RADIATION CONTROL PLAN

FOR

DEMOLITION OF BUILDING 401
NIAGARA FALLS STORAGE SITE
Lewiston, New York

Prepared by:

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Sevenson Environmental Services, Inc

USACE – Building 401 Demolition

Radiation Safety Office

Approval Sheet

Radiation Control Plan

Rev. 0

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Approved	Rebecca Scarborough	Sevenson, Site Radiation Safety Officer	Rebecca Scarborough	09/30/03
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Record of Changes

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Acronyms and Definitions

a	Alpha
ACM	Asbestos Containing Material
ALARA	As Low As is Reasonably Achievable
ALI	Annul Limit on Intake
ß	Beta
CFR	Code of Federal Regulations
CHP	Certified Health Physicist
CIH	Certified Industrial Hygienist
DAC	Derived Air Concentration
dpm	Disintegrations per minute
EM	Engineering Manual
FUSRAP	Formally Utilized Site Remedial Action Program
GM	Geiger Muller
IRF	Intake Retention Factor
LOOW	Lake Ontario Ordnance Works
LPM	Liters Per Minute
LSA	Low Specific Activity
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimal Detectable Concentration
NFSS	Niagara Falls Storage Site
NRC	Nuclear Regulatory Commission
NVLAP	National Voluntary Lab Accreditation Program
RRPT	Registered Radiation Protection Technician
RSO-NFSS-##	Radiation Safety Office-Standard Operating Procedures-Niagara Falls Storage Site
RWP	Radiation Work Permit
SSHP	Site Safety and Health Plan
Sv	Siverts
TLD	Thermoluminescent detector
TNT	Trinitrotoluene
USACE	United States Army Corps of Engineers

Radiation Control Plan

1.0 Introduction

This Radiological Control 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) decontamination, decommissioning and demolition of Building 401 at the Niagara Falls Storage Site (NFSS) located in Lewiston, New York. This plan will describe and outline the potential radiological hazards associated with the NFSS site and how materials and activities will be monitored for such hazards.

This Radiological Control 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 guidenance in accordance with:

- 29 CFR 1926.65 – Construction 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 Radiation Protection Manual EM 385-1-80
- USACE Buffalo District Radiation Safety Procedure 022, Radiation Protection Planning for Remedial Actions
- Nuclear Regulatory Commission (NRC) Regulations and Regulation Guides

NRC regulations and regulatory guides are being followed as a best management practice for the handling of unlicensed radiological material at the site.

2.0 Facility Operating History and Description

NFSS is part of the USACE Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP was established to decontaminate or control sites where residual radioactivity exceeding the current guidelines remains from the activities supported by the nation's atomic energy program.

NFSS is located at 1397 Pletcher Road, Lewiston, New York (see Figure 1), and the site is owned by the Federal Government. The site consists of an engineered Waste Containment Structure, various buildings, and open areas. The site was originally part of the Lake Ontario Ordnance Works (LOOW). The primary use of the site from early 1940s through mid 1950s was for storage, trans-shipment, and disposal of radioactive waste from various sources. Building 401 (see Figure 2) was initially the powerhouse for the production of 2,4,6-trinitrotoluene (TNT) at LOOW, and it was also used to store radioactive materials in support of Manhattan Engineer District activities during World War II. It was used for the production of Boron-10 from 1953 to 1959 and from 1965 to 1971 and them became a waste storage facility used by the Atomic Energy Commission/Department of Energy.

In 1971, Building 401 was gutted and its instrumentation and hardware were disposed of as surplus materials. This building has been largely inactive since, and evidence of bird and animal occupation has been observed. An asbestos abatement was performed on Building 401 in the spring and summer of 2002, resulting in the removal of interior asbestos containing material

(ACM). Potential external ACM was not completed as part of this abatement. Additional abatement activities are anticipated to be completed in fiscal year 2003.

3.0 Radiological Status of the Niagara Falls Storage Site

The site continues to be maintained (mowing, plowing, etc.) with emphasis on assuring that the structure's cap is free from cracks and functions well to retard radon emission and to resist rainwater infiltration. Fencing of the containment structure was completed in late September 1998 as an added security measure against vandalism.

A remedial investigation was initiated in 1999 and continues into 2003 to identify and quantify potential radiological and chemical contaminants remaining on site. Identification of contaminant levels and locations is a critical step in determining where cleanup is needed. The investigation has included three major phases, which have involved extensive sampling of soil, sediment, groundwater and surface water. This investigation is 95 % complete and the draft report on findings is expected in the spring of 2004.

Building 401 has also under gone several radiological characterization and decontamination events (see Table 3-1). There are several Low Specific Activity (LSA) boxes and drums stored inside and outside of Building 401. These boxes and drums contain materials from associated NFSS characterization and decontamination projects.

A copy of the *Current Radiological Contamination Status of Niagara Falls Storage Site (NFSS)-Building 401*, Bechtel National, Inc. August 1998, (Bechtel 1998) is located in Appendix B of this Plan.

*Table 3-1

Description	Dates
Delineation of Building 401	September 12-22, 1994
Decontamination of Building 401	December 1995 – February 1996
ORISE independent verification of Building 401	September 9-10, 1996
Delineation/Decontamination/Post-Remedial Action of Building 401	October 8-14, 1996

* (Bechtel 1998)

3.1 Contaminated Structures

Building 401 is a steel-framed four-story structure enclosing approximately 100,000 square feet of floor area on two levels (see Figures 3 and 4 for layout of floor plan). The main structural system of the building consists of steel and concrete load bearing walls supporting what may be a transite roof; the interior walls are concrete, concrete block and other construction materials. The exterior appears to be comprised of sections of corrugated steel with transite siding and roofing. Inside the building are two floors, which contain rooms, offices, and building service areas (boiler rooms and tower areas). There also is a tower area and high bay that may be as high as 75 feet or more. Additionally, Building 401

has three large concrete silos that shall be demolished along with the building proper. The building floor is a concrete slab on grade.

There are thirty-three affected and sixteen unaffected radiologically classified areas. There are also two undetermined radiologically classified areas of the building due to inaccessibility and structural degradation.

In addition to Building 401 there are three concrete silos that were used to store radioactive material.

3.2 Contaminated Systems and Equipment

Various systems, equipment, materials, and rooms were contaminated while Building 401 was an active storage area. There have been various levels of characterization and decontamination performed at Building 401 as shown in Table 3-1. These characterization surveys along with information provided in the decontamination reports will better define the methodology to determine where contaminated equipment, systems, material, and areas may be found.

3.3 Surface and Sub-Surface Soil Contamination

Areas of radioactivity exist in some soils adjacent to Building 401. These areas are identified in Figure 5 of Appendix B Areas with surface and shallow sub-surface contamination are not to be disturbed with heavy equipment operations.

3.4 Surface Water Contamination

Surface water contamination is only to be expected from water generated by dust controls, decontamination, and rain water once demolition has started. Water from the decontamination/demolition area will be collected, sampled, analyzed, if necessary treated and discharged appropriately.

3.5 Groundwater

Groundwater is not addressed for this project

3.6 Radionuclides of Concern

The historic documents from the site indicate that several radioactive elements were either stored or used at the site. These include natural uranium, uranium-238, radium-226 & 228, thorium-230 & 232, and cesium-137.

4.0 Hazard Assessment

Potential risk to human health and the environment is a primary consideration in formulating and effective Radiation Safety Program.

NON PROJECT PERSONNEL, VISITORS, PUBLIC, AND THE ENVIRONMENT

Non project personnel assigned to the NFSS and visitors not directly related to Building 401 activities will follow existing rules for employees and visitors set by the USACE. The risk for exposure to radioactive materials from Building 401 will be very minimal if any. To ensure this minimal exposure hazard, exclusion zones will be established around Building 401. The Radiation Safety Office will monitor radiological conditions at the perimeter to ensure radiological exposures associated with project activities are kept below regulatory limits for exposures to the general public and the environment.

BUILDING 401

Personnel working on the decontamination/demolition of Building 401 have the potential to be exposed to radioactive material. Site personnel entering the Exclusion Zone or handling radioactive materials will receive radiation worker training and will review the Building 401 Site Safety and Health Plan.

5.0 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 measures, Radiation Safety Office procedures (RSO-NFSS) will be implemented. These procedures, provided in Appendix A, will help identify and monitor radiological material and conditions at the site.

6.0 Personnel

6.1 Radiological Safety Technicians

Radiological monitoring will be conducted by Radiation Safety Technicians. The Radiation Safety Technician will be responsible for implementing and enforcing the Radiation Control Plan and associated procedures.

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

The Corporate Radiation Safety Officer will conduct periodic reviews of the Radiation Safety Program at the site.

6.3 Site Radiation Safety Officer – Rebecca Scarborough - Sevenson Environmental Services, Inc.

The Site Radiation Safety Officer will be responsible for ensuring the Radiation Control Plan is being executed and enforced properly.

6.4 Certified Health Physicist – Rick Haaker, CIH, CHP - Environmental Dimensions, Inc.

The Certified Health Physicist (CHP) will be responsible for reviewing and approving the Radiation Control 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 and other areas of concern. The CHP will conduct site audits as deemed necessary by the Site Radiation Safety Officer. The CHP will perform a site audit during the start up phase of work to ensure the Radiation Safety Program has been properly established.

Table 6-1

Name	Phone
Paul Jung, RRPT, Corporate Radiation Safety Officer – SES	716-284-0431 or 716-984-3657
Rebecca Scarborough, Site Radiation Safety Officer – SES	716-284-0431
Rick Haaker, CHP, CIH – Environmental Dimensions, Inc.	505-341-3578
Shawn Andrews, HP/District Radiation Safety Officer – USACE	716-879-4214

7.0 Radiation Safety and Health Program

Radiological monitoring of radiation exposure levels, contamination, and airborne radioactivity is conducted to characterize work place conditions and to identify areas requiring posting. Monitoring is performed by trained and qualified radiation safety personnel using properly calibrated instruments. Sevenson's surveillance program provides data necessary to evaluate external exposures to our personnel, concentrations of airborne radioactive materials in the facility, surface contamination levels in restricted and unrestricted areas, and radioactive effluents from the site.

7.1 Radiological Surveys

A survey is an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation. Routine surveys for radiation, contamination, and airborne radioactive materials are performed on a daily basis. The survey frequencies will be established based on historic facility patterns, potential radiological conditions, probability of change in those conditions, and area occupancy factors. Additional surveys for radiation, contamination, and/or airborne contamination are performed as specified in Radiation Safety Office procedures. Monitoring results are reviewed by the radiation safety technician. The Site Radiation Safety Officer will review each survey or sample results to identify radiological conditions out of the norm. The review ensures that all required surveys, samples, and data bases have been completed, documented, and

reviewed. Documents and spreadsheets will be kept in accordance with RSO-NFSS-07.

Survey results are made available to operations management and are used in support of pre- and post-job evaluations, ALARA preplanning, general contamination control and housekeeping, and management of radiological operations. Changes or trends which may require corrective actions are noted during that review.

Radiological surveys will be required during intrusive work activities at the site. Monitoring and survey equipment will be kept and calibrated in accordance with USACE EM 385-1-80 §§ 3-14 (a), (h), and (I). 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 shall be sourced checked at least twice daily when used as per RSO-NFSS-34. Radioactive sources used for checking instruments accountability shall be kept in accordance with RSO-NFSS-33.

Sevenson will use various radiation detection instruments for radiological surveys. The following specific equipment, or the equivalent, will be used.

- Ludlum Measurements Model 2221 Scalar/Rate meter with a 44-10 (2"x2" NaI(Tl)) gamma detection 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 material and equipment for alpha and beta 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 and/or air sample activity.
- Ludlum Measurements Model 2200 with 43-20 gas proportional detector to analyze air samples for gross alpha contamination.

Procedures for the use and application of the instruments are:

- RSO-NFSS-10 Radiological Surveys
- RSO-NFSS-11 Radiation Dose Rate Surveys
- RSO-NFSS-12 Surface Contamination Surveys
- RSO-NFSS-18 Counting and Reporting Smear Data
- RSO-NFSS-19 Release of Material for Unrestricted Use

PRE DEMOLITION RADIOLOGICAL SURVEYS

Pre demolition radiological surveys must be completed inside and outside of Building 401.

Radiological walk over surveys are to be performed on the adjacent fifteen meters around the outside Building 401 and silos in accordance with RSO-NFSS-20 and RSO-NFSS-10.

Radiological surveys are to be performed in accordance with RSO-NFSS-10, RSO-NFSS-11, RSO-NFSS-12, and RSO-NFSS-19 inside Building 401. Table 1a (Bechtel 1998) in Appendix B provides the radiological classification of rooms and areas inside Building 401. These areas and rooms will be surveyed as follows. However, Table 4a and 5a provide information that reclassifies some unaffected rooms as affected. The Radiation Safety Office will utilize all three tables to determine room classifications.

Unaffected rooms will be surveyed so that ten percent of each unaffected room has been surveyed. The survey will cover the floor and walls up to two meters high. If radioactive contamination is found to exceed any limit during the survey the entire room is to be considered affected and the room is then surveyed one hundred percent.

Affected rooms will be surveyed by using Tables 4a and 5a (Bechtel 1998) in Appendix B as a guide where radioactive material was identified, delineated, decontaminated or removed. Radiation safety technicians will locate the areas identified in Tables 4a and 5a and either ensure remediation goals have been satisfied or identify locations for decontamination by documenting the results in accordance with RSO-NFSS-10. These surveys will be reviewed by the Site Radiation Safety Officer. The Site Radiation Safety Officer will prepare a Radiation Work Permit (RSO-NFSS-09) to support the decontamination or removal of radioactive materials. After decontamination or removal of radioactive materials has been completed a post remediation survey will be performed. Post remediation surveys will be done in accordance with RSO-NFSS-10, RSO-NFSS-11, RSO-NFSS-12, and RSO-NFSS-19.

After the post remediation survey of the affected area, at least fifty percent of the affected room will be resurveyed. If radioactive contamination is found to exceed established release limits the entire room will be resurveyed.

SURVEY OF INACCESSABLE AREAS

Areas that have been classified as inaccessible by either limited means of access or structural degradation will have to be segregated during demolition activities from building debris that has been previously released from radiological controls.

This material is to be surveyed by using a 2x2 NaI(Tl) gamma scintillation detector consistence with RSO-NFSS-20. Material that exceeds one and one-half times background will require additional radiological monitoring.

PRE AND POST SHIPPING CONTAINER SURVEYS

Pre and post radiological surveys will be conducted on shipping containers. These surveys will be performed in accordance with RSO-NFSS-10, RSO-NFSS-11, RSO-

NFSS-12, and RSO-NFSS-19. Survey results will be reviewed by the Site Radiation Safety Officer to ensure compliance with United States Department of Transportation regulations.

VERIFICATION SURVEY

Once Building 401 has been demolished and the slab has been decontaminated a final verification survey will be performed. The final verification survey will be conducted in accordance with NRC NUREG 1575 Revision 1 April 2001, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). The final survey design will be submitted to the USACE for approval prior to performing the final verification survey. It will be necessary to determine background of building material from unaffected areas of the building. These background measurements may be used in the MARSSIM process.

DEMOBILIZATION REQUIREMENTS

Equipment that enters the Exclusion Zone must be appropriately surveyed and released for unrestricted use prior to leaving the site. Surveys will be conducted in accordance with RSO-NFSS-10, RSO-NFSS-12, and RSO-NFSS-19. Release surveys must be reviewed and approved by USACE prior to equipment being released from the site. Final radiological surveys will be performed on the adjacent fifteen meters around Building 401, haul roads, and staging areas in accordance with RSO-NFSS-20. Initial site radiological surveys are to be compared to final site radiological survey conditions. Final site radiological conditions shall be better than or similar to initial site radiological conditions.

7.2 Air Sampling

It will be necessary to provide sufficient air sampling and monitoring capabilities so as to assess the potential for internal deposition of airborne contaminants through inhalation within the facility. Several Radiation Safety Office procedures will be used to perform air sampling and analysis of air samples for the project.

- RSO-NFSS-14 Air Samples
- RSO-NFSS-15 Air Sample Analysis
- RSO-NFSS-17 Radon Progeny Air Sampling

GENERAL AREA MONITORING

Continuous low volume air samples will be run whenever operations are occurring. Each filter will be changed, as a minimum, on a daily basis and should be operated at a nominal flow of 30-45 LPM. Samples may be changed more frequently depending on filter loading. Samples will taken by utilizing a low volume pump, i.e., RAS-1. The air samples will be analyzed for gross α and β after the radon and thoron progeny have decayed in accordance with RSO-NFSS-15.

BREATHING ZONE MONITORING

Personnel or breathing zone air samples are performed during operations that have a high probability of generating airborne radioactive material in the workers breathing zone. The need for this type sampling is determined by an evaluation performed by the Site Radiation Safety Officer or designee. Samples are typically run for a complete 8 hour shift or the duration of the operation at a flow rate of approximately 2-4 LPM. Samples will be taken by utilizing a low volume pump, i.e., SKC personal pump. The air samples will be analyzed for gross α and β after the radon and thoron progeny have decayed in accordance with RSO-NFSS-15.

EFFLUENT AIR MONITORING

It is necessary to monitor the discharges from the facility in order to insure that no regulatory limits for airborne activity are exceeded as well as to insure that no member of the public is unnecessarily exposed to radioactive material. The results of this sampling are also used in demonstrating compliance with NRC limits to members of the general public. To meet this goal we perform boundary air monitoring. Boundary monitoring will consists of air samples taken at the Exclusion Zone boundary. Air samplers will be stationed at the four points of the compass. Effluent air samples will be collected by running a low volume air sampler i.e. RAS-1, twenty-four hours a day for seven days at 30 LPM. If this is not practical because of the availability and feasibility of electricity at the site, hi volume air samples (60 cubic feet per minute) will be taken during the work shift only. Generators will supply electricity for hi-volume air samplers. The air samples will be analyzed for gross α and β after the radon and thoron progeny have decayed in accordance with RSO-NFSS-15.

RADON AND THORON MONITORING

It will be necessary to determine the level of radon and thoron inside Building 401 prior to the start of work inside the building. It is not anticipated that radon and thoron levels will pose a concern; however, levels will be quantified to determine acceptable levels are present. RSO-NFSS-17 will be used to determine the level of radon and thoron. This procedure uses the Modified Kuznetz Method.

RADIOACTIVE AIR MONITORING QUALITY CONTROL PROGRAM

Radiological air monitoring will be conducted in accordance with RSO-NFSS-14, RSO-NFSS-15, and RSO-NFSS-17. Radiological air samples collected during the project for breathing zones, general work areas, and effluent monitoring will be sent to an outside laboratory for quality control analysis. At least ten percent of these radiological air samples will be sent to an off site laboratory for quality control analysis. All radiological air samples sent for quality control will be analyzed for gross alpha and beta activity. Fifty percent of all occupational and general area and ten percent of effluent radiological air samples sent to lab for gross alpha and beta will also be analyzed for isotopic thorium, radium, and uranium.

7.3 Respiratory Protection Program

Respiratory protection equipment is only used in operations in which engineering and administrative controls have shown to be either ineffective or not practical. The issuance, use and maintenance of respirators will be in accordance with Sevenson's Respirator Program which is located in Section O of Sevenson's Corporate Health and Safety Plan and in accordance with RSO-NFSS-16.

Respiratory protection equipment may be required on a temporary basis under certain conditions. This would include situations such as work on a piece of equipment which contains potentially dusty radioactive material. Every attempt will be made to minimize the use of respirators. However, preventing the inhalation of radioactive material due to the extremely low Annual Limit of Intake (ALI) is the primary objective. An evaluation will be performed by the Site Radiation Safety Officer or designee and the proper controls will be implemented.

7.4 Internal Exposure Determination

The Radiation Safety Office takes suitable and timely measurements of the concentrations of radioactive materials in air in work areas, the quantities of radionuclides excreted from the body, and/or suitable combinations of these measurements to assess dose.

Air sampling will be conducted for this project to monitor internal exposures. It is possible that workers at the site may be exposed to airborne radioactive material in levels in excess of ten percent of the derived air concentration (DAC) for Th-232, and Th-230 listed in 10 CFR 20, Appendix B. Since we do not know the chemical properties of the thorium nuclides the most conservative DAC for each will be used. The radium at this site is co precipitated radium sulfate. This is Class Y radium. 10 CFR 20 Appendix be does not have Y values for radium so the ALI and DAC are derived from ICRP 68[1] and ICRP 71[2]. The ALI for Ra-226 is 0.142 µCi and the DAC is 5.9E-11 µCi/ml. The ALI for Ra-228 is 0.0842 µCi and the DAC is 3.5E-11 µCi/ml. Air sampling will be the primary method to determine internal exposures.

The use the Y class DAC for insoluble radium instead of the class W listed in 10 CFR 20 Appendix B is a recommended best management practice. Adopting the more restrictive DAC is not expected to have a serious impact on operation or radiological controls.

Personnel who are issued a TLD will be required to participate in the bioassay monitoring program. Internal monitoring will be conducted by utilizing urine bioassay samples.

[1] *Dose Coefficients for Intakes of Radionuclides by Workers,* ICRP Publication 68, International Commission on Radiological Protection, Pergamon Press, July 1994.
[2] *Age-dependent Doses to Members of the Public from the Intakes of Radionuclides: Part 4 Inhalation Dose Coefficients,* ICRP Publication 71, International Commission on Radiological Protection, Pergamon Press, September 1995.

Urine bioassay samples will be collected before the TLD is issued, when the TLD is returned, and/or as required by the Site Radiation Safety Officer. Urine bioassay samples will be collected in accordance with RSO-NFSS-04 and analyzed for isotopic radium and thorium and uranium by KPA. Urine bioassay results will supplement the data compiled by the air monitoring program to determine internal exposure for insoluble radionuclide forms.

ESTIMATING DAC-HOURS

Initial estimates of intake will be In DAC-hours, that is,

$$DAC_{Hours} = [\sum Conc_i] \bullet \frac{hours}{DAC_i}$$

Since the physical and chemical properties of the radionuclides taken into the body are not known we use the most restrictive information to calculate the committed dose equivalent and we will document that information in the individual's record. We may separately assess the contribution of fractional intakes of class D, W, or Y compounds of a given radionuclide to the committed effective dose equivalent.

If the identity and concentration of each radionuclide in a mixture is known, the fraction of the DAC applicable to the mixture for use in calculating DAC-hours must be either the sum of the ratios of the concentration to the appropriate DAC value (*e.g.*, D. W, or Y) from 10 CFR 20 Appendix B for each radionuclide in the mixture or the ratio of the total concentration for all radionuclides in the mixture to the most restrictive DAC value for any radionuclide in the mixture.

If the identity of each radionuclide in a mixture is known, but the concentration of one or more of the radionuclides in the mixture is not known the DAC for the mixture must be the most restrictive DAC of any radionuclide in the mixture.

When a mixture of radionuclides in air exists, we may disregard certain radionuclides in the mixture if we use the total activity of the mixture in demonstrating compliance with the dose limits in 10 CFR 20.1201, and in complying with the monitoring,, requirements in 10 CFR 20.1502. The concentration of any radionuclide disregarded must be less than 10% of its DAC, and the sum of the percentages for all the radionuclides disregarded in the mixture cannot exceed 30%.

CALCULATION OF COMMITTED EFFECTIVE DOSE EQUIVALENT

To calculate the committed dose equivalent, we may assume that the inhalation of one ALI or an exposure of 2000 DAC-hours results in a committed effective dose equivalent of 5 rem (0.05 Siverts (Sv)) for radionuclides that have their ALI or DACs based on the committed effective dose equivalent. When the ALI (and the associated DAC) is determined by the nonstochastic organ dose limit of 50 rem (0.5 Sv), the intake of

radionuclides that would result in a committed effective dose equivalent of 5 rem (0.05 Sv) (the stochastic ALI) is listed in parentheses in10 CFR 20 Appendix B. In this case, as a simplifying assumption, use the stochastic ALIs to determine committed effective dose equivalent. However, if we use the stochastic ALI's, we must also demonstrate that the limit in 10 CFR 20.1201 is met.

The committed effective dose equivalent may be calculated using the estimated radionuclide intake by means of the following equation.

$$H_E = 5{,}000\, m\,\mathrm{Re}\, m \bullet \frac{Intake}{ALI}$$

Where

H_ε = committed effective dose equivalent (in rem) from the individual radionuclide,

Intake = intake in microcuries of the radionuclide by inhalation during the calendar year,

ALI = value of the *stochastic* inhalation ALI in microcuries

ORGAN OR TISSUE DOSE EQUIVALENT

Organ-specific committed dose equivalent need be calculated[3] only if the committed effective dose equivalent exceeds one rem or if an overexposure has occurred, because if the committed effective dose equivalent is less than one rem and no over exposure has occurred, the 50-rem nonstochastic organ limit cannot be exceeded.

The committed dose equivalent to organ or tissue may be calculated using the estimated radionuclide intake as follows:

$$H_I = 50\, rem\, \frac{Intake}{ALI}$$

Where

H_T = committed dose equivalent (in rem) to the tissue or organ from the radionuclide,

Intake = intake in microcuries of the radionuclide by inhalation during the calendar year,

ALI = value of the nonstochastic inhalation ALI in microcuries.

The preferred method for calculating organ-specific committed dose equivalents is to use

[3] *Monitoring Criteria and Methods to Calculate Occupational Radiation Doses*, Section 5, Regulation Guide 8.34, U. S. Nuclear Regulatory Commission, July 1992.

the factors in *Federal Guidance Report No. 11*[4]. The organ-specific exposure-to-dose conversion factors in Table 2.1 of that report should be used for inhalation exposures.

If a radionuclide has an ALI based on a nonstochastic dose limit to an organ, the corresponding DAC may be used to calculate the organ-specific committed dose equivalent to the organ with the highest dose.

$$H = \frac{50}{2000} \bullet \frac{C_t}{DAC}$$

Where

H = committed dose equivalent to the tissue or organ,
C = concentration of the radionuclide in microcuries/milliliter,
t = duration of the exposure in hours,
DAC = nonstochastic DAC for the radionuclide,
2000 = total hours in 1 work year,
50 = committed dose equivalent to maximum-exposed organ from an intake of 1 ALI or 2000 DAC-hours in rem

INTERPRETATION OF BIOASSAY RESULTS

NUREG/CR-4884[5] is used as a guide for determining intake retention fractions to calculate intakes from positive bioassay results. Other factors such as air sampling results, work conditions, etc. may be utilized to reconstruct the probable exposure conditions and therefore the most applicable intake retention factor (IRF). The following example illustrates the application of NUREG/CR-4884's tables of intake retention fractions to the estimation of initial intake.

$$I = \frac{A_1}{IRF}$$

Where

I = estimate of the initial intake.
A_1 = whole body content at the time (1) of measurement.
IRF = intake retention fraction.

Once the estimate of initial intake is determined the committed effective dose equivalent or the committed dose equivalent may be calculated as discussed above.

[4] *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*, EPA-520/1-88-020, Federal Guidance Report No. 11, U.S. Environmental Protection Agency, September 1988.
[5] *Interpretation of Bioassay Measurements*, NUREG/CR-4884, Brookhaven National Laboratory, US Government Printing Office, July 1987.

