adjacent vicinity properties were part of the U.S. Army's original 7,500acres LOOW. From 1944 to 1947, the Manhattan Engineer District used the LOOW area to store uranium ore processing residues from operations conducted by Linde Air Products in the Town of Tonawanda, New York. By 1948, 6,000 acres of the LOOW had been transferred or sold, and 1,500 acres had been given to the Atomic Energy Commission, which continued to use the site to store uranium ore processing residues. In the late 1940s and 1950s, additional residues and other radioactive waste were transported to the site from eastern and midwestern states. By 1968, most of the property acquired by the Atomic Energy Commission had been disposed of as surplus, leaving 213 acres. In 1975, 22 acres were transferred to the Town of Lewiston, New York.

The Niagara Falls Storage site property includes a three-story building with three adjacent silos, a small storage shed, and a storage building. All onsite and offsite areas of residual radioactivity above current guidelines were remediated between 1955 and 1992. Materials generated during remedial actions, are encapsulated within an onsite waste containment structure that encompasses approximately 10 acres.

The Niagara Falls Storage site property is adjacent to the Wastewater Treatment Plant's south property line. It is not anticipated that the Wastewater Treatment Plant was affected by radiological materials stored at the Niagara Falls Storage site, however, all earth breaking activities will require the monitoring for radiological material.

The radiological material expected to encountered at the site if any will be uranium-238, thorium-230, radium-226, and radium-228. Radium will be the isotope of concern since it will be the most limiting in terms of worker exposure. A variety of radioactive materials have been stored and/or staged at the former LOOW in support of MED and AEC activities. This includes reactor-related materials from the Knolls Atomic Power Lab (KAPL). While a variety of radionuclides might be found if residual materials form KAPL were encountered, Cs-137 would typically be present in the materials and can therefore used as an indicator of their presence. The radiological controls that have been developed for radium will indicate if cesium-137 is present.

3.0 Hazard Assessment

The potential hazards associated with the TNT Pipeline and Chemical Waste Sewer at the LOOW include chemical, physical, explosive, radioactive, and biological hazards. The potential for encountering chemical, physical, explosive, radioactive, and biological hazards will depend will depend on the location of the work being performed.

Given the site history of the area it has to be assumed that personnel performing sampling activities at the site my come into contact with radiological material. Therefore it is important that workers receive awareness training for working with radiological materials.

If radioactive material is encountered in excess of action levels, work will stop. See Section 5 for action levels.

4.0 Site Control Measures

As indicated in the SSHP the site will be set up based on a modified site zone system to control the potential spread of contamination. The Exclusion Zone and the Contamination Reduction Zone will be identified prior to the start of each task.

As part of the site control certain Radiation Safety Office procedures will be implemented. These procedures will help identify any radiological material that may be present at the site.

Radiological monitoring instrumentation will be used during all intrusive activities at the site to screen material for radioactivity.

5.0 Personnel

Radiological Safety Technician - TBD

Radiological monitoring will be conducted by an Qualified ANSI 3.1 Senior Radiation Safety Technician. The Radiation Safety Technician will be responsible for implementing and enforcing the Radiation Safety Plan and associated procedures.

Radiation Safety Officer – Paul Jung, RRPT, Sevenson Environmental Services, Inc.

The Radiation Safety Officer will be responsible for ensuring the Radiation Safety Plan is being executed and enforced properly. The Radiation Safety Officer will be on site during activities that could expose site personnel to radioactive material. The Radiation Safety Officer may assume the roll as Radiation Safety Technician if qualified to do so.

Certified Health Physicist – Bill Thomas, CIH, CHP, Integrated Environmental Management, Inc.

The Certified Health Physicist (CHP) will be responsible for reviewing and approving the Radiation Safety Plan and associated procedures. The CHP is not required to be on site during the project, however, the CHP shall be available for consultation with project personnel as required and for emergencies.

Table 5.1

Name	Phone
Paul Jung, RRPT/Radiation Safety Officer – SES	716-284-0431 or 716-984-3657 (cell)
Bill Thomas, CHP, CIH – IEM	419-423-4701
Shawn Andrews, HP/District Radiation Safety Officer – USACE	716-879-4214

6.0 Surveys and Monitoring

For the scope of work associated with this project it is not anticipated that workers will meet conditions requiring individual monitoring of external and internal occupational doses as outlined in 10 CFR 20.1502 and USACE EM 385-1-80 Section 5-5. Title 10, Code of Federal Regulations, Section 20.1502 (a)(1) states, in part, that the occupational exposure of workers (internal and/or external) shall be monitored if there is the potential to receive, in one calendar year, a radiation dose in excess of 10 percent of the limits shown in 10 CFR §20.1201(a).

Measurement of personal radiation doses from penetrating, external radiation is not required for this project because of the potential for whole body gamma exposure is less than 100 millirem for the duration of the project. Personnel exposures to external radiation were estimated using conservative assumptions. It is assumed that the Sevenson workers will be subject to no more than 50 microR per hour (5 times the average gross measured exposures), for eight (8) hours per day, six (6) days per week, for five (5) weeks. This results in an external dose potential of less than 12.0 millirem for the duration of the project.

Thermoluminescent dosimeters (TLDs) will be used to measure whole body exposures in the event that personnel encounter radiation levels in excess of 2 millirem (2,000 microrem) per hour whole body exposure or there is a potential for personnel exposure to exceed 100 millirem during the course of the project. In the event that external dosimeters are assigned, a vendor certified by the National Voluntary Laboratory Accreditation Program (NVLAP) will provide the dosimeters and complete the analysis. Each individual being monitored will be issued a TLD, assigned specifically to them by TLD number.

Air sampling is not anticipated for this project. It is not likely that workers at the site will be exposed to airborne radioactive materials in excess of ten percent of the derived air concentration (DAC) for Ra-226 listed in 10 CFR 20, Appendix B. Specifically, it is not likely that air concentrations will exceed $3x10^{-11}$ microcuries per cubic centimeter of air (e.g., DAC for Ra 226 is $3x10^{-10}$ uCi/cc). If the RSO determines that there is a potential for exposure to airborne radium in excess of the DAC, the work will stop and the Radiation Safety Officer will implement an effective air sampling program.

Radiological surveys will be required during intrusive work activities at the site. Monitoring and survey equipment will be kept in accordance with USACE EM 385-1-80 §§ 3-14.(a), (h), and (I).

Any time personnel may be exposed to radioactive material, radiation monitoring procedures will be used. Appendix A of this plan includes Sevenson's Standard Operation Procedures issued by the Radiation Safety Office to ensure the protection of the worker, visitors, the general public and the environment while working with radioactive material.

Sevenson's RSO-TNT-10 "Radiological Surveys" establishes guidelines and requirements for the performance of radiological surveys, specify minimum survey requirements, and provide requirements for the documentation of radiological surveys. Radiological surveys are conducted

on both a routine and non-routine basis for verification and documentation of radiation and contamination levels for use in the control of personnel exposure.

Sevenson's RSO-TNT-11 "Radiation Dose Rate Surveys" provides guidelines and requirements for the performance of radiation dose rate surveys.

Sevenson's RSO-TNT-12 "Surface Contamination Surveys" provides guidelines and requirements for the performance of surface contamination surveys.

Sevenson's RSO-TNT-13 "Personnel Contamination and Decontamination" describes personnel contamination monitoring requirements and describes actions to be taken upon detecting contamination during frisking.

Sevenson's RSO-TNT-34 "Source Check Instruments" provides guidelines and requirements for ensuring that instrumentation is in good working order and the instrument is responding properly and remaining in calibration.

Instrumentation used for the detection of radiation or radioactive material will be calibrated at least annually and after being serviced by an approved vendor. Instruments will be source checked before each use in accordance with RSO-TNT-34.

Sevenson will utilize various instruments during the course of this project to ensure workers are not exposed to radioactive material. Instrumentation to be used includes but is not limited to:

- Ludlum Measurements Model 2221 Scalar/Rate meter with a 44-10 (2"x2" NaI(Tl)) probe attached for screening soils and samples.
- Ludlum Measurements Model 2224-1 Rate Meter with a 43-89 (alpha/beta scintillation) probe attached to survey personnel and equipment for alpha contamination.
- Ludlum Measurements Model 12 Rate Meter with a 44-9 (GM pancake) probe attached to survey personnel and equipment for beta-gamma contamination.
- A Bicron Microrem meter to monitor work area and measure gamma dose rates.
- Ludlum Measurements Model 2929 with a 43-10-1 probe to provide gross alpha and beta-gamma smear activity.

Background will be established for both the Microrem meter (i.e., measurements in microrem per hour) and the Ludlum Model 44-10, 2x2 NaI(Tl) detector (i.e., measurements in counts per minute). A location will be selected by the Radiation Safety Officer to use as background; the area should not be impacted by radioactive materials. Action levels for changing conditions in the field will be based on a comparison to these background readings.

Geo-Probing

Soil samples will be collected at the site in order to provide the data necessary to define the levels and extent of subsurface soil contamination in the vicinity of the waste water treatment plant. The total depth of the soil borings will depend upon the depth of the buried pipe present in the sampling area, but it is anticipated a depth of 14-16 feet will be sampled. Soil borings will be

performed utilizing direct push technology. The Geoprobe® system is comprised of a pneumatically driven, truck mounted unit. The direct push sampling method involves sampling devices that are directly inserted into the soil to be samples without drilling or borehole excavation. Direct push sampling consists of advancing a sampling device into the subsurface by applying static pressure, impacts, or vibration or any combination thereof to the above ground portion of the sampler extensions until the sampler has been advanced to its full length into the desired soil strata. The soil sampling technique employed will involve continuous sampling at four-foot intervals. Samples will be collected by continuous advancement of stainless steel hollow tubes. The hollow tubes are 48-inches long, 4-inch diameter stainless steel tubes, which are fitted with disposable acetate liners.

As the sample is extracted from the ground dose rates will be monitored with the microrem meter. Once the sample tube is out of the ground it will be scanned with the 2" x 2" NaI(Tl) meter. A reading of three times background will trigger a "Stop Work Action" and the Contracting Officer will be notified.

If a "Stop Work" condition is implemented for radiological reasons site personnel and equipment directly related to the "Stop Work" condition will be surveyed for radiological contamination in accordance with Sevenson's RSO-TNT-12 and 13.

Subsurface Wooden Pipe

Residual sediment samples will be collected from a subsurface wooden pipe present in the former wastewater treatment plant area. The pipe is located approximately ten feet below ground surface and will require mechanical excavation of the soil above the pipe prior to sampling. Once the depth of the pipe is achieved, the pipe will be opened using hand tools and representative sediment samples will be obtained using a hand dipper, sample trowel, or drum thief, as warranted by the field conditions.

During residual sediment sampling excavated material will be screened for radioactive material. Soil activity will be measured with a 2" x 2" NaI(Tl) detector. Material can either be scanned before it is excavated in six inch lifts or after it has been placed on the ground by the earth moving equipment. Soil conditions and the integrity of the excavation will determine which method is utilized. Sediment samples extracted from the pipe will also be screened for radiological material with the 2" x 2" NaI(Tl) detector. A reading of three times background will trigger a "Stop Work Action" and the Contracting Officer will be notified.

If a "Stop Work" condition is implemented for radiological reasons site personnel and equipment directly related to the "Stop Work" condition will be surveyed for radiological contamination in accordance with Sevenson's RSO-TNT-12 and 13.

Vault Sampling

Residual sediment samples will be collected from the open-top vaults present in the former acid neutralization building and former pumping station located in the wastewater treatment plant area. The vaults are open depressions in the remaining concrete floors of these previously

demolished buildings. Samples will be collected using a hand dipper, sample trowel, or drum thief, as warranted by the field conditions. Only samples of sediment below any freestanding liquids will be obtained.

