URS

Radioactive Air Emissions Application for Approval to Construct or Modify Portable Ventilation Units

Environmental Engineering/Evaluation Calculations

SPRU EEC-11-001 REVISION 1

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Separations Process Research Unit – Disposition Project (SPRU-DP)

Radioactive Air Emissions Application for Approval To Construct or Modify

Portable Ventilation Units

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Section A

Site Information

Separations Process Research Unit - Disposition Project (SPRU-DP)

Site Information

The Separations Process Research Unit (SPRU), located near Schenectady, New York, was operated from February 1950 to October 1953 for laboratory scale research and development on the REDOX (reduction/oxidation) and PUREX (plutonium-uranium extraction) processes. It supported operations at the Hanford Site (Washington State), and the Savannah River Site (South Carolina). The research was performed on a laboratory scale; SPRU never was a production plant. These activities left radioactive contamination inside the facilities.

- The main upper level SPRU Disposition Project facilities occupy approximately five acres on the 170-acre Knolls Atomic Power Laboratory (KAPL) site in Niskayuna, New York near the Mohawk River. KAPL is a U.S. Naval Nuclear Propulsion Program research and development facility operated under the auspices of the U.S. Department of Energy.

The SPRU facility (Figure A-1) consists primarily of two interconnected buildings (H2 and G2), portions of which lie underground:

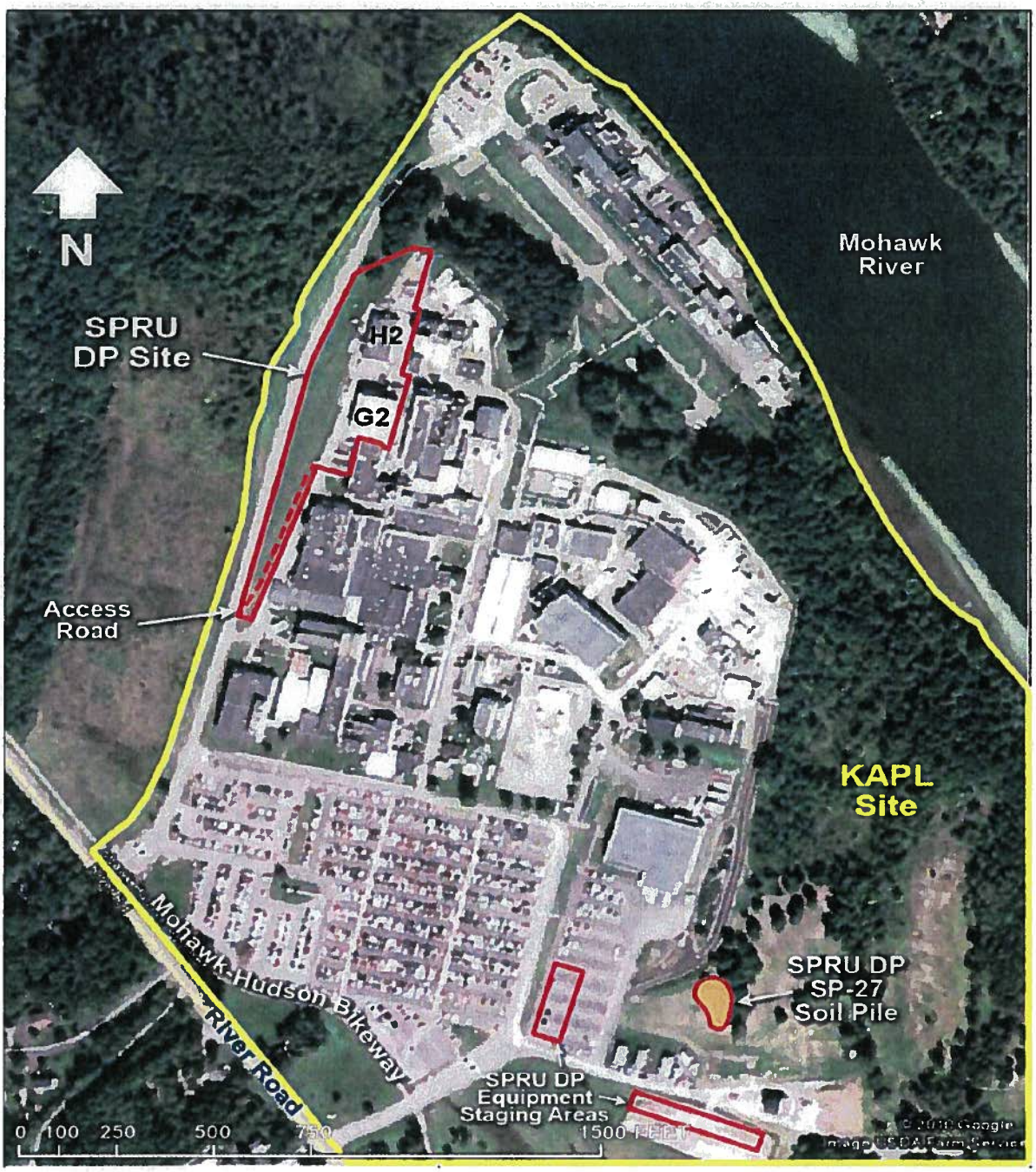
- Building G2 – housed the laboratories, hot cells, separations process testing equipment, and the tunnel system beneath Building G2. Building G2 hot cells, equipment, ventilation/process piping systems, and tunnels contain residual radioactive contamination.

- Building H2 – used for liquid and solid waste processing. All areas of this building are contaminated or potentially contaminated, and are controlled by the radiation protection program.

- H2 Tank Farm (also known as the tank vaults) – a series of seven underground stainless steel tanks in concrete vaults along the eastern side of Building H2 used for storing liquid radioactive waste. The contents of these tanks have been consolidated into tank 509E.

Pipe Tunnels – two concrete passageways, the first connecting Building H2 to Building G2; the second connecting Buildings G2, G1 and E1 (E1/G1 tunnels) which lie to the south and east of Building G2. The Pipe Tunnels contain radioactive piping and contaminated materials.

Figure A-1. Location of the SPRU Disposition Project (DP) Site



The facility is currently undergoing decontamination and decommissioning activities under the purview of the Department of Energy's (DOE) Office of Environmental Management (EM). In September 1992, the Department's Office of Nuclear Energy, (current organization is Office of Naval Reactors Laboratory Field Office [NRLFO]) and EM signed a Memorandum of Agreement (MOA) on decontaminating and decommissioning the SPRU facilities. The MOA was supplemented with the SPRU Functions, Assignments, and Responsibilities Agreement (FAR) in 2000, (current Revision 2, dated February 2009) establishing the roles and responsibilities of each Office regarding the decontamination and decommissioning of SPRU.

Upon the completion of the demolition and clean-up, and sampling to ensure the clean-up levels have been met, the land will be transferred back to the NRLFO for their continued mission use. EM and KAPL meet periodically to discuss mutual operations integration issues.

Environmental Restoration

The SPRU site process facilities and adjacent land areas are managed by the U.S. Department of Energy. The proposed action is the removal of Buildings G2 and H2, including the H2 and G2 tunnels, as well as the decontamination of the E1/G1 tunnels and the tank vaults, and removal of contaminated soils. By the end of 2010, a considerable amount of work to this end had been accomplished.

Section B

Technical Emission Point Information

I. Name & Address of Applicant

(Owner) US Department of Energy – Separations Process Research Unit- Disposition Project
Knolls Atomic Power Laboratory
Knolls Site
2425 River Road
Niskayuna, NY 12309

(Project Contractor) URS (previously Washington Group International [WGI])
Separations Process Research Unit – Disposition Project Office
2345 Nott Street East, Suite 201
Niskayuna, NY 12309

II. Name & Location of Proposed Source

Portable Ventilation Unit (PVU), multiple units 1 through 10

Separations Process Research Unit Disposition Project
Knolls Atomic Power Laboratory
Knolls Site
2425 River Road
Niskayuna, NY 12309

Facility Coordinates:	
Latitude	42 Degrees 49 Minutes North
Longitude	73 Degrees 52 Minutes West
Estimated Date of Shutdown:	To Be Determined

III. Release Point Information – Emission Point ID: PVU-01 through PVU-10

Ground Elevation - 330 ft. MSL (approximate),
Stack Height – approximately 6 ft. (typically),
Height above Structure - variable,
Exhaust Duct Inside Dimensions - 9 inches dia. (typically),
Exhaust Exit Temperature - 20-95°F, (ambient air),
Exhaust Exit Velocity - 15-60 ft./sec,
Exhaust Exit Flow Rate - 500-2,000 ACFM

IV. Technical Information About Source

Ventilation Unit Nature (typical unit)
Modular HEPA filtration unit capable of providing High Efficiency
Particulate Air (HEPA) filtration with 99.97% efficiency @ 0.3 µm AD
Particulate Air fabric pre-filter, rated minimum efficiency reporting value (MERV) 8, per ANSI/ASHRAE 52.2

Size
24"W X 24"H X 11.5"D single HEPA (typical)
Pre-filter size variable, rated at unit design flow capacity

Design
Centrifugal fan air mover, aluminum housing and fan, with conventional bag-out HEPA filter module. Vertical or horizontal operation, differential pressure gage across filter, flow indicator, mounted on a portable frame.

Design Capacity (typical)
1150 ACFM @ 1.8" w.g.

Representative Sample Withdrawal
A generic mixing device provides a representative sampling location for a shrouded probe that has been tested in accordance with ANSI/HPS N13.1-1999
20-100 LPM adjustable sample rate
47 mm dia. particulate sample filter
Sample flow rate/volume indication
Exhaust air flow rate indication

V. Method of Source Operation and Description of Emission Controls

This application is for use of stand-alone portable ventilation units (PVUs) as ventilation air filtration controls for point source emissions to the environment. Each PVU will provide suction from a defined space or enclosure before discharging to the environment as an independent integrated filtered and sampled system. A source term that includes the estimated radioactive material inventory of Building H2, G2, sludge processing and Tank Farm activities, and the E1/G1 tunnel estimated surface radioactivity inventory is the basis source term for this application. Use of these PVUs will result in emissions of lesser magnitude than modeled because the source term and the filtration efficiency are modeled conservatively. The type of work supported by these PVUs includes, but is not limited to, decontamination of the E1/G1 tunnels, decontamination of rooms and cells in Buildings G2 and H2, including H2 and H2/G2 tunnels, sludge equipment maintenance, sludge solidification, and other similar activities. Buildings H2 and G2 will be enclosed and equipped with HEPA-filtered ventilation systems. However, additional PVU ventilation is required prior to installation of the enclosures and their respective exhaust ventilation systems, as well as during other Project activities. PVUs are necessary for controlling airborne contaminants in the E1/G1 tunnels, in high-contamination-risk rooms of G2 and H2,

for sludge solidification, and may be used at a later time to supplement any additional approved exhaust systems. For example, the decontamination of rooms 106-110, 114, and 223-226 in Building G2, and rooms CT-101, 108, 111, 112, or 114 in Building H2 would use PVU support to control airborne contamination. The PVUs that are covered under this application operate as free-standing units with individual specification and operational tracking documentation. These units each discharge directly to the outdoor environment or an un-ventilated space.. Portable HEPA ventilation units that discharge within an enclosure that already has an approved operating HEPA filtered ventilation exhaust and monitoring system meeting the ANSI/HPS N13.1-1999 standards [Ref. 1] are not included in this application.

PVUs are anticipated to be used throughout the SPRU-DP facility, mostly within or on structures, where radioactive airborne contamination controls are needed to protect workers and the environment. The H2 Building debris area, access points and work areas associated with the tank vaults and equipment, the H2/G2 tunnel, the G2 building rooms with known contamination, and the E1/G1 tunnels are specific locations, but not all-inclusive, where PVUs would be set up to support active radiological work. Even though PVUs would normally be used for active work areas, additional units may be set up to augment general workplace ventilation needs, or may be left in place for some time after active work is concluded or while work is temporarily suspended.

All PVUs are equipped with a spark arrestor, pre-filter, and a HEPA filter. The HEPA filters are tested and operated according to DOE regulations and guidance, and in accordance with Project procedures. These procedures include preoperational and annual in-place testing, annual calibrations of flow meters, and frequent monitoring by technicians for dose rate buildup, filter loading, and filter breaches. The PVU emissions are monitored for radioactivity with a continuous air particulate sampler at the point of discharge. Differential pressure across each HEPA filter is monitored by a Magnehelic® or equivalent gage. Both sample flow rate and ventilation duct flow rate are measured and displayed using calibrated instruments.

It is important to note that multiple HEPA-filtered exhaust units may be operated in parallel or series to discharge to the environment through a single monitored mixing chamber. (See Attachment D, Equipment Sketches and Specification Details.)

Methodology for Managing PVU Cumulative Emissions Across the Project

This application proposes a methodology to control the radioactive emissions from the PVUs by evaluating each air sample against numerical performance criteria such that the emissions are tracked in a transparent manner. This methodology requires notification to the EPA Region 2 office when the cumulative dose from all PVUs reaches the threshold value of 75% of the prospective EDE to the MEOSI. The total quantity of gross alpha and gross beta activity that is equivalent to the threshold 75% dose will be calculated based upon the source terms and dose models provided in this application. (See Attachment A.) This total air sample activity will be divided by the number of possible weekly air samples to calculate a screening action level for the gross alpha or beta activity in a sample. As

described in Section C, this value will be referred to as the "Administrative Reporting Limit" gross activity, and will be monitored by the laboratory technicians.

The source terms herein have been derived from analytical data, empirical measurements, and estimates of contaminant distribution based upon historical documentation and process knowledge. The dose to the maximally exposed offsite individual was calculated using an EPA-approved dispersion code, CAP88-PC. [Ref. 2] Due to the density and close proximity of residences to several sector boundaries, the location of the maximally exposed offsite individual may shift year-to-year if annual dispersion results change relative to the 1989-2004 base period used in this analysis.