Any positive bioassay results will be cause for follow up sampling. Successive sample results will affirm, or allow, a reasonable estimate of the date or exposure period of the intake. In addition, the rate of clearance will indicate whether the radionuclide form was Class D or Class W.

Insoluble Class Y radionuclide forms cannot be effectively monitored through in-vitro bioassay because of the slow and dilute rate of clearance. Internal dose assignments, for Class Y radionuclide forms, will be based on cumulative DAC-hr. through analysis of breathing zone air samples. An estimate of 2.5 mrem per DAC-hr. will be used.

7.5 External Exposure Determination

All project personnel that will be working in an exclusion zone shall participate in an internal and external monitoring program administered by the Radiation Safety Office. The monitoring program shall comply with USACE EM 385-1-80 §§ 7-1 and 7-2.

Thermoluminescent dosimeters (TLDs) (or equivalent) will be used to measure whole body exposures. 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 number.

TLDs will be issued in accordance with RSO-NFSS-03 Personnel Dosimetry Requirements.

7.6 Summation of Internal and External Exposures

The requirements for summing external and internal doses in § 20.1202 is to demonstrate compliance with the dose limits in § 20.1201. The occupational dose limits for minors in § 20.1207, are 10% of the dose limits for adults, and § 20.1208, establishes a dose limit for the embryo/fetus of 0.5 rem during the entire pregnancy. Summation of external and internal doses is required in § 20.1202, when both external and internal monitoring of an individual is required to meet §§ 20.1203 and 20.1204. The requirements for summation apply to the occupationally exposed adult and minor, and to the embryo/fetus of a declared pregnant woman (See RSO-NFSS-02).

The requirements for summation of external and internal doses specified in § 20.1202, are not applicable to doses to the lens of the eye, the skin, or the extremities. Only external dose is considered in evaluating the shallow-dose equivalent, extremity dose, and eye-dose equivalent.

7.7 ALARA Program

"ALARA" is an acronym for "as low as is reasonably achievable." It is Sevenson's policy to maintain radiation exposures ALARA. The term describes a radiation protection

philosophy that makes every reasonable effort to maintain exposures to radiation as far below the dose limits in the regulations as is practical. Taking into account the state of technology, the economics of improvements in relation to benefits to public health and safety, other societal and socioeconomic considerations, and in relation to utilization of radioactive materials in the public interest.

The concept of maintaining ALARA occupational exposures does not embody a specific numerical guideline value at the present time. It is a philosophy that is operationally defined in our goals, objectives, statements of good practice, and other qualitative guidance. However, we use numerical administrative exposure control objectives to focus our efforts.

ADMINISTRATIVE CONTROL LEVELS

Our objective is to maintain personnel radiation exposure well below regulatory dose limits. The following USACE administrative control levels will be used in achieving that objective.

- a total effective dose equivalent administrative control level of 500 mrem
- an eye-dose equivalent administrative control level of 1,500 mrem, and
- a shallow-dose equivalent administrative control level of 5,000 mrem

Approval to exceed these administrative control levels may be given on a case-by-case basis by the Site Radiation Safety Officer, the USACE, and the concurrence of the affected worker. However, no person will be knowingly permitted to exceed the dose limitations in 10 CFR 20 §§ 20.1201, 20.1207, 20.1208, and 20.1301.

ADMINISTRATION OF THE ALARA PROGRAM

We provide a formally-structured ALARA program to ensure that ALARA exposures are maintained. There are two primary administrative mechanisms for our ALARA Program. The first is the formal review, approval, and implementation of Sevenson's Radiation Safety Office Standard Operating Procedures. The second is the use of Certified Health Physicist to conduct audits on the Radiation Safety Office program. In general, our ALARA program follows the guidance in NRC Regulatory Guide 8.10, *Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as is Reasonably Achievable* (September 1975).

RADIATION WORK PERMITS

Radiation Work Permits (RWP(s)) are used to control work activities at the site and to ensure proper radiation safety controls are in place. In the development of the RWP, engineering controls (e.g., containment devices, portable or auxiliary ventilation, and temporary shielding) are considered. RWPs are established to control contamination

levels; radiation dose and dose rates; air sampling and radiological survey frequency; personal protective equipment; work to be performed; and radiation safety technician support. RWPs are to be maintained in accordance with RSO-NFSS-09.

7.8 Audits and Record Keeping Program

Records will be in accordance with RSO-NFSS-07 and 10 CFR 20 Subpart L. The Radiation Safety Program will be audited at least annually as per § 20.1101 (c).

8.0 Release Criteria

Personnel exiting Exclusion Zones established for contamination control will be surveyed (frisked) for radiological contamination as per RSO-NFSS-13. Monitoring for total contamination will be performed with the Ludlum Model 43-89 detector or equivalent. This scintillation detector is capable of detecting radioactive contamination greater than 100 dpm/100 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 the presence of radium and thorium.

Equipment and materials will be surveyed in accordance with RSO-NFSS-10, RSO-NFSS-12, and RSO-NFSS-19.

Alpha activity will be used to indicate the presence of radium and beta activity will be used to indicate the presence of thorium. The other isotopes of concern have a greater release limit then that of the radium and thorium; therefore, assuming that the gross activity is only radium and thorium the chance of releasing uranium or cesium from the site is very unlikely. This assumption however, may increase the probability of classifying debris or building material as contaminated.

Smears taken to determine transferable levels of contamination will be taken over a 100 cm^2 area. Smear data will be reported in dpm/100 cm^2. Transferable contamination levels are limited to 20 dpm/100 cm^2 alpha and 200 dpm/100 cm^2 beta/gamma.

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 α	15,000 α	1,000 α
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 β-γ	15,000 β-γ	1,000 β-γ

[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.

MINIMAL DETECTABLE CONCENTRATIONS

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:

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

Scanning

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

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

Smear counting

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

Air sampling

$$MDC_{airsanple} = \frac{3 + 4.65\sqrt{B_R \bullet t}}{E \bullet t \bullet v \bullet 2.22E06}$$

Where:

MDC = Minimal Detectable Concentration
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
v = volume in ml
d' = *index of sensitivity* based on a 95% true positive and 60% false positive rate.[6] (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)

9.0 Training

Site personnel that will work in an Exclusion Zone or handle radioactive material will receive Radiation Worker Training. Sevenson' Radiation Worker Training Handout is located in Appendix I of the SSHP. Radiation Worker training will include but not be limited to the following items.

- Radiological Fundamentals
- Biological Effects of Radiation
- Radiation Limits
- ALARA
- Personnel Monitoring
- Dosimetry
- Radiological Postings and Controls
- Radiological Emergencies
- Radiation Areas
- Contamination Areas
- Radioactive Contamination and Control

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

FIGURES

Figure-1

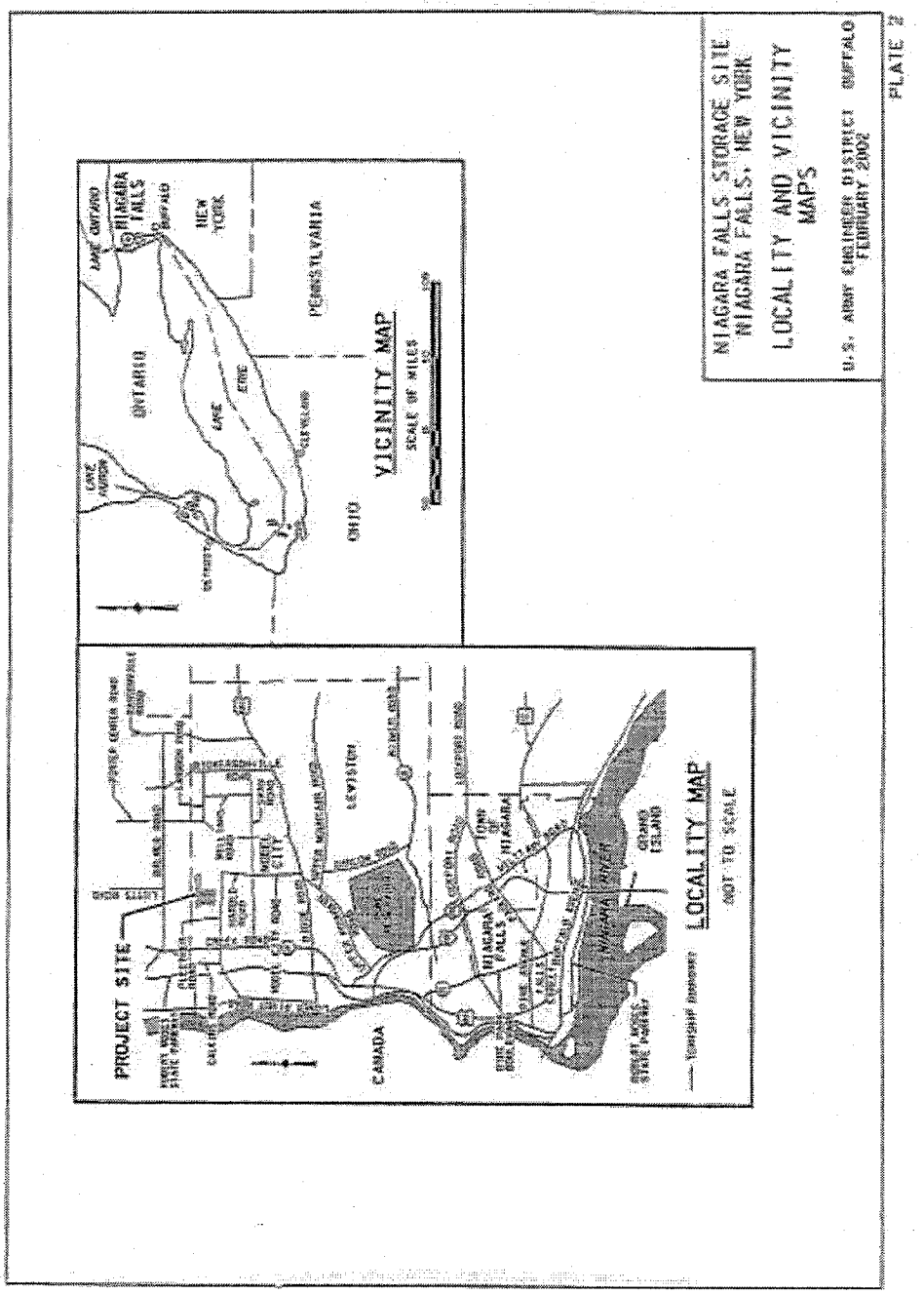

NIAGARA FALLS STORAGE SITE
NIAGARA FALLS, NEW YORK
LOCALITY AND VICINITY MAPS
U.S. ARMY ENGINEER DISTRICT BUFFALO
FEBRUARY 2002
PLATE 2
VICINITY MAP
SCALE OF MILES
ONTARIO
NEW YORK
PENNSYLVANIA
OHIO
LAKE ERIE
NIAGARA FALLS
BUFFALO
CLEVELAND
LAKE ONTARIO
LOCALITY MAP
NOT TO SCALE
PROJECT SITE
CANADA
NIAGARA RIVER
GRAND ISLAND
LEWISTON
NIAGARA FALLS

Figure-2

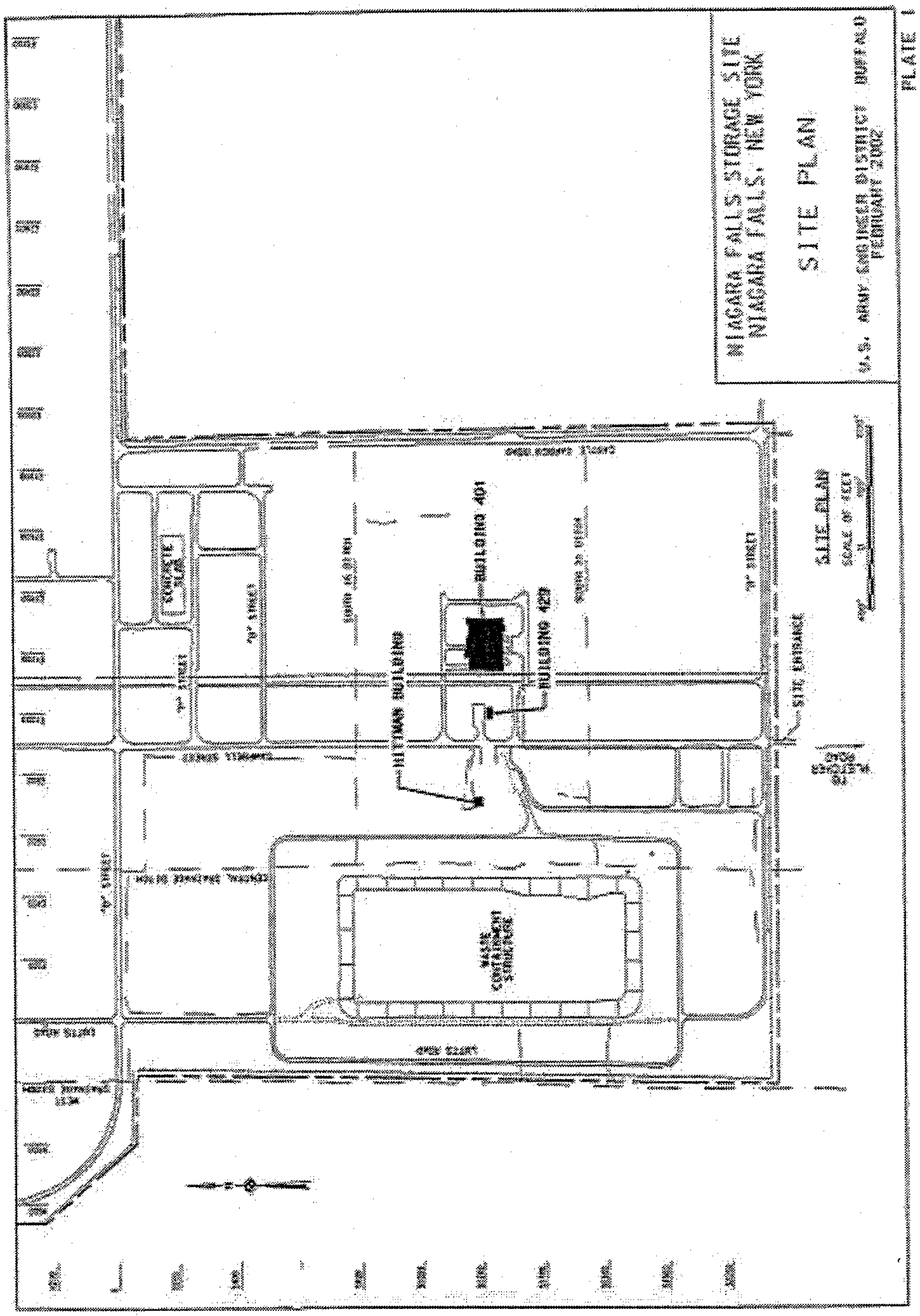

NIAGARA FALLS STORAGE SITE
NIAGARA FALLS, NEW YORK
SITE PLAN
U.S. ARMY ENGINEER DISTRICT BUFFALO
FEBRUARY 2002
PLATE 1
BUILDING 401
BUILDING 429
HITTMAN BUILDING
SITE ENTRANCE
CONCRETE SLAB
WASTE CONTAINMENT STRUCTURE
SITE PLAN

Figure-3

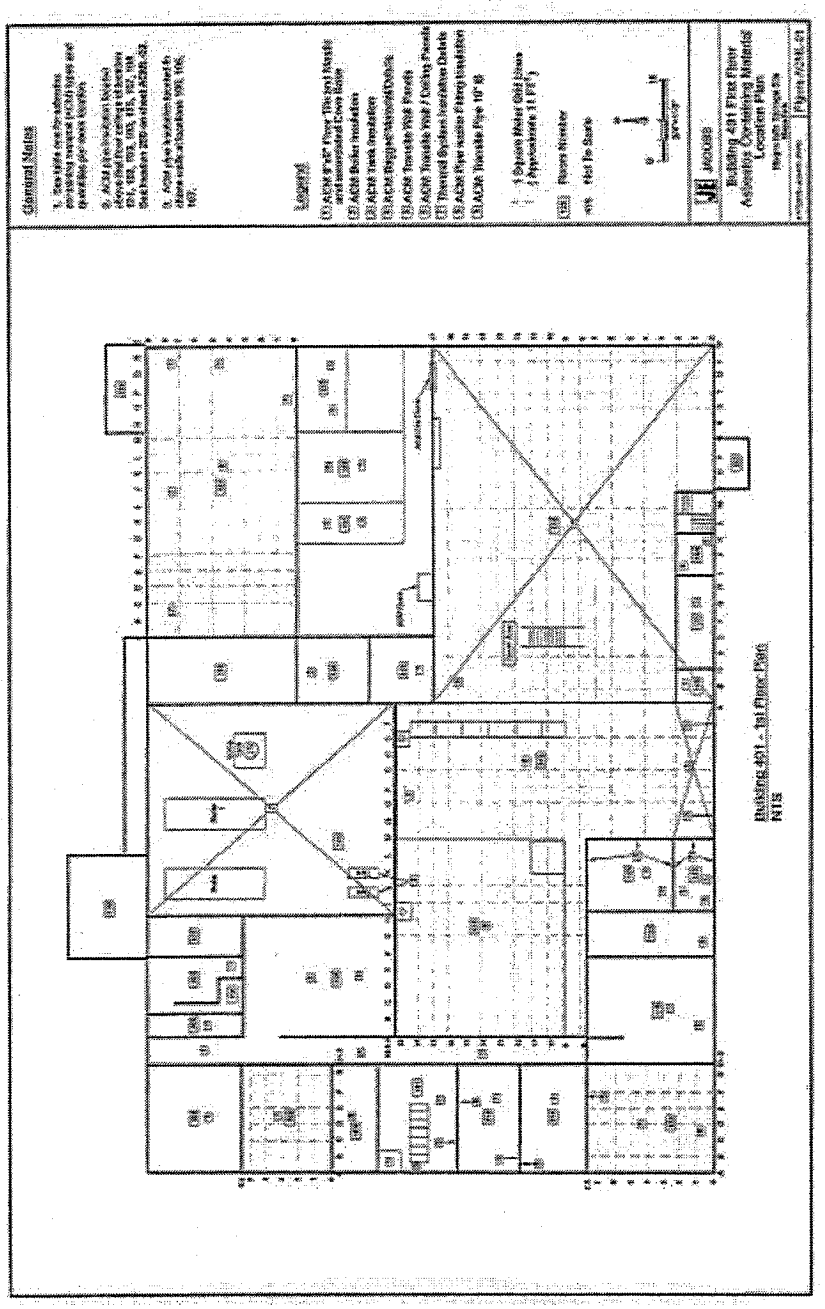

General Notes
Legend
Building 401 First Floor
Asbestos Containing Material
Location Plan
Building 401 - 1st Floor Plan
NTS

Figure-4

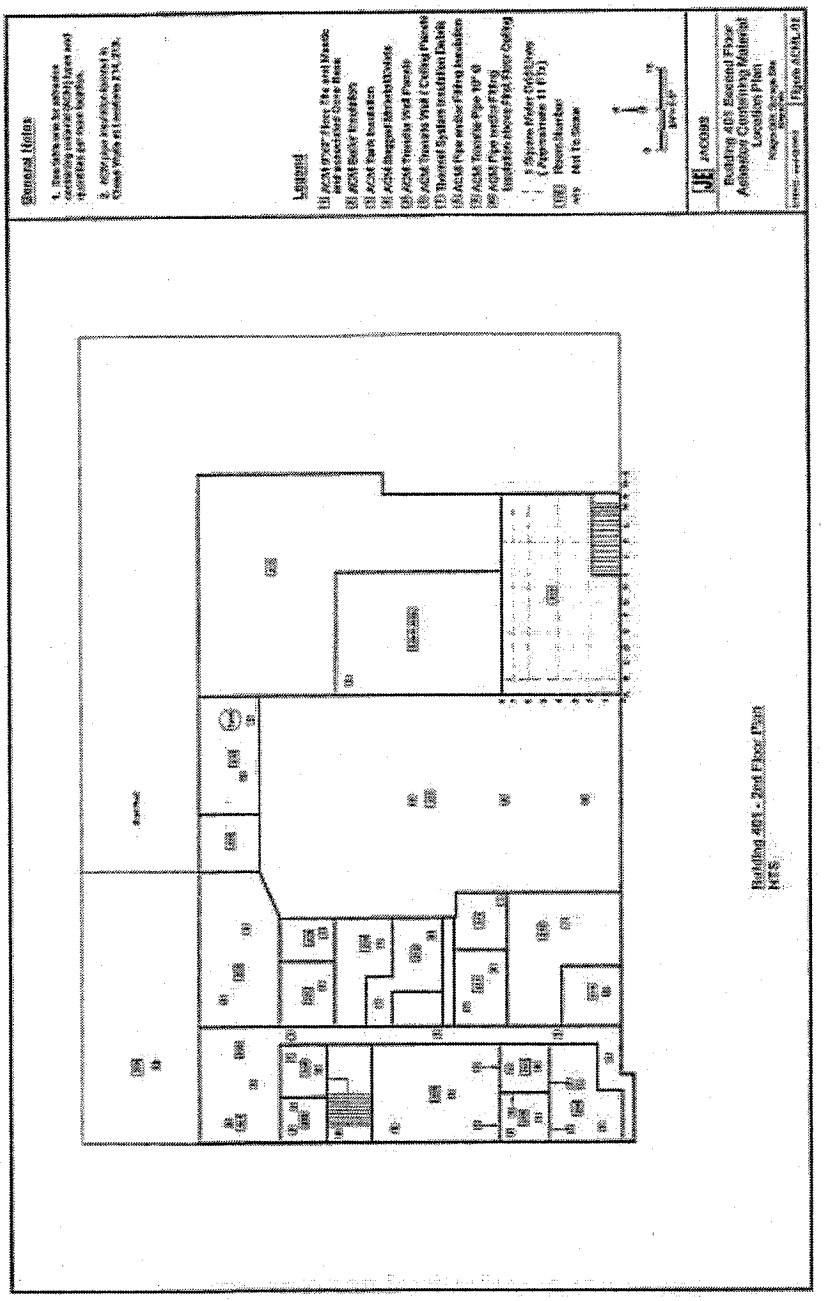
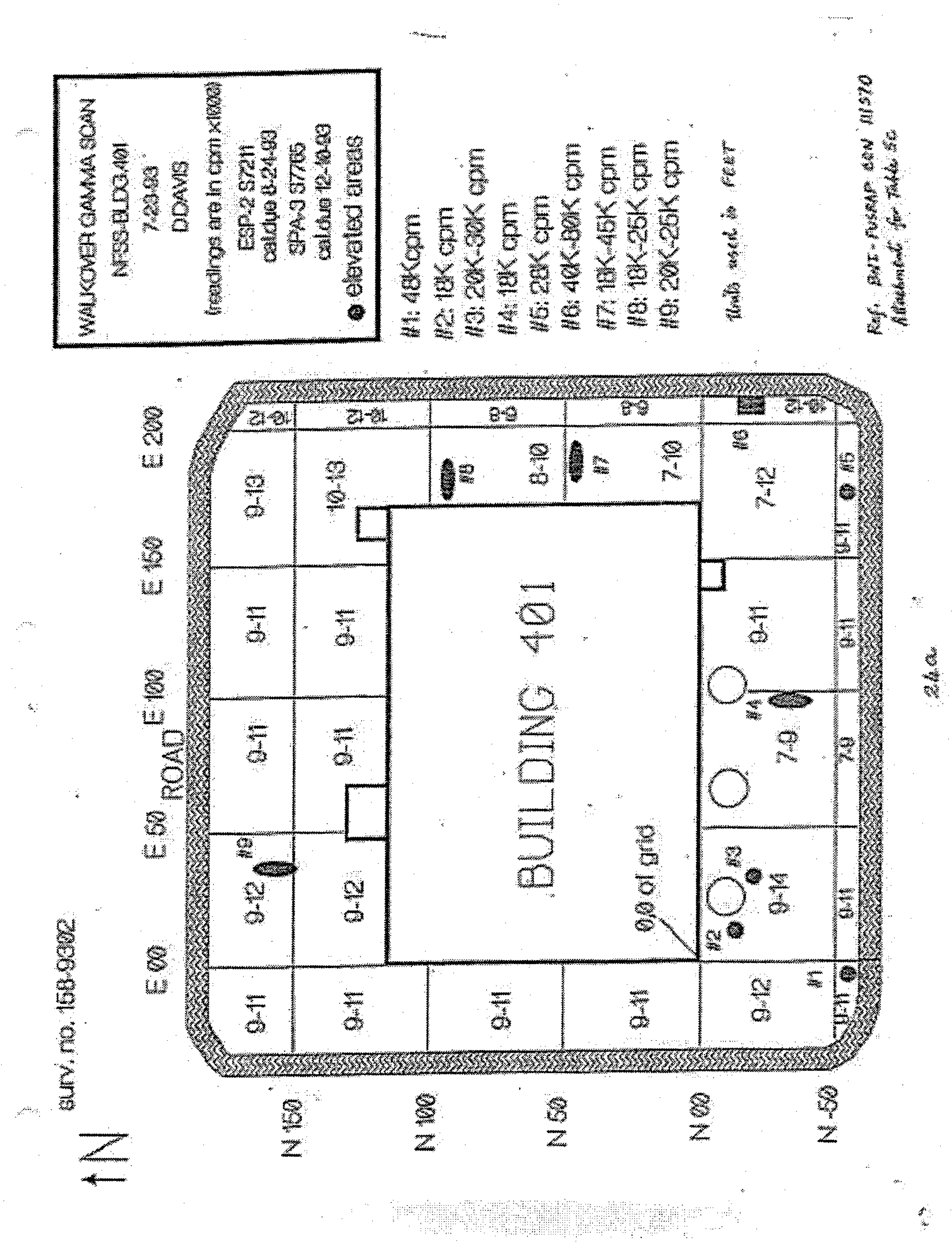


Figure-5


WALKOVER GAMMA SCAN
NFSS-BLDG401
7-23-03
DDAVIS
(readings are in cpm x1000)
ESP-2 S7211
cal due 8-24-03
SPA-3 S7765
cal due 12-10-03
elevated areas
#1: 48Kcpm
#2: 18K cpm
#3: 20K-30K cpm
#4: 18K cpm
#5: 28K cpm
#6: 40K-80K cpm
#7: 18K-45K cpm
#8: 18K-25K cpm
#9: 20K-25K cpm
surv. no. 158-9302
N
E 00
E 50
E 100
E 150
E 200
ROAD
N 150
N 100
N 50
N 00
N -50
BUILDING 401
0,0 of grid

Appendix A

RSO-NFSS-01 "Admittance and Termination"

RSO-NFSS-02 "Counseling to Exposure to Embryo and Fetus"

RSO-NFSS-03 "Personnel Dosimetry Requirements"

RSO-NFSS-04 "Bioassay Procedure"

RSO-NFSS-05 "Radiation Safety Log"

RSO-NFSS-06 "Radiological Defiency Reports"

RSO-NFSS-07 "Records for Retention"

RSO-NFSS-08 "Establishing and Posting Areas"

RSO-NFSS-09 "Radiation Work Permits"

RSO-NFSS-10 "Radiological Surveys"

RSO-NFSS-11 "Radiation Dose Rate Surveys"

RSO-NFSS-12 "Surface Contamination Surveys"

RSO-NFSS-13 "Personnel Contamination and Decontamination"

RSO-NFSS-14 "Air Sampling"

RSO-NFSS-15 "Air Sampling Analysis"

RSO-NFSS-16 "Description and Selection of Respiratory Protection"

RSO-NFSS-17 "Radon Progeny Air Sampling"

RSO-NFSS-18 "Counting and Reporting Smear Data"

RSO-NFSS-19 "Release of Material for Unrestricted Use"

RSO-NFSS-20 "Conducting 2x2 NaI(Tl) Walkovers"

RSO-NFSS-33 "Check Source Accountability"

RSO-NFSS-34 "Source Checking Instruments"

Sevenson Environmental Services, Inc

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-01

Admittance and Termination

September 17, 2003

Record of Changes

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

RADIATION SAFETY REQUIREMENTS FOR ADMITTANCE AND TERMINATION OF SES EMPLOYEES, CONTRACTORS AND VISITORS

1.0 PURPOSE

To determine the radiation safety requirements for admittance and termination of employees, contractors, and visitors to the Sevenson Environmental Services (SES) radiation site.