Vault samples will be screened for radioactive material when they are taken. Samples will be screened with the 2" x 2" NaI(Tl) detector. A reading of three times background will trigger a "Stop Work Action" and the Contracting Officer will be notified.

If a "Stop Work" condition is implemented for radiological reasons site personnel and equipment directly related to the "Stop Work" condition will be surveyed for radiological contamination in accordance with Sevenson's RSO-TNT-12 and 13.

Waste Characterization Sample

As per Section 4.3.1 in the Field Sampling Plan (January 2003), 5 discrete samples will be taken from stockpiled material and composited into 1 sample for off site waste characterization. These 5 samples will be screen for radiological material with a 2" x 2" NaI(Tl) detector before being released from the site. A reading of three times background will trigger a "Stop Work Action" and the Contracting Officer will be notified.

If a "Stop Work" condition is implemented for radiological reasons site personnel and equipment directly related to the "Stop Work" condition will be surveyed for radiological contamination in accordance with Sevenson's RSO-TNT-12 and 13.

Worker/Equipment Monitoring and Release Criteria

Personnel exiting controlled areas established for contamination control will be surveyed (frisked) for radiological contamination. Monitoring for total contamination will be performed with the Ludlum Model 43-89 detector. This scintillation detector is capable of detecting radioactive contamination greater than 200 dpm/l00 cm^2 alpha activity and 1000 dpm/100 cm^2 beta activity. These criteria are consistent with the requirements of USACE EM 385-1-80, Table 6-4, for field measurements and the presence of Ra-226.

Personnel found with detectable contamination above background on their skin or personal clothing will be promptly decontaminated. Procedures to decontaminate individuals are provided in RSO-TNT-13.

Equipment or other surfaces will be considered to be contaminated if the total (fixed and removable) beta activity is found to exceed values listed in Table 6-4 for the isotopes of concern. Equipment may be released for unrestricted use after a radiation survey verifies that contamination levels are acceptable.

Table 6-4 Acceptable Surface Contamination Levels			
Nuclide [a]	**Average** [b c] dpm/100 cm^2	**Maximum** [b d] dpm/100 cm^2	**Removable** [b e] dpm/100 cm^2
U-nat, U-235, U-238 and associated decay products	5,000 "	15,000 "	1,000 "
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100	300	20
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000	3,000	200
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and other noted above	5,000 $-(	15,000 $-(	1,000 $-(

[a] 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.

[b] As used in this table, dpm (disintegrations per minute) 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.

[c] 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 object.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of know 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.

Prior to performing field work for the day it is important that the Technician evaluate the detection sensitivity of the detection equipment used to ensure the instruments can determine if contamination is actually present in levels below release criteria. The following equations are to be used to determine the minimum detectable concentration (MDC) of an instrument.

Integrated measurement over a present time, the MDC for surface activity can be approximated by:

$$MDC = \frac{3 + 4.65\sqrt{B_R \bullet t}}{t \bullet E \bullet \frac{A}{100}}$$

Scanning

The equation that will be used for calculating the MDC for scans (MDC_{SCAN}) is:

$$MDC_{SCAN} = \frac{d' \bullet \sqrt{b_i} \bullet \frac{60}{i}}{E \bullet \sqrt{p} \bullet \frac{A}{100}}$$

where:

Smear counting

$$MDC = \frac{3 + 4.65\sqrt{B_R \bullet t}}{t \bullet E}$$

Where:

MDC = activity level in disintegrations/minute/100 cm^2
B_R = background count rate in counts/minute
t = counting time in minutes
E = detector efficiency in counts/disintegration
A = active probe area in cm^2
d' = *index of sensitivity* based on a 95% true positive and 60% false positive rate.[1] (Assumed to be 1.38 for α =0.05 and β=0.60)
i = Observation counting interval (detector width (cm) divided by scan speed (cm/s))
p = Surveyor efficiency (assumed to be 50%)
b_i = Background count per observation interval (Background * i/60)

In the event that radioactive material is detected in the samples or on the sampling equipment, the Radiation Safety Officer will evaluate the potential for exposure and verify that the administrative controls are adequate to protect the workers and minimize the spread of contamination. Work will stop if there is sufficient radioactive material to exceed three times background when surveying with a 2"x2" NaI(Tl) detector (i.e., Model 44-10 or equivalent). The Radiation Safety Officer will issue a "Stop Work" order. Radiation surveys will be performed as described in Procedure RSO-TNT-12 and RSO-TNT-13.

7.0 Training

An orientation will be provided to describe the types of radioactive material likely to be encountered at the site and the methods to measure exposures. The briefings will also describe the potential for radiation exposure and the methods to limit one's exposure. The nature of the radiation monitoring and the radioactive contamination control will be described.

[1] U.S. Nuclear Regulatory Commission, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, Table 6.5, NUREG 1575, August, 2000.

Additional training will be provided in the event that personnel encounter radioactive contamination such that personal protective equipment is required to reduce the spread of contamination. Workers will review the correct procedures to don and doff disposable protective equipment, the method to survey for radioactive contamination. Each participant will practice the correct use of the radiation survey instrument to measure contamination (alpha scintillation detector) and the steps to follow in the event contamination is detected. The limits of exposure that apply to this task will be explained and the manner in which to reduce one's exposure will be explained for each specific task where radioactive contamination is likely to be encountered. Applicable regulations promulgated by the NRC and USACE will be described.

8.0 Personal Protective Equipment

The level of PPE required for this project will be determined by the chemical exposure material at the site. It is anticipated that the level of PPE to be used during sampling is Modified Level D protection. This level includes the use of hard hat, safety glasses, steel-toe/steel shank work boot, tyvek, chemical resistant over-boots, latex gloves or other chemical resistant outer glove, and if necessary a face shield.

9.0 Documentation

Documentation for this project will be in accordance with Sevenson's RSO-TNT-06 "Radiation Safety Log", RSO-TNT-07 "Records for Retention", RSO-TNT-10 "Radiological Surveys", and RSO-TNT-34 "Source Check Instruments".

Appendix A

Sevenson Environmental Services, Inc

USACE TNT SITE

Radiation Safety Office-
Standard Operating Procedure (RSO-TNT)

Cover Sheet

RSO-TNT-05

RADIATION SAFETY LOG

Rev. 0

March 5, 2003

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RADIATION SAFETY LOG

1.0 PURPOSE

This procedure describes the method used by Radiation Safety personnel to record events of radiological significance.

2.0 APPLICABILITY/SCOPE

This procedure is applicable to all Radiation Safety personnel.

3.0 DEFINITIONS

None

4.0 PROCEDURE

4.1 It is essential that events of radiological significance, which occur during the shift, be recorded. These records serve as historical reference and to familiarize oncoming Radiation Safety personnel with the radiological status of the site.

4.2 Radiation Safety Log

4.2.1 Entries in the Radiation Safety Log should include, but not be limited to, the following: major tasks completed; ongoing radiation safety evolutions; operations or maintenance evolutions affecting radiation safety; incidents of radiological importance (e.g., personnel contamination); significant violations of radiation safety procedures or good practices; radioactive spills or unplanned releases; equipment failure or removal from service, etc.

4.2.2 A new procedure or a change in an existing procedure which significantly impacts the tasks to be performed will be noted in the log.

4.2.3 Items shall be entered in chronological order as they occur and initialed by the technician making the entry. All late entries shall be prefaced by the letters "L.E.".

4.2.4 During the shift, all Radiation Safety Technicians should review log entries completed by previous shifts in order to familiarize themselves with the site radiological status.

4.2.5 Errors in Log Entries

4.2.5.1 Draw a single line through the incorrect entry and the date/initials of the individual making the correction.

4.2.5.2 Enter the corrected entry.

NOTE: Erasing, whiting out, and writing over existing entries is prohibited. All entries/changes shall be made in black ink.

4.2.6 The Site Radiation Safety Officer shall review the Radiation Safety Log weekly.

4.2.7 The Radiation Safety Log shall be retained as a permanent record, in accordance with Ref. 6.1.

4.3 Daily Radiological Safety Report

4.3.1 The SRSO or designee will complete the Daily Radiological Safety Report (Attachment 7.1) for each day radiological activities are performed at the site. The report is to given to the Project Manager for placement into the job site file.

5.0 RESPONSIBILITIES

Responsibilities are as stated in Section 4.0 of this procedure.

6.0 REFERENCES

6.1 RSO-TNT-07, Records Retention

7.0 ATTACHMENTS

7.1 Daily Radiation Safety Report

SEVENSON ENVIRONMENTAL SERVICES, INC.

DAILY RADIATION SAFETY REPORT

Date: Work Period Covered:

Weather Conditions: Temp:

Summary of Day's Work Activity:

Maximum PPE used by Task:

Description of Monitoring and Samples Performed:

Miscellaneous:

Name: Title:

Signature:_____

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Radiation Safety Office-
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RSO-TNT-06

RADIOLOGICAL DIFIECENCY REPORTS

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1.0 PURPOSE

This procedure provides guidance for the preparation of Radiological Deficiency Reports (RDRs).

2.0 APPLICABILITY/SCOPE

This procedure is applicable to all Radiation Safety personnel.

3.0 DEFINITIONS

None

4.0 PROCEDURE

4.1 An RDR shall be prepared under the following circumstances:

1. Following an overexposure (external or internal) of personnel.
2. Following a significant breakdown of radiological controls (e.g., violation of RWP area posting).
3. Following a medical emergency in a Radiologically Controlled Area.
4. Following any other emergency which may have resulted in abnormal exposure to radiation or radioactive material (either to worker(s) or general public).
5. As required by other SOPs.

4.2 Content of the RDR

4.2.1 The RDR should be prepared by the Radiation Safety individual most directly connected with the subject incident (e.g., Radiation Safety Technician who noticed/reported the problem, etc.).

4.2.2 The RDR should contain the following:

1. Complete discussion of circumstances and events leading up to the incident.
2. Complete discussion of the incident itself including details such as time and motion, dose rates, contamination levels, air concentrations, etc.
3. Discussion of dosimetric consequences of incident (dosimetry data or calculations shall be attached if appropriate).
4. Description of actions to be taken to prevent similar occurrences in the future.

4.2.3 The depth and detail contained in the RDR should be appropriate for the seriousness of the incident (e.g., from a few paragraphs to several pages).

4.2.4 The completed RDR shall be reviewed by the Site Radiation Safety Officer (SRSO). When approved by the SRSO, a RDR Log number will be issued for the RDR and the report will be forwarded to the SES Project Manager. When approved by the SES Project Manager, copies of the RDR shall be filed in the SRSO's permanent files and the Personnel Dosimetry files of any individuals assigned radiation doses as a result of the incident.

4.2.5 Significant or generic deficiencies identified and corrected should be incorporated into the Radiation Safety Training (new hires) or daily briefing of Sevenson Environmental Radiation Site personnel.

5.0 RESPONSIBILITIES

Same as noted above in Section 4.0.

6.0 REFERENCES

6.1 RSO-SOP-07, Records Retention

7.0 ATTACHMENTS

7.1 Radiological Deficiency Report Form Log Sheet.

7.2 Radiological Deficiency Report Form.

RADIOLOGICAL DEFICIENCY REPORT FORM LOG SHEET

RDR Incident No.	Date of Incident	Brief Description of Incident	Date of Closure of Incident

RADIOLOGICAL DEFICIENCY REPORT

RDR Incident Number: _____ Date: _____
Initiator of RDR: _____

Observer(s) of Incident:

Name	Signature	Job Title

Time of Incident: _____ Weather Conditions: _____

Radiological Conditions (i.e. G.A. Dose Rate(s)): _____

Description of Incident (detailed, use reverse if necessary):

Deficiency Identified: _____

Corrective Action(s) Taken: _____

Reviewed By RSO: _____ Date: _____

Reviewed By SES Project Manager: _____
Date: _____

Sevenson Environmental Services, Inc

USACE TNT SITE

Radiation Safety Office-
Standard Operating Procedure (RSO-TNT)

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RSO-TNT-07

RECORDS FOR RETENTION

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1.0 PURPOSE

The purpose of this procedure is to specify those records which must be retained beyond the period of their working usefulness and to specify the proper disposition of these records.