Radioactive Emission Estimates

The source term that is used to calculate the EDE to the MEOSI is a bounding source term that is conservative relative to anticipated uses for PVUs. Dose estimates are based on releases of PVU discharges at a two-meter elevation. The abated dose to the MEOSI based on processing the entire source term (G2, H2, G2 and H2 tunnels, Tank Farm, and E1/G1 tunnels) is calculated to be 1.6E-03 mrem/year, as shown in Attachment A.

Technical Information About Sampling and Administrative Reporting Limit

The sampler unit for collecting airborne particulate from the PVU exhaust ducting will be a stand-alone unit consisting of a vacuum pump of sufficient capacity to withdraw a sample continuously through a 47 mm diameter filter for up to ten days. Typically, samples will be changed weekly for units in continuous operation. Sampler system maintenance, filter handling, operation, calibration, and documentation will be specified in Project procedures. The sampling will be in compliance with the quality assurance project plan [Ref. 3] specific to SPRU's radiological NESHAP-related activities, and with ANSI/HPS N13.1-1999.

The sample withdrawal point will be close to the center of the duct, and will be a shrouded probe design as described in ANSI/HPS N13.1-1999. The use of a mixing box that is scaled from a tested stack design and proof testing per the ANSI/HPS N13.1-1999 guidance will ensure collection of a representative sample. In addition the sampling system will meet ANSI/HPS N 13.1-1999 design requirements.

Sample filters will be changed and assayed for gross radioactivity weekly, or at the end of a support cycle, whichever is shorter. The filters will be composited in quarterly batches and analyzed for the radionuclides of concern listed in Table A-2 (includes radionuclides in Tables A-3 and A-4) in Attachment A, using 40 CFR 61 Appendix B, Method 114, EPA-approved measurement techniques. [Ref. 4]

Analytical detection levels allow monitoring sample activity at levels equivalent to a fraction of the Administrative Reporting Limit. Air sample filter screening levels above a specified administrative count

rate (developed in Section C) will be cause for management notification, verification testing, and evaluation of a potential release greater than normally expected variations.

Any calculated dose estimate (using gross radioactivity screening data) that, when added to the sum of the other PVU emissions to the environment, exceeds a threshold level of 75% of 1.6E-03 mrem/yr (i.e., 1.2E-03 mrem/yr to the MEOSI) for total PVU emissions for the calendar year, will be documented. EPA Region 2 will be notified by the Project DOE representative within five (5) working days that this threshold has been reached.

If the cumulative activity on PVU air filters reaches an amount that represents 1.2E-03 mrem/yr to the MEOSI, monthly documentation of PVU-origin dose projections will be provided to EPA Region 2 to more closely track annual estimated dose totals from this group of emissions.

Summary

In summary, the PVU methodology for managing PVU emissions presented here shows that, under normal operating conditions, portable ventilation units operated at SPRU-DP will, through a combination of good engineering practice and operational limitations, limit environmental releases of radioactivity to levels below well below the 40 CFR 61 Subpart H dose limits. Through the methodology proposed in this application, this is accomplished in a transparent manner with defined evaluation points, and opportunity for EPA interactions and input.

Section C

Portable Ventilation Exhaust Monitoring for Radioactivity

Portable Ventilation Exhaust Monitoring for Radioactivity

Purpose

Portable ventilation exhaust monitoring at the Separations Process Research Unit (SPRU) Disposition Project (SPRU-DP) has two major purposes:

- Provide accurate assessment of normal operations
- Provide accurate and rapid assessment of upset radioactivity releases.

To properly quantify and assess the impacts of radioactivity potentially present in effluent air, a continuous integrated sample is withdrawn and measured offline. This provides accurate and quality-controlled laboratory measurement of radionuclides present in the discharge stream. Radiological screening of the particulate radioactivity on the sample filters is conducted using on-site gas proportional alpha-beta counters. The screening data is used to assess weekly and cumulative emissions against the Administrative Reporting Limit. The filters are composited quarterly and sent to a laboratory offsite for isotopic analysis.

Upon identification of elevated gross particulate radioactivity in either workspace airborne monitoring or upon PVU exhaust filter screening, further filter analysis and area surveys will provide information required for rapid dose assessment purposes. Additional off-normal processes are described in the SPRU-DP NESHAPs Quality Assurance Project Plan. [Ref. 3]

Scope

The sampling pumps are sized to provide the sample flow rate required for the shrouded probes. Shrouded probes are tested and qualified for specific combinations of exhaust flow velocity and nozzle inlet velocity. The sample pumps installed on the PVUs are matched to the nozzle's operating requirements with the design sampling range of 27 -100 LPM when the exhaust flow rate is 500 - 2,000 CFM, and a normal operating range of 50 -100 LPM sampling for an exhaust flow rate of 1,000 - 2,000 CFM. This design provides optimum sensitivity for the sampler by collecting suitably-sized volumes, consistent with the ANSI/HPS N13.1-1999 requirements. [Ref. 1] The analysis of the sample filters will provide documented radioactive airborne particulate emissions data when combined with the measured system exhaust flow rate and sample withdrawal rate.

System Design

Each ventilation sampling system is designed to meet the applicable criteria in ANSI/HPS N13.1-1999, as referenced by 40 CFR 61 Subpart H. [Ref. 4] The shrouded withdrawal probe is specifically sized and ported to withdraw a sample from a representative point within the effluent duct, and the sample line and nozzle are designed to meet the Standard's requirements for aspiration and transport efficiency of 10 μm diameter particles.

The measured exhaust flow rate is used to adjust the sampling rate if the ventilation flow changes. Sample transport lines to the collection devices are sized to provide nonrestrictive turbulent flow under normal conditions. The sample line provides a long-radius bend for ninety-degree turns. Joints in the sample withdrawal section use butt-joined connectors that allow easy maintenance and component replacement as well as internally smooth surfaces. Materials used in sample transport lines and connectors are corrosion resistant metals non-reactive to the intended sample stream (e.g., stainless steel) in order to maintain stable internal pipe wall conditions and prevent line loss due to static electricity buildup. Heat tracing will be used if needed to maintain sample line temperatures well above dew point for the sample stream being monitored, although for typical ambient air use this is not expected to be necessary.

The accurate quantification of radionuclide emission relies on several variables, including precise unbiased measurement of sample volume. This critical factor is controlled by utilizing traceable calibrated air flow measuring devices corrected for temperature, vacuum, and intrinsic instrument bias to initially qualify the sampling system and periodically verify accuracy. Installed air flow indicators (including mass flow gages) provide system performance stability verification and total sample volume for routine sample collection.

The exhaust flow from a given ventilation system will initially be measured for velocity, temperature, humidity, and flow direction in accordance with Methods 1 and 2 of 40 CFR 60, Appendix A. [Ref. 5] Testing and inspection will be performed and documented for the operational life of each system, as applicable, per ANSI/HPS N13.1-1999. For routine PVU emission points, the full qualification and maintenance requirements will be applied as applicable under the ANSI/HPS Standard graded approach recommendations.

The ventilation system sampling and filtration equipment, flow measurements, sampling system operation, sample media controls, system parameter data management, and attendant data reduction and calculations are subject to an overall site quality assurance plan. In addition, a project-specific quality requirements document, SPRU-ENV-012, Quality Assurance Project Plan for Measurements of Radionuclide Air Concentrations for Rad NESHAP Compliance at the SPRU-DP, consistent with Method 114 of Appendix B in 40 CFR 61, is specifically directed to radioactive NESHAPs-related operations.

System Operation

The 47 mm diameter filter sample media are changed on a weekly schedule, at which time any minor adjustments to flow rate or sample line temperature are made and recorded. Sample media are counted upon removal and after a holding period (for natural isotope decay) on a laboratory instrument for gross radioactivity, and filter composites are analyzed quarterly for Sr-90, gamma emitters (Cs-137), and alpha isotopic (Pu-238/239/240, Am-241) parameters. Alpha isotopes U-233/234, U-235, and U-238 will also be analyzed during E1/G1 tunnel decontamination.

The sample flow and exhaust flow will be determined empirically and documented for each portable ventilation system. The radioactivity release quantity will be calculated based upon the relative flow rates and the radionuclide analytical values in a given sample composite or individual filter.

System Performance

For a sampler operating at 60 LPM for a calendar (three month) quarter, the sensitivity is typically 5E-18 µCi/mL for alpha isotopes, 5E-17 µCi/mL for Sr-90, and 5E-17 µCi/mL for Cs-137 for a quarterly composite. Actual flow rates will be measured and emission calculations will be based upon the empirical measurements.

Administrative Controls on PVU Operation

The PVU air sampler filters are screened upon each removal (scheduled weekly) for gross alpha and gross beta-gamma radioactivity. In normal conditions, the amount of radioactivity on each filter is added incrementally to the cumulative annual total radioactivity tracking for PVU emissions. If a filter presents a net activity level greater than 22 disintegrations per minute (dpm) of gross alpha or 256 dpm of gross beta-gamma, the environmental manager is notified (within two working days), and an evaluation of the PVU emissions total is performed. The total gross alpha and gross beta emissions associated with the abated emissions calculation are 5.6E-06 Ci alpha, and 6.5E-05 Ci beta-gamma as indicated in Table A-1 in Attachment A. These values are the total emission quantities for processing the source term at risk on the Project. If 10 PVUs were operated at 1150 CFM and 40 LPM sampling for 52 weeks, the total number of weekly air samples would be 520 filters. The net gross alpha or net gross beta activity per filter that corresponds to 75% of the Administrative Reporting Limit (ARL-A, ARL-B) is as follows:

$$ARL-A = 0.75\frac{\left(5.6E-06\,{}^{Ci}/_{year}\right)\left(2.22E+12\,{}^{dpm}/_{Ci}\right)(40_{lpm})}{\left(520\,{}^{filters}/_{year}\right)(32565_{lpm})} = 22_{dpm\,/\,filter}$$

$$ARL-B = 0.75\frac{\left(6.5E-05\,{}^{Ci}/_{year}\right)\left(2.22E+12\,{}^{dpm}/_{Ci}\right)(40_{lpm})}{\left(520\,{}^{filters}/_{year}\right)(32565_{lpm})} = 256_{dpm\,/\,filter}$$

Where:

ARL-A = alpha counts
ARL-B = beta-gamma counts
Exhaust discharge = 1,150 CFM (32,565 LPM)
Sampler flow rate = 40 LPM.
1 Curie = 2.22E+12 dpm
Action level fraction of abated emissions estimate = 75%

The SPRU DP radiological laboratory technicians will by protocol report any PVU air sample that exceeds either of these threshold Administrative Reporting Limit screening values to the SPRU Environmental Manager within two working days. This process will ensure that emissions are restricted to levels that do not exceed the Administrative Reporting Limit dose value.

Section D

Ventilation Exhaust Filtration Efficiency Testing and Acceptance Criteria

Portable Ventilation Exhaust Filtration Efficiency Testing and Acceptance Criteria

Portable Ventilation Exhaust Filtration Efficiency Testing

Ventilation is filtered through a high-efficiency particulate air (HEPA) airborne particulate removal train. Each train at minimum has a fabric pre-filter and a HEPA filter that meets nuclear air cleaning efficiency standards and has been tested to demonstrate compliance with those standards. In addition, a filter differential pressure indicator allows an objective measurement of filter resistance (loading) for maintaining adequate design filtration within equipment specifications. Periodic (annual) challenge testing of in-place filters is documented.

Filter differential pressures are checked to be within the unit recommended operating range (per the manufacturer's recommendations) prior to startup in a radiological application.

Portable Ventilation Unit Aerosol Test Procedures and Acceptance Criteria

HEPA filters are used at the SPRU-DP in forced air ventilation systems to remove radioactive particulates from ventilation exhaust streams. These filters are tested by the manufacturer to be 99.97% efficient or greater for removal of particles of 0.3 µm aerodynamic diameter. To assure that these filters are installed and functioning properly, a dioctyl phthalate (DOP), or approved equivalent aerosol challenge test is performed on each HEPA filter system prior to initial operation and after filter replacement. HEPA-filtered ventilation systems operating at the SPRU-DP are tested annually. Systems tested must demonstrate a removal efficiency of at least 99.95% for 0.7 µm aerodynamic diameter aerosols per DOE standards. [Ref. 6]

Fabric prefilters are installed per manufacturer's instructions, and are given an efficiency rating of at least MERV 8 by the manufacturer. [Ref. 7] They are not, however, tested in place as are the HEPA filter systems.

Section E

References

References

1. American National Standards Institute, *Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities*, ANSI/HPS N13.1-1999

2. CAP88-PC Version 3.0 User Guide, USEPA Office of Radiation and Indoor Air, Washington, DC. December 09, 2007

3. Quality Assurance Project Plan for Measurements of Radionuclide Air Concentrations for Rad NESHAP Compliance at the SPRU-DP, SPRU-ENV-012, May 2011

4. 40 CFR 61 Subpart H, National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities

5. 40 CFR 60, Standards of Performance for New Stationary Sources, Appendix A, Test Method 1, Sample and Velocity Traverses for Stationary Sources; and Method 2, Determination of Gas Velocity and Volumetric Flow Rate

6. DOE HDBK-1169-2003, Nuclear Air Cleaning Handbook, 2003

7. ANSI/ASHRAE Standard 52.2, Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size

Supporting References:

1. Andrew R. McFarland et al. *A Generic Mixing System for Achieving Conditions Suitable for Single Point Representative Effluent Air Sampling*, Health Physics 76(1)17-26, January 1999

2. Mark L. Maiello and Mark D. Hoover, *Radioactive Air Sampling Methods*, CRC Press, 2011

Attachment A

Source Term and Radiological Impact Modeling

Source Term and Radiological Impact Modeling

Objectives and Assumptions

Section B, "Technical Emission Point Information", provides the methodology for monitoring and managing the discharges from the PVUs covered by this application. This section (Attachment A) provides the source terms, calculated emissions, and the resulting EDE to the MEOSI that will be used in the methodology specified in Section B. This methodology requires that when the cumulative dose (derived from emission monitoring) from all PVUs covered by this application reaches the threshold value of 75% of the calculated abated EDE as determined by this Attachment, the EPA Region 2 office will be notified by the Project DOE representative within five (5) working days that this threshold has been reached. This value of 75% of the EDE value will be referred to as the "Administrative Reporting Limit" dose.