2.0 APPLICABILITY/SCOPE

This procedure is applicable to all site personnel.

3.0 DEFINITIONS

None

4.0 PROCEDURE

4.1 Prerequisites

4.1.1 All individuals requiring access to a Restricted Area or a Radiologically Controlled Area (RCA) for more than 10 consecutive workdays in a monitoring period must be issued personnel dosimetry per RSO-NFSS-3.

4.2 SES Employees, and Contractors Requiring Unescorted Access to a Restricted Area Only

4.2.1 Individuals requiring unescorted access to a Restricted Area must receive a site-specific radiation safety briefing by the SRSO or designee.

4.2.2 Additionally, personnel requiring unescorted access to a Restricted Area only must comply with the dosimetry requirements of Section 4.1, above.

4.3 SES Employees, and Contractors Requiring Unescorted Access to RCA

4.3.1 All individuals requiring access to RCA must complete a demographic profile (past work experience with radioactive material), individuals requiring access for greater than 30 days must have received an approved Radiation Worker physical examination within the past 1 year (including pulmonary function tests).

4.3.2 Individuals requiring access to RCA must have successfully completed the site-specific 4 hr. Radiation Safety Training Course, and must receive, or have record of a baseline bioassay in the Radiation Safety office.

4.3.3 Individuals must supply a baseline bioassay urinalysis. Each individual who works at the site for a period greater than 1 year shall submit a periodic bioassay urinalysis in accordance with the bioassay requirements.

4.3.4 Additionally, personnel requiring unescorted access to a RCA for 10 consecutive workdays a monitoring period must comply with the dosimetry requirements of Section 4.1, above.

4.4 SES and Escorted Visitors requiring access to Restricted/ Radiologically Controlled Areas

4.4.1 Visitors to the Restricted Area only for more than 10 consecutive workdays per monitoring period must comply with the dosimetry requirements of Section 4.1, above.

4.4.2 Escorts of individuals requiring access to the Restricted Area must indicate whether or not the individual they are escorting will enter the RCA.

4.4.3 All visitors requiring access to the RCA must complete the requirements of Sections 4.1 and 4.3, above (training requirement may be waived by the SRSO based on equivalent training, experience, etc.).

4.4.4 The requirements for the baseline and periodic bioassay urinalysis may be waived for these individuals under the following circumstances:

1. The individual is an escorted visitor who will **not** be entering RCA. The waiver may be granted by the Site Radiation Safety Officer (SRSO) or his designee based on information provided by the escort. If the escort is in doubt whether the criteria for waiving the bioassay are met, the waiver will not be granted by the SRSO or his designee. It will be the responsibility of the escort to ensure these criteria are met.

2. The SRSO or his designee may waive the requirements for the entrance, exit or periodic bioassay.

3. Governing agency personnel will be waived from baseline bioassay upon request.

4.5 Termination Bioassay of SES Employees, Contractors and Visitors from the Site

4.5.1 Personnel or their immediate supervisors that are leaving the site permanently should inform Radiation Safety personnel at least 24 hours prior to terminating their assignment.

4.5.2 Radiation Safety personnel shall schedule a bioassay for those personnel who were assigned as radiation workers.

4.5.3 Upon written request, each individual is to be given an exposure estimate for exposure received at the site during the most recent work assignment until the monthly TLD Badge record exposure data is processed.

4.5.4 Within 30 days of receiving the record monthly TLD Badge exposure data, but in no case greater than 90 days after the individual's termination date, an Occupational Radiation Exposure Report will be issued and sent to the address provided by the individual on his current demographic profile.

4.5.5 At the time of mailing of the Occupational Radiation Exposure Report a copy of the Report will be forwarded to the customer if so requested.

5.0 RESPONSIBILITY

5.1 It is the responsibility of each individual admitted to the site to comply with any and all access restrictions imposed by the SRSO.

5.2 It is the responsibility of the SRSO to maintain health physics records relative to admittance and termination requirements, issuances of dosimetry, and the administration of bioassays as required by RSO-NFSS-04.

6.0 REFERENCES

6.1 52 FR 2822, Radiation Protection Guidance to Federal Agencies for Occupational Exposure, 1987.

6.2 Federal Guidance Report No. 11, Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion, EPA 520/1-88-020, 1988.

6.3 RSO-NFSS-03, Personnel Dosimetry Requirements

6.4 RSO-NFSS-04, Bioassay Procedure

7.0 ATTACHMENTS

7.1 Visitor Access/Temporary Dosimetry Issue Form and Acknowledgement of Radiological Controls

Visitor Access/Temporary Dosimetry Issue Form

1. Full legal name:

2. Social Security No.:

3. Legal address:

4. Employer/address:

5. Area(s) access required for:

6. TLD # Issued:_____ Date Issued: _____ Date Returned: _____

7. Name/SSN of Escort:

8. Briefed/Dosimeter Issued by:

I have been briefed on the hazards associated with exposure to ionizing radiation, understand that I have been granted limited access to this site and must stay in the presence of my designated escort.

Visitor's Signature: _____ Date: _____

Reviewed by: _____ Date:_____
Site Radiation Safety Officer

Sevenson Environmental Services, Inc

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-02

Counseling for Exposure to Embryo and Fetus

September 17, 2003

Record of Changes

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COUNSELING OF OCCUPATIONALLY EXPOSED WOMEN FOR THE CONTROL OF RADIATION EXPOSURE TO EMBRYO AND FETUS

1.0 PURPOSE

To comply with the Sevenson Environmental Services (SES) Policy which describes the control of radiation exposure to pregnant and potentially pregnant women. This policy limits the exposure of the embryo/fetus to less than 0.5 rem for the entire gestation period.

2.0 APPLICABILITY/SCOPE

The counseling outlined in this procedure is applicable to all women who are or may be occupationally exposed to ionizing radiation at a SES radiation site and who are pregnant or may be pregnant.

3.0 DEFINITIONS

None

4.0 PROCEDURES

4.1 Introduction

Section 19.12 of 10CFR Part 19 (Ref. 6.1) requires that all individuals who in the course of their employment are likely to receive in a years an occupational dose in excess of 100 mrem be instructed in the health protection issues associated with exposure to radioactive materials or radiation. The NRC Regulatory Guide 8.13 (Ref. 6.2) describes the instruction that should be provided concerning biological risks to embryo/fetus resulting from prenatal exposure. NCRP Report No.116 (Ref. 6.3) discusses the current state of scientific knowledge of risk to the embryo/fetus from ionizing radiation.

4.2 Rationale for Recommending Embryo/Fetus Exposure Dose Limits

The maximum permissible dose equivalent to the embryo/fetus from occupational exposure of the pregnant female should not exceed 0.5 rem for the entire gestation period. This dose limit was selected for several reasons.

4.2.1 Regulatory Limits: NRC Regulatory Guide 8.13 places exposure limits on the embryo/fetus that are different from adult radiation workers. This recommended exposure dose limit is intended to provide protection for the embryo/fetus and not the expectant mother.

4.2.2 Scientific Basis for Dose Recommendation

As a result of extensive research that spans nearly a century, scientists have firmly established that sensitivity of cells is correlated with the age of the individual. Hence, children are more sensitive than adults, fetuses are more sensitive than children, and embryos are the most sensitive.

The particular concern for the irradiation of the embryo is based on scientific data, which suggests that maximum radiation susceptibility occurs during the period of organ

genesis which occurs early in pregnancy and possibly within a period of time when an individual may not be aware of her pregnancy.

4.3 Radiation Risk Estimates for the Embryo/Fetus

There exists extensive data that establishes some small but real risk of radiation exposure to the embryo/fetus. Almost all of these studies involve moderate to high doses of radiation (e.g., Japanese atom bomb survivors, medical radiation exposures of pregnant females). For small exposure doses at the occupational radiation worker level, radiation induced in-utero effects are nearly impossible to detect. This implies that the frequencies of in-utero effects for small exposure doses are indistinguishable from pregnant women who receive no radiation exposure. It must be pointed out, however, that the natural incidence (i.e., the absence of occupational radiation exposure) of in-utero effects is substantial.

NOTE TO COUNSELOR (RADIATION SAFETY OFFICER)

Do not imply to the person being counseled that the in-utero risk for small radiation doses is zero. Remember that while the radiation induced in-utero risk may approach zero for small exposure doses the individual still faces the same natural-incidence risks of in-utero effects as a worker not employed at the site.

4.4 Additional Points of Discussion

4.4.1 Give examples of in-utero effects and emphasize their natural and non-radiation induced incidence:

- Mental retardation
- Mongolism
- Childhood leukemia
- Impaired physical development and growth

4.4.2 Provide a brief explanation of the following:

- Radiation exposures from other sources (e.g., medical, terrestrial, cosmic, man-made consumer products)
- Units of radiation dose (i.e., dose is measured in mrem)
- Explanation of dose-response relationship (i.e., level of risk is proportional to radiation dose)
- External exposure vs. internal exposure (i.e., transport of radionuclides across placental barrier and uptakes by embryo/fetus)
- ALARA concept

5.0 RESPONSIBILITIES

In occupational exposure of a pregnant woman, the embryo/fetus enters the occupational radiation environment involuntarily and not as a radiation worker. The practicality of absolute enforcement of radiation exposure limits of 0.5 rem to the fetus is limited by the freedom of information exchange between employee and employer. The restrictive dose limit aimed at the protection of the embryo/fetus stands in conflict with the right of an individual to perform work under the provisions of a body of law which guarantees equal employment rights for all individuals.

Compliance with the SES policy which is based on the NCRP recommendations is most effectively achieved by the employee being motivated to disclose a known or suspected pregnancy at the earliest possible time.

5.1 Responsibility of Sevenson Environmental Services, Inc.

5.1.1 The Department of Health and Safety - Radiation Safety will provide special counseling, to each female worker who annually approaches 0.5 rem exposure, and provide a copy of Reg. Guide 8.13.

5.1.2 Ensure employee signature on Declared Pregnant Female Acknowledgement form (Attachment 7.2).

5.1.3 Ensure that this information remains confidential.

5.1.4 Recommend that the pregnant radiation worker accept a non-radiological work assignment for the duration of the pregnancy.

5.1.5 Provide radiological controls to restrict exposures and document that exposure doses do not exceed 0.5 rem for the duration of the pregnancy based on personnel monitoring.

5.1.6 At the request of the employee, provide alternate assignment of work outside Radiologically controlled areas for duration of pregnancy.

5.2 Responsibilities of Female Employee

5.2.1 Notification of pregnancy in writing to the Department of Health and Safety – Radiation Safety Office at the earliest time possible.

5.2.2 If desired, request reassignment to work in a non-radiological environment for the duration of the pregnancy.

5.2.3 Arrange for counseling and sign the Declared Pregnant Female Acknowledgement form.

5.2.4 Read Regulatory Guide 8.13 and ask questions.

6.0 REFERENCES

6.1 10 CFR Part 19 Section 19.12, "Instructions to Workers", 1991.

6.2 NRC Regulatory Guide 8.13, Instruction Concerning Prenatal Radiation Exposure, 1999.

6.3 NCRP Report No. 116, Limitation of Exposure to Ionizing Radiation, 1993.

7.0 ATTACHMENTS

7.1 Suggestions to Radiation Safety Officer

7.2 Declared Pregnant Female Acknowledgement

7.3 Reg. Guide 8.13

SUGGESTIONS TO RADIATION SAFETY OFFICER

1. Thoroughly study and understand the following documents:
   - 52 FR 2822
   - NCRP Report No. 91
   - NRC Regulatory Guide 8.13

   Additional suggested references for background information:
   - National Academy of Sciences, *The Effects on Populations of Exposure to Low Levels of Ionizing Radiation*, Report of the Committee on the Biological Effects of Ionizing Radiation (BEIR), 1980.
   - ICRP Publication 26, *Radiation Protection: Recommendations of the International Commission on Radiological Protection*, Pergammon Press, January, 1977.
   - UNSCEAR, *Sources and Effects of Ionizing Radiation*, Report to the General Assembly, U.N. Publication No. E.77.1X,1, 1977.

2. **Identify female radiological workers who are candidates for counseling:** Review daily RWP Sign-In Logs and identify employees whose year-to-date whole body exposure dose is approaching 500 mrem.

3. Schedule employee for counseling.

4. Counseling - Review and discuss the following:
   - Basis for radiation safety as it applies to the workers vs. the embryo/fetus
   - Basis for the 0.5 rem maximum recommended exposure dose to the embryo/fetus
   - The scientific data which defines the relationship between exposure and dose and in-utero risks for "high doses" and explain the very low/"non-detectable" risks associated with the recommended exposure limit
   - The natural incidence of in-utero effects
   - The in-utero effects of other agents (i.e., smoking, alcohol, prescription/non-prescription drugs, etc.)
   - The responsibilities of SES.
   - The responsibilities of the female employee
   - Recommend work assignment of non-radiological nature to pregnant female
   - Provide and review Regulatory Guide 8.13 with employee
   - Encourage employee to ask questions
   - If employee is pregnant, request a signed form for her personal dosimetry file.
   - Discuss confidentiality of counseling

DECLARED PREGNANT FEMALE ACKNOWLEDGEMENT

Name: _____ SSN: _____

Film Badge/Employee No.: _____ Expected Delivery Date: _____

Date of Review: _____ Reviewer: _____

I, _____have been instructed in the recommendations of the National Council on Radiation Protection (NCRP) Publication 91, the EPA's Radiation Protection Guidance to Federal Agencies for Occupational Exposure, and NRC Reg. Guide 8.13 guidelines with regard to fetal exposure while I am pregnant. I have bee given an opportunity to ask questions related to these issues and how it will affect my job at the site.

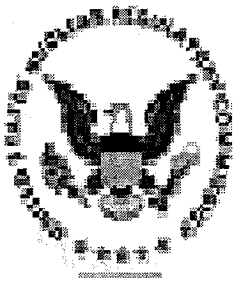
I understand these principles and choose to:

_____ a. Limit my exposure to 500 mrem for the duration of the pregnancy (limit of 150 mrem for the duration of this project.

_____ b. Retain my normal administrative exposure limits.

_____ _____

Employee Signature/Date Site Radiation Safety Officer/Date



Revision 3
JUNE 1999

U.S. Nuclear Regulatory Commission

REGULATORY GUIDE

Office of Nuclear Regulatory Research

REGULATORY GUIDE 8.13
(Draft was issued as DG-8014)

INSTRUCTIONS CONCERNING PRENATAL RADIATION EXPOSURE

A. INTRODUCTION

The code of Federal Regulations in 10 CFR 19, "Notices, Instructions and Reports to Workers: Inspections and investigations," in Section 19.12, "Instructions to Workers," requires instruction in the "health protection problems associated with exposure to radiation and/or radioactive material, in precautions or procedures to minimize exposure, and in the purpose and functions of protective devices employed." The instructions must be "commensurate with potential radiological health protection problems present in the work place."

The Nuclear Regulatory Commission's (NRC's) regulations on radiation protection are specified in 10 CFR Part 20, "Standards for Protection Against Radiation"; and 10 CFR 20.1208, "Dose to an Embryo/Fetus," requires licensees to "ensure that the dose to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5mSv)." Section 20.1208 also requires licensees to "make efforts to avoid substantial variation above monthly exposure rate to a declared pregnant woman." A declared pregnant woman is defined in 10 CFR 20.1003 as a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

This regulatory guide is intended to provide information to pregnant women, and other personnel, to help them make decisions regarding radiation exposure during pregnancy. This Regulatory Guide 8.13 supplements Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure" (Ref. 1), which contains a broad discussion of the risks from exposure to ionizing radiation.

Other sections of the NRC's regulations also specify requirements for monitoring external and internal occupational dose to a declared pregnant woman. In 10 CFR 20.1502, "Conditions Requiring Individual Monitoring of External and Internal Occupational Dose," licensees are required to monitor the

occupational dose to a declared pregnant woman, using individual monitoring device, if it is likely that the declared pregnant woman will receive, from external sources, a deep dose equivalent in excess of 0.1 rem (1 mSv). According to Paragraph (e) of 10 CFR 20.2106, "Records of Individual Monitoring Results," the licensee must maintain records of dose to an embryo/fetus if monitoring was required, and the records of dose to the embryo/fetus must be kept with the records of dose to the declared pregnant woman. The declaration of pregnancy must be kept on file, but may be maintained separately form the dose records. The licensee must retain the required form or record until the Commission Terminates each pertinent license requiring the record.

The information collections in this regulatory guide are covered by the requirements of 10 CFR Parts 19 or 20, which were approved by the Office of Management and Budget, approval numbers 3150-0044 and 3150-0014, respectively. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a current valid OMB control number.

B. DISCUSSION

As discussed in Regulatory Guide 8.29 (Ref. 1), exposure to any level of radiation is assumed to carry with it a certain amount of risk. In the absence of scientific certainty regarding the relationship between low dose exposure and health effects, and as a conservative assumption for radiation protection purposes, the scientific community generally assumes that any exposure to ionizing radiation may cause undesirable biological effects and that the likely hood of these effects increases and the dose increases. At the occupational dose limit for the whole body of 5 rem (50 mSv) per year, the risk is believed to be very low.

The magnitude of risk of childhood cancer following in utero exposure is uncertain in that both negative and positive studies have been reported. The data from these studies "are consistent with a lifetime cancer risk resulting from exposure during gestation which is two to three times that for the adult" (NCRP Report No. 116, Ref. 2). The NRC has reviewed the available scientific literature and has concluded that the 0.5 rem (5mSv) limit reflects the desire to limit the total lifetime risk of leukemia and other cancers associated with radiation exposure during pregnancy.

In order for a pregnant worker to take advantage of the lower exposure limit and dose monitoring provisions specified in 10 CFR Part 20, the woman must declare her pregnancy in writing to the licensee. A form letter for declaring pregnancy is provided in this guide or the licensee may use its own form letter for declaring pregnancy. A separate written declaration should be submitted for each pregnancy.

C. REGULATORY POSITION

1. Who Should Receive Instruction

Female workers who require training under 10 CFR 19.12 should be provided with the information contained in this guide. In addition to the information contained in Regulatory Guide 8.29 (Ref. 1), this information may be included as part of training required under 10 CFR 19.12.

2. Providing Instruction

The occupational worker may be given a copy of this guide with is Appendix, an explanation of the contents of the guide, and an opportunity to ask questions and request information. The information in this guide and Appendix should also be provided to any worker or supervisor who may have to take some action in response to such a declaration.

Classroom instruction may supplement the written information. If the licensee provides classroom instruction, the instructor should have some knowledge of the biological effects of radiation to be able to answer questions that may go beyond the information provided in this guide. Videotaped presentations may be used for classroom instruction. Regardless of whether the licensee provides classroom training, the licensee should give workers the opportunity to ask questions about information contained in this Regulatory Guide 8.13. The licensee may take credit for instruction that the worker has received within the past year at other licensed facilities of in other courses or training.

3. Licensee's Policy on Declared Pregnant Women

The instruction provided should describe the licensee's specific policy on declared pregnant women, including how those policies may affect a woman's work situation. In particular, the instruction should include a description of the licensee's policies, if any, that may affect the declared pregnant woman's work situation after she has filled a written declaration of pregnancy consistent with 10 CFR 20.1208.

The instruction should also identify who to contact for additional information as well as identify who should receive the written declaration of pregnancy. The recipient of the woman's declaration may be identified by name (e.g., John Smith), position (e.g., immediate supervisor, the radiation safety officer), or department (e.g., the personnel department).

4. Duration of Lower Dose Limits for the Embryo/Fetus

The lower dose limit for the embryo/fetus should remain in effect until the woman withdraws the declaration in writing or the woman is no longer pregnant. If a declaration of pregnancy is withdrawn, the dose limit for the embryo/fetus would apply only to the time from the estimated date of conception until the time the declaration is withdrawn. If the declaration is not withdrawn, the written declaration may be considered expired one year after submission.

5. Substantial Variations Above a Uniform Monthly Dose Rate

According to 10 CFR 20.1208(b), "The licensee shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limit in paragraph

(a) of this section" that is, 0.5 rem (5 mSv) to the embryo/fetus. The National Council on Radiation Protection and Measurements (NCRP) recommends a monthly equivalent dose limit of 0.05 rem (0.5mSv) to the embryo/fetus once the pregnancy is known (Ref.2). In view of the NCRP recommendation, any monthly dose of less than 0.1 rem (1mSv) may be considered as not a substantial variation above a uniform monthly dose rate and as such will not require licensee justification. However, a monthly dose greater than 0.1 rem (1 mSv) should be justified by the licensee.

D. IMPLEMENTAION

The purpose of this section is to provide information to licensees and applicants regarding the NRC staff's plans for using this regulatory guide.

Unless a licensee or applicant proposes an acceptable alternative method for complying with the specified portions of the NRC's regulations, the methods described in this guide will be used by the NRC staff in the evaluation of instructions to workers on the radiation exposure of pregnant women.

REFERENCES

1. USNRC, "Instruction Concerning Risks from Occupational Radiation Exposure," Regulatory Guide 8.29, Revision 1, February 1996.
2. National Council on Radiation Protection and Measurements, *Limitation of Exposure to Ionizing Radiation*, NCRP Report No. 116, Bethesda, MD, 1993.

APPENDIX

QUESTIONS AND ANSWERS CONCERNING PRENATAL RADIATION EXPOSURE

1. Why am I receiving this information?

The NRC's regulations (in 10 CFR 19.12, "Instructions to Workers") require that licensees instruct individuals working with licensed radioactive materials in radiation protection as appropriate for the situation. The instruction below describes information that occupational workers and their supervisors should know about the radiation exposure of the embryo/fetus of pregnant women.

The regulations allow a pregnant woman to decide whether she wants t formally declare her pregnancy to take advantage of lower dose limits for the embryo/fetus. This instruction provides information to help women make an informed decision whether to declare a pregnancy.

2. If I become pregnant, am I required to declare my pregnancy?

No. The choice whether to declare your pregnancy is completely voluntary. If you choose to declare your pregnancy, you must do so in writing and a lower radiation dose limit will apply to your embryo/fetus. If you choose to not to declare your pregnancy, you and your embryo/fetus will continue to be subject to the same radiation dose limit that apply to other occupational workers.

3. If I declare by pregnancy in writing, what happens?

If you choose to declare your pregnancy in writing, the licensee must take measures to limit the dose to your embryo/fetus to 0.5 rem (5 millisevert) during the entire pregnancy. This is one-tenth of the dose that an occupational worker may receive in a year. If you have already received a dose exceeding 0.5 rem (5 mSv) in the period between conception and the declaration of your pregnancy, an additional dose of 0.05 rem (0.5 mSv) is allowed during the remainder of the pregnancy. In addition, 10 CFR 20.1208, "Dose to an Embryo/Fetus," requires licensees to make efforts to avoid substantial variation above a uniform monthly dose rate so that all the 0.5 rem (5mSv) allowed dose does not occur in a short period during pregnancy.

This may mean that, if you declare your pregnancy, the licensee may not permit you to some of your normal job functions of those functions would have allowed you to receive more than 0.5 rem, and you may not be able to have some emergency response responsibilities.

4. Why do the regulations have a lower dose limit for the embryo/fetus of a declared pregnant woman that for a pregnant worker who has not declared?

A lower dose limit for the embryo/fetus of a declared pregnant woman is based on a consideration of greater sensitivity to radiation on the embryo/fetus and the involuntary nature of the exposure. Several scientific groups have recommended (References 1 and 2) that the dose to the embryo/fetus be limited to a fraction of the occupational dose limit.

5. What are the potentially harmful effects of radiation exposure to my embryo/fetus?

The occurrence and severity of health effects caused by ionizing radiation are dependent upon the type and total dose of radiation received, as wall as the time period over which the exposure was received. See Regulatory Guide 8.29, "Instruction Concerning Risks for Occupational Exposure" (Ref. 3), for more information. The main concern is embryo/fetal susceptibility to the harmful effects of radiation such as cancer.

6. Are there any risks of genetic defects?

Although radiation injury has been induces experimentally in rodents and insects, and in the experiments was transmitted and became manifested as hereditary disorders in their offspring, radiation has not been identified as a cause of such effects in humans. Therefore, the risk of genetic effects attributable to radiation exposure is speculative. For example, no genetic effects have been documented in any of the Japanese atomic bomb survivors, their children, or their grand children.

7. What if I decide that I do not want any radiation exposure at all during my pregnancy?

You may ask your employer for a job that does not involve any exposure at all to occupational radiation dose, but your employer is not obligated to provide you with a job involving no radiation exposure. Even if you receive no occupational exposure at all, your embryo/fetus will receive some radiation dose (on average 75 mrem (0.75mSv)) during your pregnancy from natural background radiation.

The NRC has reviewed the available scientific literature and concluded that the 0.5 rem (5 mSv) limit provides an adequate margin of protection for the embryo/fetus. This dose limit reflects the desire to limit the total lifetime risk of leukemia and other cancers. If this dose limit is exceeded, the total lifetime risk of cancer to the embryo/fetus may increase incrementally. However, the decision on what level of risk to accept is yours. More detailed information on potential risk to the embryo/fetus from radiation exposure can be found in References 2-10.

8. What effect will formally declaring my pregnancy have on my job status?

Only the licensee can tell you what effect a written declaration of pregnancy will have on your job status. As part of your radiation safety training, the licensee should tell you the company's policies with respect to the job status of declared pregnant women. In addition, before you declare your pregnancy, you may want to talk to you supervisor or your radiation safety officer and ask what a declaration of pregnancy would mean specifically for you and your job status.

In many cases you can continue in your present job with no change and still meet the dose limit for the embryo/fetus. For example, most commercial power reactor workers (approximately 93%) receive, in 12 months, occupational radiation doses that are less that 0.5 rem (5mSv) (Ref. 11). The licensee may also consider the likelihood of increased radiation exposures form accidents and abnormal events before making a decision to allow you to continue your present job.

If your current work might cause the dose to your embryo/fetus to exceed 0.5 rem (5 mSv), the licensee has various options. It is possible that the licensee can wand will make a reasonable accommodation that will allow you to continue performing your current job, for example, by having another qualified employee do a small part of the job that accounts for some of your radiation exposure.