2.0 APPLICABILITY/SCOPE

This procedure is applicable to all Radiation Safety personnel.

3.0 DEFINITIONS

None

4.0 PROCEDURE

4.1 Discussion

4.1.1 Record retention requirements are specified in ANSI N13.6-1966 (R1989) (Ref. 6.1). The records generated by the Radiation Safety Office which must be maintained are radiation exposure records and surveys conducted to show compliance with ANSI N13.6-1966(R1989). Records which bear directly on personnel exposures (e.g. bioassay evaluation, airborne radioactivity surveys) and records of effluent releases shall be maintained until the customer authorizes disposition. Radiation and contamination survey records shall be maintained for the same period.

4.1.2 Other records should be retained for historical purposes. These include Radiological Deficiency Reports, Training Records, instrument calibration record, Radiation Work Permits, and audit reports. These records shall also be maintained until the customer authorizes disposition of the records in paragraph 4.1.1.

4.1.3 Attachment 1 indicates the specific records for which the Radiation Safety Office is responsible.

4.2 Instructions

4.2.1 Radiation Safety Officer (RSO)— at completion of project or at least one per year, review those records indicated in Attachment 1 which are more than one year old. Those which are no longer useful in the daily operations should be submitted to the customer for long-term retention. Those records which are more than one year old, but are still actively used should be considered for submittal to the customer for long-term retention while retaining a copy at the working location.

4.2.2 RSO — as records are submitted to the customer, accurately document those records and retain a copy of the transmittal document.

5.0 RESPONSIBILITIES

Responsibilities are as stated in Section 4.0 of this procedure

6.0 REFERENCES

6.1 American National Standards Institute, Practice for Occupational Radiation Exposure Records Systems, ANSI N13.6-1966 (R1989), 1989.

7.0 ATTACHMENTS

7.1 List of Radiation Safety Office Records to be Retained (not all-inclusive)

LIST OF RADIATION SAFETY OFFICE RECORDS TO BE RETAINED

This Attachment lists those records generated by the Radiation Safety Office which should be handled in accordance with this procedure.

A. Radiation Safety Officer

1. Radiation Protection Plan
2. Environmental Monitoring Reports
3. Radiological Deficiency Reports
4. Curie estimate calculations for radioactive material shipments
5. Radiological Monitoring Records
6. Radiation Safety Log
7. Lesson Plan Records and Revisions
8. Radiological Training Records
9. Radiation Instrument Maintenance and Calibration Records

B. Dosimetry

1. Radiation Work Permits/Sign-In Logs
2. Bioassay and Radiological Health Records

Sevenson Environmental Services, Inc

USACE TNT SITE

Radiation Safety Office-
Standard Operating Procedure (RSO-TNT)

Cover Sheet

RSO-TNT-10

RADIOLOGICAL SURVEYS

Rev. 0

March 6, 2003

Record of Changes

Change No.	Page(s) Changed	Effective Date	Change No.	Page(s) Changed	Effective Date

1.0 PURPOSE

The purpose of this procedure is to establish guidelines and requirements for the performance of radiological surveys, specify minimum survey requirements, and provide requirements for the documentation of radiological surveys. Radiological surveys are conducted on both a routine and non-routine basis for verification and documentation of radiation and contamination levels for use in the control of personnel exposure.

2.0 APPLICABILITY/SCOPE

This procedure is applicable to all Sevenson Environmental Services, Inc. (SES) site safety personnel.

3.0 DEFINITIONS

3.1 Radiological surveys as used in this procedure are radiation dose-rate, contamination and airborne radioactivity surveys performed by Radiation Safety Technicians.

4.0 PROCEDURE

4.1 Discussion

4.1.1 In addition to performing the radiological survey, Radiation Safety Technicians will properly evaluate radiological survey data to establish the conditions for a work area.

4.1.2 Specific radiological survey techniques are presented in the applicable Ref. 6.1 and 6.2.

4.1.3. Radiological survey requirements for release of areas and items for unrestricted use are presented in Radiological Safety Plan.

4.1.4 Personnel contamination survey requirements are presented in Ref. 6.3.

4.2 Precautions/Limitations

4.2.1 When documenting surveys on survey maps, care should be taken not to provide so much information that it loses its usefulness.

4.3 Documentation

4.3.1 All survey documentation shall be accurately and legibly completed.

4.3.2 Survey data must contain enough detail to provide personnel with adequate information concerning radiological conditions existing within the area surveyed.

4.3.3 Any alteration or change to survey records, (either existing or being generated), shall be made neatly by drawing a single line through the incorrect entry and recording the correction/alteration adjacent to the incorrect entry. Correction fluid, other types of correction media, or techniques that obliterate the original entry are not acceptable. The original entry must remain legible. The person making the change shall initial and date the correction. Only the person making the error can change or alter the survey data. The Site Radiation Safety Officer (SRSO) or his designee may change administrative informational errors, not involving survey results.

4.3.4 Radiological surveys shall be recorded on appropriate forms as follows:

4.3.4.1 The Radiation Safety Technician performing the survey shall perform surveys as required (See Attachments 7.1 and 7.2). These surveys shall be completed on Attachments 7.3, 7.5, and 7.5, or other sheets as needed (Attachment 7.3 - shall always be the cover sheet). Each survey should be provided with a unique identification number, so the document can be tracked.

4.3.4.2 Radiation readings shall be recorded using Attachment 7.3 with attached map.

1. Record radiation readings on Attachment 7.3 as follows:

a. Locations of all contact readings and associated radiation levels must be annotated on the survey maps. Items surveyed must be clearly identified on the map.

b. Sequentially number or identify the locations where the radiation readings were taken. A Survey Record Continuation Sheet may be used if necessary.

c. Area readings are numbers only (i.e., 10)

d. If distance of radiation reading is needed i.e., 3 feet from contact, indicate this on the survey map.

e. Record survey meter model, serial number, calibration date, Background (cpm) and correction factor, as applicable, on the survey form.

f. For very detailed surveys, either a map should be used or the survey should be documented using Attachment 7.5.

g. Record the actual radiation reading on the survey record form under the appropriate dose rate column. If a type of radiation was not taken, the code "N/A" should be used.

4.3.4.3 Contamination readings shall be recorded using either Attachment 7.3, with attached maps.

1. As a minimum, record counting instrument model, serial number, calibration date, background (cpm), correction factor (if applicable), technician's printed name and signature, and date on the appropriate survey form.

2. Record contamination readings on survey form as follows:

a. For Attachment 7.3/7.4.

Sequentially number and identify locations where the contamination measurements are taken. Record the contamination level after counting on the record form under the appropriate contamination column. Results are in dpm/100 cm^2 unless otherwise noted.

b. If a map is used, it should be clearly marked with the Survey Record number, and the date. Numbers matching the sequential numbers listed on the associated survey record form should be placed on the map at the approximate location the survey was taken. All numbers should be neatly circled.

4.3.4.4 Surveys of Radioactive Material Shipping Containers shall be documented on the Radiological Survey Report Form (Attachment 7.3, 7.4, and 7.5) as follows:

1. As a minimum, record counting instrument model, serial number, calibration date, background (cpm), correction factor (if applicable), technician's printed name and signature, and date on the appropriate survey form.

2. Identify, by number, the shipping container being surveyed.

3. Sequentially number and log all smears and corresponding activity levels on a survey form. The gamma dose rate on contact with the

container, and the maximum contamination level (dpm/100cm^2). (Ref 6.5)

4.3.4.5 The Routine Radiation/Contamination Survey Record Form may have pre-printed layouts or space for special purpose diagrams or drawings. Layouts or drawings for Special Radiological Safety Survey Record Form may be pre-printed or drawn as needed. All surveys should be documented on form (Attachment 7.3) unless approved by the SRSO to do otherwise.

4.3.5 The original copy of all survey records shall be maintained until disposition in accordance with applicable records retention procedures (Ref. 6.4). The SRSO shall maintain copies of the most recent surveys.

4.3.6 The SRSO or designated technician signature and date must be recorded on all surveys to indicate his/her review for content, completeness and trend analysis.

4.4 Survey Frequencies

4.4.1 The frequency of routine surveys depends on the nature, quantity, and frequency of use of radioactive materials, as well as the specific protective facilities, equipment, and procedures that are designed to protect the worker from external and internal exposure.

4.4.2 Routine and repetitive surveys are necessary to control the containment of radioactive materials within handling systems and to ensure the continued integrity of protective equipment and procedures.

4.4.3 Non-radiological areas should be surveyed periodically to ensure that radiation and radioactive material are adequately controlled.

4.4.4 The surveys required by Attachments 7.1 and 7.2 are considered to be the minimum survey requirements. Additional surveys may be performed as necessary to properly assess radiological conditions.

4.4.5 A routine survey status system shall be maintained in the Radiation Safety Office.

4.4.6 The SRSO or designated Radiation Safety Technician shall ensure that the surveys are performed as scheduled. At the end of each shift, the schedule should be checked for completeness and status system updated upon completion of the required surveys.

4.4.7 Consideration should be given to performing job specific surveys whenever operation or maintenance to be performed includes breaking the integrity of a radioactive system. This includes work on components which could present a

radiological hazard to personnel or result in release of radioactive material. When possible, routine surveys should be performed in conjunction with job specific surveys for ALARA considerations.

4.4.8 Airborne activity, surface contamination and radiation dose-rate surveys are required whenever entering an area/cubicle in which the radiological status is not known.

5.0 RESPONSIBILITIES

Responsibilities are as stated in Section 4.0 of this procedure.

6.0 REFERENCES

6.1 RSO-TNT-11, Radiological Dose Rate Surveys

6.2 RSO-TNT-12, Surface Contamination Survey

6.3 RSO-TNT-13, Personnel Contamination Monitoring and Decontamination

6.4 RSO-TNT-07, Records Retention

6.5 49 CFR 173, Shippers – General Requirements for Shipments and Packaging

7.0 ATTACHMENTS

7.1 Routine Radiation Surveys

7.2 Routine Smear Surveys

7.3 Radiological Survey Cover Sheet

7.4 Radiological Survey Report Form

7.5 Radiological Survey Report Map Form

ROUTINE RADIATION SURVEYS

	Location	Frequency: Daily	Frequency: Weekly
1.	Occupied Decontamination Facilities	X	
2.	Accessible areas adjacent to Sample preparation and Counting labs		X
3.	Area boundaries (Including temporary ones established in excess of 24 hours)		X
4.	Radioactive material storage area		X
5.	SES Trailers and Offices		X

Weekly surveys to be every 7 days $\pm$ 2 days

ROUTINE SMEAR SURVEYS

	Location	Frequency: Daily	Frequency: Weekly*
1.	Occupied Contamination Areas		X
2.	Exits from occupied Contamination Areas	X	
3.	Sample preparation and/or Counting Labs	X	
4.	Accessible areas adjacent to sample preparation and/or Counting Labs		X
5.	Occupied Decontamination Facilities	X	
6.	Radioactive Material Storage Areas		X
7.	SES Trailers and Offices		X

Weekly surveys to be every 7 days $\pm$ 2 days

RADIOLOGICAL SURVEY REPORT FORM

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Survey performed by: (print/signature)				Date:
				Time:
Location:				Survey No:
INSTRUMENTS Model / Type	Serial Number	Calibration Date	Background	Correction Factor

SURVEY RESULTS all readings reported in dpm/100cm^2

	Description of Item	Transferable		Direct		Dose Rate (μR/hr)
		α	$	α	$	

Comments:

Reviewed By: (print/signature)	Date:

RADIOLOGICAL SURVEY REPORT FORM
CONTINUATION SHEET

RADIOLOGICAL SURVEY REPORT FORM
CONTINUATION SHEET

Pg of

Comments:	Date:
	Time:
	Survey No.:

SURVEY RESULTS all readings reported in dpm/100cm^2

	Description of Item	Transferable		Direct		Dose Rate (μR/hr)
		α	$	α	$	

RADIOLOGICAL SURVEY REPORT FORM

MAP SHEET

Location:	Date:
	Time:
	Survey No:

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RADIATION DOSE RATE SURVEYS

Rev. 0

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1.0 PURPOSE

The purpose of this procedure is to provide guidelines and requirements for the performance of radiation dose rate surveys.