Source Term Identification for Administrative Reporting Limit Methodology

An appropriate source term must be identified in order to derive the administrative reporting limit threshold dose value for this application. The source terms chosen for this effort are the entire radioactive inventory associated with the process equipment rooms and tunnels in Buildings G2 and H2, the sludge and contaminated surfaces and equipment in the Tank Farm, and the radioactive surface contamination estimated to be in the E1/G1 tunnels. This constitutes essentially all of the source terms in the Project that are associated with PVU operations, and provides a reasoned value upon which to base administrative control of emissions from PVUs.

The source terms to be modeled with CAP88-PC to determine EDE to the MEOSI and derive the administrative threshold dose are from data collected in anticipation of the:

- Decontamination of the E1/G1 tunnels,
- D&D of contaminated rooms and tunnels in Building G2,
- D&D of contaminated rooms and tunnels in Building H2, and
- Sludge processing and other Tank Farm activities.

A summary tabulation of source terms, calculated emissions, and calculated abated EDE used to establish the Administrative Reporting Limit is provided in Table A-1. Given the unabated dose (EDE) of 1.6 mrem to the MEOSI, the PVU monitoring category per ANSI/HPS N13.1-1999 is Potential Impact Category 2, requiring continuous monitoring and annual system inspection and maintenance.

Additional source term information is presented in this attachment.

Table A-1. Summary of Source Terms and Doses Used to Determine PVU Operations Controls

SPRU-DP Area	Radioactive Inventory Source Term (Ci)	Estimated Abated α Emissions (Ci/yr)	Estimated Abated β-γ Emissions (Ci/yr)*	EDE Unabated (mrem/yr)	EDE Abated (mrem/yr)
E1/G1	2.5	1.44E-07	2.42E-06	3.61E-02	3.61E-05
H2 & G2	16.1	1.60E-06	1.66E-05	4.33E-01	4.33E-04
Tank Farm	40.7	3.90E-06	4.60E-05	1.12E+00	1.12E-03
SPRU-DP Totals	59.3	5.6E-06	6.5E-05	1. 6E+00	1.6E-03
Administrative Reporting Limit					1.2E-03

* Includes Sr-90 + Y-90

The prospective dose assessment of these activities is based on the following assumptions:

- The radioactive inventories from Buildings H2 (including the Tank Farm vaults) and G2 and the E1/G1 tunnels are used as source terms for the EDE calculation
- Appendix D factors are used in both the abated (40 CFR 61.96) and unabated (40 CFR 61.93) calculations to determine E, the emissions amount in curies:

$$E = (ST)(PS)(CF)$$

Where

ST = Source Term or Source Inventory, Curie

PS = Physical state factor, dimensionless

CF = Effluent control adjustment factor, dimensionless

And:

The Physical State factors are those given in Appendix D;

The Effluent Control Adjustment Factors (CF) are those given in Table 1 of Appendix D: For unabated emission estimates, CF = 1

- All emissions from the work activities are captured by the PVUs.
- All emissions are released from a single location in the center of the SPRU DP work area and occur within a single calendar year
- The emissions are modeled as point sources from a two-meter high stack with zero velocity.
- For residence locations, the rural food option in CAP88 PC was selected. The dose at a business location is calculated to be one-third the dose that would occur if a residence were located at the business location
- The meteorological data recorded at the Knolls Atomic Power Laboratory (KAPL) for a 15-year period average (1989-2004) are applicable and were used in this calculation
- The analysis explicitly excludes all radionuclides in the process source term that were not detected in analyzed samples.

Source Term and Effective Dose Equivalent Calculation

The discussion below provides basic information on the source terms for the E1/G1 tunnels, the Buildings H2 and G2 process equipment rooms, and the Tank Farm.

E1/G1 Tunnel Source Term and Dose

The extent of contamination in the E1/G1 tunnel structures, pipes, and equipment cannot be known exactly prior to decontamination and removal of components. Therefore, a source term model has been developed using standard industry methods to bound the radiological inventory. A composite sample of contamination from the tunnel floors was collected and characterized. The results derived from the sample analysis are provided in Table A-2. Of the nuclides listed in Table A-2, Cs-137 (Ba-137m) is the only radionuclide that emits significant photon radiation. Therefore the measured radiation dose rate in the tunnel may be correlated to the activity of Cs-137 using dose-to-curie radiation transport calculations. The activity of the other radionuclides in the characterization sample is calculated proportionately to their concentration in the characterization sample. It should be noted that the E1/G1 tunnel isotopic mix is not the same as other structure and equipment surfaces at the SPRU-DP.

The source term was assumed to represent a radionuclide distribution in the piping, walls, floors and sumps of the tunnels. The quantities of other radionuclides were calculated according to the relative abundance of each radionuclide compared to Cs-137 in a dry composite sample from the E1/G1 tunnels. The results are also provided in Table A-2.

E1/G1 Radiological Discharges to the Atmosphere

The Project will arrange the ventilation so that HEPA air filtration is provided at work locations in the E1/G1 tunnels. When used for local control of a decontamination tool or to control flow into a hut or

tent, the ventilation intake will be arranged to provide for capture of contaminants. Air flow directions will be verified by smoke tests or equivalent air flow direction tests to ensure that the discharges are filtered through the portable filtration units. The filtration will consist of a fabric pre-filter that meets a minimum efficiency reporting value (MERV) of 8, according to ANSI/ASHRAE 52.2 [Ref. A-1], followed by a HEPA filter that is tested by the manufacturer per DOE requirements for 99.97% efficiency. [Ref. A-2] The exhaust may be directed outside the work space, or combined with another system, through a continuously sampled emissions point.

E1G1 Abated Emission and EDE

The 40CFR61 Appendix D physical state factor of 1E-03 for particulate material is used in the emissions calculations. [Ref. A-3] PVUs will contain a fabric filter followed by a HEPA filter for abatement of releases to the atmosphere. The fabric filter is specified to have a 0.1 release factor per Appendix D and the HEPA filter has a specified release factor of 0.01 per Appendix D. The overall Total Adjustment Factor is therefore:

$$\text{Total Adjustment Factor} = (1E\text{-}03)*(0.1)*(0.01) = 1E\text{-}06$$

The emission can be determined by multiplying the Total Adjustment Factor by the inventory of each radionuclide as shown in Table A-2. The emissions were input into CAP88 Revision 3.0, and the resulting abated dose is 3.6E-05 mrem EDE/year as shown in the CAP88 Synopsis report in Attachment C-1. The doses are tabulated in the CAP88 Summary Report. This dose is one input in determining the threshold limit for PVU administrative controls.

Table A-2. E1/G1 Tunnel Radiological Inventory and Emissions

Radio-nuclide	E1/G1 Tunnel Radioactive Inventory Source Term (Ci)	Emissions per Appendix D (Ci/Yr)
H-3	0.0003	3.0E-10
Tc-99	0.0002	2.0E-10
Am-241	0.0007	7.0E-10
Pu-238	0.0013	1.3E-09
Pu-239	0.0019	1.9E-09
Th-230	0.0001	1.0E-10
Th-232	0.0001	1.0E-10
U-233	0.13	1.3E-07
U-235	0.0050	5.0E-09
U-238	0.0048	4.8E-09
Sr-90	0.11	1.1E-07
Cs-137	2.2	2.2E-06
Co-60	0.0005	5.0E-10
Ni-63	0.0035	3.5E-09
Pu-241	0.0008	8.0E-10
Total	2.5	2.5E-06

Unabated Emission and EDE

For this calculation, the unabated dose uses the Appendix D physical state factor of 1E-03 in the emissions calculation with no reduction taken for abatement. The Total Adjustment Factor is therefore 1E-03, and the unabated dose is 3.6E-02 mrem EDE/year.

Buildings H2 and G2 Source Terms and Dose

The source term from the H2 and G2 buildings and structures is derived primarily from the contaminated rooms and tunnels in Buildings G2 and H2. The G2/H2 Tunnel, the H2 emergency tunnel, the H2 Tunnel (Room 108), and the H2 debris pile are also considered to be part of H2. The D&D process will remove contaminated systems from certain rooms and decontaminate the structural surfaces of the rooms. In order to establish confinement boundaries at appropriate locations, large portions of the buildings may be wrapped or tented. Therefore the entire radiological inventory of the buildings is applicable to this evaluation, since it is assumed that the entire source terms associated with

Buildings H2 and G2 are subject to potential release while the PVUs are operating to control emissions from the work area.

In most rooms, the dose rate appeared to emanate from contamination on the floor of the room; however, some rooms contained tanks or other components that appeared to contribute significantly to the general area dose rates within the room. In these cases, the tanks were modeled as separate sources and the content of the tank or component was added to the source term ascribed to the floor. The resulting source term is provided in Table A-3.

H2 and G2 Abated Emissions and EDE

The removal and decontamination will be conducted using portable ventilation equipment that contains a fabric filter followed by a HEPA filter for abatement of releases to the atmosphere. The fabric filter is specified to have a release factor of 0.1 per Appendix D and the HEPA filter has a specified release factor of 0.01 per Appendix D. The overall Total Adjustment Factor consistent with Appendix D is therefore:

Total Adjustment Factor = (1E-03)*(0.1)*(0.01) = 1E-06

The source terms are multiplied by Total Adjustment Factor to calculate point source emissions. The emissions are also provided in Table A-3.

Table A-3. Buildings G2 and H2 Radiological Inventory and Emissions

Radionuclide	Buildings G2 and H2 Radiological Inventory Source Term (Ci)	Emissions per Appendix D (Ci/yr)
Am-241	0.2	2.0E-07
Pu-239	1.4	1.4E-06
Sr-90	1.8	1.8E-06
Cs-137	12.7	1.3E-05
Total	16.1	1.6E-05

The emissions were input into CAP88 Revision 3.0 and the resulting dose is 4.3E-04 mrem EDE/year as shown in the CAP88 Synopsis Report in Attachment C-2. The doses are tabulated in the CAP88 Summary Report, and are another input in determining the threshold limit for PVU administrative controls.

H2 and G2 Unabated Emissions and EDE

For this calculation the unabated dose uses the Appendix D physical state factor of 1E-03 in the emissions calculations with no reduction taken for abatement. The Total Adjustment Factor is therefore 1E-03, and the unabated dose is 4.3E-01 mrem EDE/year.

Tank Farm Source Terms and Dose

The buildings and structures that are included in this source term are associated with the sludge that has been consolidated in Tank 509E, as well as the equipment and structure of the tank farm vaults. The H2 Tunnel (Room 108) is considered to be part of Building H2. The total activity in the sludge is obtained from radionuclide concentrations reported in sludge analysis sampling and the total volume of sludge (9,800 gallons). The current radiological inventory for the tank farm vault structures was developed in the historical site assessment.

PVU emissions assume that the entire source term associated with the Tank Farm is subject to potential release. The source term is provided in Table A-4.

Tank Farm Abated Emissions and EDE

The emissions from sludge solidification and decontamination of the vaults will be controlled using portable ventilation equipment that contains a fabric filter followed by a HEPA filter for abatement of releases to the atmosphere. The fabric filter is specified to have a release factor of 0.1 per Appendix D and the HEPA filter has a specified release factor of 0.01 per Appendix D. The overall Total Adjustment Factor consistent with Appendix D is therefore:

Total Adjustment Factor = (1E-03)*(0.1)*(0.01) = 1E-06

The source terms are multiplied by Total Adjustment Factor to calculate point source emissions. The emissions are also provided in Table A-4.

Table A-4. Tank Farm Radiological Inventory and Emissions

Radionuclide	Tank 509E Sludge Inventory (Ci)	Tank Vaults Inventory (Ci)	Tank Farm Inventory Source Term (Ci)	Emissions per Appendix D (Ci/yr)
Am-241	0.40	0.10	0.5	5.0E-07
Pu-239	2.5	0.90	3.4	3.4E-06
Sr-90	7.5	2.81	10.3	1.0E-05
Cs-137	20	6.45	26.5	2.6E-05
Totals	30.4	10.26	40.7	4.1E-05

The emissions were input into CAP88 Revision 3.0 and the resulting dose is 1.1E-03 mrem/year as shown in the CAP88 Synopsis Report in Attachment C-3. The doses are tabulated in the CAP88 Summary Report, and are an input in determining the threshold limit for PVU administrative controls.

Tank Farm Unabated Emissions and EDE

For this calculation the unabated dose uses the Appendix D physical state factor of 1E-03 in the emissions calculations with no reduction taken for abatement. The Total Adjustment Factor is therefore 1E-03, and the unabated dose is 1.1E+00 mrem/yr.

Emission and Dose Summary

As calculated in the context of this application, the total abated dose to the maximally exposed offsite individual, which includes G2, H2, Tank Farm, and E1/G1 tunnel emissions, is estimated to be 1.6E-03 mrem, (rounded) as indicated in Table A-5.

The MEOSI location for this combination of emission location and wind data file is the residence identified to be 540 m in the South Southwest sector relative to the center of the SPRU DP work area. The dose to the individual at the business in the NNW sector at 470 meters was obtained by dividing the dose at that sector and distance in the Summary reports of Attachments C-1, C-2, and C-3 by a factor of three. Table A-5 provides a summary of the respective doses for each source area.