9. What information must I provide in my written declaration of pregnancy?

You should provide, in writing, your name, a declaration that you are pregnant, the estimated date of conception (only the month and year need be given), and the date that you give the letter to the licensee. A form letter that you can use is included at the end of these questions and answers. You may use that letter, use a form letter the licensee has provided to you, or write your own letter.

10. To declare my pregnancy, do I have to have documented medical proof that I am pregnant?

NRC regulations do not require that you provide medical proof of your pregnancy. However, NRC regulations do not preclude the licensee for requesting medical documentation of your pregnancy, especially if a change in your duties is necessary in order to comply with the 0.5 rem (5mSv) dose limit.

11. Can I tell the licensee orally rather than I writing that I am pregnant?

No. The regulations require that the declaration must be in writing.

12. If I have not declared my pregnancy in writing, but the licensee suspects that I am pregnant, do the lower dose limits apply?

No. The lower dose limits for pregnant women apply only if you have declared your pregnancy in writing. The United States Supreme Court has ruled (in *United Automobile Workers International Union v. Johnson Controls, Inc.*, 1991) that "Decisions about the welfare of future children bust be left to the parents who conceive, bear, support, and raise then rather that to the employers who hire those parents" (Reference 7). The Supreme Court also ruled that your employer may not restrict you from a specific job "because of concerns about the next generation." Thus, the lower limits apply only if you choose to declare your pregnancy in writing.

13. If I am planning to become pregnant but I am not yet pregnant and I inform the licensee of that in writing, do the lower dose limits apply?

No. The requirement for lower limits applies only if you declare in writing that you are already pregnant.

14. What if I miscarriage or find out that I am not pregnant?

If you have declared your pregnancy in writing, you should promptly inform the licensee in writing that you are not longer pregnant, however, if you have not formally declared your pregnancy in writing, you need not inform the licensee or your nonpregnant status.

15. How long is the dose limit in effect?

The dose to the embryo/fetus must be limited until you withdraw your declaration in writing or you inform the licensee in writing that you are no longer pregnant. If the declaration is not withdrawn, the written declaration may be considered expired one year after submission.

16. If I have declared by pregnancy in writing, can I revoke my declaration of pregnancy even if I am still pregnant?

Yes, you may. The choice is entirely yours. If you revoke your declaration of pregnancy, the lower dose limit for the embryo/fetus no longer applies.

17. What if I work under contract at a licensed facility?

The regulations state that you should formally declare your pregnancy to the licensee in writing. The licensee has the responsibility to limit the dose to the embryo/fetus.

18. Where can I get additional information?

The references to this Appendix contain helpful information, especially Reference 3, NRC's Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure," for general information on radiation risks. The licensee should be able to give this document to you.

For information on legal aspects, see Reference 7, "The Rock and the Hard Place: Employer liability to Fertile or Pregnant Employees and Their Unborn Children – What Can the Employer Do?" which is an article in the journal *Radiation Protection Management.*

You may telephone the NRC headquarters at (301) 415-7000. Legal questions should be directed to the Office of the General Counsel, and technical questions should be directed to the Division of Industrial and Medical Nuclear Safety.

You may also telephone the NRC headquarters at the following numbers: Region I, (610) 337-5000; Region II, (404) 562-4400; Region III, (630) 829-9500; and Region IV, (817) 860-8100. legal questions should be directed to the Regional Counsel, and technical questions should be directed to the Division of Nuclear Materials Safety.

REFERENCES FOR APPENDIX

1. National Council on Radiation Protection and Measurements, *Limitation of Exposure to Ionizing Radiation*, NCRP Report No. 116, Bethesda, MD, 1993.
2. International Commission On Radiological Protection, *1990 Recommendations of the International Commission on Radiological Protection*, ICRP Publication 60, Ann. ICRP 21:NO. 1-3, Pergamon Press, Oxford, UK, 1991.
3. USNRC, "Instruction Concerning Risks form Occupational Radiation Exposure," Regulatory Guide 8.29, Revision 1, February 1996[1] (Electronically available at www.NRC.gov/NRC/rg/index.html)
4. Committee on the Biological Effects of Ionizing Radiations, National Research Council, *Health Effects of Exposure to Low Levels of Ionizing Radiation* (BEIR V), National Academy Press, Washington, DC, 1990.
5. United Nations Scientific Committee on the Effects of Atomic Radiation, *Sources and Effects of Ionizing Radiation*, United Nations, New York, 1993.
6. R. Doll and R. Wakeford, "Risk of Childhood Cancer from Fetal Irradiation," *The British Journal of Radiology*, 70, 130-139, 1997.
7. David Eiedis, Donald E. Jose, and Timm O. Phoebe, "The Rock and the Hard Place: Employer Liability to Fertile or Pregnant Employees and Their Unborn Children – What Can the Employer Do?" *Radiation Protection Management*, 11, 41-49, January/February 1994.
8. National Council on Radiation Protection and Measurements, *Considerations Regarding the Unintended Radiation Exposure of the Embryo, Fetus, or Nursing Child*, NCRP Commentary No. 9, Bethesda, MD, 1994.
9. National Council on Radiation Protection and Measurements, *Risk Estimates for Radiation Protection,* NCRP Report No. 115, Bethesda, MD, 1993.
10. National Radiological Protection Board, *Advice on Exposure to Ionizing Radiation During Pregnancy,* National Radiological Protection Board, Chilton Didcot, UK, 1998.

[1] Single copies of regulatory guides, both active and draft, and draft NUREG documents may be obtained free of charge by writing the Reproduction of Distribution Services Section, OCIO, USNRC, Washington, DC 20555-0001, or by fax to (301) 415-2289, or by email to DISTRIBUTION@NRC.GOV. Active guides may also be purchased from the National Technical Information Service on a standing order basis. Details on the service may be obtained by writing NTIS, 5285 Port Royal Road, Springfield, VA 22161. Copies of active and draft guides are available for inspection of copying for a fee form the NRC Public Document Room at 2120 L Street NW., Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202) 634-3273; fax (202) 634-3343.

11. M.L. Thomas and D. Hagemeyer, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities, 1996," Twenty-Ninth Annual Report, NUREG-0713, Vol. 18, USNRC, 1998.[2]

[2] Copies are available at current rates form the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20402-9328 (telephone (202) 512-1800); or from the National Technical Information Service by writing NTIS at 5285 Port Royal Road, Springfield, VA 22161. Copies are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW., Washington, DC 20555; Telephone (202) 634-3273; fax (202) 634-3343.

FORM LETTER FOR DECLARING PREGNANCY

This form letter is provided for your convenience. To make your written declaration of pregnancy, you may fill in the blanks in the form letter, you may use a form letter the licensee has provided to you, or you may write your own letter.

DECLARATION OF PREGNANCY

To:_____

In accordance with the NRC's regulations at 10 CFR 20.1208, "Dose to an Embryo/Fetus," I am declaring that I am pregnant. I believe I became pregnant in _____(only the month and year need be provided).

I understand the radiation dose to my embryo/fetus during the entire pregnancy will not be allowed to exceed 0.5 rem (5 millisievert) (unless that dose has already been exceeded between the time of conception and submitting this letter). I also understand that meeting the lower dose limit may require a change in job of job responsibilities during my pregnancy.

_____

(Your signature)

_____

(Your name printed)

_____

(Date)

REGULATORY ANALYSIS

A separate regulatory analysis was not prepared for this regulatory guide. A regulatory analysis prepared for 10 CFR Part 20, "Standards for Protection Against Radiation" (56 FR 23360), provides the regulatory basis for this guide and examines the cost and benefits of the rule as implemented by the guide. A copy of the "Regulatory Analysis for the Revision of 10 CFR Part 20" (PNL-6712, November 1988) is available for inspection and copying for a fee at the NRC Public Document Room at 2120 L Street NW, Washington, DC, as an enclosure to Part 20 (56 FR 23360).

Sevenson Environmental Services, Inc

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-03

Personnel Dosimetry Requirements

September 17, 2003

Record of Changes

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

1.0 PURPOSE

To provide the guidelines for the requirements, use and reporting of personnel dosimetry and for the administrative control of exposure limits.

2.0 APPLICABILITY

This procedure is applicable to all Sevenson Environmental Services (SES) site personnel and ancillary personnel.

3.0 DEFINITIONS

None

4.0 PROCEDURE

4.1 The administrative requirements for issuing of personnel dosimetry are defined in RSO-NFSS-01 (Ref. 6.1).

4.2 Issuing Personnel Dosimetry

4.2.1 The Radiation Safety Office will be responsible for issuing personnel dosimeters.

4.2.2 Radiation Safety Staff will make sure that issuing requirements are meet as stated in RSO-NFSS-01.

4.2.3 Individuals that require dosimetry will be required to complete a NRC Form 4 or equivalent (Attachment 7.1) for current and past years exposure.

4.2.4 If the individual has a previous dose history from a facility have the individual complete a Request for Report of Previous Radiation Exposure (Attachment 7.2). If the individual has a current year dose history the Radiation Safety Office may accept an estimate from the employee until the individuals dose records have been obtained.

4.2.5 The Site Radiation Safety Officer (SRSO) or designee will ensure that an individual with a current year dose record will not exceed site limits for annual site exposure.

4.2.6 Once the above is completed the individual will be issued a dosimeter. The dosimeter number, name, social security number and date of birth for the individual is to recorded on the Dosimetry Issue Log (Attachment 7.3).

4.3 Requirements for Wearing Personnel Dosimetry

4.3.1 A Thermoluminescence Detector (TLD) or equivalent is required to be worn by all personnel entering a Restricted Area (except escorted visitors) and all personnel entering a Radiologically Controlled Area (RCA) for greater than 10 consecutive workdays.

4.4 Use of Personnel Dosimetry

4.4.1 Personnel dosimetry is required to be worn at all times when in a Restricted Area or a RCA.

4.4.2 TLDs shall be worn on the front of the body between the neck and waist on the outermost garment unless otherwise directed by Radiation Safety.

NOTE: The TLD should be worn underneath the anti-contamination clothing.

4.4.5 Dosimetry shall be picked up and returned daily to the proper storage location as designated by the SRSO or designee.

4.4.6 Each individual is responsible for ensuring they are wearing their assigned dosimetry.

4.4.7 Discrepancies involving dosimetry (i.e., lost or damaged TLD, improper use of dosimetry, etc.) shall be reported in accordance with RSO-NFSS-06, Ref. 6.2.

4.4.8 TLDs are normally exchanged on a monthly basis unless otherwise specified by SRSO. If the TLD from the previous wear period is not returned, the new issue TLD is retained by SRSO until the TLD is recovered and/or the incident resolved.

4.4.9 All dosimetry shall be returned to the SRSO upon termination of employment or completion of work assignment.

4.5 Initial Administrative Control of Exposure Limits

4.5.1 The individual's initial administrative dose limits shall be as specified in the Radiation Safety Program.

4.6 Annual Administrative Control of Exposure Limits

4.6.1 At the beginning of each new calendar year, the annual limits for all individuals will automatically be reset by the SRSO.

4.6.2 The administrative dose limits for this project are described in the Radiation Control Plan. No individual at this site will be allowed to accumulate more than 100 mrem TEDE (external plus internal) per calendar year.

4.6.3 The SRSO is responsible for reviewing and analyzing the personnel exposures received, the man-rem total for the project, and for reporting this information in the closeout report.

4.7 Reporting Requirements

4.7.1 General Requirements

4.7.2 The specific reporting requirements as listed in Attachment 7.4 are outlined below:

4.7.2.1 At the written request of a worker formerly engaged in work activities at the site, SES shall furnish a report of radiation exposure to the worker or the worker's designee. The report shall be furnished within 30 days.

4.7.2.2 At the request of a worker who is terminating employment or assignment to work involving radiation exposure, SES shall furnish a written report of the exposure received by the worker. The report shall include the exposure received in the current calendar quarter. If the final exposure results are not available at the time, a written estimate of the dose will be provided and clearly indicated as such.

4.7.2.3 Where necessary or desirable, in order to aid in determining the extent of an individual's exposure to concentrations of radioactive material, bioassay services will be made available to individuals and a copy of the reports of such services will be reported to the client.

5.0 RESPONSIBILITIES

5.1 Site Radiation Safety Officer shall:

- Direct the wearing and use of personnel dosimetry.
- Review of the annual exposure limits.
- Report any over-exposures and excessive levels of concentration in accordance with SES policies.

6.0 REFERENCES

6.1 RSO-NFSS-01, Radiation Safety Requirements of Admittance and Termination of SES Employees, Contractors and Visitors to the site

6.2 RSO-NFSS-06, Radiological Deficiency Reports

6.3 Sevenson Environmental Services Radiation Safety Program

7.0 ATTACHMENTS

7.1 NRC Form 4

7.2 Request for Report of Previous Radiation Exposure

7.3 Dosimetry Issue Log

7.4 NRC Form 5

NRC FORM 4
(9/1998)
10 CFR PART 20

U.S. NUCLEAR REGULATORY COMMISSION

CUMULATIVE OCCUPATIONAL DOSE HISTORY

APPROVED BY OMB NO. 3150-0005 **EXPIRES: 09/30/2001**
Estimated burden per response to comply with this mandatory information collection request: 30 minutes. The record is used to ensure that doses to individuals do not exceed regulatory limits. This information is required to record an individual's lifetime occupational exposure to radiation to ensure that the cumulative exposure to radiation does not exceed regulatory limits. Forward comments regarding burden estimates to the Records Management Branch (T-6F33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project collection does not display a current valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. NAME (LAST, FIRST, MIDDLE INITIAL)	2. IDENTIFICATION NUMBER	3. ID TYPE	4. SEX MALE ☐ FEMALE ☐	5. DATE OF BIRTH (MM/DD/YYYY)

6. MONITORING PERIOD (MM/DD/YYYY)		7. LICENSEE NAME		8. LICENSE NUMBER		9. RECORD ☐ ESTIMATE ☐ NO RECORD ☐	10. ROUTINE ☐ PSE ☐
11. DDE	12. LDE	13. SDE, WB	14. SDE, ME	15. CEDE	16. CDE	17. TEDE	18. TODE
6. MONITORING PERIOD (MM/DD/YYYY)		7. LICENSEE NAME		8. LICENSE NUMBER		9. RECORD ☐ ESTIMATE ☐ NO RECORD ☐	10. ROUTINE ☐ PSE ☐
11. DDE	12. LDE	13. SDE, WB	14. SDE, ME	15. CEDE	16. CDE	17. TEDE	18. TODE
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11. DDE	12. LDE	13. SDE, WB	14. SDE, ME	15. CEDE	16. CDE	17. TEDE	18. TODE
6. MONITORING PERIOD (MM/DD/YYYY)		7. LICENSEE NAME		8. LICENSE NUMBER		9. RECORD ☐ ESTIMATE ☐ NO RECORD ☐	10. ROUTINE ☐ PSE ☐
11. DDE	12. LDE	13. SDE, WB	14. SDE, ME	15. CEDE	16. CDE	17. TEDE	18. TODE
6. MONITORING PERIOD (MM/DD/YYYY)		7. LICENSEE NAME		8. LICENSE NUMBER		9. RECORD ☐ ESTIMATE ☐ NO RECORD ☐	10. ROUTINE ☐ PSE ☐
11. DDE	12. LDE	13. SDE, WB	14. SDE, ME	15. CEDE	16. CDE	17. TEDE	18. TODE

19. SIGNATURE OF MONITORED INDIVIDUAL	20. DATE SIGNED	21. CERTIFYING ORGANIZATION	22. SIGNATURE OF DESIGNEE	23. DATE SIGNED

PAGE ____ OF ____

INSTRUCTIONS AND ADDITIONAL INFORMATION PERTINENT TO THE COMPLETION OF NRC FORM 4

(All doses should be stated in rems)

1. Type or print full name of the monitored individual in the order of last name (include "Jr," "Sr," "III," etc.), first name, middle initial (if applicable).
2. Enter the individual's identification number, including punctuation. This number should be the 9-diget social security number if at all possible. If the individual has no social security number, enter the number from another official identification such as a passport or a work permit.
3. Enter the code for the identification used as shown below:

CODE	ID TYPE
SSN	U.S. Social Security Number
PPN	Passport Number
CSI	Canadian Social Insurance Number
WPN	Work Permit Number
PADS	PADS Identification Number
OTH	Other

4. Check the box that denotes the sex of the individual being monitored.
5. Enter the date of birth of the individual being monitored in the format MM/DD/YYYY.
6. Enter the monitoring period for which this report is filed. The format should be MM/DD/YYYY.
7. Enter the name of the licensee or facility not licensed by the NRC that provided monitoring.
8. Enter the NRC license number or numbers.
9. Place an "X" in Record, Estimate, or No Record. Choose "Record" if the dose data listed represent a final determination of the dose received to the best of the licensee's knowledge. Choose "Estimate" only if the listed dose data are preliminary and will be superseded by a final determination resulting in a subsequent report. An example of such an instance would be dose data based on selfreading dosimeter results and the licensee intends to assign the record dose on the basis of TLD results that are not yet available.
10. Place an "X" in either Routine or PSE. Choose "Routine" if the data represent the results of monitoring for routine exposures. Choose "PSE" if the listed dose data represents the results of If more than one PSE was received in a single year, the licensee should sum them and report the total of all PSEs.
11. Enter the deep dose equivalent (DDE) to the whole body.
12. Enter the dose equivalent (LDE) recorded for the lens of the eye.
13. Enter the shallow dose equivalent recorded for the skin of the whole body (SD, WB).
14. Enter the shallow dose equivalent recorded for the skin of the extremity receiving the maximum dose (SDE, ME).
15. Enter the committed effective dose equivalent (CEDE).
16. Enter the committed dose equivalent (CDE) recorded for the maximally exposed organ.
17. Enter the total effective dose equivalent (TEDE). The TEDE is the sum of lines 11 thru 15.
18. Enter the total organ dose equivalent (TODE) for the maximally exposed organ. The TODE is the sum of items 11 thru 16.
19. Signature of the monitored individual. The signature of the monitored individual on this form indicates that the information contained on the form is complete and correct to the best of his or her knowledge.
20. Enter the date this form was signed by the monitored individual.
21. [OPTIONAL] Enter the name of the licensee or facility not licensed by NRC, providing monitoring for exposure to radiation (such as a DOE facility) or the employer if the individual is not employed by the licensee and the employer chooses to maintain exposure records for its employees.
22. [OPTIONAL] Signature of the person designated to represent the licensee or employer who chooses to countersign the form should have on file documentation of all the information on the NRC form 4 being signed.
23. [OPTIONAL] Enter the date this form was signed by the designed representative.

PRIVACY ACT STATEMENT

Pursuant TO 5 U.S.C. 552a(e)(3), enacted into law by Section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals who supply information to the U.S. Nuclear Regulatory Commission on NRC Form 4. This information is maintained in a system of records designated as NRC-27 and described at 58 Federal Register 36473 (July 7, 1993), or the most recent Federal Register publication of the Nuclear Regulatory Commission's "Republication of Systems of Records Notices" that is available at the NRC Public Document Room, Gelman Building, Lower Level, 2120 L Street NW, Washington, D.C.

1. AUTORITY: Sections 53, 63, 65, 103, 104, 161(b), and 161(o) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2073, 2093, 2095, 2111, 2133, 2134, 2201(b), AND 2201(o)). Executive Order 9397, November 22, 1943.
2. PRINCIPLE PURPOSE(S): The information used by the NRC in its evaluation of the risk of radiation exposure associated with the licensed activity and in exercising its statutory responsibility to monitor and regulate the safety and health practices of its licensees. The data permits a meaningful comparison of both current and long-term exposure experience among types of licensees and among licensees within each type. Data on your exposure to radiation is available to you upon request.
3. ROUTINE USE(S): The information may be used to provide data to other Federal and State agencies involved in monitoring and/or evaluation radiation permanent or temporary basis and exposure received by monitored visitors. The information may also be disclosed to an appropriate Federal, State, Local, or foreign agency in the event the information indicates a violation or potential violation of law and in the course of an administrator or judicial proceeding. In addition, this information may be transferred to an appropriate Federal, State, local, or foreign agency to the extent relevant and necessary for that agency's decision about you. Information from this form issued by a court of competent jurisdiction, and in presenting evidence, to a Congressional office to respond to their inquiry make at your request, or to NRC-paid experts, consultants, and others under contract with the NRC, on a need-to-know basis.
4. WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION: It is voluntary that you furnish the requested information, including social security number; however, the licensee must complete NRC form 5 on each individual for whom personnel monitoring is required under 10 CFR 20.2106. Failure to do so may subject the licensee to enforce action in assure that NRC has an accurate identifier not subject to the coincidence of similar names or birth dates among the large number of persons on whom data is maintained.

monitoring of planned special exposures received during the monitoring period.		5. SYSTEM MANAGER(S) AND ADDRESS: REIRS Project Manager, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC 20555-001

REQUEST FOR PREVIOUS EXPOSURE

DEPARTMENT OF HEALTH AND SAFETY
RADIATION SAFETY OFFICE
2749 LOCKPORT ROAD
NIAGARA FALLS, NY 14305
716-284-0431

Sevenson Environmental Services, Inc.

REQUEST FOR REPORT OF PREVIOUS RADIATION EXPOSURE

To Whom It May Concern:

In consideration of Sevenson Environmental Services, Inc.'s decision to evaluate my application for employment in a position requiring access to radiological controlled areas, I _____, hereby authorize Sevenson Environmental Services, Inc. to obtain my accumulated lifetime radiation exposure history form any source which may be in possession of such data, including, but not limited to, current or former employer.

I understand that this information may assist Sevenson Environmental Services, Inc. in evaluating my application for employment and in making decisions regarding possible work assignments with radioactive material.

Please send: __ Record __ Estimate

__ Current Year __ Previous years

Send report to: Sevenson Environmental Services, Inc.
Department of Health and Safety - Radiation Protection
2749 Lockport Road
Niagara Falls, NY 14305
Fax: 716-284-1796

_____ _____
Signature Social Security Number

_____ _____
Signature (Witness) Date

DOSIMETRY ISSUE LOG

Name	SSN or ID	Company	DOB	TLD#	Date Issued	Date Returned	Comments

NRC FORM 5

U.S. Nuclear Regulatory Commission

Occupation Exposure Record

NRC Form 5 Equivalent

1. Date of Preparation:	2. Monitored Individual:	3. SSN:	4. DOB:	5. SEX

6. Name and Address of Reporting Organization:	7. Type of Report	8. Signature of Radiation Safety Officer Date
Sevenson Environmental Services, Inc. Department of Health and Safety Radiation Safety Office 2749 Lockport Rd Niagara Falls, NY 14503	☐ Estimate ☐ Final Record ☐ Annual Summary	

9. Facility	10. Exposure periods From To	Internal Data				External Data				
		Radionuclide		11. CDE	12. CEDE	13. SDE	14. LDE	15. DDE	16. TODE	17. TEDE
		Symbol	Class							
A.										
B.										
C.										
D.										
Total Exposure for All Facilities										

18. Bioassay Results: Reference Isotope(s):

All Exposures Reported in REM

CDE: Committed Dose Equivalent
CEDE: Committed Effective Dose Equivalent
SDE: Shallow Dose Equivalent
LDE: Lens Dose Equivalent (Eye)
*AC: All compounds

DDE: Deep Dose Equivalent
TODE: Total Organ Dose Equivalent
TEDE: Total Effective Dose Equivalent
MDA: Minimum Detectable Activity

Sevenson Environmental Services, Inc

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-04

Bioassay Procedure

September 17, 2003

Record of Changes

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

BIOASSAY PROCEDURE

1.0 PURPOSE

The purpose of this procedure is to establish bioassay frequencies, bioassay method requirements and bioassay action levels.

2.0 APPLICABILITY/SCOPE

This procedure is applicable to all Sevenson Environmental Services (SES) radiation site personnel.

3.0 DEFINITIONS

None

4.0 PROCEDURE

4.1 General Description

4.1.1 The bioassay program provides monitoring of internal radioactive material. Due to the specific decay characteristics of various isotopes, several different bioassay methods are utilized. Radioanalysis of excreta (urine) samples is the principal means of bioassay at the site.

4.1.2 Bioassay sample results/reporting shall be calculated and reported in accordance with Lochamy (NBS Special Publication 456, *Measurements for the Safe Use of Radiation*, U.S. Department of Commerce, 1976).

4.2 Bioassay Sampling Requirements

4.2.1 A baseline urinalysis is initially required for Radiologically Controlled Area (RCA) entries. This urinalysis will normally be obtained in conjunction with permanent Thermoluminescence Detector (TLD) assignment.

4.2.2 An urinalysis is required prior to going to another facility, at which entry into a RCA is expected.

4.2.3 An urinalysis is required upon termination of employment or completion of radiologic al work assignment. This urinalysis will normally be obtained in conjunction with permanent TLD termination.

4.2.4 An urine sample analysis is required following assignment of ≥ 2 DAC hours in any one day or ≥ 10 DAC hours in a calendar week.

4.2.4.1 If the DAC hours calculated from the excreta sample analysis is greater than that assigned by the air sample, the dosimetry records shall be updated to show the higher DAC hours.

4.2.5 An urine sample analysis is required for any individual who experiences skin contamination on the neck or above or positive nasal smears. In addition, the Site Radiation Safety Officer (SRSO) may specify a urinalysis anytime the inhalation of radioactive material is suspected. This shall not include contamination from radon decay products.

4.2.6 An urine sample analysis is required following any event which indicates a respirator failure during radiological work, unless air sampling results can adequately demonstrate that DAC hour assignments resulting from the failure are less than the values stated in Section 4.2.4 of this procedure.

4.2.7 Supplemental bioassay shall be performed as directed by the SRSO.

NOTE: The SRSO or designee may grant specific exemption/modification to the above bioassay requirements. Such exemption shall be documented in writing.

4.3 Bioassay Method Requirement

4.3.1 Excreta

4.3.1.1 Excreta samples shall be collected and handled as detailed in Section 4.6.

4.3.1.2 Excreta analysis vendors shall participate in a recognized QA or intercomparison testing program which is traceable to the National Institute of Standards and Technology (NIST). The results of this testing shall be reviewed and maintained by the SRSO.

4.3.1.3 Excreta analysis methods shall have a Minimum Detectable Activity (MDA) of 10% of the guideline values specified in the site Radiation Protection Program.

4.4 Bioassay Investigative Reports

A Bioassay Investigative Report is to be completed by SRSO for all bioassay results that exceed the action levels established in Section 4.5.

4.4.1 The SRSO will perform an investigation and make dose commitments based on appropriate methodology (e.g., FGR No. 11, ICRP 26, 30, NUREG/CR-4884, etc.). This evaluation shall include, as necessary:

1. Calculated DAC hours.

2. Calculated dose to the target organ(s) and/or total body (EDE) as appropriate.

3. Subsequent bioassay evaluation.

4. Limitations imposed on the individual.

This information is to be documented using Attachment 7.2 or computer generated form as appropriate.

4.4.2 The completed assessment shall be retained in the permanent project files.

4.5 Bioassay Action Levels

A Bioassay Investigative Report is required for bioassay results, which exceed the site action level as specified in the Radiation Protection Program.