2.0 APPLICABILITY/SCOPE

This procedure is applicable to all Radiation Safety personnel.

3.0 DEFINITIONS

3.1 Radiation dose rate surveys, as used in this procedure, are gamma surveys performed to control/assess personnel radiation exposures.

4.0 PROCEDURE

4.1 Discussion

4.1.1 The minimum required frequencies for routine and non-routine radiation surveys is contained in Ref. 6.1.

4.1.2 Documentation requirements for radiation surveys are contained in Ref. 6.1.

4.2 General Guidelines and Requirements

4.2.1 Instrument selections for making radiation measurements depends upon the type of radiation anticipated, the anticipated levels and the characteristics/capabilities of the instrument.

4.2.2 Technicians performing radiation surveys shall take the necessary precautions to maintain their exposures as low as reasonably achievable. The following precautionary measures should be considered.

4.2.2.1 Perform a review of previous surveys and operations performed in the area since the last survey to determine the expected radiation level.

4.2.2.2 Ensure instrument operability prior to entering the area to be surveyed or the controlled area surrounding the area to be surveyed, if applicable.

4.2.2.3 Ensure the necessary support equipment is available (recording equipment, watch, bags for contamination control if applicable, etc.) prior to entering the area or surrounding controlled area.

4.2.2.4 If an instrument must be carried through or into a contaminated or potentially contaminated area and is likely to become contaminated, ensure the instrument is enclosed in protective material prior to entering the area.

4.2.2.5 Enter survey areas with instrument set on a scale appropriate for expected radiation levels. (Avoid saturation of the detector.)

4.2.3 Radiation surveys shall be taken in such a manner that no portion of the surveyor's body is placed between the sensitive portion of the detector and the source of radiation. (This is to ensure the most accurate measurement possible of the area being surveyed is obtained.) For Example:

4.2.3.1 The surveyor should not wrap his/her hand completely around the instrument probe. The probe should be held at the base.

4.2.3.2 General area surveys should be taken in such a manner to ensure a 360° indication of the area surveyed is obtained.

4.2.4 Major changes (e.g. ≥ a factor of 3) in radiation levels should be reported to the Site Radiation Safety Officer (SRSO).

4.3 Equipment:

4.3.1 Survey Maps

4.3.2 Portable Gamma Dose Rate Survey Instruments

4.4 Instructions

4.4.1 Gamma Radiation Surveys

4.4.1.1 Observe general guidelines and requirements addressed in Section 4.2 of the discussion above.

4.4.1.2 Obtain survey maps for area to be surveyed.

4.4.1.3 Log all required survey and instrument information on survey form in accordance with Ref. 6.1.

4.4.1.4 Use the instrument selected in accordance with the operating instructions provided in the appropriate instrumentation procedure.

4.4.1.5 For general area surveys, position the instrument/probe and orient your body such that a 360° unshielded indication is observed.

4.4.1.6 For hot spot surveys scan the component/system with the instrument/probe center of detection within 1 inch of the surface (avoid contact with a contaminated/potentially contaminated surface.)

4.4.1.7 Surveys taken prior to the performance of specific work tasks should consist of general work area surveys, hot spot surveys, and surveys performed on contact with the item/component/ system to be worked. Stratified dose rates and/or gradients caused by shielding or other conditions should be identified and documented to support proper dosimetry placement for whole body and extremity sets.

4.4.1.8 Record results and return the survey form to the SRSO for review and approval in accordance with Ref. 6.1.

5.0 RESPONSIBILITIES

Radiation Safety personnel are responsible for the implementation of this procedure.

6.0 REFERENCES

6.1 RSO-TNT-10, Radiological Surveys

7.0 ATTACHMENTS

None

Sevenson Environmental Services, Inc

USACE TNT SITE

Radiation Safety Office-
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Cover Sheet

RSO-TNT-12

SURFACE CONTAMINATION SURVEYS

Rev. 0

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1.0 PURPOSE

The purpose of this procedure is to establish guidelines and requirements for the performance of surface contamination surveys.

2.0 APPLICABILITY/SCOPE

This procedure is applicable to all Radiation Safety personnel.

3.0 DEFINITIONS

3.1 The surface contamination survey techniques used are:

3.1.1 Indirect Survey Method — This method measures removable contamination. The indirect survey techniques (smear and wipe) are as follows:

3.1.1.1 Smear Surveys — A smear is obtained by using an absorbent filter disk to wipe with moderate pressure, across the area/item to be surveyed. The smear is to cover an area of approximately 100 cm^2. The smear is then counted by using either laboratory counting equipment or a ratemeter with any detector probe, using reproducible geometry.

3.1.1.2 Wipe Surveys — A wipe is obtained by wiping an absorbent pad or towel over a larger area or the entire surface, if practical. The wipe is then counted using a ratemeter with a detector.

3.1.2 Direct Survey Method — This method measures both fixed and removable levels of surface contamination. The direct frisk is performed by scanning the survey location using an instrument, i.e., as a ratemeter with a Ludlum 43-65 detector.

4.0 PROCEDURE

4.1 Precautions/Limitations

4.1.1 Survey techniques used to monitor personnel contamination are presented in Ref. 6.1.

4.1.2 Surface contamination survey requirements for the release of area/items/or materials are contained in Ref. 6.2.

4.1.3 Documentation and record keeping requirements for surface contamination surveys are contained in Ref. 6.2.

4.1.4 The administrative limits for surface contamination are contained in Ref. 6.4.

4.1.5 General Guidelines and Requirements

4.1.5.1 Personnel performing/counting surface contamination surveys shall take necessary precautions to minimize the possibility of cross contamination.

(i.e., changing gloves after handling highly contaminated surface, wrapping instruments in poly or other suitable material.)

NOTE: Detector windows of α instrumentation must **not** be covered by any material.

4.1.5.2 Prior to entering the area for the purpose of performing a surface contamination survey, personnel must be aware of anticipated contamination levels. A review of previous surveys and operations performed in the area since the last survey should be made to determine the expected radiation and surface contamination levels.

4.1.5.3 When high levels of surface contamination are expected, start the survey at the periphery of the area and proceed toward the point suspected of having high levels of contamination. To minimize the spread of high levels, change shoe covers prior to leaving the highly contaminated area, if practical.

4.1.5.4 When low background, sufficient sensitivity, accessibility, surface geometry, etc., permit, a direct scan using an detection instrument with an appropriate compatible count rate meter for surveys should be performed in accordance with Section 4.2 of this procedure. Any portable count rate instrument used for contamination surveys should have the capability of providing an audible response for the observed count rate.

4.1.5.5 If background levels, surface geometry, large area to be surveyed (floors, walls, etc.) do not permit a direct frisk, a smear survey in accordance with Section 4.3 or a wipe survey in accordance with Section 4.4 should be performed. When background radiation levels permit, smears/wipes may be counted on the spot with the rate meter. Where background levels do not permit on-the-spot counting, the smears/wipes shall be taken to a low background area within a radiological control area for counting. Care must be taken to ensure that the smear/wipe are counted such that no spread of loose surface contamination takes place as a result of the counting process.

4.1.5.6 Contamination surveys in non-contaminated areas shall be performed as required by Ref. 6.2. Any surface contamination found in non-contaminated areas shall have the area immediately secured and further surveys made in the vicinity to determine the extent of the activity. The survey data shall be reported to SRSO for evaluation.

4.1.5.7 Major changes in loose surface contamination in known contaminated areas should be reported to SRSO.

4.1.5.8 Smears/wipes in known highly contaminated areas that do not serve a specific purpose should not be taken.

4.2 Perform a direct frisk as follows:

1. Observe general requirements addressed in Section 4.1.5.

2. Taking precautions to ensure the instrument/probe does not come in contact with the surveyed surface, hold the probe within 1/8" of the surface.

3. Scan the entire surface of the survey point or item at a slow rate. (Approximately 2" per second)

4. If the direct scan indicates levels greater than the allowable limits of Ref. 6.2, perform a smear or wipe survey as indicated in Section 4.3 or Section 4.4 as applicable. Control the area as a contamination area if the smear/wipes indicate levels greater than the allowable limits of Ref. 6.4.

5. Determine activity levels in accordance with Section 4.5.

6. Document results in accordance with Ref. 6.2.

4.3 Smear Survey Technique (indirect method)

4.3.1 Where background levels, surface geometry, etc., prohibit direct scans for surface contamination, perform a smear survey as follows:

1. Observe General Requirements addressed in Section 4.1.5.

2. Obtain a survey form to map the locations of the smear samples.

3. Using moderate pressure, wipe an area approximately 100 cm^2 with the smear.

4. Count the smear samples in accordance with Section 4.5. Document results in accordance with Ref. 6.2.

5. Determine activity levels in accordance with Section 4.5.

6. Document the results in accordance with Ref. 6.2.

4.4 Wipe Survey Technique (Indirect Method)

4.4.1 Where surface geometry, etc., prohibit direct frisks of an area and/or it is desired to survey large areas, perform a wipe survey as follows:

1. Observe the general requirements listed in Section 4.1.5.

2. Wipe the surface to be surveyed with cloth or paper wipe. Masslin or other oil-impregnated materials are not to be used.

3. Count samples in accordance with Section 4.5. Document results in accordance with Ref. 6.2.

4. Determine the activity levels in accordance with Section 4.5.

5. Document the results in accordance with Ref. 6.2.

4.5 Counting Smear/Wipe Samples

4.5.1 Prior to handling smear/wipe samples, take the necessary precautions to prevent cross-contamination.

4.5.2 Scan the samples with a field instrument prior to continuing.

4.5.3 When counting smears/wipes, count the sample for at least 60 seconds.

4.5.4 Determine the activity levels as follows:

$$dpm = \frac{\text{(gross cpm - background cpm)}}{\text{instrument efficiency}}$$

4.5.4.1 Record the results in accordance with Ref. 6.2.

4.5.5 If a more precise measurement is desired such as for release surveys, alpha, etc., smears may be counted using laboratory count equipment.

4.5.5.1 Determine activity levels as follows:

Count smears for at least 1 minute.

$$dpm = \frac{\text{(Gross counts/count time)-(Background counts/background time)}}{\text{counter efficiency}}$$

4.5.5.2 Record the results in accordance with Ref. 6.2.

4.5.6 If further analysis is not desired, (i.e., isotopic analysis), dispose of samples appropriately.

4.6 Equipment:

4.6.1 Survey Forms

4.6.2 Envelopes or Plastic Bags

4.6.3 Smear Papers, Cloths

4.6.4 Appropriate Portable Survey Instruments

4.6.5 Laboratory Counters

5.0 RESPONSIBILITIES

Surface contamination surveys are performed by the Radiation Safety Technicians to assess surface contamination to aid in controlling the spread of radioactive contamination to unrestricted or less contaminated surfaces.