Table A-5. Abated Dose Summary per 40CFR61.93 for PVU Operations (mrem/yr)

SPRU-DP Area Evaluated	Sector	
	NNW @ 470 m Business MEOSI	SSW @ 540 m Residence MEOSI
E1/G1	3.3E-05	3.6E-05
G2 & H2	4.3E-04	4.3E-04
Tank Farm	1.1E-03	1.1E-03
TOTAL	1.56E-03	1.57E-03

Results and Administrative Reporting Dose

The total abated EDE to the MEOSI is 1.6E-03 mrem/yr. This dose is based on the source terms and abatement factors described in this section of the application, the activities that could occur during the identified scope of work, and the use of the adjustment factors in Appendix D. These are bounding calculations that overestimate releases for the PVUs based on conservative source terms and the fact that much of the work scope will actually be conducted after the HEPA ventilation systems for the Buildings H2 and G2 enclosures are placed into service. The PVU ventilation exhausts will be monitored

with ANSI/HPS N13.1-1999 compliant continuous samplers for those PVUs covered by this application. [Ref. A-4]

The Administrative Reporting Limit dose is determined by multiplying the MEOSI EDE, 1.6E-03 mrem/year, by 75%. This results in an Administrative Reporting Limit dose value of 1.2E-03 mrem/year. The Project will develop protocols to implement threshold recognition and notification based on gross alpha and gross beta screening measurements by the site laboratory. The gross count rate action levels will correspond to the Administrative Reporting Limit. A management protocol will also be implemented requiring EPA Region 2 to be notified by the Project DOE representative if the cumulative projected dose of the PVUs covered under this application reaches 1.2E-03 mrem/year. This notification would provide DOE an opportunity to discuss the status of any enhanced mitigations for continued use of PVUs, and for EPA to obtain information on the PVU operations and provide feedback to DOE.

References

A-1. ANSI/ASHRAE Standard 52.2, Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size

A-2. DOE HDBK-1169-2003, Nuclear Air Cleaning Handbook, 2003

A-3. 40 CFR 61, Appendix D, Methods for Estimating Radionuclide Emissions, December 1989

A-4. American National Standards Institute, *Sampling and Monitoring Release of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities*, ANSI/HPS N13.1-1999

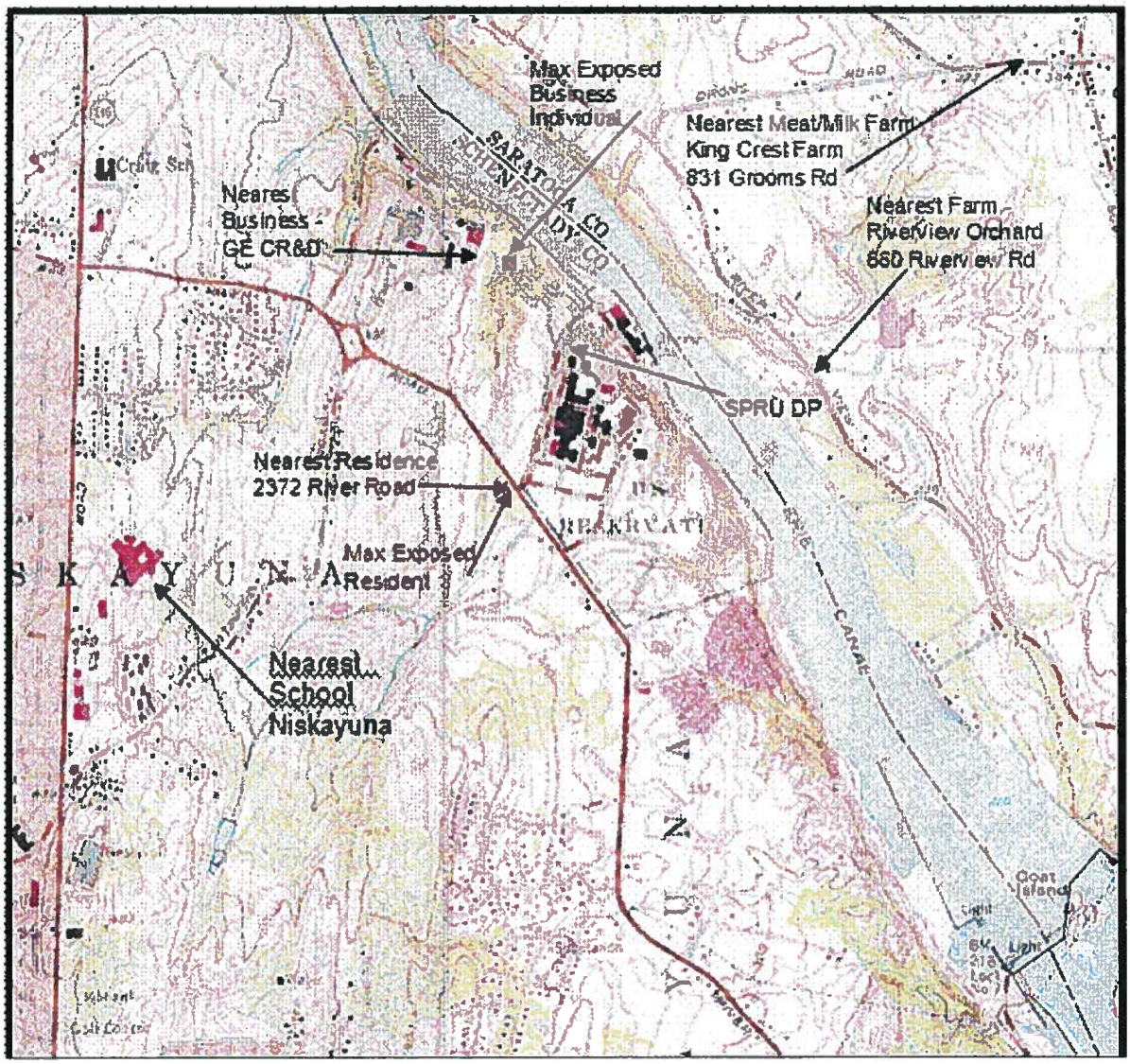
Attachment B

Meteorological Monitoring and Airborne Radionuclide Dispersion Modeling at SPRU-DP

Meteorological Monitoring and Airborne Radionuclide Dispersion Modeling at SPRU

All meteorological data are derived from the Knolls Atomic Power Laboratory (KAPL). The environs and key receptor locations are shown below in Figure B-1.

Figure B-1. Location of the SPRU-DP Relative to Adjacent Sites and Key Receptors



The KAPL meteorological program data from 1989-2004 were used to prepare prospective dose estimates for the planned activities associated with PVU operation. Appropriate annual meteorological datasets will be used for retrospective compliance reporting.

ATTACHMENT C

CAP88-PC Dose Runs Using SPRU-DP Source Terms

ATTACHMENT C-1

CAP88-PC Dose Runs Using SPRU-DP Source Term for E1/G1 Tunnels

C A P 8 8 - P C

Version 3.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 5, 2011 10:14 amm

Facility: SPRU DP
Address: 2425 River Road
City: Niskayuna
State: NY Zip: 12309

Source Category: E1G1 PVU
Source Type: Stack
Emission Year: 2011

Comments: E1G1 dose-to-curie source term
Appendix D plus abatement

Effective Dose Equivalent (mrem/year)
3.61E-05

At This Location: 540 Meters South Southwest

Dataset Name:
Dataset Date: 5/5/2011 9:46:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\knol890

May 5, 2011 10:14 amm
SYNOPSIS

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 540 Meters South Southwest
Lifetime Fatal Cancer Risk: 2.13E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
Adrenals	2.30E-05
B Surfac	5.24E-05
Breasts	1.85E-05
St Wall	2.20E-05
ULI Wall	2.40E-05
Kidneys	2.22E-05
Lungs	2.58E-05
Ovaries	2.34E-05
R Marrow	3.43E-05
Spleen	2.21E-05
Thymus	2.15E-05
Uterus	2.36E-05
Bld Wall	2.37E-05
Brain	1.94E-05
Esophagu	2.36E-05
SI Wall	2.30E-05
LLI Wall	2.88E-05
Liver	2.23E-05
Muscle	2.07E-05
Pancreas	2.35E-05
Skin	1.96E-05
Testes	2.07E-05
Thyroid	2.15E-05
EFFEC	3.61E-05

May 5, 2011 10:14 amm
SYNOPSIS

RADIONUCLIDE EMISSIONS DURING THE YEAR 2011

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
Cs-137	F	1	2.2E-06	2.2E-06
Ba-137m	M	1	2.2E-06	2.2E-06
Sr-90	M	1	1.1E-07	1.1E-07
Y-90	M	1	1.1E-07	1.1E-07
U-233	S	1	1.3E-07	1.3E-07
Ni-63	M	1	3.5E-09	3.5E-09
Pu-238	S	1	1.3E-09	1.3E-09
Pu-239	S	1	1.9E-09	1.9E-09
U-235	S	1	5.0E-09	5.0E-09
U-238	S	1	4.8E-09	4.8E-09
H-3	V	0	3.0E-10	3.0E-10
Tc-99	M	1	2.0E-10	2.0E-10
Am-241	M	1	7.0E-10	7.0E-10
Th-230	S	1	1.0E-10	1.0E-10
Th-232	S	1	1.0E-10	1.0E-10
Co-60	M	1	5.0E-10	5.0E-10
Pu-241	S	1	8.0E-10	8.0E-10

SITE INFORMATION

Temperature: 10 degrees C
Precipitation: 100 cm/y
Humidity: 8 g/cu m
Mixing Height: 1000 m

User specified location of max exposed individual.
(ILOC, JLOC): 8, 2

May 5, 2011 10:14 amm
SYNOPSIS

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 2.00
Diameter (m): 0.30

Plume Rise Momentum (m/s): 0.00
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.400	0.440
Fraction From Assessment Area:	0.300	0.600	0.560
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

470	540	620	650	700	720	730
900	930	1000	1120	1190	1300	1500
1720						

C A P 8 8 - P C

Version 3.0

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
May 5, 2011 10:14 amm

Facility: SPRU DP
Address: 2425 River Road
City: Niskayuna
State: NY Zip: 12309

Source Category: E1G1 PVU
Source Type: Stack
Emission Year: 2011

Comments: E1G1 dose-to-curie source term
Appendix D plus abatement

Dataset Name:
Dataset Date: 5/5/2011 9:46:00 AM
Wind File: . C:\Program Files\CAP88-PC30\WndFiles\knol8904.WND

May 5, 2011 10:14 amm

SUMMARY
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
Adrenals	2.30E-05
B Surfac	5.24E-05
Breasts	1.85E-05
St Wall	2.20E-05
ULI Wall	2.40E-05
Kidneys	2.22E-05
Lungs	2.58E-05
Ovaries	2.34E-05
R Marrow	3.43E-05
Spleen	2.21E-05
Thymus	2.15E-05
Uterus	2.36E-05
Bld Wall	2.37E-05
Brain	1.94E-05
Esophagu	2.36E-05
SI Wall	2.30E-05
LLI Wall	2.88E-05
Liver	2.23E-05
Muscle	2.07E-05
Pancreas	2.35E-05
Skin	1.96E-05
Testes	2.07E-05
Thyroid	2.15E-05
EFFEC	3.61E-05

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.37E-05
INHALATION	1.18E-05
AIR IMMERSION	1.88E-09
GROUND SURFACE	5.69E-07
INTERNAL	3.56E-05
EXTERNAL	5.71E-07
TOTAL	3.61E-05

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Page 2

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
Cs-137	2.16E-05
Ba-137m	5.62E-07
Sr-90	2.00E-06
Y-90	7.00E-09
U-233	1.08E-05
Th-229	0.00E+00
Ra-225	0.00E+00
Ac-225	0.00E+00
Fr-221	0.00E+00
Ni-63	1.40E-11
Pu-238	1.77E-07
U-234	0.00E+00
Th-230	0.00E+00
Ra-226	0.00E+00
Rn-222	0.00E+00
Po-218	0.00E+00
Pb-214	0.00E+00
Bi-214	0.00E+00
Po-214	0.00E+00
Pb-210	0.00E+00
At-218	0.00E+00
Pu-239	2.58E-07
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Th-227	0.00E+00
Ra-223	0.00E+00
Rn-219	0.00E+00
Po-215	0.00E+00
Pb-211	0.00E+00
Fr-223	0.00E+00
U-235	3.59E-07
U-238	3.27E-07
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
H-3	0.00E+00
Tc-99	0.00E+00
Th-232	0.00E+00
Ra-228	0.00E+00
Ac-228	0.00E+00
Th-228	0.00E+00
Ra-224	0.00E+00
Co-60	0.00E+00
Pu-241	0.00E+00
Am-241	0.00E+00
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
U-237	0.00E+00
TOTAL	3.61E-05

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Page 3

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
Esophagu	2.31E-13
Stomach	8.26E-13
Colon	2.46E-12
Liver	3.55E-13
LUNG	1.05E-11
Bone	7.01E-14
Skin	1.81E-14
Breast	6.92E-13
Ovary	2.83E-13
Bladder	5.90E-13
Kidneys	1.24E-13
Thyroid	5.66E-14
Leukemia	2.10E-12
Residual	3.02E-12
Total	2.13E-11
TOTAL	4.26E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.22E-11
INHALATION	8.84E-12
AIR IMMERSION	1.03E-15
GROUND SURFACE	3.03E-13
INTERNAL	2.10E-11
EXTERNAL	3.04E-13
TOTAL	2.13E-11

May 5, 2011 10:14 amm SUMMARY
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NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
Cs-137	1.10E-11
Ba-137m	3.03E-13
Sr-90	1.18E-12
Y-90	2.15E-15
U-233	8.09E-12
Th-229	0.00E+00
Ra-225	0.00E+00
Ac-225	0.00E+00
Fr-221	0.00E+00
Ni-63	1.09E-17
Pu-238	9.99E-14
U-234	0.00E+00
Th-230	0.00E+00
Ra-226	0.00E+00
Rn-222	0.00E+00
Po-218	0.00E+00
Pb-214	0.00E+00
Bi-214	0.00E+00
Po-214	0.00E+00
Pb-210	0.00E+00
At-218	0.00E+00
Pu-239	1.36E-13
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Th-227	0.00E+00
Ra-223	0.00E+00
Rn-219	0.00E+00
Po-215	0.00E+00
Pb-211	0.00E+00
Fr-223	0.00E+00
U-235	2.72E-13
U-238	2.47E-13
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
H-3	0.00E+00
Tc-99	0.00E+00
Th-232	0.00E+00
Ra-228	0.00E+00
Ac-228	0.00E+00
Th-228	0.00E+00
Ra-224	0.00E+00
Co-60	0.00E+00
Pu-241	0.00E+00
Am-241	0.00E+00
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
U-237	0.00E+00
TOTAL	2.13E-11