4.6 Excreta Sample Collection and Handling

4.6.1 Radiation Safety Personnel — Provide the individual with a copy of the appropriate sample collections instructions, Attachment 7.3 as applicable, and a new sample collection container marked with the individual's name and social security number.

4.6.2 Individual — Collect the sample in accordance with the provided instructions and return it to appropriate department (see Attachment 7.3).

4.6.3 Radiation Safety Personnel - Upon receiving a sample from an individual, obtain a bioassay sample number from the Sample Logbook. Ensure that the individual's name, SSN and sample start and stop dates are properly documented.

4.6.4 Radiation Safety Personnel - Send excreta sample to the appropriate laboratory for analysis within 5 working days of collection. Ship samples to off-site laboratories using the following requirements:

1. Tightly seal all containers.

2. Include a Chain-of-Custody form, which indicates the sample inventory and the analysis to be performed (see Attachment 7.1).

3. Send a copy of the Chain-of-Custody form to the laboratory under separate cover (may be Faxed).

4. Notify the laboratory by phone when an emergency sample evaluation is required.

4.6.6 Radiation Safety Personnel — Upon receipt of analytical report from the laboratory, review the results and log the results in the individual's file on the Bioassay History form.

5.0 RESPONSIBILITIES

The procedure responsibilities are as stated in the text.

6.0 REFERENCES

None

7.0 ATTACHMENTS

7.1 Chain-of-Custody form (example)

7.2 Bioassay Investigative Report

7.3 24-Hour Urine Sample Collection Instructions

CHAIN-OF-CUSTODY
(example)

PROJECT NO.:					SITE NAME:	NO. OF CON-TAINERS							REMARKS
SAMPLER'S SIGNATURE:													
STATION NO.	DATE	TIME	COMP	GRAB	STATION LOCATION								

RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE/TIME	RECEIVED FOR LABORATORY BY:	DATE/TIME	REMARKS:	
Distribution: Original accompanies shipment. Copy to coordinator field files.					

BIOASSAY INVESTIGATION REPORT

1. Individual Name _____

2. SSN _____

3. Bioassay Type _____ Bioassay Date _____

4. Bioassay Results:

5. Action Taken:

6. Results of Investigation/Dose Commitment:

Assessment Completed by: _____
(Signature/Title/Date)

Assessment Reviewed by: _____
Site Radiation Safety Officer/Date

6. Dosimetry Records updated on _____ by _____
(Signature)

Distribution:

Original: Individuals Radiation Exposure History File
cc: Corporate Radiation Safety Officer, SES

24-HOUR URINE SAMPLE COLLECTION INSTRUCTIONS

Utilizing the container provided, collected a urine sample using the method described below. Any special sampling instructions modifying this procedure are stipulated in the special instructions section below.

Precautions:

1. Use good personal hygiene during the collection of the sample.
2. Do not take the sample collection container in any radiological controlled areas.

Instructions:

1. Begin collection of the urine sample after your next normal sleep period.
2. Record the date and time of the first collection on the sample container.
3. Record the date and time of the exposure on the sample container.
4. Continue collecting your urine excreta for the next 24 hours.
5. Record the date and time of the last collection on the sample container.
6. Return the completed sample to Radiation Safety within the next normal working day.

Special Instructions: None.

Sevenson Environmental Services, Inc

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-05

Radiation Safety Log

September 17, 2003

Record of Changes

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

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-NFSS-07, Records Retention

7.0 ATTACHMENTS

7.1 Daily Radiation Safety Report

DAILY RADIATION SAFETY REPORT

SEVENSON ENVIRONMENTAL SERVICES
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:_____

Sevenson Environmental Services, Inc

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-06

Radiological Defiency Reports

September 17, 2003

Record of Changes

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

RADIOLOGICAL DEFICIENCY REPORTS

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 RSO-NFSS procedures.

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-NFSS-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

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-07

Records for Retention

September 17, 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 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 Site Radiation Safety Officer (SRSO) 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 SRSO — 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. Site 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

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-08

Establishing and Posting Areas

September 17, 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 describe the minimum criteria used in establishing radiologically controlled areas and to describe the method by which these areas shall be posted.

2.0 APPLICABILITY/SCOPE

This procedure is applicable to all Sevenson Environmental Services (SES) site radiation workers.

3.0 DEFINITIONS

3.1 Radiologically Controlled Area[1] — a generic term referring to any or all of the following: Radiation Area, Airborne Radioactivity Area, Radioactive Material Area, or Contaminated Area or any other posting established for Radiation Safety purposes.

3.2 Radiation Area — any area, accessible to personnel, in which there exists penetrating radiation at such levels that a major portion of the body could receive in any one hour a dose of 5 mrem or greater.

3.3 Airborne Radioactivity Area – Any area, accessible to personnel, in which airborne Radioactive materials exit in concentrations in excess of those listed in 10 CFR 20 Appendix B Table 1 Col. 3.

3.4 Contaminated Area – any area contaminated with loose surface radioactive contamination that is greater than the activity value listed in NRC Regulation Guide 1.86 page 5 column 3.

3.5 Radioactive Materials Area — any area which contains radioactive material in excess of 10 times the limits contained in Appendix C to 10 CFR 20. Duplicate posting is not required if the outer boundary has the appropriate posting.

4.0 PROCEDURE

4.1 Radiation Safety Technician — Designate and post radiologically controlled areas in accordance with guidelines contained in General Survey and Monitoring Requirements (Ref 6.3).

4.2 Radiation Safety Technician — Adjust posting as necessary whenever operations performed in the radiologically controlled area changes the radiological status or whenever surveys indicate reposting is required.

4.3 Radiation Safety Technician — Inform the SRSO of any changes in postings.

4.4 Areas of specific concern that are located within a posted area may require additional posting. These areas should be posted with a sign(s) bearing the radiation caution symbol and stating the appropriate requirements (Examples: Keep Out; Respiratory Protection required; TLD Required,

[1] These areas are commonly called "RWP Areas" since a valid RWP in required for entry into the area.

etc.) or any additional information needed to aid individuals in minimizing their exposure to radiation or radioactive material.

4.5 Normally inaccessible areas, such as overheads, which may have radiation measurements resulting in the need for control as radiation areas, shall be posted with cautionary signs at appropriate access points.

4.5.1 These signs will require notification of the Radiation Safety Office prior to working in such areas.

4.5.2 If these areas become accessible due to maintenance or modification work, then they shall be managed in accordance with Paragraph 3.0.

5.0 RESPONSIBILITIES

Responsibilities are as set forth in Section 4.0 of this procedure.

6.0 REFERENCES

6.1 Health and Safety Plan — Radiation Protection Program

6.2 RSO-NFSS-10, Radiological Surveys

6.3 10 CFR 20.1902 Posting Requirements

7.0 ATTACHMENTS

None

Sevenson Environmental Services, Inc

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-09

Radiation Work Permits

September 17, 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 set forth the requirements for the preparation and use of the Radiation Work Permit (RWP).

2.0 APPLICABILITY/SCOPE

The procedure is applicable to all personnel involved in preparing and using RWP's.

3.0 DEFINITIONS

3.1 RWP — an administrative method of controlling personnel access to Radiologically Controlled Areas for the purpose of minimizing internal and external radiological hazards, maintaining the total dose equivalent **A**s **L**ow **A**s is **R**easonably **A**chievable (ALARA) and working with maximum radiological safety.

4.0 PROCEDURE

4.1 General Requirements

4.1.1 An RWP is required for any of the following conditions:

1. Entering a Radiation Area
2. Entering a Contaminated Area
3. Entering an Airborne Radioactivity Area
4. When the radiological conditions in an area, equipment or system to be entered or opened are unknown.
5. Transfer of Radioactive Material outside the Restricted Area, with the following exceptions:

   a. Personnel involved in the transfer that will not handle the Radioactive Material and will not be exposed to a radiation area.

   b. Sealed calibration/check sources provided the material is under the direct custody of the user and is less than 2.5 mrem/hr on contact with the outside of the source container.

   c. Radiological instrumentation under the direct custody of Radiation Safety personnel.

4.1.2 Entry may be made into an RWP Area without an RWP in the event that safety of personnel or equipment is endangered. The entry will be made with a Radiation Safety Technician and/or a dose rate-monitoring device, if the situation/time permits. Following such entry, an RWP will be executed to document the entry.

4.1.3 RWP Classifications

4.1.3.1 Job Specific RWP's are normally prepared with current radiological survey data. Job Specific RWP's may be prepared without current radiological survey data and may authorize planned work to be performed when:

a. Job involves entry into numerous plant locations and/or areas not immediately accessible where acquiring all survey data prior to RWP issue is not practical, or dose to Radiation Safety Technician can be minimized by having radiological working conditions checked just prior to commencement of work activities.

- and -

b. A qualified Radiation Safety Technician provides continuous coverage until survey data is documented.

4.1.3.2 Standing RWP's are RWP's issued for routine repetitive duties such as inspections, surveillance, and others as determined by the Site Radiation Safety Officer. Other tasks may be performed using a Standing RWP if all the following conditions are met:

a. No contaminated or potentially contaminated system opening, with the exception of instrumentation.

b. Task is of short duration.

c. Task is not expected to cause any significant changes in static radiological conditions of areas.

d. Approval of the Site Radiation Safety Officer.

4.1.4 Individual(s) entering RWP Areas must be qualified Radiation Workers in accordance with RSO-NFSS-01 (Ref. 6.1).

4.2 Initiation of RWP's

~~4.2.1 The supervisor of the person(s) who is going to perform the work will initiate the RWP.~~

4.2.2 RWP's will be submitted to the Site Radiation Safety Officer for review and approval at least 24 hours prior to scheduled work.

4.2.3 The Supervisor (or designee) initiating the RWP completes the following section of the RWP:

1. Type of RWP (RWP number will be assigned by Radiation Safety).
2. Description of work to be performed.
3. RWP start and expiration date.
4. Job location.

4.2.4 After completing the applicable portions of the RWP, it is taken to the Radiation Safety Office and discussed. All supporting documentation should be included.

4.3 Preparation of RWP's

4.3.1 The Radiation Safety Technician/Site Radiation Safety Officer shall review the initiated RWP and all supporting documentation for completeness and adequacy.

4.3.2 The qualified Radiation Safety Technician(s) preparing the RWP completes the following sections (not necessarily in sequence):

1. RWP Number.
2. Protective Equipment Required.
3. Respiratory Devices Required.
4. Special Precautions.
5. Radiological Survey Data (discuss survey data as needed).

4.3.3 Sevenson's Site Radiation Safety Officer and Project Manager shall review the RWP and indicate approval for issuance by signing and dating the "Approved by" space in the approval section of the RWP. Any changes to an approved RWP must be authorized in writing on the record copy by the SES Site Radiation Safety Officer. Any change must be reflected on all official copies.

4.3.4 Use of RWP Copies —

4.3.4.1 One copy of the RWP and any attached documents shall be kept in the active RWP binder/file.

4.3.4.2 All other official copies shall be distributed/used as directed by the Site Radiation Safety Officer.

4.4 RWP Entrance and Exit

4.4.1. After reading the RWP the worker shall complete the RWP Sign-In Log as follows:

1. NAME(print), Signature, SSN#, Time in, - Signature signified understanding of the radiological conditions and requirements specified.

2. Upon completion of job and exit from area - worker shall complete the Time out section of the RWP sign in log.

3. Comments – To be used for respiratory equipment use (ex. Type) or other appropriate remarks by the Radiation Worker or Radiological Safety Technician.

4.4.2 Radiation Safety personnel, or those personnel issuing respiratory devices, shall verify the following prior to allowing entry onto the RWP Area:

1. Radiation Worker Training - current.

2. Sufficient yearly exposure remaining to complete task.

3. Respirator Training - current.

4. Respirator Medical exam - within one year.

4.4.3 Individuals shall be informed of the radiological conditions and necessary radiological precautions associated with the work. This shall be done by the RWP and/or a pre-job briefing.

4.5 Termination of RWP's

4.5.1 RWP's shall be terminated for the following conditions:

1. The job is complete.

2. The expiration date has expired.

3. Work done on RWP is not being performed in accordance with instructions on the RWP. (RWP may be placed on hold in lieu of termination).

4. Radiological conditions have degraded significantly from the conditions for which the RWP was written.

5. A change to a Standing RWP is warranted.

4.5.2 Terminate the RWP by signing and dating the space provided in the Termination section.

4.5.3 Upon termination of the RWP, all Sign-In Logs for the RWP, Continuation Sheets, etc. are to be retained in Radiation Safety Office files.

5.0 RESPONSIBILITIES

Responsibilities are as stated in Section 4.0.

6.0 REFERENCES

6.1 RSO-NFSS-01, Radiation Safety Requirements for Admittance and Termination of SES Employees, Contractors and Visitors.

7.0 ATTACHMENTS

7.1 RWP

7.2 RWP Sign-In Log

RADIATION WORK PERMIT

RWP #	REV	ACTIVATION DATE	ACTIVATION TIME	EXPIRATION DATE	EXPIRATION TIME
SES	0				

Standing		Location	
Job Specific			

Task/Work Listing	
1.	

Protective Clothing/Safety Requirements								
Set "D"		Set "C"		Mod C"		Other		See Special Instructions

Radiological Conditions		
Pre-Job Survey #		Various (see related job survey)

Approvals	Signature	Date
SES PM		

SES SRSO Approval / Date	SES SRSO Termination / Date	Reason

SPECIAL INSTRUCTIONS
1.
2.

RADIATION SAFETY INSTRUCTIONS
1.
2.

Set ID	Protective Clothing/Safety Equipment
Set "D"	DOSIMETRY, SAFETY GLASSES WITH SIDE SHIELDS, STEEL TOED WORK SHOES AND PLANT COVERALLS
Set "C"	DOSIMETRY, SAFETY GLASSES, STEEL TOED WORK SHOES, TYVEK COVERALLS, COTTON LINERS, RUBBER GLOVES, RUBBER SHOES, RESPIRATOR AND PLANT COVERALLS
Mod "C"	DOSIMETRY, SAFETY GLASSES, STEEL TOED WORK SHOES, TYVEK COVERALLS, COTTON LINERS, RUBBER GLOVES, RUBBER SHOES AND PLANT COVERALLS

RADIATION WORK PERMIT
SIGN IN LOG

RWP: SES-_____ DATE: _____
REV _____

RWP
SIGN IN LOG

By my signature, I state that I have read, understand and will comply with all requirements outlined in this RWP and have reviewed the radiological conditions to be expected.

NAME (print)	SIGNATURE	SSN #	Time In	Time Out	Comments

Sevenson Environmental Services, Inc

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-10

Radiological Surveys

September 17, 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-NFSS-11, Radiological Dose Rate Surveys

6.2 RSO-NFSS-12, Surface Contamination Survey

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

6.4 RSO-NFSS-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

RADIOLOGICAL SURVEY REPORT FORM

Pg. 1 of

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	β	α	β	

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	β	α	β	

RADIOLOGICAL SURVEY REPORT FORM

MAP SHEET

Location:	Date:
	Time:
	Survey No:

Sevenson Environmental Services, Inc

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-11

Radiation Dose Rate Surveys

September 17, 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 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-NFSS-10, Radiological Surveys

7.0 ATTACHMENTS

None

Sevenson Environmental Services, Inc

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-12

Surface Contamination Surveys

September 17, 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 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 a 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. (Use MDC_{scan} formula to determine scan speed)

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-NFSS-13, Personnel Contamination Monitoring and Decontamination

6.2 RSO-NFSS-10, Radiological Surveys

7.0 ATTACHMENTS

None

Sevenson Environmental Services, Inc

Niagara Falls Storage Site
Building 401 Demolition

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

Cover Sheet

RSO-NFSS-13

Personnel Contamination Surveys

September 17, 2003

Record of Changes

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

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 $\geq$ 20 cpm_{net} (net counts per minute) alpha (α) or $\geq$ 50 cpm_{net} beta/gamma ($\beta\gamma$). 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} a or 50 cpm_{net} ß?, 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-NFSS-06, Radiological Deficiency Reports

6.2 RSO-NFSS-04, Bioassay Procedure

6.3 RSO-NFSS-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 a survey meters and 50 cpm_{net} for ß? 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 a FRISKING INDICATES ≥ 20 cpm ABOVE BACK-GROUND, ß? 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 a survey meters and 50 cpm_{net} for ß? 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 a FRISKING INDICATES ≥ 20 cpm ABOVE BACK-GROUND, ß? 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: _____ cm^2 CONTAMINATION LEVEL: _____ $dpm/100cm^2$

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

DECONTAMINATION METHODS

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,	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			obtain them without delay. Apply to eye 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.) All Surfaces	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° to 40°; 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. <u>For small surfaces</u> Blot up liquid and hand wipe with water and appropriate commercial detergent.	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.
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	Contamination may be reduced	

			increased by using 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 surfaces, paint or plastic finishes, etc.)	Dissolves organic materials (oil, paint, etc.)	Immerse entire unit in solvent or apply by wiping procedure (see Detergents).	Quick dissolving action. Recovery of solvent possible by distillation.	Requires good ventilation and fire 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 without 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

Niagara Falls Storage Site
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Radiation Safety Office-
Standard Operating Procedure (RSO-NFSS)

Cover Sheet

RSO-NFSS-14

Air Sampling

September 17, 2003

Record of Changes

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

1.0 PURPOSE

This procedure provides guidance for the collection of air samples at the Fields Brook Superfund Site.

2.0 APPLICABILITY/SCOPE

This procedure applies to Radiological Safety personnel performing the air sampling.

3.0 DEFINITIONS

3.1 Continuous Air Sampling/Monitoring — a method of sampling used to detect changes in airborne activity levels in routinely occupied areas. These units often provide alarm capabilities for air activity levels which exceed predetermined set points.

3.2 Grab Sample — an air sample technique which consists of drawing a known volume of air in a short duration (typically 5 minutes) through a media and measuring the activity collected in the media. The sample is used to assess airborne radiological conditions during entry into an area, during work evolution and to verify airborne conditions indicated by constant air sampling/monitoring equipment.

3.3 Breathing Zone Air Sample — a sample of the breathing zone air concentration capable of detecting a minimum of 25% DAC. Refer to Ref. 6.1. In cases where the air sample is used to verify adequate respiratory protection, a sample of sufficient volume to detect 25% DAC including the protection factor (PF) provided by respiratory protection device(s) is needed.

3.4 Breathing Zone Air (BZA) — the region near a workers mouth and nostrils from which air is drawn into the workers lungs during work. Air taken from this region will represent the air the worker is breathing.

4.0 PROCEDURE

4.1 Particulate Air Sampling

4.1.1 Obtain air sampling equipment, filters and envelopes/tags.

4.1.2 Set up the sampling system with the appropriate filter.

4.1.2.1 Place filter in the air sampler with the rough side as the collection surface.

4.1.3 Complete the following sections, as applicable, of the Air Sample Collection Envelope/Tag:

4.1.3.1 Date on/off

4.1.3.2 Time Sample on/off

4.1.3.3 Flow Rate

4.1.3.4 Type of Sample (including RWP # as appropriate)

4.1.3.5 Sampler Number

4.1.3.6 Sampler Calibration Due Date

4.1.3.7 Location

4.1.3.8 Respirator Type/Code

NOTE: If sample is a BZA sample place name and social security number(s) of person or persons covered by the air sample on the envelope/tag.

4.1.4 Operate the air sampler in accordance with the appropriate operating procedures.

4.1.5 Start the air sampler once the filter/cartridge is properly installed. Adjust the flow if necessary.

4.1.6 Draw an air sample in a manner that would result in a representative sample as defined in 3.3 and 3.4.

NOTE: The sample should be of sufficient volume to detect 10% of DAC. Lapel samplers may not provide the necessary volume required to obtain 10% of DAC due to sampler limitations.

4.1.7 Turn the air sampler off once a sample has been drawn.

4.1.8 Ensure the remainder of the applicable information (i.e., Time/Date off) is on the envelope or tag.

4.1.9 Field count as necessary per Ref. 6.1.

4.1.10 Place the particulate filter into the appropriate envelope.

4.1.11 Transport the sample to a counting station.

4.1.12 Analyze the sample and document in accordance with Ref. 6.1.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Technician

5.1.1 Insure all equipment used for air sample collection is operating properly and has current calibration certification as required.

5.1.2 Place air sampler in a location that is representative of the air concentration in that area or breathing zone, as applicable.

5.1.3 Ensure the sample being collected is a valid air sample and not surface contamination.

5.1.4 Perform a field analysis per Ref. 6.1, as necessary.

5.1.5 Submit sample(s) to the count facility for analysis as soon as possible after collection.

NOTE: Air samples taken for radon progeny analysis (Working Level analysis via the Modified Kusnetz Method) must be precisely timed with a stop watch. The actual collection time, time between collection and analysis, counting time, etc. are critical for obtaining proper results (see Ref. 6.2).

5.1.6 Use proper Radiation Safety practices to ensure that no cross-contamination occurs.

6.0 REFERENCES

6.1 RSO-NFSS-15, Air Sample Analysis

6.2 RSO-NFSS-17, Air Sampling and analysis for Radon Progeny

6.3 ANSI N13.1-1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities, 1969.

6.4 NUREG 1400, Air Sampling In the Work Place, 1993

6.4 Applicable Equipment Operating Procedures

7.0 ATTACHMENTS

7.1 Sample Collection Tag

SAMPLE COLLECTION TAG

Air Filter #:_____

Date:_____

Model:_____ Serial #:_____

Location:_____

On Time:_____ Flow Rate:_____

Off Time:_____ Flow Rate:_____

Date Counted:_____

Gross Count:_____

Quality Count:_____

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RSO-NFSS-15

Air Sampling Analysis

September 17, 2003

Record of Changes

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

1.0 PURPOSE

This procedure provides guidance for handling, counting, radionuclide determination, laboratory analysis, technical and managerial review of data and actions to be taken on air sample analysis.

2.0 APPLICABILITY/SCOPE

This procedure applies to all Radiation Safety personnel performing, analyzing and interpreting air samples.

3.0 DEFINITIONS

3.1 Lower Limit of Detection (LLD) the count rate or corresponding sample concentration which can be detected with 95% certainty (e.g., limit Type I and Type II Statistical errors to < 5%). Mathematically, the LLD is defined as:

$$LLD = 4.65\sqrt{\frac{S_B}{t}}$$

Where:

4.66	=	"Z" Score for 95% confidence "2-tail" statistical test
S_b	=	Background count rate in cpm
t	=	Sample counting time in minutes

3.2 Working Level (WL) - any combination of the short-lived a emitting progeny of ^{222}Rn in 1 liter of air having a total potential a energy of 130,000 MeV. In typical indoor radon environments (assuming 50% equilibrium), 1 WL . 200 pCi/L of ^{222}Rn.

4.0 PROCEDURE

4.1 Analysis of air particulate samples for radon progeny will be performed in accordance with standard operating procedure Air Sampling and Analysis for Radon Progeny (Ref. 6.1).

4.2 Analysis of Air Samples for Alpha and Beta Emitters other than Radon Progeny

4.2.1 Insure that normal daily QC checks have been performed on counting system.

4.2.2 Allow air sample (filter) to decay 24 - 72 hours after being taken (allows radon progeny to decay).

4.2.3 Remove filter from envelope and place rough side up.

4.2.4 Set counter for appropriate counting time.

4.2.5 Place sample holder slide in topmost slot of sample holder.

4.2.6 Press red "start" button on counter (red LED next to button should illuminate).

4.2.7 At end of counting time (red LED next to start button goes out) record total counts on data sheet (Attachment 7.1).

4.2.8 Replace filter in envelope and store for future use.

4.2.9 Complete the Air Sample Data Sheet (Attachment 7.1).

4.2.10 The Site Radiation Safety Officer may select samples for recount (QA) or to be sent to an outside laboratory for analysis.

5.0 RESPONSIBILITIES

As in Section 4.0, above.

6.0 REFERENCES

6.1 RSO-NFSS-17, Air Sampling and Analysis for Radon Progeny

6.2 RSO-NFSS-14, Air Sampling

7.0 ATTACHMENTS

7.1 Air Sample Data Sheet

AIR SAMPLE DATA SHEET

Air Sample Data Sheet

AIR SAMPLE DATA SHEET			Sample No.:	Tech:
Check One				
	Hi Volume		Date:	
	Breathing Zone (PAS)		Start Time:	End Time:
	Occupational		Total Time:	
Location:			Start flow rate (cfm) (L/min)	End flow rate (cfm) (L/min)
			Average flow rate (cfm) (L/min)	Total Volume (L)
Check box to indicate which worker of the group wore the personal air sampler (PAS)- max. 4 persons per PAS			Background cpm	Gross Count
	Name	S.S. No.	Initial Count Time (min)	Net cpm
	Occupation		Fractional Activity	Total Activity (µCi)
	Name	S.S. No.	Conc. (µCi/ml)	Th-232 Conc. (µCi/ml)
	Occupation			
			Sampler Model	Sampler Serial No.
	Name	S.S. No.	Counter Type	
	Occupation			
			Counter Serial No.	Counter Model No.
	Name	S.S. No.		
	Occupation		Counter Efficiency	
Comments:				
Counted by:			Date/Time:	
Reviewed by:			Date:	

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Standard Operating Procedure (RSO-NFSS)

Cover Sheet

RSO-NFSS-16

Description and Selection of Respiratory Protection

September 17, 2003

Record of Changes

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

DESCRIPTION AND SELECTION OF RESPIRATORY PROTECTIVE EQUIPMENT

1.0 PURPOSE

This procedure describes the types of respiratory protection devices available and gives the criteria to be used for their proper selection to minimize personnel exposure to airborne radioactive materials.

2.0 APPLICABILITY/SCOPE

This procedure applies to any individual involved in the selection of respiratory protection equipment for use in a radiological environment. Individuals concerned about the selection of respiratory protection equipment for non-radiological hazards should refer to the appropriate procedures for Non-Radiological Respiratory Protection.

3.0 DEFINITIONS

3.1 Radiation Work Permit (RWP) - The document used as an administrative method of controlling personnel access to areas designated as radiological hazards for the purpose of minimizing exposure to internal and external radiation.

3.2 Non-Radiological Respiratory Protection Permit (NRP) - The document used as an administrative method of selecting and authorizing the use of respirators to minimize internal exposures to non-radiological airborne hazards.

3.3 Breathing Zone - The region near a worker's mouth and nostrils from which air is drawn into the worker's lungs during work. Air taken from this whether standing, sitting, or moving.

4.0 PROCEDURE

4.1 Prerequisites

4.1.1 All respiratory protective devices, which are selected to afford a protection factor against airborne radioactive material, shall be NIOSH certified in accordance with Ref. 6.1, or specifically approved for use by SES.

4.1.2 Engineering and process controls (HEPA filtered ventilation, containment, etc.) shall be considered prior to the selection of respiratory protection equipment.

4.1.3 When an NRP is issued for an RWP area, a copy of the NRP shall be maintained at the appropriate control point.

4.1.3.1 When an NRP applies to an RWP area such that it requires greater respiratory protection than the RWP, the NRP requirement shall be on the RWP.

4.1.3.2 Where respiratory protection is not specified on the RWP, but is specified on the NRP for the same area, there shall be no respiratory protection specified on the RWP.