6.0 REFERENCES

6.1 RSO-TNT-13, Personnel Contamination Monitoring and Decontamination

6.2 RSO-TNT-10, Radiological Surveys

7.0 ATTACHMENTS

None

Sevenson Environmental Services, Inc

USACE TNT SITE

Radiation Safety Office-
Standard Operating Procedure (RSO-TNT)

Cover Sheet

RSO-TNT-13

PERSONNAL CONTAMINATION AND DECONTAMINATION

Rev. 0

March 21, 2003

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1.0 PURPOSE

This procedure describes personnel contamination monitoring requirements and describes actions to be taken upon detecting contamination during frisking.

2.0 APPLICABILITY/SCOPE

This procedure is applicable to all Radiation Safety personnel.

3.0 DEFINITIONS

3.1 Contaminated Individual — an individual who is found to be externally contaminated as indicated by an Ludlum 43-89 frisk of ≥ 20 cpm_{net} (net counts per minute) alpha (") or ≥ 50 cpm_{net} beta/gamma ($()). If the contamination can be identified to consist only of radon decay products, the person shall be regarded as uncontaminated.

3.2 Hand and Foot Frisk — a personnel survey technique in which the hands and soles of the feet are surveyed for surface contamination. Hand and foot frisks shall be performed by all individuals leaving a Radiologically Controlled Area (RCA), if, in the opinion of the Site Radiation Safety Officer (SRSO), there is a low probability of clothing or personnel contamination (e.g., low contamination levels in area, or subject person was only performing a walk-through inspection, surveillances or certain surveys). If positive results are obtained by a hand and foot frisk, a whole body frisk shall be performed.

3.3 Whole body Frisk — the personnel survey technique in which the entire body is surveyed for surface contamination. Whole body frisks are used to qualitatively and quantitatively establish external personnel contamination. A whole body frisk shall be performed on any individual who has worked in a RCA, especially one in which in which high-level contamination is known to exist.

4.0 PROCEDURE

4.1 Performing Whole Body Frisks

4.1.1 A Whole body frisk shall be performed by each individual immediately upon exiting a posted RCA and/or as otherwise directed by Radiological Safety personnel.

4.1.2 Whole body frisks shall be performed in accordance with Attachment 7.1.

4.2 Performing Hand and Foot Frisks

4.2.1 A hand and foot frisk shall be performed by individuals who, in the opinion of the SRSO, have a low probability of clothing and/or personnel contamination, such as personnel performing inspections, surveillances or certain surveys.

4.2.2 Hand and foot frisks shall be performed in accordance with Attachment 7.2.

4.3 Decontamination of Contaminated Individuals

Upon notification of a contaminated individual, Radiation Safety personnel shall decontaminate the individual as follows:

4.3.1 Technician

Perform a whole body frisk of the individual in accordance with Attachment 7.1. If the survey confirms that the individual is contaminated, initiate Attachment 7.3 (Personnel Contamination Form).

NOTE: Ensure that all frisk survey results are logged in cpm_{net} (unless otherwise specified) and the time of each survey is included on the Personnel Contamination Form. Estimate and log the area(s) of skin contaminated (cm^2).

NOTE: Obtain nasal smears if contamination has occurred above the shoulders and for any other situation where an internal deposition is suspected. All nasal smears should be recorded on the Personnel Contamination Form in units of dpm/smear.

4.3.2 At an appropriate decontamination facility, decontaminate the individual using a suitable technique(s). Guidelines for decontamination methods are contained in Attachment 7.4. Apply the decontamination techniques in progressive order. Application of the decontamination technique shall include the following considerations.

NOTE: To accommodate special situations, techniques not listed in Attachment 7.4 may be utilized on a case by case basis with the concurrence of qualified medical personnel.

NOTE: Decontamination of contaminated wounds, severely injured or internally contaminated personnel, shall be performed under the direction of qualified medical personnel.

4.3.2.1 Brief the individual as to the severity and significance of the contamination and the methods to be used for decontamination.

NOTE: The psychological well being of the contaminated worker should always be considered. The unusual nature of ionizing radiation may create apprehension, and occasionally, unreasonable fear may accompany contamination. Every effort to reassure the worker and to allay his fears should be made.

4.3.2.2 Document the technique and log the decontamination results for each decontamination attempt.

4.3.2.3 Do not decontaminate to the point of skin reddening/ abrasion.

4.3.2.4 Decontamination of ears, eyes, mouth and other orifices shall be performed under the direction of qualified medical personnel.

4.3.2.5 Decontamination of nasal passages shall be limited to repeated nose blowing by the individual. Supplemental nasal irrigation as required shall be performed under the direction of qualified medical personnel.

4.3.3 Determine and record the specifics of the contamination event. These specifics shall include the estimated time of contamination and description of the most likely cause. As necessary initiate controls, to prevent further contaminations until corrective actions have been determined and initiated, in accordance with Ref. 6.1.

NOTE: In the event that the individual cannot be decontaminated below 20 cpm_{net} α or 50 cpm_{net} $\beta\gamma$, notify SRSO or designee prior to release of the individual.

4.3.4 As required by Ref. 6.2, have the individual submit appropriate bioassay samples.

4.3.5 Whole Body Counter Operator — If a Whole body count is performed, provide Radiation Safety with the results to allow completion of the applicable section of the Personnel Contamination Form.

4.3.6 Site Radiation Safety Officer — Review the contamination event with the individual and have the individual sign the Personnel Contamination Form.

4.3.7 Site Radiation Safety Officer — Review the Personnel Contamination Form for completeness and accuracy. Sign the Personnel Contamination Form and forward the Personnel Contamination Form to the Radiation Safety Officer for review.

4.3.8 Site Radiation Safety Officer — If necessary, initiate an Radiological Deficiency Report (RDR) in accordance with Ref. 6.1

4.3.9 Site Radiation Safety Officer — Review the Personnel Contamination Form for completeness and accuracy. Sign the Personnel Contamination Form. As required, incorporate the assessed skin dose into the individual's exposure record in accordance with Ref. 6.3. Place the completed Personnel Contamination Form into the individual's exposure file.

4.4 Documentation of contaminated clothing

4.4.1 Technician

4.4.1.1 Using Attachment 7.5, "Clothing Contamination Report", document the circumstances, decontamination methods, survey results, and disposition of clothing determined to be contaminated. This documentation shall include survey results on both inside and outside surfaces of the contaminated clothing.

4.4.1.2 Record the estimated time of the contamination on Attachment 7.5 at the top in the box marked "Time".

4.4.1.3 Record the time(s) of decontamination under "Survey Results".

4.4.2 Site Radiation Safety Officer

4.4.2.1 Review and sign Attachment 7.5 prior to distribution.

5.0 RESPONSIBILITIES

5.1 Each individual is responsible to:

5.1.1 Properly perform a whole body frisk upon exiting a posted RCA or as otherwise directed by Radiation Safety.

5.1.2 Properly perform hand and foot frisks as the exit from the Restricted Area.

5.2 Site Radiation Safety Officer is responsible to:

5.2.1 Maintain calibrated frisking devices/stations strategically throughout the site to support whole body and hand and foot frisking requirements.

5.2.2 Periodically observe personnel frisking operations to ensure compliance with this procedure.

5.2.3 Decontaminate those individuals identified to be contaminated.

5.2.4 Document the details of the contamination event and initiate corrective action(s) in those cases where program deficiencies are identified.

5.2.5 Support Radiation Safety personnel with regards to the identification and corrections to radiological practices which contribute to skin contaminations, in accordance with Ref. 6.1.

5.2.6 Maintain Personnel Contamination Forms in the appropriate personnel files.

6.0 REFERENCES

6.1 RSO-SOP-06, Radiological Deficiency Reports

6.2 RSO-SOP-04, Bioassay Procedure

6.3 RSO-SOP-03, Personnel Dosimetry Requirements

7.0 ATTACHMENTS

7.1 Whole Body Frisk Technique

7.2 Hand and Foot Frisk Technique

7.3 Personnel Contamination Form

7.4 Decontamination Methods

Recommended Whole Body Frisk Technique

GENERAL USE OF FRISKER (Ludlum 43-89 or equivalent)

1. Probe to be held within 1/8" of surface being monitored.

2. Probe to be moved over surface at a rate of less than 2"/sec.

3. If so equipped, Radiation Safety will maintain alarm at 20 cpm_{net} for α survey meters and 50 cpm_{net} for βγ survey meters.

4. The net cpm above background shall be visually observed.

5. Entire whole body frisk will require 2-3 minutes - if available, timers shall be used.

FRISK TECHNIQUE

1. Perform frisker check.

   • Start with both hands
   • Neck and Shoulders
   • Shoes, top and bottom

NOTE: IN THE EVENT THAT α FRISKING INDICATES ≥ 20 cpm ABOVE BACKGROUND, βγ FRISKING INDICATES ≥ 50 cpm ABOVE BACKGROUND, OR FRISKER ALARMS, NOTIFY RADIATION SAFETY PERSONNEL FOR ASSISTANCE.

Recommended Hand and Foot Frisk Technique

GENERAL USE OF FRISKER (Ludlum 43-89 or equivalent)

1. Probe to be held within 1/8" of surface being monitored.

2. Probe to be moved over surface at a rate of less than 2"/sec.

3. If so equipped, Radiation Safety will maintain alarm at 20 cpm_{net} for α survey meters and 50 cpm_{net} for βγ survey meters.

4. The net cpm above background shall be visually observed.

SPECIFIC TECHNIQUE

1. Perform frisker check.

2. Frisk both hands.

3. Frisk the bottoms of both feet.

NOTE: IN THE EVENT THAT α FRISKING INDICATES ≥ 20 cpm ABOVE BACKGROUND, βγ FRISKING INDICATES ≥ 50 cpm ABOVE BACKGROUND, OR FRISKER ALARMS, PERFORM A WHOLE BODY FRISK AND NOTIFY RADIATION SAFETY PERSONNEL FOR ASSISTANCE.

Personnel Contamination Form

REPORT NO:_____ DATE/TIME: _____

NAME:_____ TLD NO:_____

LOCATION:_____ RWP:_____

DISCOVERED BY: ___ FRISK ___ H/F MON ___ PCM ___ OTHER

OCCURRENCE AREA: ___ RCA ___ NON RAD ___ CSCA ___ OTHER

CONTAMINATION TYPE: ___ SKIN/HAIR ___ CLOTHING ___ NASAL ___ OTHER

LOCATION OF CONTAMINATION:

SURFACE AREA: _____ cm² CONTAMINATION LEVEL: _____ dpm/100cm²

RESIDENCE TIME: _____ Hours SURVEY #: _____ (attach)

SKIN EXPOSURE: _____ dpm-hr SKIN DOSE: _____ mrem

CORRECTIVE ACTION:

APPARENT CAUSE:

COMMENTS:

DISPOSITION: ___ RELEASE CLEAN ___ DISCARDED ___ OTHER

Preparer: _____ SRSO:_____
Signature/date Signature/date

Individual: _____ PM:_____
Signature/date Signature/date

Personnel Decontamination

Method*	Surface	Action	Technique	Advantages	Disadvantages
Soap and water	Skin and hands	Emulsifies and dissolves contaminate	Wash 2-3 minutes an monitor. Do not wash more than 4 times.	Readily available and effective for most radioactive contamination.	Continued washing will defat the shin. Indiscriminate washing of other than affected parts may spread contamination.
Soap and water	Hair	Same as above	Wash several times. If contamination is not lowered to acceptable levels, shave the head and apply skin decontamination methods if necessary.	None	None
Lava soap, soft brush, and water	Skin and hands	Emulsifies, dissolves, and erodes	Use light pressure with heavy lather. Wash for 2 minutes, 3 times. Rinse and monitor, use care not to scratch or erode the skin. Apply lanolin or hand cream to prevent chapping.	Same as above.	Continued washing will abrade the skin.
Tide or other detergent (plain)	Same as above	Same as above	Make into a paste. Use additional water with a mild scrubbing action. Use care not to erode the skin.	Slightly more effective than washing with soap.	Will defat and abrade skin and must be used with care.
Flushing	Eyes, ears, nose and mouth	Physical removal by flushing	Roll back the eyelid as far as possible, flush with large amounts of water. If isotonic irritants are available, obtain them without delay. Apply to eye	If used immediately will remove contamination. May also be used for ears, nose, and throat.	When using for nose and mouth, contaminated individual should be warned not to swallow the rinses.