May 5, 2011 10:14 amn

SUMMARY
Page 5

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	470	540	620	650	700	720	730
N	4.2E-05	3.4E-05	2.8E-05	2.7E-05	2.4E-05	2.3E-05	2.3E-05
NNW	9.8E-05	7.7E-05	6.2E-05	5.7E-05	5.1E-05	4.9E-05	4.8E-05
NW	4.2E-05	3.4E-05	2.8E-05	2.6E-05	2.4E-05	2.3E-05	2.3E-05
WNW	2.9E-05	2.4E-05	2.1E-05	2.0E-05	1.8E-05	1.8E-05	1.7E-05
W	3.0E-05	2.5E-05	2.1E-05	2.0E-05	1.8E-05	1.8E-05	1.7E-05
WSW	2.9E-05	2.4E-05	2.0E-05	1.9E-05	1.8E-05	1.7E-05	1.7E-05
SW	3.1E-05	2.6E-05	2.2E-05	2.1E-05	1.9E-05	1.8E-05	1.8E-05
SSW	4.4E-05	3.6E-05	3.0E-05	2.8E-05	2.5E-05	2.4E-05	2.4E-05
S	5.5E-05	4.4E-05	3.6E-05	3.4E-05	3.0E-05	2.9E-05	2.9E-05
SSE	5.3E-05	4.3E-05	3.5E-05	3.3E-05	2.9E-05	2.8E-05	2.8E-05
SE	4.7E-05	3.8E-05	3.1E-05	2.9E-05	2.7E-05	2.6E-05	2.5E-05
ESE	5.7E-05	4.6E-05	3.7E-05	3.5E-05	3.2E-05	3.0E-05	3.0E-05
E	6.7E-05	5.4E-05	4.3E-05	4.0E-05	3.6E-05	3.5E-05	3.4E-05
ENE	4.0E-05	3.3E-05	2.7E-05	2.5E-05	2.3E-05	2.2E-05	2.2E-05
NE	3.5E-05	2.9E-05	2.4E-05	2.3E-05	2.1E-05	2.0E-05	2.0E-05
NNE	3.5E-05	2.9E-05	2.4E-05	2.3E-05	2.1E-05	2.0E-05	2.0E-05

	Distance (m)						
Direction	900	930	1000	1120	1190	1300	1500
N	1.8E-05	1.8E-05	1.6E-05	1.5E-05	1.4E-05	1.3E-05	1.2E-05
NNW	3.5E-05	3.3E-05	3.0E-05	2.6E-05	2.5E-05	2.2E-05	1.9E-05
NW	1.8E-05	1.7E-05	1.6E-05	1.5E-05	1.4E-05	1.3E-05	1.2E-05
WNW	1.4E-05	1.4E-05	1.3E-05	1.2E-05	1.2E-05	1.1E-05	1.1E-05
W	1.4E-05	1.4E-05	1.3E-05	1.2E-05	1.2E-05	1.1E-05	1.1E-05
WSW	1.4E-05	1.4E-05	1.3E-05	1.2E-05	1.2E-05	1.1E-05	1.1E-05
SW	1.5E-05	1.4E-05	1.4E-05	1.3E-05	1.2E-05	1.2E-05	1.1E-05
SSW	1.9E-05	1.8E-05	1.7E-05	1.5E-05	1.5E-05	1.4E-05	1.3E-05
S	2.2E-05	2.1E-05	1.9E-05	1.7E-05	1.7E-05	1.5E-05	1.4E-05
SSE	2.1E-05	2.1E-05	1.9E-05	1.7E-05	1.6E-05	1.5E-05	1.4E-05
SE	2.0E-05	1.9E-05	1.7E-05	1.6E-05	1.5E-05	1.4E-05	1.3E-05
ESE	2.3E-05	2.2E-05	2.0E-05	1.8E-05	1.7E-05	1.6E-05	1.4E-05
E	2.6E-05	2.5E-05	2.3E-05	2.0E-05	1.9E-05	1.7E-05	1.5E-05
ENE	1.7E-05	1.7E-05	1.6E-05	1.4E-05	1.4E-05	1.3E-05	1.2E-05
NE	1.6E-05	1.5E-05	1.4E-05	1.3E-05	1.3E-05	1.2E-05	1.1E-05
NNE	1.6E-05	1.5E-05	1.4E-05	1.3E-05	1.3E-05	1.2E-05	1.1E-05

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SUMMARY
Page 6

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)
Direction	1720
N	1.1E-05
NNW	1.7E-05
NW	1.1E-05
WNW	1.0E-05
W	1.0E-05
WSW	1.0E-05
SW	1.0E-05
SSW	1.2E-05
S	1.3E-05
SSE	1.2E-05
SE	1.2E-05
ESE	1.3E-05
E	1.4E-05
ENE	1.1E-05
NE	1.1E-05
NNE	1.1E-05

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SUMMARY
Page 7

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	470	540	620	650	700	720	730
N	2.5E-11	2.0E-11	1.6E-11	1.5E-11	1.4E-11	1.3E-11	1.3E-11
NNW	5.9E-11	4.7E-11	3.7E-11	3.4E-11	3.0E-11	2.9E-11	2.8E-11
NW	2.5E-11	2.0E-11	1.6E-11	1.5E-11	1.4E-11	1.3E-11	1.3E-11
WNW	1.7E-11	1.4E-11	1.2E-11	1.1E-11	1.0E-11	9.9E-12	9.7E-12
W	1.7E-11	1.4E-11	1.2E-11	1.1E-11	1.0E-11	1.0E-11	9.9E-12
WSW	1.7E-11	1.4E-11	1.2E-11	1.1E-11	1.0E-11	9.8E-12	9.7E-12
SW	1.8E-11	1.5E-11	1.3E-11	1.2E-11	1.1E-11	1.0E-11	1.0E-11
SSW	2.6E-11	2.1E-11	1.7E-11	1.6E-11	1.5E-11	1.4E-11	1.4E-11
S	3.3E-11	2.6E-11	2.1E-11	2.0E-11	1.8E-11	1.7E-11	1.7E-11
SSE	3.2E-11	2.6E-11	2.1E-11	1.9E-11	1.7E-11	1.7E-11	1.6E-11
SE	2.8E-11	2.3E-11	1.8E-11	1.7E-11	1.5E-11	1.5E-11	1.5E-11
ESE	3.4E-11	2.7E-11	2.2E-11	2.1E-11	1.8E-11	1.8E-11	1.7E-11
E	4.0E-11	3.2E-11	2.6E-11	2.4E-11	2.1E-11	2.0E-11	2.0E-11
ENE	2.4E-11	1.9E-11	1.6E-11	1.5E-11	1.3E-11	1.3E-11	1.3E-11
NE	2.1E-11	1.7E-11	1.4E-11	1.3E-11	1.2E-11	1.2E-11	1.1E-11
NNE	2.1E-11	1.7E-11	1.4E-11	1.3E-11	1.2E-11	1.2E-11	1.1E-11

	Distance (m)						
Direction	900	930	1000	1120	1190	1300	1500
N	1.0E-11	9.9E-12	9.2E-12	8.3E-12	7.9E-12	7.4E-12	6.7E-12
NNW	2.1E-11	2.0E-11	1.8E-11	1.5E-11	1.4E-11	1.3E-11	1.1E-11
NW	1.0E-11	9.8E-12	9.1E-12	8.2E-12	7.8E-12	7.3E-12	6.6E-12
WNW	7.9E-12	7.7E-12	7.2E-12	6.6E-12	6.4E-12	6.1E-12	5.6E-12
W	8.0E-12	7.7E-12	7.3E-12	6.7E-12	6.4E-12	6.1E-12	5.7E-12
WSW	7.8E-12	7.6E-12	7.1E-12	6.6E-12	6.4E-12	6.0E-12	5.6E-12
SW	8.3E-12	8.0E-12	7.5E-12	6.9E-12	6.6E-12	6.3E-12	5.8E-12
SSW	1.1E-11	1.0E-11	9.5E-12	8.6E-12	8.1E-12	7.6E-12	6.8E-12
S	1.3E-11	1.2E-11	1.1E-11	9.8E-12	9.3E-12	8.6E-12	7.6E-12
SSE	1.2E-11	1.2E-11	1.1E-11	9.6E-12	9.1E-12	8.4E-12	7.4E-12
SE	1.1E-11	1.1E-11	9.9E-12	8.9E-12	8.4E-12	7.8E-12	7.0E-12
ESE	1.3E-11	1.3E-11	1.2E-11	1.0E-11	9.7E-12	8.9E-12	7.9E-12
E	1.5E-11	1.4E-11	1.3E-11	1.1E-11	1.1E-11	9.8E-12	8.6E-12
ENE	9.9E-12	9.5E-12	8.8E-12	8.0E-12	7.6E-12	7.1E-12	6.5E-12
NE	8.9E-12	8.7E-12	8.1E-12	7.4E-12	7.0E-12	6.6E-12	6.1E-12
NNE	8.9E-12	8.6E-12	8.0E-12	7.3E-12	7.0E-12	6.6E-12	6.1E-12

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SUMMARY
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INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)
Direction	1720
N	6.1E-12
NNW	9.5E-12
NW	6.1E-12
WNW	5.3E-12
W	5.3E-12
WSW	5.3E-12
SW	5.5E-12
SSW	6.3E-12
S	6.9E-12
SSE	6.8E-12
SE	6.4E-12
ESE	7.1E-12
E	7.7E-12
ENE	6.0E-12
NE	5.7E-12
NNE	5.6E-12

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Clean Air Act Assessment Package - 1988

W E A T H E R D A T A

Non-Radon Individual Assessment
May 5, 2011 10:14 amm

Facility: SPRU DP
Address: 2425 River Road
City: Niskayuna
State: NY Zip: 12309

Source Category: E1G1 PVU
Source Type: Stack
Emission Year: 2011

Comments: E1G1 dose-to-curie source term
Appendix D plus abatement

Dataset Name:
Dataset Date: 5/5/2011 9:46:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\knoi8904.WND

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WEATHER
Page 1

HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class							
Dir	A	B	C	D	E	F	G	Wind Freq
N	1.428	1.768	1.898	1.971	1.042	0.663	0.000	0.097
NNW	1.539	1.808	2.332	2.139	1.073	0.711	0.000	0.130
NW	1.387	1.444	1.400	1.248	0.838	0.702	0.000	0.044
WNW	1.303	1.365	1.193	0.882	0.701	0.563	0.000	0.027
W	1.143	1.134	0.909	0.792	0.631	0.613	0.000	0.022
WSW	1.149	1.078	1.033	0.913	0.666	0.615	0.000	0.021
SW	1.297	1.372	1.445	1.322	0.938	0.660	0.000	0.038
SSW	1.380	1.712	1.779	1.961	1.135	0.820	0.000	0.069
S	1.297	1.420	1.398	1.357	1.035	0.782	0.000	0.057
SSE	1.433	1.539	1.555	1.374	0.981	0.715	0.000	0.050
SE	1.628	2.068	2.500	2.116	1.082	0.700	0.000	0.068
ESE	1.911	2.708	3.690	3.554	1.425	0.785	0.000	0.190
E	1.735	2.592	3.292	2.957	1.308	0.750	0.000	0.101
ENE	1.599	1.833	2.230	1.635	0.909	0.676	0.000	0.035
NE	1.459	1.806	1.810	1.199	0.918	0.643	0.000	0.026
NNE	1.425	1.590	1.218	1.003	0.820	0.615	0.000	0.027

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	1.774	2.251	2.847	3.130	1.528	0.914	0.000
NNW	1.839	2.323	3.177	3.125	1.554	1.041	0.000
NW	1.660	1.934	2.060	2.160	1.306	1.019	0.000
WNW	1.540	1.674	1.659	1.606	1.167	0.812	0.000
W	1.341	1.436	1.368	1.404	1.009	0.861	0.000
WSW	1.356	1.451	1.653	1.896	1.049	0.842	0.000
SW	1.554	1.873	2.212	2.446	1.450	0.944	0.000
SSW	1.660	2.264	2.866	3.155	1.640	1.154	0.000
S	1.585	1.991	2.311	2.474	1.576	1.146	0.000
SSE	1.666	2.145	2.544	2.218	1.399	1.023	0.000
SE	1.912	2.639	3.548	3.315	1.506	0.980	0.000
ESE	2.130	3.077	4.303	4.520	1.921	1.146	0.000
E	2.026	2.952	4.182	4.253	1.831	1.125	0.000
ENE	1.913	2.527	3.687	3.035	1.430	0.981	0.000
NE	1.794	2.398	3.034	2.335	1.396	0.891	0.000
NNE	1.715	2.187	2.104	1.884	1.270	0.822	0.000