4.2 Obtain the air sample concentrations and contamination survey data from the Radiation Work Permit, and identify the type and concentration of radionuclides present.

4.2.1 Respiratory protection equipment is to be selected to provide a protection factor greater than the multiple by which peak concentrations of airborne radioactive materials are expected to exceed the values specified FGR No. 11 (Ref. 6.2), as determined by the sampling of airborne contamination. Isotopes for which a protection factor may not be taken are not considered in this respirator selection process. Exposures to these isotopes are calculated as if no respirator were worn.

4.2.1.1 If it is impractical or impossible to obtain current airborne radioactivity measurements prior to an entry, past airborne concentration histories for the area or the type of work to be performed shall be used in estimating expected airborne radioactivity levels. An air sample shall be taken during such an entry to verify the actual levels.

4.2.2 Where surface contamination exists in concentrations which may be expected to become airborne during the work to be performed, past airborne concentration histories for the area and the type of work to be performed shall be used in estimating expected airborne radioactivity levels.

4.2.3 Air samples shall be obtained during work activities for estimating exposure to workers, and for continuing evaluation to determine adequate respiratory protection, when a reasonable potential for airborne contamination exists. Air samples shall be representative of the breathing zone airborne radioactivity concentration where work activities are likely to create airborne contamination.

4.3 As a guideline, respiratory protection may be used when past airborne concentration histories for an area and the type of work to be performed show a reasonable probability that an airborne concentration of 1 DAC or more may develop. Both internal and external sources of exposure will be considered such that the total exposure to the individual will be minimized.

4.4 Respirators are not selected on the basis of contamination levels, although contamination level data may be used to determine the probability of airborne levels developing during certain work activities.

4.5 Consider non-radiological respiratory hazards that may impact selection, e.g., confined space, chlorine, asbestos, etc., in accordance with Procedures for Non-Radiological Respiratory Protection.

4.6 Use of respirators affording greater protection against higher concentrations may be dictated based on evaluation of the following characteristics of the work and user requirements:

4.6.1 Activity to be performed

4.6.2 Working conditions, i.e., temperature, presence of water, mobility, space constraints

4.6.3 Duration of required respirator usage

4.6.4 Proximity of respirable air

4.6.5 User acceptance, comfort and qualifications

NOTE: User comfort and the degree of stress associated with respirators are considered during fit testing. Respirators are selected so that any specific job can be performed with a minimum of stress compatible with the job requirements and the degree of protection needed.

4.7 Document the type of respirator required on the RWP.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Office

5.1.1 Those persons assigned the task of evaluating the need for, and determining the type of, respiratory protection devices to be used shall adhere to the requirements and guidelines set forth in this procedure when writing an RWP.

5.1.2 Radiation Safety personnel will maintain a copy of current NRPs in RWP areas at the appropriate control point. The Job Supervisor delivers the NRP to the control point for reference by Radiation Safety and supervisory personnel.

5.1.3 Radiation Safety personnel are responsible for the collection and analysis of radiological air samples, contamination surveys, calculation of DAC hours, and maintenance of these records.

5.2 Site Radiation Safety Officer or Designee

5.2.1 Provide specifications for the selection of respiratory protection devices, and periodically review the selection process to ensure compliance with this procedure.

5.3 Health and Safety Department

5.3.1 Health and Safety personnel determine when an NRP applies to an RWP area.

5.3.2 When an NRP applies to an RWP area, Safety and Health personnel shall ensure the NRP is available for reference at the appropriate control point.

5.3.3 Health and Safety personnel periodically shall monitor worker compliance with NRP requirements.

5.4 Job Supervisor

5.4.1 The Job Supervisor posts NRP areas with a copy of the effective NRP required for work.

5.4.2 When an NRP applies to an RWP area, the Job Supervisor delivers a copy of the NRP to the appropriate control point.

5.4.3 The job supervisor shall monitor worker compliance with RWP and NRP requirements.

5.4.4 The job supervisor shall terminate the NRP at the completion of the job and ensure that all copies of the terminated NRP are returned to the Health and Safety Department.

6.0 REFERENCES

6.1 30 CFR 11, Respiratory Protective Devices; Tests for Permissibility.

6.2 Federal Guidance Report No. 11, Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion, EPA 520/1-88-020, 1988.

6.3 29 CFR 1910.134, General Industry Standard - Respiratory Protection.

6.4 ANSI Z88.2-1980, Practices for Respiratory Protection.

6.5 NRC Regulatory Guide 8.15, Acceptable Programs for Respiratory Protection.

6.6 NRC NUREG-0041, Manual of Respiratory Protection Against Airborne Radioactive Materials.

7.0 ATTACHMENT

7.1 None

Sevenson Environmental Services, Inc

Niagara Falls Storage Site
Building 401 Demolition

Radiation Safety Office-
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Cover Sheet

RSO-NFSS-17

Radon Progeny Air Sampling

September 17, 2003

Record of Changes

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

RADON PROGENY AIR SAMPLING

1.0 PURPOSE

This procedure provides guidance for the collection and analysis of air samples for radon progeny. This procedure reports radon progeny in units of Working Levels (WL).

2.0 APPLICABILITY/SCOPE

2.1 This procedure applies to Radiological Safety personnel performing the air sampling.

2.1 Technical Basis: This method is known as the modified Kusntez Method, Reference 6.1. Air is drawn through a glass fiber filter for 5 minutes and airborne radon progeny are collected on the filter. The filter is placed on contact with a calibrated alpha scintillation detector and counted for 10 minutes at a known time from the end of sampling. The counts in the 10 minute counting period are used to calculated the Potential Alpha Energy Concentration (PAEC) in units of ?J/m^3. The PAEC is then converted to units of Working Levels.

2.2 Occupational Limits on Airborne Radon Progeny

2.2.1 The National Institute for Occupational Safety and Health (NIOSH) has recommended an occupational limit for radon progeny, Reference 6.2: The average work shift concentration shall not exceed 0.083 Working Level.

2.2.2 The Mine Safety and Health Administration (MSHA) states that "no person shall be permitted to receive an exposure in excess of 4 WLM [Working Level Months] in any calendar year." (30 CFR 57.5038) For example, if the average concentration is 0.333 WL for a month, a person is exposed to 0.333 WLM. If this continues for 12 months, the person's exposure is 4 WLM per year. In addition, MSHA states that "persons shall not be exposed to air containing concentrations of radon daughters exceeding 1.0 WL in active workings." (30 CFR 57.5039)

3.0 DEFINITIONS

3.1 One Working Level (WL) - any combination of short lived radon progeny in 1 liter of air that will ultimately release 1.3 E 5 MeV of alpha energy during decay to Pb-210.

4.0 PROCEDURE

4.1 Equipment

4.1.1 Ludlum Model 2221 ratemeter/scaler, or equivalent.

4.1.2 Alpha scintillation detector

4.1.3 Glass fiber filters

4.1.4 Filter holder

4.1.5 Vacuum pump

4.1.6 Watch or stopwatch

4.1.7 Calibrated air flow device (e.g., calibrated rotameter)

NOTE: A calibrated LV-1 may be used to take the air sample in lieu of a vacuum pump and calibrated air flow device.

4.2 Particulate Air Sampling

4.2.1 Obtain air sampling equipment, filters and envelopes.

4.2.2 Set up the sampling system with the appropriate filter.

4.2.2.1 Place filter in the air sampler with the rough side as the collection surface.

4.2.3 Complete the following sections, as applicable, of the Air Sample Collection Envelope:

4.2.3.1 Date on

4.2.3.3 Sampler Number

4.2.3.4 Location

NOTE: If sample is a BZA sample place name and social security number(s) of person or persons covered by the air sample on the envelope.

4.2.4 Operate the air sampler in accordance with the appropriate operating procedures.

4.2.5 Start the air sampler once the filter/cartridge is properly installed. Adjust the flow, if necessary, to 10-20 lpm. Record the exact time and flow rate.

4.2.6 Turn the air sampler off after exactly 5 minutes of sampling. Record the time and date.

4.2.7 Place the particulate filter into the appropriate envelope.

4.2.8 Transport the sample to a counting station.

4.2.9 Analyze the sample and document in accordance with section 4.3 below.

4.3 Counting the Air Sample

4.3.1 Mount the glass fiber filter against the alpha scintillation probe, dirty side facing the probe face.

4.3.2 At a time interval between 35 to 85 minutes after the end of sampling, begin a 10 minute count of the filter.

4.3.3 Record the gross counts. Dismount the filter.

4.3.4 If not already done, measure the counter background with a clean (unused) glass fiber filter in units of cpm.

4.3.5 If not already done, measure the counting efficiency of the system using a calibrated alpha standard in units of cps/Bq.

4.3.6 Calculate the PAEC in units of ?J/m; as follows:

$$PAEC = \frac{N}{E \;\; T_S \;\; Q \;\; T_f}$$

Where:

N	=	Sample net cpm
E	=	Fractional counter efficiency (cps/Bq)
T_s	=	Sampling time in minutes
Q	=	Sample flow rate in m^3/min
T_f	=	Time factor given in table

4.3.7 Calculate the relative standard deviation of the measurement, s_p in % as follows:

$$\sigma_p = \frac{\sqrt{\frac{cpm_g}{T_c} + \frac{cpm_b}{T_c}}}{cpm_g - cpm_b} X \quad 100$$

Where:

cpm_g	=	Gross counts per minute
cpm_b	=	Background counts per minute
T_c	=	Time counted in minutes

4.3.8 Calculate and record the radon progeny concentration in units of Working Level; use the following equation:

$$WL = \frac{PAEC}{2.08E04}$$

4.3.9 Notify the Site Radiation Safety Officer if calculated WL exceeds 0.083.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Technician

5.1.1 Insure all equipment used for air sample collection is operating properly and has current calibration certification as required.

5.1.2 Place air sampler in a location that is representative of the air concentration in that area or breathing zone, as applicable.

5.1.3 Ensure the sample being collected is a valid air sample and not surface contamination.

5.1.4 Perform a field analysis per Ref. 6.1, as necessary.

5.1.5 Submit sample(s) to the count facility for analysis as soon as possible after collection.

NOTE: Air samples taken for radon progeny analysis (Working Level analysis via the Kusnetz technique) must be precisely timed with a stop watch. The actual collection time, time between collection and analysis, counting time, etc. are critical for obtaining proper results (see Ref. 6.2).

5.1.6 Use proper Radiation Safety practices to ensure that no cross-contamination occurs.

6.0 REFERENCES

6.1 US Department of Energy, Environmental Measurements Laboratory, Section 2.2, Vo. 1, Standard Procedures Manual, HASL-300, 28th Edition, February 1997.

6.2 National Institute for Occupational Safety and Health, Public Health Service, US Department of Health and Human Services, "A Recommended Standard for Occupational Exposure to Radon Progeny in Underground Mines", DHHS (NIOSH) Publication No. 88-101, October 1987.

6.4 Applicable Equipment Operating Procedures

7.0 ATTACHMENTS

7.1 Table 1- Time Factors for use in the Modified Kusnetz Method

TIME FACTORS FOR USE IN THE MODIFIED KUSNETZ METHOD

TABLE 1

Time Factors for Use in the Modified Kusnetz Method			
Time after sampling in minutes*	Time Factor T_f	Time after sampling in minutes*	Time Factor T_f
40	7.21	66	4.71
42	7.02	68	4.52
44	6.83	70	4.32
46	6.63	72	4.18
48	6.44	74	4.04
50	6.25	76	3.94
52	6.06	78	3.75
54	5.87	80	3.61
56	5.67	82	3.51
58	5.48	84	3.32
60	5.29	86	3.17
62	5.10	88	3.03
64	4.90	90	2.88

* Midpoint of counting interval

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Radiation Safety Office-
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RSO-NFSS-18

Counting and Reporting Smear Data

September 17, 2003

Record of Changes

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

COUNTING AND REPORTING SMEAR DATA

1.0 PURPOSE

This procedure provides guidance for the counting and reporting of smears for the detection of loose (removable) radioactive surface contamination.

2.0 APPLICABILITY/SCOPE

This procedure is applicable to all Radiation Safety personnel.

3.0 DEFINITIONS

3.1 Smear C a circular piece of filter paper or cloth wiped over an area of 10 cm by 10 cm. (100 cm^2 or approximately 4 in by 4 in.) to detect the presence of loose or removable radioactive contamination.

3.2 Large Area Smear C a smear taken over an area > 100 cm^2. Large area smears are useful as a conservative means of detecting "gross" contamination over a large area. Normally, if a large area smear detects > 200 dpm, a detailed contamination survey is required to quantitatively determine the contamination level per 100 cm^2. Large area smears (?300 cm^2) are also necessary for determining the contamination levels of packages to be shipped in accordance with DOT regulations.

4.0 PROCEDURE

4.1 General

4.1.1 Smears are taken whenever the presence of loose or removable radioactive contamination is possible, such as prior to releasing equipment or tools for use in unrestricted areas. The site limit for such removable contamination is 20 dpm/100 cm^2, therefore, a smear should be capable of detecting a relatively small fraction of this amount (e.g., 25%).

4.1.2 The procedure for performing smear samples is described in RSO-NFSS-12 (Ref. 6.1) and RSO-NFSS-21 (Ref. 6.2).

4.1.3 After obtaining a smear, as in Section 4.1.2, above, the sample should be counted for a sufficient time to obtain a Lower Limit of Detection (LLD) ?25% of the removable contamination limit (exception: large area smears may be counted for a sufficient time to detect ?50% of the applicable contamination limits).

4.2 Analysis and Calculations

4.2.1 Perform a background count equal to or greater than the sample counting time. Note that long background counts (e.g., > 100 min.) are required to accurately establish the true background of a low-background ? counting system. Then, perform a 1-minute count of the dedicated check source prior to counting smears. Enter data for the counting system, background and check source counts in the "Radiological Instrument Daily Source Check Record". Check source count rate must be within acceptable limits (within ?2s for check source counts) before proceeding to count smears.

4.2.2 Calculate the LLD for the counting system using the following formula:

$$LLD_{(DPM/SMEAR)} = \frac{3 + 4.65\sqrt{cpm_{bkg} \times T}}{E \times T}$$

where:

cpm_{bkg} = long-term, true counting system background count rate (from 4.2.1, above)
E = counting system efficiency (determined when counting system is calibrated C posted on instrument)
T = sample count time in minutes

4.2.3 Leave the counting system set for the appropriate counting time. Using forceps, place smear in sample holder (be sure to center smear in planchet, with numbered side **down**. Close sample holder drawer and press the count button to start count.

4.2.4 After count is complete remove smear and hold for recount if necessary later. Calculate smear activity as follows:

$$dpm/smear = \frac{\left(\frac{cpm_{gross}}{T}\right) - cpm_{bkg}}{E}$$

where:

$counts_{gross}$ = gross sample counts for counting time T
cpm_{bkg} = background count rate
E = counting system efficiency
T = sample count time in minutes

4.2.5 Enter data in Smear Counting Log.

4.2.6 Record data on appropriate Radiological Survey Forms. Refer to RSO-NFSS-12 for actions in case of contaminated smears.

4.2.7 Retain Smear Counting Log and Radiological Survey Forms in accordance with RSO-NFSS-07 (Ref. 6.3).

5.0 RESPONSIBILITIES

Same as noted above in Section 4.0.

6.0 REFERENCES

6.1 RSO-NFSS-12, Surface Contamination Surveys

6.2 RSO-NFSS-07, Records Retention

7.0 ATTACHMENTS

None

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RSO-NFSS-19

Release of Material for Unrestricted Use

September 17, 2003

Record of Changes

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

1.0 PURPOSE

To provide personnel with guidance for releasing material from the site for unrestricted use. This also includes material to be disposed of as hazardous (e.g., asbestos) but non-radioactive waste.

2.0 SCOPE/APPLICABILITY

This procedure is applicable to all personnel.

3.0 DEFINITIONS

None

4.0 PROCEDURE

Note: Any one of the following sections may be omitted at the discretion of the Site Radiation Safety Officer (SRSO) based on prior knowledge of the nuclides involved.

4.1 General

The uranium series (^{238}U and its radioactive progeny) presents a potential α, β (internal) and γ (external) radiation hazard. Therefore, release criteria for material at the site are based on: surface contamination levels (Ref: Regulatory Guide 1.86), the specific activity of ^{226}Ra and γ exposure standards (Ref: 40 CFR 192). In summary this includes:

1. Fixed (non-removable) α and β-γ surface contamination.
2. Removable or loose α and β-γ surface contamination.
3. Specific activity (pCi/g) of material (e.g., soil and building materials).
4. γ exposure rates from radioactive material (primarily radon progeny).

4.2 Surface Contamination

4.2.1 Material considered for unrestricted release at the site should be surveyed for both fixed and removable α contamination. The limits for fixed and removable α contamination are contained in the enclosed table (Attachment 7.1).

4.2.2 Material considered for unrestricted release at the site should be surveyed for both fixed and removable β-γ contamination. The limits for fixed and removable β-γ contamination are contained in the enclosed table (Attachment 7.1).

Note: Due to the significantly more stringent α surface contamination standards, the β-γ may be omitted at the discretion of the SRSO. However, it should be noted that the limits for α and β-γ surface contamination apply independently of one another.

4.2.3 SRSO-NFSS-12 describes the methods for performing surface contamination surveys. Material with inaccessible areas, specifically where the α activity has been sealed into the surface (e.g., by painting), may be considered for released if the following criteria are met.

Note: Since ^{226}Ra is normally found in equilibrium with its daughters, it is often possible to determine if material contaminated with α emitters may be released for unrestricted use by performing γ measurements of radium and its progeny even if the α measurements cannot be made for various reasons. The Section 4.4, below, describes procedures that may be used in such circumstances or in conjunction with α contamination surveys of accessible areas.

4.3 Specific γ Activity

Limits for specific activity for release of material for unrestricted and restricted use are contained in the enclosed table (Attachment 7.1). The criterion is also applicable to building materials such as contaminated plaster or concrete.

4.4 γ Exposure Standards

A γ dose rate survey may be performed of material considered for release for unrestricted use (primarily large, bulky material which cannot be bulk counted) using a suitable survey meter (e.g., a μR Meter). The limits for γ exposure rates are contained in the enclosed table (Attachment 7.1). It should be noted that since this criteria may be less stringent than the specific activity standard in Section 4.3, above[1], the specific activity criteria is the preferred standard. Under normal circumstances, γ dose rate surveys alone should not be used in the absence of α surface contamination surveys to determine if material may be released for unrestricted use, unless contamination surveys are impossible or impractical.

5.0 RESPONSIBILITIES

Radiation Safety personnel are responsible for performing and/or supervising the measurements necessary for releasing material under the provisions of this RSO-NFSS procedure. The SRSO is responsible for final authorization of release of material at the site.

6.0 REFERENCES

6.1 RSO-NFSS-12 — Surface Contamination Surveys.

[1] If the residual material is not more or less evenly distributed in the material being surveyed, a γ dose rate limit of 20 μR/hr is not conservative.

6.2 40 CFR 192 — Environmental Protection Agency.

6.3 USNRC Regulatory Guide 1.86 *Termination of Operating Licenses for Nuclear Reactors*

6.4 RSO-NFSS-22 — Gross γ Counting of Material for Transportation/Release from Site

7.0 ATTACHMENTS

7.1 Table: Release Limits

TABLE: RELEASE LIMITS[2]

Criteria	Average[2]	Maximum[3]	Removable[4]
α Surface Contamination[5]	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
β-γ Surface Contamination[6]	5,000 dpm/100 cm^2	15,000 dpm/100 cm^2	1,000 dpm/100 cm^2
^{226}Ra and ^{232}Th in material released for unrestricted use[6]	N.A.	5 pCi/g	N.A.
^{226}Ra and ^{232}Th in material released for restricted use[7]	N.A.	15 pCi/g	N.A.
γ Dose Rate (large objects which can not be readily bulk counted)	N.A.	20 μR/hr	N.A.

2 Measurements of average surface contamination should not be averaged over more than 1 m^2. For objects of less surface area, the average should be derived for each such object.

3 The maximum surface contamination limits apply to areas of not more that 100 cm^2.

4 Determined by wiping the area with a dry filter paper, applying moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

5 Where surface contamination by both α and β-γ emitting nuclides exists, the limits established for α and β-γ emitting nuclides should apply independently.

6 5 pCi/g limit applies to material released for unrestricted use including non-hazardous waste, etc. 15 pCi/g applies to material released from site but not for unrestricted use. This would include otherwise hazardous waste (e.g., asbestos waste), etc.

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RSO-NFSS-34

Source Checking Instruments

September 17, 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 servic e 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-NFSS-07 Records for Retention

6.2. RSO-NFSS 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:_____

Appendix B

Bechtel National, Inc., Current Radiological Contamination Status of Niagara Falls Storage Site (NFSS)-Buildings 401, 402, and the Soils Outside of Building 401, August 1998 (Final).

Appendix B

CURRENT RADIOLOGICAL CONTAMINATION STATUS OF NIAGARA FALLS STORAGE SITE (NFSS)-BUILDINGS 401, 403 AND THE SOILS OUTSIDE OF BUILDING 401

August 1998
(Final)

Prepared by:

Bechtel National,Inc.
(FUSRAP-Buffalo District)

Prepared for:

United States Army Corps of Engineers
(FUSRAP-Buffalo District)

Appendix B

TABLE ON CONTENTS

Appendix B

SYNOPSIS

This report provides information on the current radiological contamination status of the Buildings, 401 and 403 at Niagara Falls Storage Site (NFSS), Lewiston, New York and the areal extent of radiological contamination of the soils outside Building 401. The information provided in this report is presented by a series of tables (Tables 1a through 6c) supported by relevant drawings (Attachments A through E) and reference documents (1 through 12).

Tables 1a and 1b report the past use of the rooms in Buildings, 401 and 403 which is based on earlier published reports. The initial radiological contamination condition of the rooms was determined from the historical (site) assessment of these rooms, whereby the rooms were classified as "Affected or Unaffected" by radiological activities. Based on this classification, the appropriate type of radiological survey plan was designed and implemented for the rooms.

Tables 2a through 2b present the applicable residual radioactivity guidelines for the Buildings, 401, 403 and the soils, respectively. It may be noted that prior to August 28, 1995, the guidelines presented in Table 2a were used for both the Buildings, 401 and 403 as their clean-up criteria. Later, based on the isotopic analysis of the samples collected from Building 403, it was determined that a "new" clean-up criterion would be used for this building. This "new" criterion (residual radioactivity guidelines) applicable to Building 403 is reported in Table 2b. Table 2c reports the residual radioactivity guidelines (generic i.e. per DOE Order 5400.5 and site specific) for the soils outside Building 401.

Table 3 documents the chronology of the major radiological surveys that have been performed at the two buildings under the FUSRAP program (since June 1981). The surveys were performed to delineate, decontaminate and/or verify decontamination of residual radioactivity. The names and telephone numbers of the key personnel who led these radiological surveys at various times is also listed for future reference.

Tables 4a and 4b present the findings of the Oak Ridge Institute of Science and Education (ORISE) radiological survey (performed during September 12-22, 1994) of predominantly the floor and lower wall areas of the two buildings. The radium-226 (Ra-226) and thorium-232 (Th-232) residual radioactivity surface guidelines (Table 2a) were used to assess the radiological condition of these buildings. The areas that exceeded these guidelines are presented in these tables. Since the clean-up criteria for Building 403 has changed since this survey report was published, the use of Table 4b in this report will be limited to use for "information only".

Table 5a reports the status radiological contamination of Building 401 with respect to Ra-226 and Th-232 residual radioactivity guidelines (see Table 2a). Table 5b reports the status radiological contamination of Building 403 with respect to the uranium residual radioactivity guidelines (see Table 2b). Table 5c demarcates the areas outside of Building 401 which exceed the generic and site-specific guidelines (see Table 2c). The depth of radiological contamination at these areas has not been determined, and will be at the discretion of the cognizant field engineer. These tables (Tables 5a through 5c) comprehensively report all areas that have been identified by either Battelle (Reference 1), ORISE (Reference 3) and Thermo NUtech / SEC (References 7 through 10) to exceed the applicable residual radioactivity guidelines. A Unique Identification Number (UIN) identifies each area within the buildings that is recommended for decontamination and/or post-remedial action (FRA) survey. No UIN is assigned to the areas that require "No action". It is suggested that future documentation that is prepared for the closure of this project makes use of these UINs.

Tables 6a, 6b, and 6c provide the current container/waste inventory at NFSS.

Attachments A through E are engineering drawings that describe the layout of the Buildings, 401 and 403, the radiologically impacted areas within the buildings and actions required to meet the respective clean-up guidelines. The actions required are grouped into three categories (task codes): scoping survey (SS), decontamination followed by FRA survey (DFS) and FRA survey (FS). Wherever applicable, details of the contaminated areas (overheads etc.) are shown. Ten of the twelve references cited in this report are enclosed. References 11, and 12 are communication with professionals involved in various stages of this project and information gathered during a recent visit of the two buildings. This input is appropriately incorporated in this report. A glossary of (radiological) survey terms is listed in the last page of this report.

Appendix B

LIMITATIONS OF THIS REPORT

The information compiled in this report describes the current radiological condition of the areas in the NFSS Buildings, 401 and 403 and the soils outside of Building 401. This information is limited only to the areas that have been investigated by Bechtel National, Inc., its subcontractors or an impartial party (the independent verification contractor) and is substantiated by referenced documents. Recommendations provided in this report (in Tables 5a and 5b) are the professional opinion of Bechtel National, Inc. based on relevant work experience and knowledge of these two buildings.

Appendix B

Table 1a
Historical use of NFSS Building 401 (the former steam plant and Boron production facility).

Room (First Floor)	[1]Past Use	[2]Affected (A)/ Unaffected (UA)	Room - (Second Floor)	[1]Past Use	[2]A/UA
101	Room	A	201	Office	A
102	Spectroscopy Laboratory	A	202	Office	A
103	Room	A	203	Shower	A
105	Shower	A	204	Office	A
106	Shower	A	205	Office	UA
107	Boiler Room	A	206	Room	A
108	Shower and Locker Room	UA	207	Room	A
109	Room	A	208	Room	A
111	Stairway/Room	UA	209	Shower	A
112	Hallway	UA	211	Toilet, Lockers	A
113	Room	UA	213	Toilet	UA
114	Room	UA	214	Office	UA
115	Room	A	215	Office	A
116	Room	UA	216	Boiler Room	Not applicable
117	Storage Area	A	217	Fan, Dryer	UA
118	Room	UA	218	Tower	Not applicable
119	Storage Area	A	219	Office	A
120	Boiler Room	UA	220	Laboratory	A
121	Boron Reclaiming Room	A	221	Office	A
122	Tower Area	A	222	Office	A
123	Smoke Room	A			
124	Electric Shop	A			
125	Room	UA			
127	Boron Grinding Room	UA			
128	Room	A			
129	Vault	A			
130	Storage Area	A			
131	Laboratory	UA			
132	Storage	A			
133	Room	UA			
134	Garage	A			

Table 1b
Historical use of NFSS Building 403 (formerly the firehouse and later the administrative office).

Room/Past Use	[2]A/UA
Laboratory	A
West Office	UA
North Storage (Supply Room)	A
Tool Storage Room (West Storage)	A
Storage (Men's and Women's)	A
Restrooms (Men's and Women's)	UA
East Office	UA
Boiler (Furnace) Room	UA
Fire-house Tower	A
Garage	A

[1] Reference 2.
[2] Reference 3.