Personnel Decontamination

Method*	Surface	Action	Technique	Advantages	Disadvantages
Flushing – con't			continually and then flush with large amounts of water.		
Flushing	Wounds	Physical removal by flushing	Wash wound with large amounts of water and spread edges to stimulate bleeding, if not profuse. If profuse, stop bleeding first, clean edges of wound, bandage, and if any contamination remains, it may be removed by normal cleaning methods, as above.	Quick and efficient if wound is not severe.	May spread contamination to other areas of the body if not done carefully.
Sweating	Skin of hands and feet	Physical removal by sweating	Place hand or foot in plastic glove or booty. Tape shut. Place near source of heat for 10-15 minutes or until hand or foot is sweating profusely. Remove glove and then wash using standard techniques. Or glove can be worn for several hours using only body heat.	Cleansing action is from inside out. Hand does not dry out.	If glove or booty is not removed shortly after profuse sweating starts and part washed with soap and water immediately, contamination may seep into pores.

* Begin with the first method and then proceed step by step to the more severe methods, as necessary

Area and Material Decontamination

Method*	Surface	Action	Technique	Advantages	Disadvantages
Vacuum cleaning	Dry surfaces	Removes contaminated dust by suction	Use conventional vacuum technique with HEPA filter.	Good on dry, porous surfaces, avoids water reactions.	All dust must be filtered out of exhaust. Machine is contaminated.
Water	All nonporous surfaces (metal, painted, plastic, etc.)	Dissolves and erodes	<u>For large surfaces</u> Hose with high-pressure water at an optimum distance. Spray vertical surfaces at an angle of incidence of 30^{o} to 40^{o}; work from top to bottom to avoid recontamination. Work upwind to avoid spray. Determine cleaning rate experimentally if possible; otherwise, use a rate of 4 square feet per minute.	All water equipment may be utilized. Allows operation to be carried out from distance. Contamination may be reduced by 50%. Water equipment may be used for solutions of other decontaminating agents.	Drainage must be controlled. Not suitable for porous materials. Oiled surfaces cannot be decontaminated. Not applicable on dry contaminated surfaces. Spray will be contaminated.
	All Surfaces		<u>For small surfaces</u> Blot up liquid and hand wipe with water and appropriate commercial detergent.		
Steam	Nonporous surfaces (especially painted or oil stained surfaces)	Dissolves and erodes	Work from top to bottom and from upwind. Clean surface at a rate of 4 square feet per minute. The cleaning efficiency of steam will be greatly increased by using	Contamination may be reduced	

			detergents.		
Detergents	Nonporous surfaces (metal, painted, glass, plastic, etc.)	Emulsifies contaminant and increased wetting power of water and cleaning efficiency of steam.	Rub surface 1 minute with rag moistened with detergent solution then wipe with dry rag; use clean surface of the rag for each application. Use a power rotary brush with pressure feed for more efficient cleaning. Apply solution from a distance with a pressure proportioner. Do not allow solution to drip onto other surfaces. Mist application is all that is necessary.	Dissolves industrial film and other materials which hold contamination. Contamination may be reduces by 90%.	May require personal contact with wet surfaces. May not be efficient for long standing contamination.
Complexing agents	Nonporous surfaces (especially unweathered surfaces; i.e., no rust or calcareous growth)	Forms soluble complexes with contaminated material.	Complexing agent solution should contain 3% (by weight) of agent. Spray surface with solution. Keep surface moist 30 minutes by spraying with solution periodically. After 30 minutes, flush material off with water. Complexing agents may be used on vertical and overhead surfaces by adding chemical foam (sodium carbonate or aluminum sulfate).	Holds contamination in solution. Contamination may be reduced by 75% in 4 minutes on unweathered surfaces. Easily stored; carbonates and citrates are non toxic, non corrosive.	Requires application for 5 to 30 minutes. Little penetrating power; of small value on weathered surfaces.
Organic solvents	Nonporous surfaces (greasy or waxed	Dissolves organic materials (oil, paint,	Immerse entire unit in solvent or apply by	Quick dissolving action. Recovery of solvent	Requires good ventilation and fire

	surfaces, paint or plastic finishes, etc.)	etc.)	wiping procedure (see Detergents).	possible by distillation.	precautions. Toxic to personnel. Material bulky.
Inorganic acids	Metal surfaces (especially with porous deposits; i.e., rust or calcareous growth); circulatory pipe systems	Dissolves porous deposits	Use dip-bath procedure for moveable items. Acid should be kept at a concentration of 1 to 2 normal (9 to 18% hydrochloric, 3 to 6% sulfuric acid). Leave on weathered surfaces for 1 hour. Flush surface for 1 hour. Flush surface with water, scrub with water-detergent solution, and rinse. Leave in pipe circulatory system 2 to 4 hours; flush with plain water, a water detergent solution, then with plain water.	Corrosive action on metal and porous deposits. Corrosive action may be moderated by addition of corrosive inhibitors to solution.	Personnel hazard. Wear goggles, rubber boots, gloves, and aprons. Good ventilation required because of toxicity and explosive gases. Acid mixtures should not be heated. Possibility of excessive corrosion if used with-out inhibitors. Sulfuric acid not effective on calcareous deposits.
Abrasion	Nonporous surfaces	Removes surface	Use conventional procedures, such as sanding, filing, and chipping; keep surface damp to avoid hazard.	Contamination may be reduces to as low a level as desired.	Impracticable for porous surfaces because of penetration by moistures.
Sandblasting	Non porous surfaces	Removes surface	Keep sand wet to lessen spread of contamination. Collect used abrasive or flush away with water.	Practical for large surface areas.	Contamination spread over area must be removed. Contaminated dust is personnel hazard.
Vacuum blasting	Porous and nonporous surfaces	Removes surface; traps and controls contaminated waste.	Hold tool flush to surface to prevent escape of contamination.	Contaminated waste ready for disposal. Safest abrasion method.	Contamination of equipment.

* Begin with the first listed method and then proceed step by step to the more severe methods, as necessary.

Sevenson Environmental Services, Inc

USACE TNT SITE

Radiation Safety Office-
Standard Operating Procedure (RSO-TNT)

Cover Sheet

TNT-TNT-34

SOURCE CHECKING INSTURMENTS

Rev. 0

March 7, 2003

Record of Changes

Change No.	Page(s) Changed	Effective Date	Change No.	Page(s) Changed	Effective Date

1. PURPOSE

Establish the source/response check criteria for radiological instrumentation used for the detection of radioactivity. All survey instruments, counting instruments, and other equipment used for radioactivity detection and measurements requiring calibration by radioactive means shall be cared for and maintained by this procedure.

2. APPLICABILTY/SCOPE

The following types of equipment shall be calibrated and maintained according to this procedure:

2.1. Counting Instruments

2.2. Radiation Survey Instruments

3. DEFINITIONS

None

4. PROCEDURE

4.1. Obtain current Source Check Log (Attachment 7.1)

4.2. Each instrument that is used will require a source check to insure the instrument is operating within it's calibration settings.

4.3. Instruments will be source checked prior to use daily by using a check source of radioactivity of know concentration and reproducible geometry.

4.4. Each instrument will have a 95% confidence limit established for each check source required for source checking. This is only done once, usually after calibration or if a new check source is to be used to source check the instrument.

4.4.1. To establish a 95% confidence range at least 10 measurement shall be taken with the instrument using the same detector of check source geometry being used for the source check.

4.4.2. Personnel performing the 95% confidence test shall use Attachment 7.2 (95% Confidence Test) to record the results in the corresponding locations.

4.4.3. If the instrument has ratemeter capabilities, a one minute count should be performed.

4.4.4. If the instrument has only scaler capabilities then the technician shall obtain scaled numbers by waiting for the instrument to stabilize.

4.4.5. Once the reading has been recorded start the next reading by either pressing the "Reset"

of "Zero" button on the meter, or if there are not Reset of Zero button remove the detector from the source till it is at background and repeat steps 4.6.3.4 and 4.6.3.5 till the 10 readings have been collected.

4.4.6. Once the 10 measurements are taken, they are to be averaged.

4.4.7. Take the square root of the average number, then multiply the answer by 1.96. Take number is your ± number for your source range. For example, you average for the ten numbers is 100 cpm. The square root of 100 = 10. 10 * 1.96 = 19.6, 100 + 19.6 = 119.6 and 100 – 19.6 = 80.4, so your source check range would be 80.4 cpm – 119.6 cpm.

4.4.8. The check source used and range will be added to Attachment 7.1.

4.5. Once an instrument has a source range established a source check must be performed before the instrument is placed into service.

4.6. Source checks are to performed at the beginning of the shift before the instrument is used.

4.7. To perform a source check the following steps are to be implemented.

4.8. Choose instrument for source check.

4.9. Perform a visual inspection of the instrument.

4.9.1. Ensure there is not physical damage to the housing or if applicable the probe.

4.9.2. If applicable verify correct probe with scaler/rate meter.

4.9.3. Ensure the calibration sticker is still attached, legible and calibration was performed no greater than twelve months prior.

4.9.4. If all of the above are satisfactory place a check mark in the Visual Inspection Column.

4.10. Check Battery Response

4.10.1. Adjust the range switch to BAT position. If the instrument has a BAT button instead adjust the range switch to highest range position and depress the BAT button.

4.10.2. The instrument should respond with the needle entering the BAT OK region.
Note: With the Ludlum Model 2221 acceptable battery check is greater than 4.8 on the LCD display when the BAT button is depressed.

4.10.3. If the instrument passes the battery response place a check mark in the Battery OK column of the Source Check Log then proceed to step 4.4.

4.10.4. If the instrument does not pass the battery response, replace batteries as describe in the manufactures instruction manual.

4.10.5. Once batteries have been replaced follow steps 4.3.1 and 4.3.2.

4.10.6. If the instrument passes the battery response proceed to step 4.4.

4.10.7. If the instrument does not pass the battery response, mark an "X" on the Source Check Log column for battery OK, tag instrument out of service and contact manufacture's technical support for assistance.

4.10.8. If the instrument does not require batteries, then write "NA" in the Battery OK column.

4.11. Check Audio Response (if applicable)

4.11.1. Turn instrument range switch to the highest multiplier position.

4.11.2. Ensure the AUD switch is at the 'ON' position.

4.11.3. Expose the detector to a radiation check source. The speaker should click with the audio switch turned to the 'ON' position.

4.11.4. If audio is working properly proceed to step 4.5.

4.11.5. If audio is not working properly, the instrument may not be used in an application that requires the user to utilize the audio function.

4.11.6. Instruments with an in operable audio function may be used for applications that do not require an audio response. Such instruments will be tagged or labeled "Audio Not Working".

4.11.7. If audio response is working properly place a check mark in the Audio Response column of the Source Check Log, if it is not working properly than place an "X" in the column, if there is no audio option for the instrument than write "NA" in the column.

4.12. Check Slow/Fast Response Switch

4.12.1. Move the range switch to the lower scales until a meter reading is indicated.

4.12.2. The Toggle switch labeled F-S should have a fast response in "F" position and slow response in "S" position.

4.12.3. If Slow/Fast Response Switch is working properly, place a check mark in the Fast/Slow Response column of the Source Check Log, then proceed to step 4.6.