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WEATHER
Page 2

FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	0.0166	0.0272	0.0957	0.3246	0.1128	0.0496	0.0000
NNW	0.0545	0.0977	0.3024	0.6829	0.1892	0.1114	0.0000
NW	0.1726	0.1982	0.2801	0.3102	0.1571	0.1343	0.0000
WNW	0.3168	0.2595	0.2241	0.1501	0.1260	0.1430	0.0000
W	0.3407	0.2808	0.1912	0.1379	0.1484	0.2055	0.0000
WSW	0.3033	0.2154	0.1907	0.1714	0.1769	0.2088	0.0000
SW	0.1651	0.1754	0.1730	0.1833	0.1429	0.1270	0.0000
SSW	0.0990	0.1235	0.1747	0.2745	0.1366	0.1343	0.0000
S	0.1012	0.1067	0.1444	0.3154	0.2270	0.2020	0.0000
SSE	0.0900	0.0926	0.1268	0.3648	0.2827	0.1904	0.0000
SE	0.0595	0.0805	0.1347	0.3520	0.1984	0.1184	0.0000
ESE	0.0221	0.0672	0.1973	0.4392	0.0981	0.0398	0.0000
E	0.0493	0.0984	0.3142	0.7300	0.1996	0.1051	0.0000
ENE	0.0573	0.0792	0.1773	0.3875	0.2655	0.1989	0.0000
NE	0.0593	0.0815	0.1454	0.2847	0.2817	0.2338	0.0000
NNE	0.0495	0.0546	0.0897	0.2538	0.2790	0.2020	0.0000
TOTAL	0.0798	0.1019	0.1989	0.4155	0.1711	0.1176	0.0000

ADDITIONAL WEATHER INFORMATION

Average Air Temperature: 10.0 degrees C
283.16 K
Precipitation: 100.0 cm/y
Humidity: 8.0 g/cu m
Lid Height: 1000 meters
Surface Roughness Length: 0.010 meters
Height Of Wind Measurements: 10.0 meters
Average Wind Speed: 2.660 m/s

Vertical Temperature Gradients:
STABILITY E 0.073 k/m
STABILITY F 0.109 k/m
STABILITY G 0.146 k/m

ATTACHMENT C-2

CAP88-PC Dose Runs Using SPRU-DP Source Term for Buildings G2 & H2

C A P 8 8 - P C

Version 3.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 5, 2011 11:59 amm

Facility: SPRU DP
Address: 2425 River Road
City: Niskayuna
State: NY Zip: 12309

Source Category: G2 & H2 for PVU
Source Type: Stack
Emission Year: 2011

Comments: REC-10-012 G2 & H2 source term
Appendix D plus abatement

Effective Dose Equivalent (mrem/year)
4.33E-04

At This Location: 540 Meters South Southwest

Dataset Name:
Dataset Date: 5/5/2011 11:59:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\knol890

May 5, 2011 11:59 amm

SYNOPSIS
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 540 Meters South Southwest
Lifetime Fatal Cancer Risk: 1.98E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
Adrenals	1.33E-04
B Surfac	8.82E-04
Breasts	1.08E-04
St Wall	1.28E-04
ULI Wall	1.43E-04
Kidneys	1.29E-04
Lungs	1.79E-04
Ovaries	1.40E-04
R Marrow	3.45E-04
Spleen	1.29E-04
Thymus	1.25E-04
Uterus	1.37E-04
Bld Wall	1.39E-04
Brain	1.13E-04
Esophagu	1.48E-04
SI Wall	1.34E-04
LLI Wall	1.83E-04
Liver	1.65E-04
Muscle	1.20E-04
Pancreas	1.37E-04
Skin	1.20E-04
Testes	1.25E-04
Thyroid	1.25E-04
EFFEC	4.33E-04

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Page 2

RADIONUCLIDE EMISSIONS DURING THE YEAR 2011

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
Cs-137	F	1	1.3E-05	1.3E-05
Ba-137m	M	1	1.3E-05	1.3E-05
Sr-90	M	1	1.8E-06	1.8E-06
Y-90	M	1	1.8E-06	1.8E-06
Pu-239	S	1	1.4E-06	1.4E-06
Am-241	M	1	2.0E-07	2.0E-07

SITE INFORMATION

Temperature: 10 degrees C
Precipitation: 100 cm/y
Humidity: 8 g/cu m
Mixing Height: 1000 m

User specified location of max exposed individual.
(ILOC, JLOC): 8, 2

May 5, 2011 11:59 amm

SYNOPSIS
Page 3

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 2.00
Diameter (m): 0.30

Plume Rise Momentum (m/s): 0.00
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.400	0.440
Fraction From Assessment Area:	0.300	0.600	0.560
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

470	540	620	650	700	720	730
900	930	1000	1120	1190	1300	1500
1720						

C A P 8 8 - P C

Version 3.0

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
May 5, 2011 11:59 amm

Facility: SPRU DP
Address: 2425 River Road
City: Niskayuna
State: NY Zip: 12309

Source Category: G2 & H2 for PVU
Source Type: Stack
Emission Year: 2011

Comments: REC-10-012 G2 & H2 source term
Appendix D plus abatement

Dataset Name:
Dataset Date: 5/5/2011 11:59:00 AM
Wind File: . C:\Program Files\CAP88-PC30\WndFiles\knol8904.WND

May 5, 2011 11:59 amm SUMMARY
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
Adrenals	1.33E-04
B Surfac	8.82E-04
Breasts	1.08E-04
St Wall	1.28E-04
ULI Wall	1.43E-04
Kidneys	1.29E-04
Lungs	1.79E-04
Ovaries	1.40E-04
R Marrow	3.45E-04
Spleen	1.29E-04
Thymus	1.25E-04
Uterus	1.37E-04
Bld Wall	1.39E-04
Brain	1.13E-04
Esophagu	1.48E-04
SI Wall	1.34E-04
LLI Wall	1.83E-04
Liver	1.65E-04
Muscle	1.20E-04
Pancreas	1.37E-04
Skin	1.20E-04
Testes	1.25E-04
Thyroid	1.25E-04
EFFEC	4.33E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.68E-04
INHALATION	2.62E-04
AIR IMMERSION	1.09E-08
GROUND SURFACE	3.35E-06
INTERNAL	4.30E-04
EXTERNAL	3.36E-06
TOTAL	4.33E-04

May 5, 2011 11:59 amm

SUMMARY
Page 2

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
Cs-137	1.25E-04
Ba-137m	3.24E-06
Sr-90	3.27E-05
Y-90	1.15E-07
Pu-239	2.00E-04
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Am-241	7.19E-05
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
Th-229	0.00E+00
TOTAL	4.33E-04

May 5, 2011 11:59 amm

SUMMARY
Page 3

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
Esophagu	1.40E-12
Stomach	4.93E-12
Colon	1.63E-11
Liver	8.59E-12
LUNG	1.11E-10
Bone	3.69E-12
Skin	1.14E-13
Breast	4.10E-12
Ovary	2.37E-12
Bladder	3.58E-12
Kidneys	7.76E-13
Thyroid	3.39E-13
Leukemia	2.23E-11
Residual	1.80E-11
Total	1.98E-10
TOTAL	3.95E-10

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	8.36E-11
INHALATION	1.12E-10
AIR IMMERSION	5.93E-15
GROUND SURFACE	1.76E-12
INTERNAL	1.96E-10
EXTERNAL	1.77E-12
TOTAL	1.98E-10

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SUMMARY
Page 4

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
Cs-137	6.34E-11
Ba-137m	1.75E-12
Sr-90	1.93E-11
Y-90	3.51E-14
Pu-239	1.02E-10
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Am-241	1.13E-11
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
Th-229	0.00E+00
TOTAL	1.98E-10

May 5, 2011 11:59 amm

SUMMARY
Page 5

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	470	540	620	650	700	720	730
N	5.1E-04	4.1E-04	3.3E-04	3.0E-04	2.7E-04	2.6E-04	2.5E-04
NNW	1.3E-03	9.9E-04	7.8E-04	7.1E-04	6.3E-04	6.0E-04	5.8E-04
NW	5.1E-04	4.0E-04	3.2E-04	3.0E-04	2.7E-04	2.6E-04	2.5E-04
WNW	3.4E-04	2.7E-04	2.2E-04	2.1E-04	1.9E-04	1.8E-04	1.8E-04
W	3.5E-04	2.8E-04	2.3E-04	2.1E-04	1.9E-04	1.8E-04	1.8E-04
WSW	3.4E-04	2.7E-04	2.2E-04	2.1E-04	1.9E-04	1.8E-04	1.8E-04
SW	3.7E-04	3.0E-04	2.4E-04	2.2E-04	2.0E-04	1.9E-04	1.9E-04
SSW	5.5E-04	4.3E-04	3.5E-04	3.2E-04	2.9E-04	2.7E-04	2.7E-04
S	6.9E-04	5.5E-04	4.3E-04	4.0E-04	3.5E-04	3.4E-04	3.3E-04
SSE	6.7E-04	5.3E-04	4.2E-04	3.9E-04	3.4E-04	3.3E-04	3.2E-04
SE	5.8E-04	4.6E-04	3.7E-04	3.4E-04	3.0E-04	2.9E-04	2.8E-04
ESE	7.2E-04	5.7E-04	4.5E-04	4.2E-04	3.7E-04	3.5E-04	3.5E-04
E	8.5E-04	6.7E-04	5.3E-04	4.9E-04	4.3E-04	4.1E-04	4.0E-04
ENE	4.9E-04	3.9E-04	3.1E-04	2.9E-04	2.6E-04	2.5E-04	2.4E-04
NE	4.3E-04	3.4E-04	2.7E-04	2.5E-04	2.3E-04	2.2E-04	2.1E-04
NNE	4.3E-04	3.4E-04	2.7E-04	2.5E-04	2.3E-04	2.2E-04	2.1E-04

	Distance (m)						
Direction	900	930	1000	1120	1190	1300	1500
N	1.9E-04	1.8E-04	1.6E-04	1.5E-04	1.4E-04	1.2E-04	1.1E-04
NNW	4.1E-04	3.9E-04	3.5E-04	3.0E-04	2.7E-04	2.4E-04	2.0E-04
NW	1.9E-04	1.8E-04	1.6E-04	1.4E-04	1.3E-04	1.2E-04	1.1E-04
WNW	1.4E-04	1.3E-04	1.2E-04	1.1E-04	1.0E-04	9.6E-05	8.7E-05
W	1.4E-04	1.3E-04	1.2E-04	1.1E-04	1.0E-04	9.7E-05	8.8E-05
WSW	1.4E-04	1.3E-04	1.2E-04	1.1E-04	1.0E-04	9.6E-05	8.7E-05
SW	1.5E-04	1.4E-04	1.3E-04	1.2E-04	1.1E-04	1.0E-04	9.1E-05
SSW	2.0E-04	1.9E-04	1.7E-04	1.5E-04	1.4E-04	1.3E-04	1.1E-04
S	2.4E-04	2.3E-04	2.1E-04	1.8E-04	1.7E-04	1.5E-04	1.3E-04
SSE	2.3E-04	2.2E-04	2.0E-04	1.7E-04	1.6E-04	1.5E-04	1.3E-04
SE	2.1E-04	2.0E-04	1.8E-04	1.6E-04	1.5E-04	1.3E-04	1.2E-04
ESE	2.5E-04	2.4E-04	2.2E-04	1.9E-04	1.8E-04	1.6E-04	1.4E-04
E	2.9E-04	2.8E-04	2.5E-04	2.1E-04	2.0E-04	1.8E-04	1.5E-04
ENE	1.8E-04	1.7E-04	1.6E-04	1.4E-04	1.3E-04	1.2E-04	1.1E-04
NE	1.6E-04	1.5E-04	1.4E-04	1.3E-04	1.2E-04	1.1E-04	9.7E-05
NNE	1.6E-04	1.5E-04	1.4E-04	1.3E-04	1.2E-04	1.1E-04	9.7E-05

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INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)
Direction	1720
N	9.8E-05
NNW	1.7E-04
NW	9.6E-05
WNW	8.0E-05
W	8.0E-05
WSW	8.0E-05
SW	8.3E-05
SSW	1.0E-04
S	1.1E-04
SSE	1.1E-04
SE	1.0E-04
ESE	1.2E-04
E	1.3E-04
ENE	9.5E-05
NE	8.8E-05
NNE	8.8E-05

May 5, 2011 11:59 amm SUMMARY
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INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	470	540	620	650	700	720	730
N	2.3E-10	1.9E-10	1.5E-10	1.4E-10	1.2E-10	1.2E-10	1.2E-10
NNW	5.7E-10	4.5E-10	3.5E-10	3.2E-10	2.9E-10	2.7E-10	2.7E-10
NW	2.3E-10	1.8E-10	1.5E-10	1.4E-10	1.2E-10	1.2E-10	1.2E-10
WNW	1.6E-10	1.3E-10	1.0E-10	9.7E-11	8.7E-11	8.4E-11	8.3E-11
W	1.6E-10	1.3E-10	1.1E-10	9.8E-11	8.9E-11	8.6E-11	8.4E-11
WSW	1.6E-10	1.3E-10	1.0E-10	9.6E-11	8.7E-11	8.4E-11	8.2E-11
SW	1.7E-10	1.4E-10	1.1E-10	1.0E-10	9.4E-11	9.0E-11	8.9E-11
SSW	2.5E-10	2.0E-10	1.6E-10	1.5E-10	1.3E-10	1.3E-10	1.2E-10
S	3.1E-10	2.5E-10	2.0E-10	1.8E-10	1.6E-10	1.6E-10	1.5E-10
SSE	3.0E-10	2.4E-10	1.9E-10	1.8E-10	1.6E-10	1.5E-10	1.5E-10
SE	2.6E-10	2.1E-10	1.7E-10	1.6E-10	1.4E-10	1.3E-10	1.3E-10
ESE	3.2E-10	2.6E-10	2.0E-10	1.9E-10	1.7E-10	1.6E-10	1.6E-10
E	3.9E-10	3.0E-10	2.4E-10	2.2E-10	2.0E-10	1.9E-10	1.8E-10
ENE	2.2E-10	1.8E-10	1.4E-10	1.3E-10	1.2E-10	1.1E-10	1.1E-10
NE	1.9E-10	1.6E-10	1.3E-10	1.2E-10	1.1E-10	1.0E-10	9.9E-11
NNE	1.9E-10	1.6E-10	1.3E-10	1.2E-10	1.0E-10	1.0E-10	9.9E-11