[3] Reference 2.
[4] Reference 3.
[5] This room was not surveyed because its structural degradation prohibited access.
[6] Inaccessible area.
[7] Building-use history and past radiological survey data.

Appendix B

[1]Table 2a
Residual radioactivity guidelines (surface criteria) applicable to NFSS Building 401.
[DOE Order 5400.5]

[2]Radionuclide	Total Activity (dpm/100 cm²) Average in 1 m².	Maximum in 100 cm²	Removable Activity (dpm/100 cm²)
Radium (Ra)-226	100	300	20
Thorium (Th)-232	1,000	3,000	200

[3]Table 2b
Residual radioactivity guidelines (surface criteria) applicable to NFSS Building 403.
[DOE Order 5400.5]

[4]Radionuclide	Total Activity (dpm/100 cm²) Average in 1 m².	Maximum in 100 cm²	Removable Activity (dpm/100 cm²)
Uranium (U)-Natural, U-235, U-238 and associated decay products, alpha emitters	5,000	15,000	1,000

Table 2c
Residual radioactivity guidelines for NFSS soils.

Radionuclides	Soil Concentration (pCi/g) [5]above background
Ra-226, Ra-228, Th-230 and Th-232	5 pCi/g averaged over the first 15 cm layer of soil below the surface. 15 pCi/g averaged over 15 cm thick layers of soil more than 15 cm below the surface. (per DOE Order 5400.5)
[6]Cesium-137	33 pCi/g for any 15 cm layer of soil (site specific)
[7]Total U	80 pCi/g for any 15 cm layer of soil (site specific)

Table 3
Chronology of the major radiological surveys (delineation, decontamination and post-remedial action) performed under the FUSRAP program at NFSS Buildings 401 and 403, since June 1991.

Radionuclides	Date/Duration	Key Contact(s)/Telephone nos.
Delineation of Buildings 401 and 403	Sept. 12-22, 1994	Tim Vitkus [ORISE]; (423)576-3073
Decontamination of Building 401	Dec. 1995 - Feb. 1996	Doug Davis/Craig Rieman [SEC]; (716)447-9381
[8]ORISE(VC) visit of Building 401	Sept. 9-10, 1996	Tim Vitkus [ORISE]; (423)576-3073
Delineation/Decontamination/Post-Remedial Action of Building 401	Oct. 8-14, 1996	Doug Davis/Craig Rieman (SEC);
Delineation/Decontamination/Post-Remedial Action of Building 403	Dec. 1996 - Jan. 1997	Doug Davis/Craig Rieman (SEC);

[1]Reference 3.
[2]For radiological survey data evaluation alpha (α) activity levels were used for determining residual Ra-226 contamination and beta (β) activity levels were used for residual Th-232 contamination; (References 3, 12).
[3]Oak Ridge Institute of Science and Education (ORISE) applied the guidelines presented in Table 2a to determine the radiologically contaminated areas within NFSS Buildings, 401 and 403 (Reference 3) as of 1994-95 ("old"). Table 2b that represents the current ("new") applicable guidelines for Building 403 per Reference 5 subsequently superseded the application of Table 2a to Building 403 as of 1995.
[4]These uranium guidelines specify α activity. However, the ratio of α to β decay for natural uranium in equilibrium with its daughters is 1:1. Because, rough, dirty, or damp surfaces significantly attenuate α radiation, β measurements were performed and compared to the uranium guidelines; (Reference 12).
[5]The current background radiological (Ra-226, Ra-228, Th-230 and Th-232) concentration in the NFSS soils has to be determined. It may be noted that in 1988, the background concentration of Ra-226 and U-238 for NFSS soils was 1 pCi/g (Landis, M.; ORISE; 1988).
[6]USDOE, *Memorandum from P. Grass to J. Flora, NFS- Residual radioactivity guidelines*, FUSRAP/FDCC CCN No.: 050308; Aug. 30, 1988.
[7]Ibidem.
[8]ORISE was the Independent Verification Contractor (IVC) for the NFSS Buildings 401 and 403 remediation activity.

Table 4a
Areas within NFSS Building 401 exceeding the residual radioactivity guidelines (surface criteria) as identified by Battelle (June 1981) and ORISE radiological surveys (April 1995).

Room / [1]Survey Unit	Unique Identification Number	Surface	[2]Location (grid)	Direct Measurement-Total α/β (dpm/100cm²)	Measurement Type	Reference (Details)
102 / A2	102-A	Ceiling (Pipe)	E 4	680 / 2,700	Single Point (Direct)	3 (Figure 49, Table 6)
108 / A7	108-A	Locker	Locker 1, N3	82 / 2,800	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-B	Locker	Locker 1, N4	30 / 4,300	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-C	Locker	Locker 1, N5	<35 / 1,000	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-D	Locker	Locker 1, N6	<35 / 1,400	Single Point (Direct)	3 Figure 54, Table 6)
108 / A7	108-E	Locker	Locker 1, S1	130 / 13,000	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-F	Locker	Locker 1, S2	<35 / 1,500	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-G	Locker	Locker 1, S3	46 / 1,100	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-H	Locker	Locker 1, S4	81 / 2,000	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-I	Locker	Locker 1, S5	<35 / 1,200	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-J	Locker	Locker 1, S6	62 / 3,500	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-K	Locker	Locker 1, S7	190 / 13,000	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-L	Locker	Locker 1, S8	<35 / 8,200	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-M	Locker	Locker 2, S1	47 / 2,500	Single Point	3 (Figure 54, Table 6)

[1] The alphabet "A" and "U" in the nomenclature of a survey unit means "Affected Area" and "Unaffected Area". It should be noted that even though a particular area was deemed to be "Unaffected" by past radiological operations, it underwent some form of radiological contamination delineation survey.
[2] E=Easting, N=Northing, the numerical values are in meters.
An example of a grid nomenclature to denote overheads 121-V, Wall (I-Beam) is A7 (+3.5) which means that the Wall I-Beam is located in the grid A7 at a height of 3.5 m above the building ground-level.

Appendix B

Table 4a
Areas within NF83 Building 401 exceeding the residual radioactivity guidelines (surface criteria)
as identified by Battelle (June 1997) and ORISE radiological surveys (April 1995)

Room / Survey Unit	Unique Identification Number	Surface	Location (grid)	Direct Measurement-Total (a+b) (dpm/100cm²)	Measurement Type	Reference (Details)
					(Direct)	
106 / A7	106-N	Locker	Locker 2, S2	88 / 5,300	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-O	Locker	Locker 2, S3	<39 / 3,000	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-P	Locker	Locker 2, S9	47 / 2,400	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-Q	Locker	Locker 2, N1	79 / 4,500	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-R	Locker	Locker 2, N2	33 / 4,300	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-S	Locker	Locker 2, N3	<39 / 1,800	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-T	Locker	Locker 2, N4	74 / 1,100	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-U	Locker	Locker 2, N5	<39 / 2,700	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-V	Locker	Locker 2, N7	58 / 2,100	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-W	Locker	Locker 2, N8	42 / 2,500	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-X	Locker	Locker 2, N9	68 / 2,400	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-Y	Locker	Locker 3, S1	63 / 2,300	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-Z	Locker	Locker 3, S2	74 / 1,800	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-AA	Locker	Locker 3, S3	189 / 10,000	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-AB	Locker	Locker 3, S5	47 / 1,100	Single Point (Direct)	3 (Figure 54, Table 6)
106 / A7	106-AC	Locker	Locker 3, S6	53 / 2,800	Single Point (Direct)	3 (Figure 54, Table 6)

Appendix B

Table 4a
Areas within XF03 Building 401 exceeding the residual radioactivity guidelines (surface criteria) as identified by Battelle (June 1991) and ORISE radiological surveys (April 1995).

Room / Survey Unit	Unique Identification Number	Surface	Location (grid)	Direct Measurement: Total αβ (dpm/100cm²)	Assessment Type	Reference (Details)
108 / A7	108-AD	Locker	Locker 3, 69	58 / 5,000	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-AE	Locker	Locker 4, 61	67 / 1,300	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-AF	Locker	Locker 4, 62	36 / 1,500	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-AG	Locker	Locker 4, 64	<35 / 1,500	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-AH	Locker	Locker 4, 69	38 / 4,600	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-AI	Locker	Locker 4, 610	37 / 2,600	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-AJ	Locker	Locker 4, 612	100 / 11,000	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-AK	Locker	Locker 5, 62	<35 / 1,500	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-AL	Locker	Locker 5, 69	280 / 13,000	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-AM	Locker	Locker 5, 610	<35 / 1,600	Single Point (Direct)	3 (Figure 54, Table 6)
108 / A7	108-AN	Locker	Locker 5, 612	67 / 2,300	Single Point (Direct)	3 (Figure 54, Table 6)
115 / A1	115-A	Floor (Drain)	E 9	2,000 / 9,000	Grid Block (5 pt.)	3 (Figure 53, Table 6)
117 / A6	117-A	Floor (Drain)	H 10'	421 / 1,600	Single Point (Direct)	3 (Figure 48, Table 6)
119 / A1	119-A	Floor	S 19	<39 / 2,600	Single Point (Direct)	3 (Figure 48, Table 6)
119 / A1	119-B	Ceiling	Q 18 (+6)	1,820 / 44,000	Single Point (Direct)	3 (Figure 48, Table 6)
121 / A3	121-A	Floor	E 1	<47 / 34,000	Single Point (Direct)	3 (Figure 53, Table 6)
121 / A3	121-B	Floor	B 0	<37 / 1,700	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121 / A3	121-C	Floor	B 2	46 / 1,800	Grid Block (5 pt.)	3 (Figure 50, Table 6)

Appendix B

Table 4a
Areas within NFSS Building 401 exceeding the residual radioactivity guidelines (surface criteria) as identified by Battelle (June 1981) and ORISE radiological surveys (April 1995).

Room / Survey Unit	Unique Identification Number	Surface	Location (grid)	Direct Measurement - Total (c/h) (dpm/100cm²)	Measurement Type	Reference (Details)
121/A3	121-D	Floor	C 1	<37 / 2,000	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-E	Floor	C 3	<37 / 1,900	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-F	Floor	C 4	<37 / 1,800	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-G	Floor	C 5*	<37 / 1,400	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-H	Floor	D 1	<47 / 1,400	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-I	Floor	D 4	<37 / 1,800	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-J	Floor	E 3*	<47 / 1,200	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-K	Floor	E 5	<47 / 1,400	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-L	Floor	F 5	<47 / 1,400	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-M	Floor	G 1	<47 / 2,700	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-N	Floor	G 2	<47 / 1,700	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-O	Floor	G 3	<47 / 2,000	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-P	Floor	G 5	<47 / 1,300	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-Q	Floor	H 0	<47 / 1,500	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-R	Floor	H 1	<47 / 1,700	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-S	Floor	H 2	<37 / 1,800	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-T	Floor	H 3	<47 / 2,100	Grid Block (5 pt.)	3 (Figure 50, Table 6)
121/A3	121-Y	Wall (I-beam)	A 7 (+ 3.5)	80 / 1,400	Single Point (Direct)	3 (Figure 50, Table 6)
121/A3	121-W	Wall (Lower Ledge)	P 9	810 / 6,200	Single Point (Direct)	3 (Figure 50, Table 6)
121/A3*	121-K	Ceiling (I-Beam)	G 3 (+0.5)	<47 / 3,000	Single Point (Direct)	3 (Figure 50, Table 6)
121/A3*	121-Y	Ceiling (I-Beam)	H 4	<47 / 6,500	Single Point (Direct)	3 (Figure 50, Table 6)
121/A3*	121-Z	Ceiling (I-Beam)	L 3.5	1400 / 240,000	Single Point (Direct)	3 (Figure 50, Table 6)
121/A3	121-AA	Mezzanine	D 3*	870 / 2,000	Single Point (Direct)	3 (Figure 50, Table 6)
121/A3	121-AB	Mezzanine (I-Beam)	F 3*	<47 / 4,300	Single Point (Direct)	3 (Figure 50, Table 6)
121/A3	121-AC	Mezzanine (I-Beam)	I 3*	<47 / 2,000	Single Point (Direct)	3 (Figure 50, Table 6)

Appendix B

Table 4a
Areas within NFSS Building 401 exceeding the residual radioactivity guidelines (surface criteria)
as identified by Battelle (June 1951) and ORISE radiological surveys (April 1995)

Room / Survey Unit	Unique Identification Number	Surface	Location (grid)	Direct Measurement - Total w/b (dpm/100cm²)	Measurement Type	Reference (Details)
121 / A3	121-A0	Support Beam	H 4	95 / 3,500	Single Point (Direct)	3 (Figure 50, Table 6)
121 / A3	102-A	Air Duct	A 2 (+0.7)	70 / 3,300	Single Point (Direct)	3 (Figure 50, Table 6)
122 / A4	122-A	Floor	Y 7	480 / 2,700	Single Point (Direct)	3 (Figure 51, Table 6)
122 / A4	122-B	Floor	R 6	30 / 2,300	Grid Block (5 pt.)	3 (Figure 51, Table 6)
122 / A4	122-C	Floor	R 7	<35 / 1,800	Grid Block (5 pt.)	3 (Figure 51, Table 6)
122 / A4	122-D	Wall (Lower Ledge)	W 12 (+0.6)	<35 / 2,000	Single Point (Direct)	3 (Figure 51, Table 6)
122 / A4	122-E	Wall (Lower Ledge)	W 13 (+1.0)	<35 / 1,000	Single Point (Direct)	3 (Figure 51, Table 6)
122 / A4	122-F	Wall (Upper Ledge)	W 13 (+2.3)	140 / 600	Single Point (Direct)	3 (Figure 51, Table 6)
122 / A4	122-G	Support Beam	H 8	75 / 6,200	Single Point (Direct)	3 (Figure 51, Table 6)
122 / A4	122-H	Air Duct	B11 (+3.0)	<47 / 1,200	Single Point (Direct)	3 (Figure 51, Table 6)
201 / U8	201-U8-A	Blower	Near Center	120 / <470	Grid Block (5 pt.)	3 (Figure 57, Table 6)
211 / A8	211-A	Locker	Locker 41	93 / 7,100	Single Point (Direct)	3 (Figure 55, Table 6)
211 / A8	211-B	Locker	Locker 42	200 / 13,000	Single Point (Direct)	3 (Figure 55, Table 6)
211 / A8	211-C	Locker	Locker 43	47 / 2,300	Single Point (Direct)	3 (Figure 55, Table 6)
211 / A8	211-D	Locker	Locker 44	120 / 14,000	Single Point (Direct)	3 (Figure 55, Table 6)
211 / A8	211-G	Locker	Locker 45	85 / 4,500	Single Point (Direct)	3 (Figure 55, Table 6)
211 / A8	211-E	Locker	Locker 46	58 / 3,900	Single Point (Direct)	3 (Figure 55, Table 6)
211 / A8	211-F	Locker	Locker 47	<39 / 6,100	Single Point (Direct)	3 (Figure 55, Table 6)

Appendix B

Table 4a
Areas within HFSS Building 401 exceeding the residual radioactivity guidelines (surface criteria) as identified by Battelle (June 1997) and ORISE radiological surveys (April 1998).

Room / Survey Unit	Unique Identification Number	Surface	Location (grid)	Direct Measurement - Total (dpm/100cm²)	Measurement Type	Reference (Details)
211 / A8	211-G	Locker	Locker 48	68 / 12,000	Single Point (Direct)	3 (Figure 65, Table 6)
211 / A8	211-H	Locker	Locker 49	47 / 2,400	Single Point (Direct)	3 (Figure 64, Table 6)
217 / A5	217-A	Floor	L 4	<39 / 6,600	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-B	Floor	H 4	63 / 3,700	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-C	Floor	H 5	56 / 1,300	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-D	Floor	H 6	<39 / 2,700	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-E	Floor	N 7	79 / 2,300	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-F	Upper Wall (I-Beam)	N 5 (+0.4)	180 / 110,000	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-G	Lower Wall (I-Beam)	N 6 (+0.4)	46 / 4,100	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-H	Lower Wall (I-Beam)	N 7 (+0.4)*	66 / 15,000	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-I	Upper Wall (I-Beam)	N 6 (+0.4)*	42 / 10,000	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-J	Upper Wall (I-Beam)	E Wall (31)	<39 / 21,000	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-K	Upper Wall (I-Beam)	E Wall (32)	42 / 7,200	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-L	Upper Wall (I-Beam)	E Wall (33)	<39 / 8,500	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-M	Upper Wall (I-Beam)	E Wall (34)	84 / 83,000	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-N	Lower Wall (I-Beam)	E Wall (35)	68 / 2,100	Single Point (Direct)	3 (Figure 62, Table 6)
217 / A5	217-O	Lower Wall	E Wall (36)	181 / 13,000	Single Point	3 (Figure 62, Table 6)

Table 4a
Areas within NFSS Building 401 exceeding the residual radioactivity guidelines (surface criteria) as identified by Battelle (June 1981) and ORISE radiological surveys (April 1995).

Room / [1]Survey Unit	Unique Identification Number	Surface	[2]Location (grid)	Direct Measurement- Total α/β (dpm/100cm²)	Measurement Type	Reference (Details)
		(I-Beam)			(Direct)	
217 / A5	217-P	Lower Wall (I-Beam)	E. Wall (37)	<39 / 7,500	Single Point (Direct)	3 (Figure 52, Table 6)
217 / A5	217-Q	Lower Wall (I-Beam)	E. Wall (38)	42 / 59,000	Single Point (Direct)	3 (Figure 52, Table 6)
217 / U7	217-U7-A	Blower	SE Corner	<39 / 49,000	Grid Block (5 pt.)	3 (Figure 56, Table 6)

Notes:
[1]Location grid identification in the table as reported in Reference 3 does not correspond with the corresponding figure and hence corrected.
[2]Reference 1 (appendix G, table G3-1, page G3-9) corroborates these locations to have radiological contamination exceeding applicable guidelines.
[3]Locker 1, S2 means Locker set # 1 South face, locker # 2, etc.

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Appendix B

Table 4b
Areas within Building 403 exceeding the "old" residual radioactivity guidelines (surface criteria)
as identified by CRESS radiological surveys (April 1995).

Room	Unique Identification Number	Surface	Location (grid)	Direct Measurement Total+dfc (dpm/100cm²)	Measurement Type	Reference (Details)
Men's Shower Room	MSR-A	Floor	Location 41	810 / 3,000	Grid Block (5 pt.)	3 (Figure 5b, Table 6)
Men's Shower Room	MSR-B	Floor	Location 42	<47 / 1,300	Grid Block (5 pt.)	3 (Figure 5b, Table 6)
Men's Shower Room	MSR-C	Lower Wall	Location 43	<47 / 2,400	Grid Block (5 pt.)	3 (Figure 5b, Table 6)
Men's Shower Room	MSR-D	Lower Wall	Location 44	<47 / 2,100	Grid Block (5 pt.)	3 (Figure 5b, Table 6)
Men's Shower Room	MSR-E	Upper Wall	Location 45	35 / 2,200	Single Point (Direct)	3 (Figure 5b, Table 6)
Men's Room	MR-A	Floor	Location 46	120 / 1,100	Single Point (Direct)	3 (Figure 5b, Table 6)
Garage @ Storage Room	GR-A	Floor (Drain)	Location 53	650 / 15,000	Single Point (Direct)	3 (Figure 5b, Table 6)
Garage SW Quad	GR-B	Floor	Location 54	<47 / 4,300	Single Point (Direct)	3 (Figure 5b, Table 6)
Garage @ Men's Room	GR-C	Floor	Location 47	<47 / 1,400	Grid Block (5 pt.)	3 (Figure 5b, Table 6)
Tool Room (NW)	TR-A	Floor	Location 48	280 / 12,000	Single Point (Direct)	3 (Figure 5b, Table 6)
Tool Room (SE)	TR-B	Floor	Location 50	80 / 1,700	Single Point (Direct)	3 (Figure 5b, Table 6)
Tool Room (SE)	TR-C	Floor	Location 51	110 / 6,000	Single Point (Direct)	3 (Figure 5b, Table 6)
Tool Room (E Wall)	TR-D	Floor	Location 52	240 / 2,400	Grid Block (5 pt.)	3 (Figure 5b, Table 6)
Tool Room (NE)	TR-E	Floor	Location 58	65 / 4,100	Single Point (Direct)	3 (Figure 5b, Table 6)
Tool Room (W Wall)	TR-F	Floor	Location 59	130 / 3,800	Single Point (Direct)	3 (Figure 5b, Table 6)
Tool Room (Ledge)	TR-G	Lower Wall	Location 49	160 / 5,200	Single Point (Direct)	3 (Figure 5b, Table 6)
Tool Room (S Wall)	TR-H	Lower Wall	Location 60	470 / 7,300	Single Point (Direct)	3 (Figure 5b, Table 6)
Tool Room (S)	TR-I	Ceiling	Location 61	1,700 / 14,000	Single Point (Direct)	3 (Figure 5b, Table 6)
Ladies Shower Room	LSR-A	Floor	Location 55	<47 / 1,200	Grid Block (5 pt.)	3 (Figure 5b, Table 6)
Ladies Room	LR-A	Lower Wall	Location 56	<47 / 2,800	Single Point (Direct)	3 (Figure 5b, Table 6)
Ladies Room	LR-B	Upper Wall	Location 57	<47 / 2,400	Grid Block (5 pt.)	3 (Figure 5b, Table 6)

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Table 4b
Areas within Building 403 exceeding the "old" residual radioactivity guidelines (surface criteria)
as identified by CHSSE radiological surveys (April 1998).

Room	Unique Identification Number	Surface	Location (grid)	Direct Measurement Total effi. (dpm/100cm²)	Measurement Type	Reference (Details)
Lab (New Sink)	LAB-A	Lower Wall	Location 61	110 / 1,880	Single Point (Direct)	3 (Figure 58, Table 6)
Lab (Near Sink)	LAB-B	Lower Wall	Location 62	100 / 1,100	Single Point (Direct)	3 (Figure 58, Table 6)
Lab (East Wall)	LAB-C	Hood	Location 63	220 / 600	Single Point (Direct)	3 (Figure 58, Table 6)
Lab (East Wall)	LAB-D	Hood Vent	Location 64	790 / 7,900	Single Point (Direct)	3 (Figure 58, Table 6)

Appendix B

Table 6b
Status of radiological contamination in HFSS Building 401 as of December 1995.

Room	Unique Identification Number	Contaminated Item and Contamination Details	Action Taken [Reference]	Immediate Action to be Taken	Future Action (as applicable)	Task Code
102	102-A	15 ft long, 1.5 in. diameter hanging pipe, also extending above the ceiling tile. The pipe extremities (< 1 sq ft) are the suspected to be radiologically impacted.	Pipe removed, prepared for disposal, [6,11]	Perform and document a Post-Remedial Action (PRA) survey of the affected area.	Perform decontamination of the affected area if the PRA survey indicates that the applicable criteria have not been met.	PS (PRA Survey)
102	102-B	2 sq. m (22 sq. ft.) of floor area adjacent to the hallway (note: This is the floor area underneath the former pipe, 102-A).	Fixed and removable radiologically (α and β-γ) was decontaminated from a 22 sq ft area. The average α activity of the decontaminated area was reported to be 68 dpm/100 cm²(total) and the average β-γ activity was reported to be 138 dpm/100 m² (total). [6,7,8]	Perform and document a PRA survey of the affected area.	Perform decontamination of the affected area if the PRA survey indicates that the applicable criteria have not been met.	PS
109	109-A through 109-AK	Lockers and the pedestals on wheels/legs are mounted on.	Lockers removed and surface of pedestals decontaminated. The pedestal area (≈ 4,160 sq ft) has not been surveyed. [8]	Perform and document a PRA survey of the affected area (pedestals).	Perform decontamination of the affected area if the PRA survey indicates that the applicable criteria have not been met.	PS
115	115-A	Drain, top belt of the drain, and surrounding concrete.	Drain, top belt, and surrounding concrete to a depth of 1 foot removed. The average direct surface αs contamination in the drain and concrete floor (35 sq ft) was reported to be 229 and 2,359 dpm/100 cm², respectively. The β-γ contamination was below the guidelines. [4,6,7]	Perform and document a PRA survey of the affected area.	Perform and document a PRA survey, if necessary.	DPS (Decontamination and PRA Survey)
117	117-A	Drain, top belt of the drain, and surrounding concrete.	Drain, top belt, and surrounding concrete to a depth of 1 foot removed. Area (≈ 20 sq ft) surveyed and no residual contamination found. [4]	Perform and document a PRA survey of the affected area.	Perform decontamination of the affected area if the PRA survey indicates that the applicable criteria have not been met.	PS
117	117-X	Ceiling (I-beam)	Removed contaminated section (≈ 2 ft.) of the I-Beam for disposal.	Ensure the disposal action. Perform and document a	Perform decontamination of the affected area if the PRA survey	PS

Appendix B

Table 5a
Status of radiological contamination in HFSS Building 401 as of December 1998.

Room	Unique Identification Number	Contaminated Item and Contamination Details	Action Taken [Reference]	Immediate Action to be Taken	Future Action (as applicable)	Task Code
			[7,11]	FRA survey of the remaining extremities of the removed I-beam.	Indicates that the applicable criteria have not been met.	FS
117	117-Y	Ceiling (I-Beam)	Removed contaminated section (≈ 2 ft.) of the I-Beam for disposal; [7,11]	Ensure the disposal action. Perform and document a FRA survey of the remaining extremities of the removed I-beam.	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria have not been met.	FS
117	117-Z	Ceiling (I-Beam)	Removed contaminated section (≈ 2 ft.) of the I-Beam for disposal; [7,11]	Ensure the disposal action. Perform and document a FRA survey of the remaining extremities of the removed I-beam.	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria have not been met.	FS
117	117-XX	Ceiling (I-Beam)	Delineated residual radioactivity (area ≈ 4 ft. of the overhead beam. The direct surface β,γ contamination was reported to be 20 K dpm/100 cm^2. [7]	Perform and document decontamination and FRA survey of the affected area.	Perform Quality Assurance (QA) survey, if necessary.	DFS
117	117-XY	Ceiling (I-Beam)	Estimated residual radioactivity (area ≈ 4 ft. of the overhead beam. The direct surface β,γ contamination was reported to be 28K dpm/100 cm^2. [7]	Perform and document decontamination and FRA survey of the affected area.	Perform Quality Assurance (QA) survey, if necessary.	DFS
119	119-A	Drain, top bell of the drain, and surrounding concrete.	Drain, top bell, and surrounding concrete to a depth of 1 foot removed. Area (≈ 20 sq ft) surveyed and no residual contamination found. [4]	Perform and document a FRA survey of the affected area.	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria have not been met.	FS
119	119-B	15 ft. of 12 sq in. overhead air-duct along the west wall.	Duct removed, prepared for disposal, area surveyed. No residual contamination found. [4]	Ensure proper disposition of the removed air-duct. Perform and document a FRA survey of the remaining extremities of the removed air-duct.	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria have not been met.	FS
119	119-C	Overhead beam (angle iron)	Delineated residual β,γ radioactivity from ≈ 6 ft. of the	Perform and document a decontamination and FRA survey of the affected area.	Perform Quality Assurance (QA) survey, if necessary.	DFS

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Appendix B

Table 5a
Status of radiological contamination in NFSS Building 401 as of December 1998.