4.12.4. If the Slow/Fast Response Switch is not working properly, place an "X" in the Slow/Fast Response Switch column, tag the instrument out of service and inform the SRSO. The instrument will be sent to a vender that is authorized to repair and recalibrate the instrument.

4.12.5. If the instrument does not have a Slow/Fast Response Switch than write "NA" in the

column.

4.13. Source Check

4.13.1. Obtain a Source Check Log that has been updated to reflect current instrument inventory 95% Confidence Test data. This is usually updated by the Site Radiation Safety Officer after reviewing the 95% Confidence Test data.

4.13.2. Obtain check source as listed on the Source Check Log.

4.13.3. Perform a one-minute background check and record background on the Source Check Log background column.

4.13.4. Source check per instrument procedure.

4.13.5. Compare meter reading to source range.

4.13.6. If meter reading falls into the acceptable source check range, than record meter reading in the results column.

4.13.7. If meter reading does not fall into the acceptable source check range, than ensure the detector to source geometry is correct. Ensure all settings are correct on the meter. Redo source check. If source check does not pass the second time the instrument is to be taken out of service.

4.13.8. Once the instrument has passed the source check it is ready for field use.

5. RESPONSIBILITIES

5.1. As stated in Section 4.0

6. REFERENCES

6.1. RSO-TNT-07 Records for Retention

6.2. RSO-TNT Instrumentation Procedures

7. ATTACHMENTS

7.1. Source Check Log

7.2. 95% Confidence Level

Instrument Source Check Log

DATE:

Instrument Type/Model	Instr. S/N	Probe Type/Model	Probe S/N	Cal. Date	Range (cpm)	Source used	Actual (cpm)	Bkgd. (cpm)	Eff.	Batt OK	Audio Ok	F/S Switch OK	HPT Init.

95% CONFIDENCE SHEET

Date:_____

Instrument/Probe:_____ Calibration Date:_____

Source:_____ Technician:_____

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Total:_____ Average:_____

Average^{-2}:_____ Range:_____

Range = Average^{-2} * 1.96, $\pm$ Average

Reviewed by:

Reviewed by:_____ Date:_____

Sevenson Environmental Services, Inc

USACE TNT SITE

Radiation Safety Office-
Standard Operating Procedure (RSO-TNT)

Cover Sheet

RSO-TNT-501

LUDLUM MODEL 19

Rev. 0

March 5, 2003

Record of Changes

Change No.	Page(s) Changed	Effective Date	Change No.	Page(s) Changed	Effective Date

LUDLUM MODEL 19 OPERATING PROCDURE

1.0 PURPOSE

To provide operating instructions for the Ludlum Model 19 Micro R portable exposure rate meter.

2.0 APPLICABILITY

This procedure is applicable to the Ludlum Model 19 Micro R portable exposure rate meter. The instrument is used for measuring low level gamma exposure rates, generally in non-radiological areas.

3.0 DEFINITIONS/ACRONYMS

NONE

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Precautions

4.1.1 Keep instrument dry. Do not leave outdoors or allow to get wet.

4.1.2 Turn instrument OFF before replacing batteries.

4.1.3 Response of the instrument is unpredictable in strong magnetic or radio frequency fields.

4.2 Limitations

4.2.1 **IF** instrument is out of calibration, malfunctions, fails QA/QC check, or is suspected of being defective **THEN**, place instrument Out of Service and return to health physics instrument program manager.

4.2.2 Micro R minimum and maximum exposure rates are 1.0 FR/hr and 5000 FR/hr, respectively.

4.2.3 Instrument will operate in a ambient temperature range of -15EC to 50EC (5EF to 122EF) and relative humidity up to 90% non-condensing.

4.2.4 Instrument response time is 3 seconds in the F (fast) position and 11 seconds in the S (slow) position.

5.0 PREREQUISITES

5.1 Instrument should have a current and approved operating and calibration procedure.

5.2 Instrument shall have a current calibration tag/sticker.

6.0 TEST EQUIPMENT, APPARATUS, REAGENTS, AND SUPPLIES

6.1 Ludlum Model 19 Micro R exposure rate meter.

6.2 Gamma (Cs-137 or equivalent) check source.

7.0 ACTION STEPS

7.1 Pre-operational checks

7.1.1 Calibration due date is not past.

7.1.2 Physical condition, i.e., loose screws.

7.1.3 Move meter switch to any range position and press BAT button.

7.1.4 Needle should indicate within the BAT OK area.

7.1.4.1 Replace with new batteries if required.

7.1.4.2 Dispose of old batteries in a designated hazardous waste receptacle.

7.1.5 Source check performed as per RSO-TNT-34.

7.2 Operation

7.2.1 Set AUD switch to ON.

7.2.2 Set F/S switch to S.

7.2.3 Press RES button. Check meter pointer returns to zero position.

NOTE:

Background should be around 6 - 10 FR/hr in nonradiological areas. Range selector should be set on the second scale as a minimum.

7.2.4 Set range selector on anticipated scale.

7.2.4.1 The 0-25 scale (in red numbers) corresponds to the 25 and 250 positions on the range selector switch.

7.2.4.2 The 0-50 scale (in black numbers) corresponds to the 50, 500 and 5000 positions on the range selector switch.

7.2.4.3 When entering an area with unknown radiation levels, set range setting on highest scale.

7.2.4.4 When instrument response stabilizes, progressively lower the range to the lowest setting for which the needle stays in the middle (1/3 to 2/3) of the scale, if possible.

7.2.4.5 Press RES button as necessary to reset the meter.

7.2.4.6 Press L button as necessary to illuminate meter face.

7.2.5 Perform desired radiation survey as specified by the RWP or health physics supervision.

7.2.6 If meter reading goes off-scale on highest range, leave area and obtain a meter with a higher scale range.

7.2.7 Record readings on appropriate survey form as per RSO-TNT-11.

7.2.8 Turn instrument OFF when not in use.

8.0 ACCEPTANCE CRITERIA OR PRECISION AND ACCURACY

8.1 Source check must be within the acceptable range as per RSO-TNT-34.

9.0 REFERENCES

9.1 Policies and Standards

9.1.1 Technical Manual for the Ludlum Model 19 Micro R.

9.2 Procedures

9.2.1 RSO-TNT-11, Radiation Dose Rate Surveys

9.2.2 RSO-TNT-34, Source Checking Instruments

10.0 RECORDS

10.1 All completed forms shall be maintained in accordance with the RSO-TNT-07, Records for Retention.

11.0 APPENDIXES

NONE

Sevenson Environmental Services, Inc

USACE TNT SITE

Radiation Safety Office-
Standard Operating Procedure (RSO-TNT)

Cover Sheet

RSO-TNT-502

LUDLUM MODEL 12 WITH 44-9

Rev. 0

March 5, 2003

Record of Changes

Change No.	Page(s) Changed	Effective Date	Change No.	Page(s) Changed	Effective Date

LUDLUM MODEL 12 with 44-9 OPERATING PROCDURE

1.0 PURPOSE

To provide operating instructions for the Ludlum Model 12 count ratemeter with the Ludlum Model 44-9 pancake G-M probe.

2.0 APPLICABILITY

This procedure is applicable to the Ludlum Model 12 count ratemeter with the Ludlum Model 44-9 pancake G-M probe. The system is typically used to frisk personnel and equipment for beta/gamma contamination. The count ratemeter is to be used only with the specific detector probe it was calibrated with.

3.0 DEFINITIONS/ACRONYMS

NONE

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Precautions

4.1.1 Do **NOT** place sharp or pointed objects directly on detectors probe monitoring surface.

4.1.2 Keep instrument and detector dry. Do not leave outdoors or allow to get wet.

4.1.3 Response of the instrument is unpredictable in strong magnetic or radio frequency fields.

4.1.4 Turn instrument OFF before replacing batteries.

4.1.5 Do not use in high background areas (greater than 300 cpm).

NOTE:
Background will increase on rainy days due to radon.

4.2 **Limitations**

4.2.1 **IF** instrument is out of calibration, malfunctions, fails QA/QC check, or is suspected of being defective **THEN**, place instrument Out of Service and return to health physics instrument program manager.

4.2.2 Instrument will saturate (response will be zero) in high beta/gamma radiation fields.

4.2.3 Instrument will operate in a ambient temperature range of -15EC to 50EC (5EF to 122EF) and relative humidity up to 90% non-condensing.

4.2.4 Instrument response time is 3 seconds in the F (fast) position and 11 seconds in the S (slow) position.

5.0 PREREQUISITES

5.1 Instrument should have a current and approved operating and calibration procedure.

5.2 Instrument shall have a current calibration tag/sticker.

5.3 Instrument should have appropriate correction factor tag/stickers for point and plane source.

5.4 Instrument shall only be operated using the detector it was calibrated with.

6.0 TEST EQUIPMENT, APPARATUS, REAGENTS, AND SUPPLIES

6.1 Ludlum Model 12 portable count ratemeter with the Ludlum Model 44-9 pancake G-M probe.

6.2 Beta/gamma check source.

7.0 ACTION STEPS

7.1 **Pre-operational checks**

7.1.1 Verify detector probe serial number is the same serial number written on the side of the survey meter.

7.1.2 Calibration due date is not past.

7.1.3 Physical condition, i.e., holes in detector, loose screws and connectors, cracks in cable, dirt in detector.

7.1.4 Verify the meter will re-zero. Press RESET button to re-zero the analog meter if necessary.

7.1.5 Verify dead time switch (not present on older models) is in the OFF position.

7.1.6 Move meter switch to the BAT position.

7.1.6.1 Needle should indicate within the BAT OK area.

7.1.6.2 Replace with new batteries if required.

7.1.6.3 Dispose of old batteries in a designated hazardous waste receptacle.

7.1.7 Source check performed as per RSO-TNT-34.

7.2 **Operation**

7.2.1 Set SLOW/FAST response switch to SLOW.

7.2.2 Turn audio ON/OFF switch to ON.

7.2.3 Set range selector on anticipated scale. Use the lowest range for which the needle stays in the middle (1/3 to 2/3) of the scale, if possible.

7.2.4 Note and record background reading on appropriate survey form as per RSO-TNT-10.

7.2.5 Background readings in non-radiological areas are normally 50 - 60 cpm. If background readings are greater than 300 cpm, obtain results in a lower background area if possible.

7.2.6 Move the probe as close as possible (without touching) over the surface to be monitored, not to exceed 2 in/sec (10 ft/min).

7.2.7 If an increase in the audio (clicking) frequency **OR** meter face response (unable to hear audio frequency due to noise level) then,

7.2.7.1 Hold the probe stationary over the potentially contaminated area.

7.2.7.2 90% response is achieved in approximately 20 seconds in slow response mode.

7.2.7.3 Multiply the meter reading by the counting range setting to obtain the reading in cpm.

7.2.7.4 Subtract background reading from gross cpm.

7.2.7.5 Multiply the net results by the appropriate correction factor to record results in dpm on required survey forms as per HP-O-2.