	Distance (m)						
Direction	900	930	1000	1120	1190	1300	1500
N	8.8E-11	8.4E-11	7.7E-11	6.8E-11	6.4E-11	5.9E-11	5.2E-11
NNW	1.9E-10	1.8E-10	1.6E-10	1.4E-10	1.3E-10	1.1E-10	9.4E-11
NW	8.7E-11	8.3E-11	7.6E-11	6.7E-11	6.3E-11	5.8E-11	5.2E-11
WNW	6.4E-11	6.2E-11	5.8E-11	5.2E-11	5.0E-11	4.6E-11	4.2E-11
W	6.5E-11	6.3E-11	5.8E-11	5.3E-11	5.0E-11	4.7E-11	4.3E-11
WSW	6.4E-11	6.2E-11	5.7E-11	5.2E-11	4.9E-11	4.6E-11	4.2E-11
SW	6.8E-11	6.6E-11	6.1E-11	5.5E-11	5.2E-11	4.9E-11	4.4E-11
SSW	9.2E-11	8.8E-11	8.0E-11	7.1E-11	6.7E-11	6.1E-11	5.4E-11
S	1.1E-10	1.1E-10	9.6E-11	8.4E-11	7.8E-11	7.1E-11	6.1E-11
SSE	1.1E-10	1.0E-10	9.3E-11	8.2E-11	7.6E-11	6.9E-11	6.0E-11
SE	9.7E-11	9.2E-11	8.4E-11	7.4E-11	7.0E-11	6.4E-11	5.6E-11
ESE	1.2E-10	1.1E-10	1.0E-10	8.8E-11	8.2E-11	7.4E-11	6.4E-11
E	1.3E-10	1.3E-10	1.1E-10	9.9E-11	9.2E-11	8.3E-11	7.1E-11
ENE	8.4E-11	8.1E-11	7.4E-11	6.6E-11	6.2E-11	5.7E-11	5.0E-11
NE	7.5E-11	7.2E-11	6.6E-11	6.0E-11	5.6E-11	5.2E-11	4.7E-11
NNE	7.5E-11	7.2E-11	6.6E-11	5.9E-11	5.6E-11	5.2E-11	4.7E-11

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SUMMARY
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INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)
Direction	1720
N	4.7E-11
NNW	8.0E-11
NW	4.7E-11
WNW	3.9E-11
W	3.9E-11
WSW	3.9E-11
SW	4.1E-11
SSW	4.8E-11
S	5.4E-11
SSE	5.3E-11
SE	5.0E-11
ESE	5.7E-11
E	6.2E-11
ENE	4.6E-11
NE	4.3E-11
NNE	4.3E-11

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Clean Air Act Assessment Package - 1988

W E A T H E R D A T A

Non-Radon Individual Assessment
May 5, 2011 11:59 amm

Facility: SPRU DP
Address: 2425 River Road
City: Niskayuna
State: NY Zip: 12309

Source Category: G2 & H2 for PVU
Source Type: Stack
Emission Year: 2011

Comments: REC-10-012 G2 & H2 source term
Appendix D plus abatement

Dataset Name:
Dataset Date: 5/5/2011 11:59:00 AM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\knol8904.WND

May 5, 2011 11:59 amm

WEATHER
Page 1

HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class							
Dir	A	B	C	D	E	F	G	Wind Freq
N	1.428	1.768	1.898	1.971	1.042	0.663	0.000	0.097
NNW	1.539	1.808	2.332	2.139	1.073	0.711	0.000	0.130
NW	1.387	1.444	1.400	1.248	0.838	0.702	0.000	0.044
WNW	1.303	1.365	1.193	0.882	0.701	0.563	0.000	0.027
W	1.143	1.134	0.909	0.792	0.631	0.613	0.000	0.022
WSW	1.149	1.078	1.033	0.913	0.666	0.615	0.000	0.021
SW	1.297	1.372	1.445	1.322	0.938	0.660	0.000	0.038
SSW	1.380	1.712	1.779	1.961	1.135	0.820	0.000	0.068
S	1.297	1.420	1.398	1.357	1.035	0.782	0.000	0.057
SSE	1.433	1.539	1.555	1.374	0.981	0.715	0.000	0.050
SE	1.628	2.068	2.500	2.116	1.082	0.700	0.000	0.068
ESE	1.911	2.708	3.690	3.554	1.425	0.785	0.000	0.190
E	1.735	2.592	3.292	2.957	1.308	0.750	0.000	0.101
ENE	1.599	1.833	2.230	1.635	0.909	0.676	0.000	0.035
NE	1.459	1.806	1.810	1.199	0.918	0.643	0.000	0.026
NNE	1.425	1.590	1.218	1.003	0.820	0.615	0.000	0.027

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	1.774	2.251	2.847	3.130	1.528	0.914	0.000
NNW	1.839	2.323	3.177	3.125	1.554	1.041	0.000
NW	1.660	1.934	2.060	2.160	1.306	1.019	0.000
WNW	1.540	1.674	1.659	1.606	1.167	0.812	0.000
W	1.341	1.436	1.368	1.404	1.009	0.861	0.000
WSW	1.356	1.451	1.653	1.896	1.049	0.842	0.000
SW	1.554	1.873	2.212	2.446	1.450	0.944	0.000
SSW	1.660	2.264	2.866	3.155	1.640	1.154	0.000
S	1.585	1.991	2.311	2.474	1.576	1.146	0.000
SSE	1.666	2.145	2.544	2.218	1.399	1.023	0.000
SE	1.912	2.639	3.548	3.315	1.506	0.980	0.000
ESE	2.130	3.077	4.303	4.520	1.921	1.146	0.000
E	2.026	2.952	4.182	4.253	1.831	1.125	0.000
ENE	1.913	2.527	3.687	3.035	1.430	0.981	0.000
NE	1.794	2.398	3.034	2.335	1.396	0.891	0.000
NNE	1.715	2.187	2.104	1.884	1.270	0.822	0.000

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WEATHER
Page 2

FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	0.0166	0.0272	0.0957	0.3246	0.1128	0.0496	0.0000
NNW	0.0545	0.0977	0.3024	0.6829	0.1892	0.1114	0.0000
NW	0.1726	0.1982	0.2801	0.3102	0.1571	0.1343	0.0000
WNW	0.3168	0.2595	0.2241	0.1501	0.1260	0.1430	0.0000
W	0.3407	0.2808	0.1912	0.1379	0.1484	0.2055	0.0000
WSW	0.3033	0.2154	0.1907	0.1714	0.1769	0.2088	0.0000
SW	0.1651	0.1754	0.1730	0.1833	0.1429	0.1270	0.0000
SSW	0.0990	0.1235	0.1747	0.2745	0.1366	0.1343	0.0000
S	0.1012	0.1067	0.1444	0.3154	0.2270	0.2020	0.0000
SSE	0.0900	0.0926	0.1268	0.3648	0.2827	0.1904	0.0000
SE	0.0595	0.0805	0.1347	0.3520	0.1984	0.1184	0.0000
ESE	0.0221	0.0672	0.1973	0.4392	0.0981	0.0398	0.0000
E	0.0493	0.0984	0.3142	0.7300	0.1996	0.1051	0.0000
ENE	0.0573	0.0792	0.1773	0.3875	0.2655	0.1989	0.0000
NE	0.0593	0.0815	0.1454	0.2847	0.2817	0.2338	0.0000
NNE	0.0495	0.0546	0.0897	0.2538	0.2790	0.2020	0.0000
TOTAL	0.0798	0.1019	0.1989	0.4155	0.1711	0.1176	0.0000

ADDITIONAL WEATHER INFORMATION

Average Air Temperature: 10.0 degrees C
283.16 K
Precipitation: 100.0 cm/y
Humidity: 8.0 g/cu m
Lid Height: 1000 meters
Surface Roughness Length: 0.010 meters
Height Of Wind Measurements: 10.0 meters
Average Wind Speed: 2.660 m/s

Vertical Temperature Gradients:
STABILITY E 0.073 k/m
STABILITY F 0.109 k/m
STABILITY G 0.146 k/m

ATTACHMENT C-3

CAP88-PC Dose Runs Using SPRU-DP Source Term for Sludge and Tank Farm

C A P 8 8 - P C

Version 3.0

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Individual Assessment
May 5, 2011 12:58 pmm

Facility: SPRU DP
Address: 2425 River Road
City: Nishkayuna
State: NY Zip: 12309

Source Category: Sludge and Tank Farm
Source Type: Stack
Emission Year: 2011

Comments: SLudge and vault D&D via PVU
Appendix D with abatement

Effective Dose Equivalent (mrem/year)
1.12E-03

At This Location: 540 Meters South Southwest

Dataset Name:
Dataset Date: 5/5/2011 12:32:00 PM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\knol890

May 5, 2011 12:58 pmm

SYNOPSIS
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 540 Meters South Southwest
Lifetime Fatal Cancer Risk: 5.22E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
Adrenals	2.81E-04
B Surfac	3.68E-03
Breasts	2.28E-04
St Wall	2.71E-04
ULI Wall	3.24E-04
Kidneys	2.73E-04
Lungs	4.07E-04
Ovaries	2.97E-04
R Marrow	1.49E-03
Spleen	2.71E-04
Thymus	2.64E-04
Uterus	2.89E-04
Bld Wall	2.96E-04
Brain	2.38E-04
Esophagu	3.20E-04
SI Wall	2.84E-04
LLI Wall	4.76E-04
Liver	3.59E-04
Muscle	2.54E-04
Pancreas	2.88E-04
Skin	2.85E-04
Testes	2.65E-04
Thyroid	2.64E-04
EFFEC	1.12E-03

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SYNOPSIS
Page 2

RADIONUCLIDE EMISSIONS DURING THE YEAR 2011

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
Cs-137	F	1	2.6E-05	2.6E-05
Ba-137m	M	1	2.6E-05	2.6E-05
Sr-90	M	1	1.0E-05	1.0E-05
Y-90	M	1	1.0E-05	1.0E-05
Pu-239	S	1	3.4E-06	3.4E-06
Am-241	M	1	5.0E-07	5.0E-07

SITE INFORMATION

Temperature:	10 degrees C
Precipitation:	100 cm/y
Humidity:	8 g/cu m
Mixing Height:	1000 m

User specified location of max exposed individual.
(ILOC, JLOC): 8, 2

May 5, 2011 12:58 pmm

SYNOPSIS
Page 3

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 2.00
Diameter (m): 0.30

Plume Rise Momentum (m/s): 0.00
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.400	0.440
Fraction From Assessment Area:	0.300	0.600	0.560
Fraction Imported:	0.000	0.000	0.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES (M) USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

470	540	620	650	700	720	730
900	930	1000	1120	1190	1300	1500
1720						

C A P 8 8 - P C

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Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
May 5, 2011 12:58 pmn

Facility: SPRU DP
Address: 2425 River Road
City: Nishkayuna
State: NY Zip: 12309

Source Category: Sludge and Tank Farm
Source Type: Stack
Emission Year: 2011

Comments: SLudge and vault D&D via PVU
Appendix D with abatement

Dataset Name:
Dataset Date: 5/5/2011 12:32:00 PM
Wind File: . C:\Program Files\CAP88-PC30\WndFiles\knol8904.WND

May 5, 2011 12:58 pmm SUMMARY
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
Adrenals	2.81E-04
B Surfac	3.68E-03
Breasts	2.28E-04
St Wall	2.71E-04
ULI Wall	3.24E-04
Kidneys	2.73E-04
Lungs	4.07E-04
Ovaries	2.97E-04
R Marrow	1.49E-03
Spleen	2.71E-04
Thymus	2.64E-04
Uterus	2.89E-04
Bld Wall	2.96E-04
Brain	2.38E-04
Esophagu	3.20E-04
SI Wall	2.84E-04
LLI Wall	4.76E-04
Liver	3.59E-04
Muscle	2.54E-04
Pancreas	2.88E-04
Skin	2.85E-04
Testes	2.65E-04
Thyroid	2.64E-04
EFFEC	1.12E-03

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	4.71E-04
INHALATION	6.44E-04
AIR IMMERSION	2.30E-08
GROUND SURFACE	7.33E-06
INTERNAL	1.11E-03
EXTERNAL	7.35E-06
TOTAL	1.12E-03

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SUMMARY
Page 2

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
Cs-137	2.61E-04
Ba-137m	6.77E-06
Sr-90	1.87E-04
Y-90	6.55E-07
Pu-239	4.87E-04
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Am-241	1.80E-04
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
Th-229	0.00E+00
TOTAL	1.12E-03

May 5, 2011 12:58 pmm SUMMARY
Page 3

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
Esophagu	2.98E-12
Stomach	1.06E-11
Colon	4.37E-11
Liver	2.04E-11
LUNG	2.69E-10
Bone	1.13E-11
Skin	2.77E-13
Breast	8.83E-12
Ovary	5.29E-12
Bladder	7.73E-12
Kidneys	1.68E-12
Thyroid	7.27E-13
Leukemia	1.02E-10
Residual	3.84E-11
Total	5.22E-10
TOTAL	1.04E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.43E-10
INHALATION	2.75E-10
AIR IMMERSION	1.24E-14
GROUND SURFACE	3.71E-12
INTERNAL	5.18E-10
EXTERNAL	3.73E-12
TOTAL	5.22E-10

May 5, 2011 12:59 pmm

SUMMARY
Page 4

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
Cs-137	1.32E-10
Ba-137m	3.65E-12
Sr-90	1.10E-10
Y-90	2.01E-13
Pu-239	2.47E-10
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Am-241	2.83E-11
Np-237	0.00E+00
Pa-233	0.00E+00
U-233	0.00E+00
Th-229	0.00E+00
TOTAL	5.22E-10