Room	Unique Identification Number	Contaminated Item and Contamination Details	Action Taken (Reference)	Immediate Action to be Taken	Future Action (as applicable)	Task Code
			angle iron; contamination ranged from 10K - 200K dpm/100cm²; [6,7].			
120	120-A	Sump-water in it (1 by 8 ft; survey	None; [11]	Perform and document a scoping survey (GS) of the affected area.	Determine future action (make sample for analyses), as necessary based on results of GS.	SS
121	121-A through 121-T	400 sq ft of concrete floor.	Contamination removed by surface grinding. Area not surveyed; [1]	Perform and document a FRA survey of the affected area.	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria have not been met.	FS
121	121-W	6 ft piece of wooden wall plate board.	Removed and prepared for disposal; [1].	Ensure the disposal again. (See Table 6b)	Not applicable	Not applicable
121	121-U	Extremities of section of air ducts along east and north walls (overhead).	Dust removed and prepared for disposal. Extremities suspected of contamination; [4].	Perform and document FRA survey of the affected area.	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria have not been met.	FS
121	121-V	10 ft sections of 18 ft of 6 in. and 8 in. I-beams.	Decontaminated by stripping [4].	Perform and document a FRA survey of the affected area.	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria have not been met.	FS
121	121-XX, 121-XY	Additional 40 ft of 6 in. and 8 in. I-beam.	Delineated residual radioactivity; [4]	Determine contamination levels, perform and document decontamination and FRA survey.	Perform Quality Assurance (QA) survey, if necessary.	DFS
121	121-XZ	6 in. I-beam has a 6 in. section protruding into Room 121	None; [11]	Determine contamination levels, perform and document decontamination and FRA survey.	Perform Quality Assurance (QA) survey, if necessary.	DFS
121	121-YY	Window sill	None; [11]	Determine contamination levels, perform and document decontamination and FRA survey.	Perform Quality Assurance (QA) survey, if necessary.	DFS
122	122-A through 122-C	Contaminated concrete floor area (≈ 50 sq ft).	Decontaminated by grinding; [4].	Perform and document a FRA survey of the affected area.	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria have not been met.	FS
122	122-G	Three wooden wall supports.	Removed and prepared for	Pursue the disposal action.	Not applicable	Not applicable

Appendix B

Table 5a
Status of radiological contamination in RFSS Building 401 as of December 1995.

Room	Unique Identification Number	Contaminated Item and Contamination Details	Action Taken; [Reference]	Immediate Action to be Taken	Future Action (as applicable)	Task Code
			disposal [4].	(See Table 6b)		
122	122-H	3 ft of air duct in the Tower area.	The air duct has been removed and placed on the floor [8,11].	Ensure appropriate disposition of the removed air duct. Perform and document a FRA survey of the affected area.	Not applicable	PS
122	122-I	One 8 in. I-Beam 7+ flange (140 ft) (diagonal support). (see details in Appendix B)	Stripping and sponge blasting performed, but task is not complete. Determine the contamination level of 1 ft. of asbestos-containing-material pipe hanging [4,8].	Complete decontamination, and perform a FRA survey of the affected area, document the task.	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria have not been met.	DPS
122	122-J	10 ft. section of a 6 in. I-beam.	Residual radioactivity is identified on the 10 ft. section of the I-Beam and an asbestos-lagging pipe. [8,11].	Perform and document decontamination and FRA survey.	Perform Quality Assurance (QA) survey, if necessary.	DPS
122	122-K	16 ft. I-Beam-south end of room	None; [11].	Perform and document a scoping survey (SS) of the affected area.	Determine future action based on results of SS.	SS
122	122-L	6 ft. section of an I-Beam located 15 ft. from the east wall of the room.	None; [11].	Determine contamination levels, perform and document decontamination and FRA survey.	Perform Quality Assurance (QA) survey, if necessary.	DPS
134	134-A	10 ft. section of a 6 in. I-beam.	To eliminate suspected residual radioactivity; [11].	Determine contamination levels, perform and document decontamination and FRA survey.	Perform Quality Assurance (QA) survey, if necessary.	DPS
203	203-A	Isolated area (< 1 sq ft) of contamination on the floor; [4].	Decontamination complete; [4,7,11].	Perform and document decontamination and FRA survey.	Not applicable	PS
211	211-A through 211-H	Lockers and the pedestals lockers are mounted on.	Lockers removed (since August '96) and surface of pedestals ground. Pedestal area (= 40 sq ft) not surveyed; [4,10,11].	Perform and document a FRA survey of the affected area (preferably).	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria have not been met.	PS
217	217-F through 217-I	80 ft of 6 in I-Beam along east wall.	Cut out a portion of the beam to access the 12 in. I-beam (217-J...). Delineate radiological	Determine contamination levels, perform and document	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria	DPS

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Table 5a
Status of radiological contamination in NFSS Building 401 as of December 1995.

Room	Unique Identification Number	Contaminated Item and Contamination Details	Action Taken; [Reference]	Immediate Action to be Taken	Future Action (as applicable)	Task Code
			contamination.	decontamination/removal and FRA survey.	have not been met.	
217	217-J through 217-Q	100 ft of 12 in. I-Beam along east wall.	Decontamination (by stripping) attempted. Sponge-blasting recommended; [9].	Determine contamination levels, perform and document decontamination/removal and FRA survey.	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria have not been met.	DPS
217	217-R	Wooden deck under Room 217	Needs vacuuming of loose radiological contamination; [8, 11]	Determine contamination levels, perform and document decontamination and FRA survey.	Perform Quality Assurance (QA) survey, if necessary.	DPS
217	217-M7-A	Blower and duct.	Removed and prepared for disposal. Another 3 ft of duct (near the blower hook-up) needs to be dismantled and decontaminated, as necessary; [4, 11]	Ensure the disposal action. (see Table 6b) Determine contamination levels, perform and document decontamination/removal and FRA survey.	Determine contamination levels, perform and document FRA survey.	DPS
217	217-S	Equipment stands and adjacent floor-area (≈ 125 sq ft).	Surface grinding performed. Survey required; [4, 11].	Determine contamination levels, perform and document FRA survey.	Perform decontamination of the affected area if the FRA survey indicates that the applicable criteria have not been met.	PS
217	217-T and 217-U	Wooden wall support frames. (Affected area is marked with red paint).	Decontamination needed; [11].	Determine contamination levels, perform and document decontamination/removal and FRA survey.	Not applicable	DPS
217	217-V	Asbestos pipe insulation (≈ 4 linear ft) along the east wall.	Decontamination/removal of affected area is needed; [11].	Determine contamination levels, perform and document decontamination/removal and FRA survey.	Not applicable	DPS
217	217-W	Floor area (≈ 100 sq ft) along the eastern edge of the room.	Decontamination is complete; [11].	Determine contamination levels, perform and document FRA survey.	Not applicable	PS
217	217-X	Beam, pipe hangers and diagonals (≈ 4 linear ft)	None; [11].	Determine contamination levels, perform and document.	Not applicable	DPS

Appendix B

Table 6a
Status of radiological contamination in NFSS Building 401 as of December 1998.

Room	Unique Identification Number	Contaminated Item and Contamination Details	Action Taken (Relevance)	Immediate Action to be Taken	Future Action (as applicable)	Task Code
				decontamination/removal and PSA survey.		
217	217-Y	I-Beam (5 linear ft)	None. [11].	Determine contamination levels, perform and document decontamination/removal and PSA survey.	Not applicable	DP8
217	217-Z	I-Beam (6 linear ft)	None. [11].	Determine contamination levels, perform and document decontamination/removal and PSA survey.	Not applicable	DP8

Appendix B

Table 5b

Status of radiological contamination in NFSS Building 401 (based on criteria established per Reference 9) as of January 1997.

Room	Surfaces; Unique Identification Number	Direct Surface (1 X dpm/100 cm²)	Transferable (1 X dpm/100 cm²)	Reference (Details)	Action required	Task Code
East Office	Floors (≈ 140 sq ft); EO-A.	Below guidelines	No data available	9, 10, 11	Perform and document FRA survey.	PS
East Office	Walls (≈ 280 sq ft); EO-B.	Below guidelines	No data available	9, 10, 11	Perform and document FRA survey.	PS
West Office	Floors (≈ 280 sq ft); WO-A.	Below guidelines	No data available	9, 10, 11	Perform and document FRA survey.	PS
West Office	Walls	Below guidelines	Below guidelines	9,10	No action	NA
West Office (Old HP Office)	Walls	Below guidelines	Below guidelines	9,10	No action	NA
Garage	Track bay Floor	Below guidelines	Below guidelines	9,10	No action	NA
Garage	Floor Drain (≈ 1 sq ft) near North Storage; GR-A	Above guidelines (up to 18K-Total)	Not applicable	3,9	Perform and document FRA survey. Decontaminate, if necessary.	DPS
Garage	Walls (≈ 1,600 sq ft); GR-D.	Below guidelines	No data available	9, 10, 11	Perform and document FRA survey.	PS
Garage	Wall J Beam	Below guidelines	Below guidelines	9,10	No action	NA
Garage	Overhead (Wooden I-Beam) (≈ 2 linear ft); GR-E. (see details in Attachment E)	Above guidelines (up to 18K)	Below guidelines	9,10	Perform and document decontamination and FRA radiological survey.	DPS
Garage	Ceiling (≈ 50 sq ft); GR-F. (see details in Attachment E)	Above guidelines (up to 15K)	No data available	9,10	Perform and document decontamination and FRA radiological survey.	DPS
Garage (East wall)	Vent door/Louvres (≈ 4 sq ft); GR-G. (see details in Attachment E)	Above guidelines (up to 8K)	Below guidelines	9,10	Perform and document decontamination and FRA radiological survey.	DPS
Garage (West wall)	Vent door/Louvres (≈ 4 sq ft); GR-H. (see details in Attachment E)	Above guidelines (up to 13K)	Below guidelines	9,10	Perform and document decontamination and FRA radiological survey.	DPS

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Table 5b
Status of radiological contamination in MF68 Building 401 (based on criteria established per Reference 5) as of January 1997.

Room	Surface, Unit or Identification Number	Direct Surface (Typ. dpm/100 cm²)	Transferable (Typ. dpm/100 cm²)	Reference (Details)	Action required	Task Code
Tool Storage Room (West Storage)	Walls	Below guidelines	Below guidelines	8, 10	No action	NA
Tool Storage Room (West Storage)	Floor (NW corner) (10 sq ft); TR-A	Above guidelines (up to 12K-Total)	Not applicable	3,9	Perform and document FRA survey. Decontaminate, if necessary.	DPS
Tool Storage Room (West Storage)	Floor (SE corner); TR-C.	Above guidelines (up to 6K-Total)	Not applicable	3,9	Perform and document FRA survey. Decontaminate, if necessary.	DPS
Tool Storage Room (West Storage)	Lower Wall (ledge) (10 sq ft); TR-G.	Above guidelines (up to 5.2K-Total)	Not applicable	3,9	Perform and document FRA survey. Decontaminate, if necessary.	DPS
Tool Storage Room (West Storage)	South Wall (lower); TR-H.	Above guidelines (up to 7.2K-Total)	Not applicable	3,9	Perform and document FRA survey. Decontaminate, if necessary.	DPS
Tool Storage Room (West Storage)	Ceiling; TR-I.	Above guidelines (up to 14K-Total)	Not applicable	3,8	Perform and document FRA survey. Decontaminate, if necessary.	DPS
North Storage (Supply Room)	Walls	Below guidelines	Below guidelines	9, 10	No action	NA
Women's showers	Floor	Below guidelines	Below guidelines	9, 10	No action	NA
Women's showers	Walls	Below guidelines	Below guidelines	9, 10	No action	NA
Men's showers	Floor	Below guidelines	Below guidelines	9, 10	No action	NA
Men's showers	Walls	Below guidelines	Below guidelines	9, 10	No action	NA
Boiler (Furnace) Room	Floor	Below guidelines	Below guidelines	9, 10	No action	NA
Boiler (Furnace) Room	Walls	Below guidelines	Below guidelines	9, 10	No action	NA
Laboratory (Lab)	Walls	Below guidelines	Below guidelines	9, 10	No action	NA

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Table 5b
Status of radiological contamination in NFSS Building 403 (based on criteria established per Reference 5) as of January 1997.

Room	Surfaces; Unique Identification Number	Direct Surface β,γ; dpm/100 cm²	Transferable β,γ; dpm/100 cm²	Reference (Details)	Action required	Task Code
Lab.	East Wall at hood vent (≈ 20 sq ft); LAB-D.	Above guidelines (up to 7.9K-Total)	Not applicable	3,9	Perform and document PRA survey. Decontaminate, if necessary.	DPS
Lab. (Fume)-hood	Top (roof) (≈ 10 sq ft); LAB-E. (see details in Attachment E)	Above guidelines (up to 14K)	Below guidelines	9,10	Perform and document decontamination and PRA radiological surveys.	DPS
Lab. (Fume)-hood	Walls (≈ 60 sq ft); LAB-F.	Below guidelines	No data available	9,10	Walls behind the fume-hoods will require a scoping survey to delineate the contamination, when the fume-hoods are removed.	Scoping survey (SS)
Fire-house Tower	Floor (E0m,N0m,H 0m), (≈ 2 sq ft); FT-A.	Above guidelines (up to 5K)	Below guidelines	9,10	Perform and document decontamination and PRA radiological surveys.	DPS
Fire-house Tower	Floor drain (E0.4m,N9.9m, HL~0.3m), (≈ 2 sq ft); FT-B. Pipe in drain (E0.4m,N9.9m,HL~0.3m), (≈ 20 sq ft); FT-C.	Above guidelines (up to 8K) Above guidelines (up to 12K)	Below guidelines	9,10	Perform and document decontamination and PRA radiological surveys.	DPS
Fire-house Tower	North Wall (≈ 60 sq ft); FT-O. (see details in Attachment E)	Above guidelines (up to 63K)	No data available	1,9,10	One pass decontamination has been done. Perform and document decontamination, as necessary and PRA radiological surveys.	DPS

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Table 5b

Status of radiological contamination in NFSS Building 403 (based on criteria established per Reference 6) as of January 1997.

Room	Surface, Unique Identification Number	Direct Surface (Dpm/100 cm²)	Transferable (Dpm/100 cm²)	Reference (Details)	Action required	Task Code
Fire-house Tower	South Wall (≈ 69 sq ft; FT-E. (see details in Attachment E)	Above guidelines (up to 140K)	No data available	1,9,10	One pass decontamination has been done. Perform and document decontamination, as necessary and PRA radiological surveys.	DPS
Fire-house Tower	West Wall (≈ 69 sq ft); FT-F. (see details in Attachment E)	Above guidelines (up to 45K)	No data available	1,9,10	One pass decontamination has been done. Perform and document decontamination, as necessary and PRA radiological surveys.	DPS
Fire-house Tower	East Wall (≈ 69 sq ft); FT-G. (see details in Attachment E)	Above guidelines (up to 56K)	No data available	1,9,10	One pass decontamination has been done. Perform and document decontamination, as necessary and PRA radiological surveys.	DPS

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Table 5c
Soils (in the vicinity of NFSS Building 401) exceeding the residual radioactivity guidelines.

[1]Location grid (center of contaminated area)	[2]Radiologically impacted area (sq. ft.)/estimated	[3]Soil sample concentration (pCi/g)	[4]Walkover gamma-scan readings (counts per minute, cpm)
N157E38	100	Ra-226 = 9.7-47.6	20,000 (20K) – 25,000 (25K)
N129E167	20	Below applicable guidelines	Elevated direct radiation
N163E180	100	Ra-226 = 31.8; Th-230 = 36	18K – 25 K
N46E167	100	No data available	18K – 45K
N-19E207	70	Ra-226 = 114.8; Th-230 = 260	40K – 90K
N-54E175	25	No data available	35K
N-33W97	100	Below applicable guidelines	18K
N-14E11 and N-21E33	25+25	Ra-226 = 19.8; Th-230 = 19	18K – 30 K
N-54E-4	25	No data available	48K

[1]NWED of the locational grid system (in meters) is the south-west corner of Building 401. All the soil samples were collected from depth of 0-15 cm.
[2]The areal extent was delineated using the walkover gamma scan readings. For the purposes of a pictorial representation, a square or rectangular shape bounded each radiologically impacted area (see Attachment D).
[3]Reference 3 (see Table 5, Page 68). Note: The error values are not reported.
[4]Radiological survey performed by Thermo NUtech (Doug Davis), July 23, 1993; Surv. No. 158-9302, (attached), except the additional location (written in italics) identified by ORISE (Reference 5). In general, the locations identified to be radiologically contaminated by Thermo NUtech (July, 1993) were corroborated by ORISE (April, 1995). Note: The background walkover gamma-scan readings are 9K-14K cpm.
[5]The soil sample collected was from a depth of 15-30 cm.

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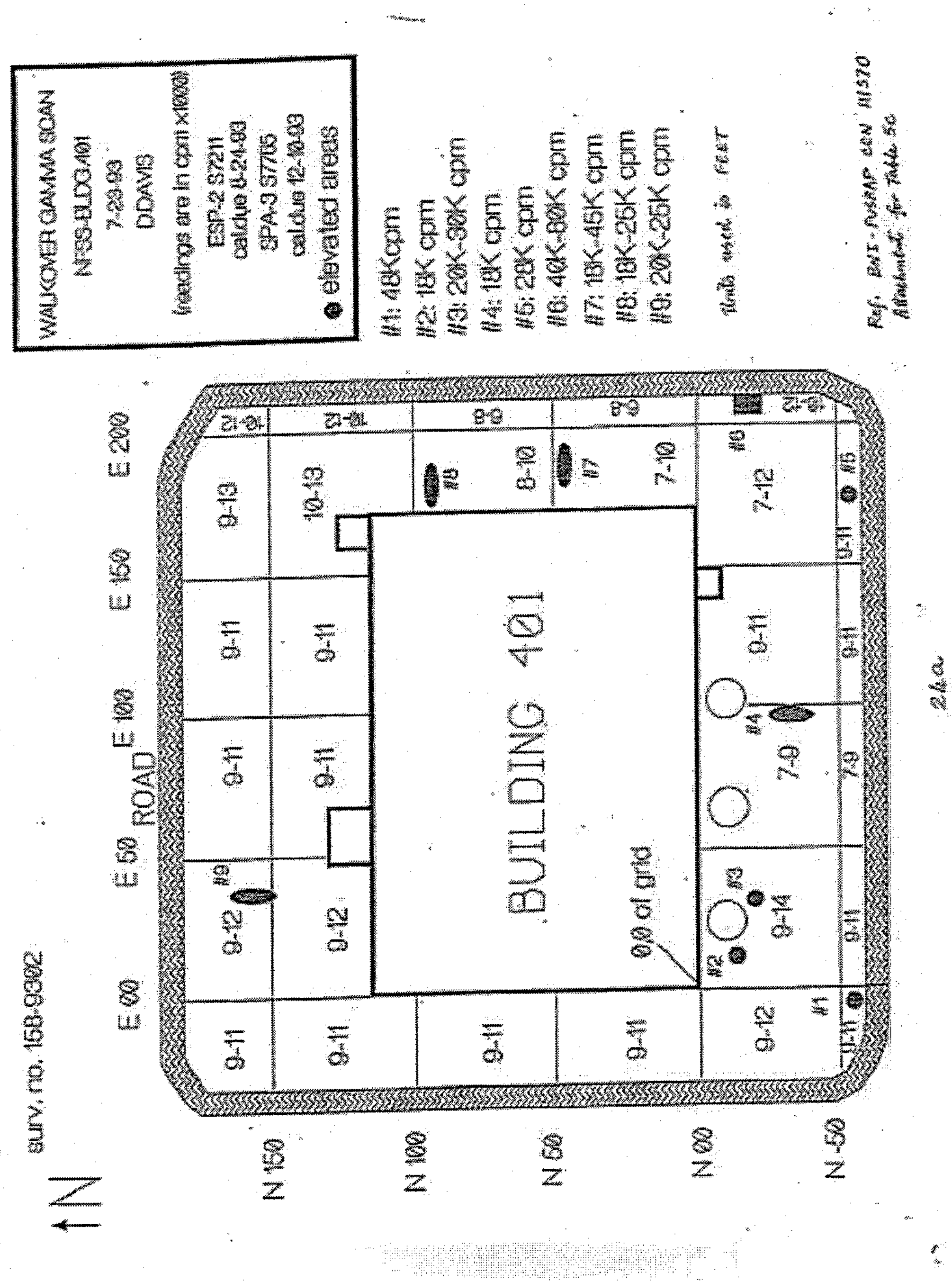
WALKOVER GAMMA SCAN
NFSS-BLDG.401
7-29-93
DDAVIS
(readings are in cpm x1000)
ESP-2 S7211
cal.due 8-21-93
SPA-3 S7705
cal.due 12-10-93
elevated areas
#1: 48Kcpm
#2: 18K cpm
#3: 20K-30K cpm
#4: 18K cpm
#5: 28K cpm
#6: 40K-80K cpm
#7: 18K-45K cpm
#8: 18K-25K cpm
#9: 20K-25K cpm
surv. no. 158-9302
N
E 00
E 50
E 100
E 150
E 200
ROAD
N 150
N 100
N 50
N 00
N -50
BUILDING 401
0,0 of grid

Appendix B

Table 6a
Waste/Materials stored inside NFSS Building 401 (as of April 17, 1998).

Building	Room	Waste Stored
401	118	Miscellaneous chemicals
401	119	Supersacks containing PPE. Four drums containing used storage media
401	128	Six drums containing HEPA dust
401	217	Two three foot long pieces of I-beam

Table 6b
Waste/Materials stored outside NFSS Building 401 in the Temporary Storage Area (as of July 9, 1998); (see Attachment D, drawing 158-DDxyz-C04).

Item No.	Container No.	Container Type	[1]Description of Contents
01	3077	LSA Box	Dismantled lockers from Rm. 109
02	3048	LSA Box	Not labeled
03	3645	LSA Box	Pipe, wall studs, metal drain, wood, air duct, pipe hangers from
04	3523	LSA Box	Wooden ladder from Rm. 119
05	9459	LSA Box	Not labeled
06	9551	LSA Box	Building debris from decontamination of East Wall of Rm. 217
07	3528	LSA Box	Building debris from decontamination of East Wall of Rm. 217
08	3527	LSA Box	Not labeled
09	3501	LSA Box	Dismantled lockers (B), wall studs from Rm. 213
10	3538	LSA Box	Not labeled
11	9459	LSA Box	Washing machine/misc parts
12	3537	LSA Box	Dismantled lockers from Rm. 109
13	3074	LSA Box	Dismantled lockers from Rm. 109
14	3042	LSA Box	Not labeled
15	3076	LSA Box	Dismantled lockers from Rm. 109
16	---	55-gal drum	"Peel Away"
17	---	55-gal drum	Not labeled
18	---	55-gal drum	Vacuum Dust
19	---	55-gal drum	"Peel Away"
20	---	55-gal drum	Building debris
21	---	55-gal drum	Building debris from decontamination of East Wall of Rm. 217
22	---	55-gal drum	Pipe, pipe hangers, air duct
23	2077	LSA Box	Blower, vent ducts
24	3076	LSA Box	Not labeled

Table 6c
[2]Empty waste-containers stored outside NFSS Building 401 (as of July 9, 1998).

Container No.	Now empty, but was used as an overpack to hold a 55-gal drum containing:
3047	Ammonia (ammonium hydroxide)
3701	Nitric acid
3043	Sodium hydroxide
3077	Muriatic acid
3045	Wastewater

[1] The item Nos. that are "Not labeled" need to be opened to determine their contents.
[2] Reference 11.
[3] These waste containers need to be opened, the interior and exterior be decontaminated, as necessary and prepared for recycle and reuse, as applicable.

Appendix B

Attachments:
(Supporting drawings enclosed)

A. Niagara Falls Storage Site Bldg. 401 and 403 Decontamination-Site and Vicinity Plans-158-DDxyz-C01.
B. Niagara Falls Storage Site Bldg. 401 Decontamination-First Floor Plan, Elevations and Detail-158-DDxyz-C02.
C. Niagara Falls Storage Site Bldg. 401 Decontamination-Second Floor Plan, Elevations and Section-158-DDxyz-C03.
D. Niagara Falls Storage Site Bldg. 401 Decontamination-Excavation Plan and Temporary Storage Area-158-DDxyz-C04.
E. Niagara Falls Storage Site Bldg. 403 Decontamination-Floor Plan and Elevations-158-DDxyz-C05.

References enclosed:
(Arranged in chronological order)

1. Anderson, T.L., et al, A comprehensive characterization and hazard assessment of the DOE-Niagara Falls Storage Site prepared for the U.S. Department of Energy Remedial Action Program, Battelle Columbus Laboratories, Ohio, June 1981; NYNFSS BMI-2074 (Revised).

2. Huber P.R. to Vitkus, T.J., Information on Building 401 at Niagara Falls Storage Site (NFSS) (1981-1984); BNI-FUSRAP CDN 111570.

3. Vitkus, T.L., et al, Radiological Survey of Buildings 401, 403 and the Hittman Building, Niagara Falls Storage Site, Lewiston, New York, Oak Ridge Institute for Science and Education (ORISE), Tennessee, March 1995; BNI-FUSRAP CDN 128541.

4. Dettorre, B.J. to Arndt, S.K., NFSS, Bldg. 401 Decontamination Status/Plan, August 22, 1996; BNI-FUSRAP CDN 158-GDA-GEV-00006.

5. Surface release criteria for Building 403, Niagara Falls Storage Site, August 28, 1996; BNI-FUSRAP CDN 145851.

6. Vitkus, T.J. to Arndt, S.K., NFSS, Bldg. 401- IVC's field notes., dated September 9-10, 1996; BNI-FUSRAP CDN 158-GDA-GEV-00009.

7. FUSRAP Data Transmittal D-27987-contains the SEC radiological surveys (158DT00015.xls-158DT00020.xls, dated October-December 1996) for certain areas within NFSS Building 401 which have the potential of having residual radioactivity contamination. Note: The same information is included in the FUSRAP Data Transmittals D-27951 and D-27491.

8. SEC radiological survey data for NFSS Building 401, S/N S7789/99012; dated October 1996.

9. FUSRAP Data Transmittal D-28115-contains the SEC radiological surveys (158DT00021.xls-158DT00050.xls, dated January 1997) for areas within NFSS Building 403 that have with potential of having residual radioactivity contamination.

10. E-mail - Riemen C.R. to Arndt S.K., NFSS Bldg. 403-Radiological contamination status as of April 10, 1997; BNI FUSRAP CDN 158-GDA-GEV-00010.

11. S. K. Arndt's personal communication with SEC-HP technicians and NFSS Buildings 401 and 403 visit, July, 1998 (not enclosed).

12. S. K. Arndt's personal communication with Tim Vitkus (ORISE) on the interpretation of residual radioactivity guidelines for the NFSS Buildings 401 and 403, July 1998 (not enclosed).

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