7.2.8 As necessary, press RESET button to reset the meter movement.

7.2.9 Turn instrument OFF when not in use.

8.0 ACCEPTANCE CRITERIA OR PRECISION AND ACCURACY

8.1 Source check must be within the acceptable range as per RSO-TNT-34.

9.0 REFERENCES

9.1 **Policies and Standards**

9.1.1 Technical Manual for the Ludlum Model 12 and Model 44-9.

9.2 **Procedures**

9.2.1 RSO-TNT-11, Radiation Dose Rate Surveys

9.2.2 RSO-TNT-34, Source Checking Instruments

10.0 RECORDS

10.1 All completed forms shall be maintained in accordance with the RSO-TNT-07, Records for Retention.

11.0 APPENDIXES

NONE

Sevenson Environmental Services, Inc

USACE TNT SITE

Radiation Safety Office-
Standard Operating Procedure (RSO-TNT)

Cover Sheet

RSO-TNT-503

LUDLUM MODEL 2224-1 WITH 43-89

Rev. 0

March 5, 2003

Record of Changes

Change No.	Page(s) Changed	Effective Date	Change No.	Page(s) Changed	Effective Date

1.0 PURPOSE

To provide operating instructions for the Ludlum Model 2224-1 scaler/ratemeter with the Ludlum Model 43-89 alpha/beta scintillation probe.

2.0 APPLICABILITY

This procedure is applicable to the Ludlum Model 2224-1 scaler/ratemeter with the Ludlum Model 43-89 alpha/beta scintillation probe. The system is typically used to frisk personnel and equipment for alpha and beta/gamma contamination. The scaler/ratemeter is to be used only with the specific detector probe it was calibrated with.

3.0 DEFINITIONS/ACRONYMS

NONE

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Precautions

4.1.1 Do **NOT** place sharp or pointed objects directly on detectors probe monitoring surface.

4.1.2 Keep instrument and detector dry. Do not leave outdoors or allow to get wet.

4.1.3 Response of the instrument is unpredictable in strong magnetic or radio frequency fields.

4.1.4 Turn instrument OFF before replacing batteries.

4.1.5 Do not use in high background areas (greater than 300 cpm beta/gamma).

NOTE:
Background will increase on rainy days due to radon.

4.2 **Limitations**

4.2.1 **IF** instrument is out of calibration, malfunctions, fails QA/QC check, or is suspected of being defective **THEN**, place instrument Out of Service and return to health physics instrument program manager.

4.2.2 Instrument will saturate (response will be zero) in high beta/gamma radiation fields.

4.2.3 Instrument will operate in a ambient temperature range of -15EC to 50EC (5EF to 122EF) and relative humidity up to 90% non-condensing.

4.2.4 Instrument response time is 3 seconds in the F (fast) position and 11 seconds in the S (slow) position.

5.0 PREREQUISITES

5.1 Instrument should have a current and approved operating and calibration procedure.

5.2 Instrument shall have a current calibration tag/sticker.

5.3 Instrument should have appropriate correction factor tag/stickers for point and plane source.

5.4 Instrument shall only be operated using the detector it was calibrated with.

6.0 TEST EQUIPMENT, APPARATUS, REAGENTS, AND SUPPLIES

6.1 Ludlum Model 2224-1 portable scaler/ratemeter with the Ludlum Model 43-89 alpha/beta scintillation probe.

6.2 Alpha and Beta/gamma check source.

7.0 ACTION STEPS

7.1 **Pre-operational checks**

7.1.1 Verify detector probe serial number is the same serial number written on the side of the survey meter.

7.1.2 Calibration due date is not past.

7.1.3 Physical condition, i.e., holes in detector, loose screws and connectors, cracks in cable, dirt in detector.

7.1.4 Verify the meter will re-zero. Press RESET button to re-zero the analog meter if necessary.

7.1.5 Verify dead time switch (not present on older models) is in the OFF position.

7.1.6 Move meter switch to the BAT position.

7.1.6.1 Needle should indicate within the BAT OK area.

7.1.6.2 Replace with new batteries if required.

7.1.6.3 Dispose of old batteries in a designated hazardous waste receptacle.

7.1.7 Source check performed as per RSO-TNT-34.

7.2 **Operation**

7.2.1 Set SLOW/FAST response switch to SLOW.

7.2.2 Turn audio ON/OFF switch to ON.

7.2.3 Set range selector on anticipated scale. Use the lowest range for which the needle stays in the middle (1/3 to 2/3) of the scale, if possible.

7.2.4 Note and record background reading on appropriate survey form as per RSO-TNT-10.

7.2.5 Background readings in non-radiological areas are normally 250 - 300 cpm beta/gamma. If background readings are greater than 400 cpm beta/gamma, obtain results in a lower background area if possible.

7.2.6 Move the probe as close as possible (without touching) over the surface to be monitored, not to exceed 2 in/sec (10 ft/min).

7.2.7 If an increase in the audio (clicking) frequency **OR** meter face response (unable to hear audio frequency due to noise level) then,

7.2.7.1 Hold the probe stationary over the potentially contaminated area.

7.2.7.2 90% response is achieved in approximately 20 seconds in slow response mode.

7.2.7.3 Multiply the meter reading by the counting range setting to obtain the reading in cpm.

7.2.7.4 Subtract background reading from gross cpm.

7.2.7.5 Multiply the net results by the appropriate correction factor to record results in dpm on required survey forms as per RSO-TNT-10.

7.2.8 As necessary, press RESET button to reset the meter movement.

7.2.9 Turn instrument OFF when not in use.

8.0 ACCEPTANCE CRITERIA OR PRECISION AND ACCURACY

8.1 Source check must be within the acceptable range as per RSO-TNT-34.

9.0 REFERENCES

9.1 Policies and Standards

9.1.1 Technical Manual for the Ludlum Model 2224-1 and Model 43-89.

9.2 Procedures

9.2.1 RSO-TNT-10, Radiological Surveys

9.2.2 RSO-TNT-34, Source Checking Instruments

10.0 RECORDS

10.1 All completed forms shall be maintained in accordance with the RSO-TNT-07, Records for Retention.

11.0 APPENDIXES

NONE

Sevenson Environmental Services, Inc

USACE TNT SITE

Radiation Safety Office-
Standard Operating Procedure (RSO-TNT)

Cover Sheet

RSO-TNT-504

LUDLUM MODEL 2221 WITH 44-10

Rev. 0

March 5, 2003

Record of Changes

Change No.	Page(s) Changed	Effective Date	Change No.	Page(s) Changed	Effective Date

LUDLUM MODEL 2221 with 44-10 OPERATING PROCDURE

1.0 PURPOSE

To provide operating instructions for the Ludlum Model 2221 portable scaler rate meter contamination survey instrument with the Ludlum Model 44-10 2"x2" NaI(Tl) gamma detection probe.

2.0 APPLICABILITY

This procedure is applicable for the Ludlum Model 2221 portable scaler rate meter radiation survey instrument with the Ludlum Model 44-10 . The instrument may be used as a scaler or as a rate meter. The survey meter is to be used only with the specific detector probe it was calibrated with.

3.0 DEFINITIONS/ACRONYMS

NONE

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Precautions

4.1.1 Keep instrument dry. Do not leave outdoors or allow to get wet.

4.1.2 Turn instrument OFF before replacing batteries.

4.1.3 Response of the instrument is unpredictable in strong magnetic or radio frequency fields.

4.2 Limitations

4.2.1 **IF** instrument is out of calibration, malfunctions, fails QA/QC check, or is suspected of being defective **THEN**, place instrument Out of Service and return to health physics instrument program manager.

4.2.2 Maximum count rate is 999,900 cpm.

4.2.3 Instrument will operate in a ambient temperature range of -15EC to 50EC (5EF to 122EF) and relative humidity up to 90% non-condensing.

4.2.4 Instrument response time is 3 seconds in the F (fast) position and 11 seconds in the S (slow) position.

5.0 PREREQUISITES

5.1 Instrument should have a current and approved operating and calibration procedure.

5.2 Instrument shall have a current calibration tag/sticker.

6.0 TEST EQUIPMENT, APPARATUS, REAGENTS, AND SUPPLIES

6.1 Ludlum Model 2221 with Ludlum 44-10 detection probe.

6.2 Gamma (Cs-137 or equivalent) check source.

7.0 ACTION STEPS

7.1 Pre-operational checks

7.1.1 Verify detector probe serial number is the same serial number written on the side of the survey meter.

7.1.2 Calibration due date is not past.

7.1.3 Physical condition, i.e., holes in mylar window, loose screws and connectors, cracks in cable.

7.1.4 Source check was performed as per RSO-TNT-34.

7.1.5 Switch the power ON/OFF switch to the ON position. The following will be displayed:

7.1.5.1 A random number will first be observed.

7.1.5.2 Then 8:8:8:8:8:8.

7.1.5.3 And a third displayed number.

7.1.6 Press and hold down BAT button. If voltage is 4.4 volts or less, the meter fails the battery test. Perform the following:

7.1.6.1 Turn instrument OFF.

7.1.6.2 Open meter case and replace the batteries with four new "D" batteries.

7.1.6.3 Dispose of old batteries in designated hazardous waste receptacle.

7.1.6.4 Repeat battery test. If response is still not satisfactory, place instrument Out of Service.

7.1.7 Perform background count as follows:

7.1.7.1 Set SCALER/DIG.RATE switch to SCALER mode.

7.1.7.2 Set CONT.MINUTES selector to 1.0.

7.1.7.3 Place probe on a radiological clean surface.

7.1.7.4 Press COUNT button to initiate background counting sequence.

7.1.7.5 Counting sequence is completed when the 2 colons (:) disappear from the display.

7.1.7.6 Record background reading (value displayed is a number of counts, not a count rate) on appropriate survey form as per RSO-TNT-11.

7.1.7.7 Depress ZERO button to zero the analog meter.

7.2 Operation

7.2.1 Switch the power ON/OFF switch to the ON position. The following will be displayed:

7.2.1.1 A random number will first be observed.

7.2.1.2 Then 8:8:8:8:8:8.

7.2.1.3 Then a third number.

7.2.2 Each time the instrument is turned ON, perform a battery check as per .

7.2.3 Set SCALER/DIG.RATE switch to desired operating mode.

7.2.4 IF SCALER (timed count) mode is selected THEN, perform the following:

7.2.4.1 Set CONT.MINUTES selector to desired counting interval.

7.2.4.2 Hold detector probe stationary as close as possible without touching (no greater than ¼ inch) the surface to be monitored.

7.2.4.3 Press COUNT button to initiate counting sequence.

7.2.4.4 After count is complete, use appropriate time and correction factors to record results on survey forms as per RSO-TNT-11.

7.2.5 IF DIG.RATE (rate meter) mode is selected THEN,

7.2.5.1 Set rate meter RESP F/S switch to S.

7.2.5.2 Set range selector to anticipated scale. Use the lowest range for which the needle stays in the middle (1/3 to 2/3) of the scale, if possible.

7.2.5.3 Move the probe at less than 1/2 meter/sec as close as possible (no greater than 2-inchs) over the surface to be monitored.

7.2.5.4 Hold the probe stationary for measurements when contamination is detected (an increase in the count rate is shown on the meter face) until full response is achieved (~22 seconds for 90% response in slow mode).

7.2.5.5 If contamination is detected then,

7.2.5.5.1 Set CONT.MINUTES selector to 1.0.

7.2.5.5.2 Set SCALER/DIG.RATE switch to SCALER.

7.2.5.5.3 Hold detector probe stationary and press COUNT button.

7.2.5.6 After count is complete, use appropriate correction factors to record results on survey forms as per RSO-TNT-11.

7.2.6 Turn instrument OFF when not in use.

8.0 ACCEPTANCE CRITERIA OR PRECISION AND ACCURACY

8.1 Source check must be within the acceptable range as per RSO-TNT-34.

9.0 REFERENCES

9.1 Policies and Standards

9.1.1 Technical Manual for the Ludlum Model 2221 and Ludlum Model 44-10.

9.2 Procedures

9.2.1 RSO-TNT-11, Radiation Dose Rate Surveys

9.2.2 RSO-TNT-34, Source Checking Instruments

10.0 RECORDS

10.1 All completed forms shall be maintained in accordance with the RSO-TNT-07, Records for Retention.

11.0 APPENDIXES

NONE