May 5, 2011 12:58 pmm

SUMMARY
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INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	470	540	620	650	700	720	730
N	1.3E-03	1.1E-03	8.5E-04	7.9E-04	7.0E-04	6.8E-04	6.6E-04
NNW	3.3E-03	2.5E-03	2.0E-03	1.8E-03	1.6E-03	1.5E-03	1.5E-03
NW	1.3E-03	1.0E-03	8.4E-04	7.8E-04	6.9E-04	6.7E-04	6.5E-04
WNW	8.9E-04	7.2E-04	5.8E-04	5.4E-04	4.9E-04	4.7E-04	4.7E-04
W	9.0E-04	7.3E-04	5.9E-04	5.5E-04	5.0E-04	4.8E-04	4.7E-04
WSW	8.8E-04	7.1E-04	5.8E-04	5.4E-04	4.9E-04	4.7E-04	4.6E-04
SW	9.6E-04	7.7E-04	6.3E-04	5.8E-04	5.3E-04	5.1E-04	5.0E-04
SSW	1.4E-03	1.1E-03	9.0E-04	8.3E-04	7.4E-04	7.1E-04	7.0E-04
S	1.8E-03	1.4E-03	1.1E-03	1.0E-03	9.2E-04	8.8E-04	8.6E-04
SSE	1.7E-03	1.4E-03	1.1E-03	1.0E-03	8.9E-04	8.5E-04	8.3E-04
SE	1.5E-03	1.2E-03	9.5E-04	8.8E-04	7.9E-04	7.5E-04	7.4E-04
ESE	1.8E-03	1.5E-03	1.2E-03	1.1E-03	9.6E-04	9.2E-04	9.0E-04
E	2.2E-03	1.7E-03	1.4E-03	1.3E-03	1.1E-03	1.1E-03	1.0E-03
ENE	1.3E-03	1.0E-03	8.1E-04	7.5E-04	6.7E-04	6.5E-04	6.3E-04
NE	1.1E-03	8.8E-04	7.1E-04	6.6E-04	5.9E-04	5.7E-04	5.6E-04
NNE	1.1E-03	8.8E-04	7.1E-04	6.6E-04	5.9E-04	5.7E-04	5.6E-04

	Distance (m)						
Direction	900	930	1000	1120	1190	1300	1500
N	4.9E-04	4.7E-04	4.3E-04	3.8E-04	3.6E-04	3.3E-04	2.9E-04
NNW	1.1E-03	1.0E-03	9.0E-04	7.7E-04	7.1E-04	6.3E-04	5.3E-04
NW	4.9E-04	4.7E-04	4.3E-04	3.8E-04	3.5E-04	3.3E-04	2.9E-04
WNW	3.6E-04	3.5E-04	3.2E-04	2.9E-04	2.8E-04	2.6E-04	2.3E-04
W	3.6E-04	3.5E-04	3.2E-04	2.9E-04	2.8E-04	2.6E-04	2.3E-04
WSW	3.6E-04	3.4E-04	3.2E-04	2.9E-04	2.7E-04	2.6E-04	2.3E-04
SW	3.8E-04	3.7E-04	3.4E-04	3.1E-04	2.9E-04	2.7E-04	2.4E-04
SSW	5.2E-04	5.0E-04	4.5E-04	4.0E-04	3.7E-04	3.4E-04	3.0E-04
S	6.3E-04	6.0E-04	5.4E-04	4.7E-04	4.4E-04	4.0E-04	3.4E-04
SSE	6.1E-04	5.8E-04	5.2E-04	4.6E-04	4.3E-04	3.9E-04	3.4E-04
SE	5.4E-04	5.2E-04	4.7E-04	4.2E-04	3.9E-04	3.6E-04	3.1E-04
ESE	6.6E-04	6.3E-04	5.7E-04	4.9E-04	4.6E-04	4.2E-04	3.6E-04
E	7.6E-04	7.2E-04	6.5E-04	5.6E-04	5.2E-04	4.7E-04	4.0E-04
ENE	4.7E-04	4.5E-04	4.1E-04	3.7E-04	3.5E-04	3.2E-04	2.8E-04
NE	4.2E-04	4.1E-04	3.7E-04	3.3E-04	3.1E-04	2.9E-04	2.6E-04
NNE	4.2E-04	4.0E-04	3.7E-04	3.3E-04	3.1E-04	2.9E-04	2.6E-04

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SUMMARY
Page 6

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

	Distance (m)
Direction	1720
N	2.6E-04
NNW	4.5E-04
NW	2.6E-04
WNW	2.2E-04
W	2.2E-04
WSW	2.1E-04
SW	2.2E-04
SSW	2.7E-04
S	3.0E-04
SSE	3.0E-04
SE	2.8E-04
ESE	3.2E-04
E	3.5E-04
ENE	2.5E-04
NE	2.4E-04
NNE	2.4E-04

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SUMMARY
Page 7

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	470	540	620	650	700	720	730
N	6.1E-10	4.9E-10	4.0E-10	3.7E-10	3.3E-10	3.2E-10	3.1E-10
NNW	1.5E-09	1.2E-09	9.2E-10	8.5E-10	7.5E-10	7.2E-10	7.0E-10
NW	6.1E-10	4.9E-10	3.9E-10	3.6E-10	3.3E-10	3.1E-10	3.1E-10
WNW	4.2E-10	3.4E-10	2.8E-10	2.6E-10	2.3E-10	2.3E-10	2.2E-10
W	4.2E-10	3.4E-10	2.8E-10	2.6E-10	2.4E-10	2.3E-10	2.3E-10
WSW	4.1E-10	3.3E-10	2.7E-10	2.6E-10	2.3E-10	2.2E-10	2.2E-10
SW	4.5E-10	3.6E-10	3.0E-10	2.8E-10	2.5E-10	2.4E-10	2.4E-10
SSW	6.5E-10	5.2E-10	4.2E-10	3.9E-10	3.5E-10	3.4E-10	3.3E-10
S	8.2E-10	6.5E-10	5.2E-10	4.8E-10	4.3E-10	4.1E-10	4.0E-10
SSE	8.0E-10	6.3E-10	5.0E-10	4.7E-10	4.2E-10	4.0E-10	3.9E-10
SE	7.0E-10	5.5E-10	4.4E-10	4.1E-10	3.7E-10	3.5E-10	3.5E-10
ESE	8.5E-10	6.8E-10	5.4E-10	5.0E-10	4.5E-10	4.3E-10	4.2E-10
E	1.0E-09	8.0E-10	6.3E-10	5.9E-10	5.2E-10	5.0E-10	4.9E-10
ENE	5.9E-10	4.7E-10	3.8E-10	3.5E-10	3.2E-10	3.1E-10	3.0E-10
NE	5.1E-10	4.1E-10	3.3E-10	3.1E-10	2.8E-10	2.7E-10	2.6E-10
NNE	5.1E-10	4.1E-10	3.3E-10	3.1E-10	2.8E-10	2.7E-10	2.6E-10

	Distance (m)						
Direction	900	930	1000	1120	1190	1300	1500
N	2.4E-10	2.3E-10	2.1E-10	1.9E-10	1.7E-10	1.6E-10	1.4E-10
NNW	5.0E-10	4.7E-10	4.2E-10	3.6E-10	3.4E-10	3.0E-10	2.5E-10
NW	2.3E-10	2.2E-10	2.0E-10	1.8E-10	1.7E-10	1.6E-10	1.4E-10
WNW	1.7E-10	1.7E-10	1.6E-10	1.4E-10	1.4E-10	1.3E-10	1.2E-10
W	1.9E-10	1.7E-10	1.6E-10	1.4E-10	1.4E-10	1.3E-10	1.2E-10
WSW	1.7E-10	1.7E-10	1.6E-10	1.4E-10	1.4E-10	1.3E-10	1.2E-10
SW	1.8E-10	1.8E-10	1.7E-10	1.5E-10	1.4E-10	1.3E-10	1.2E-10
SSW	2.5E-10	2.4E-10	2.2E-10	1.9E-10	1.8E-10	1.7E-10	1.5E-10
S	3.0E-10	2.8E-10	2.6E-10	2.3E-10	2.1E-10	1.9E-10	1.7E-10
SSE	2.9E-10	2.7E-10	2.5E-10	2.2E-10	2.1E-10	1.9E-10	1.6E-10
SE	2.6E-10	2.5E-10	2.3E-10	2.0E-10	1.9E-10	1.7E-10	1.5E-10
ESE	3.1E-10	3.0E-10	2.7E-10	2.4E-10	2.2E-10	2.0E-10	1.7E-10
E	3.6E-10	3.4E-10	3.1E-10	2.7E-10	2.5E-10	2.2E-10	1.9E-10
ENE	2.3E-10	2.2E-10	2.0E-10	1.8E-10	1.7E-10	1.6E-10	1.4E-10
NE	2.0E-10	2.0E-10	1.8E-10	1.6E-10	1.5E-10	1.4E-10	1.3E-10
NNE	2.0E-10	1.9E-10	1.8E-10	1.6E-10	1.5E-10	1.4E-10	1.3E-10

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SUMMARY
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INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

	Distance (m)
Direction	1720
N	1.3E-10
NNW	2.2E-10
NW	1.3E-10
WNW	1.1E-10
W	1.1E-10
WSW	1.1E-10
SW	1.1E-10
SSW	1.3E-10
S	1.5E-10
SSE	1.5E-10
SE	1.4E-10
ESE	1.5E-10
E	1.7E-10
ENE	1.3E-10
NE	1.2E-10
NNE	1.2E-10

C A P 8 8 - P C

Version 3.0

Clean Air Act Assessment Package - 1988

W E A T H E R D A T A

Non-Radon Individual Assessment
May 5, 2011 12:58 pmm

Facility: SPRU DP
Address: 2425 River Road
City: Nishkayuna
State: NY Zip: 12309

Source Category: Sludge and Tank Farm
Source Type: Stack
Emission Year: 2011

Comments: SLudge and vault D&D via PVU
Appendix D with abatement

Dataset Name:
Dataset Date: 5/5/2011 12:32:00 PM
Wind File: C:\Program Files\CAP88-PC30\WndFiles\kno18904.WND

May 5, 2011 12:58 pmm

WEATHER
Page 1

HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class							
Dir	A	B	C	D	E	F	G	Wind Freq
N	1.428	1.768	1.898	1.971	1.042	0.663	0.000	0.097
NNW	1.539	1.808	2.332	2.139	1.073	0.711	0.000	0.130
NW	1.387	1.444	1.400	1.248	0.838	0.702	0.000	0.044
WNW	1.303	1.365	1.193	0.882	0.701	0.563	0.000	0.027
W	1.143	1.134	0.909	0.792	0.631	0.613	0.000	0.022
WSW	1.149	1.078	1.033	0.913	0.666	0.615	0.000	0.021
SW	1.297	1.372	1.445	1.322	0.938	0.660	0.000	0.038
SSW	1.380	1.712	1.779	1.961	1.135	0.820	0.000	0.068
S	1.297	1.420	1.398	1.357	1.035	0.782	0.000	0.057
SSE	1.433	1.539	1.555	1.374	0.981	0.715	0.000	0.050
SE	1.628	2.068	2.500	2.116	1.082	0.700	0.000	0.068
ESE	1.911	2.708	3.690	3.554	1.425	0.785	0.000	0.190
E	1.735	2.592	3.292	2.957	1.308	0.750	0.000	0.101
ENE	1.599	1.833	2.230	1.635	0.909	0.676	0.000	0.035
NE	1.459	1.806	1.510	1.199	0.918	0.643	0.000	0.026
NNE	1.425	1.590	1.218	1.003	0.820	0.615	0.000	0.027

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	1.774	2.251	2.847	3.130	1.528	0.914	0.000
NNW	1.839	2.323	3.177	3.125	1.554	1.041	0.000
NW	1.660	1.934	2.060	2.160	1.306	1.019	0.000
WNW	1.540	1.674	1.659	1.606	1.167	0.812	0.000
W	1.341	1.436	1.368	1.404	1.009	0.861	0.000
WSW	1.356	1.451	1.653	1.896	1.049	0.842	0.000
SW	1.554	1.873	2.212	2.446	1.450	0.944	0.000
SSW	1.660	2.264	2.866	3.155	1.640	1.154	0.000
S	1.585	1.991	2.311	2.474	1.576	1.146	0.000
SSE	1.666	2.145	2.544	2.218	1.399	1.023	0.000
SE	1.912	2.639	3.548	3.315	1.506	0.980	0.000
ESE	2.130	3.077	4.303	4.520	1.921	1.146	0.000
E	2.026	2.952	4.182	4.253	1.831	1.125	0.000
ENE	1.913	2.527	3.687	3.035	1.430	0.981	0.000
NE	1.794	2.398	3.034	2.335	1.396	0.891	0.000
NNE	1.715	2.187	2.104	1.884	1.270	0.822	0.000

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WEATHER
Page 2

FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	0.0166	0.0272	0.0957	0.3246	0.1128	0.0496	0.0000
NNW	0.0545	0.0977	0.3024	0.6829	0.1892	0.1114	0.0000
NW	0.1726	0.1982	0.2801	0.3102	0.1571	0.1343	0.0000
WNW	0.3168	0.2595	0.2241	0.1501	0.1260	0.1430	0.0000
W	0.3407	0.2808	0.1912	0.1379	0.1484	0.2055	0.0000
WSW	0.3033	0.2154	0.1907	0.1714	0.1769	0.2088	0.0000
SW	0.1651	0.1754	0.1730	0.1833	0.1429	0.1270	0.0000
SSW	0.0990	0.1235	0.1747	0.2745	0.1366	0.1343	0.0000
S	0.1012	0.1067	0.1444	0.3154	0.2270	0.2020	0.0000
SSE	0.0900	0.0926	0.1268	0.3648	0.2827	0.1904	0.0000
SE	0.0595	0.0805	0.1347	0.3520	0.1984	0.1184	0.0000
ESE	0.0221	0.0672	0.1973	0.4392	0.0981	0.0398	0.0000
E	0.0493	0.0984	0.3142	0.7300	0.1996	0.1051	0.0000
ENE	0.0573	0.0792	0.1773	0.3875	0.2655	0.1989	0.0000
NE	0.0593	0.0815	0.1454	0.2847	0.2817	0.2338	0.0000
NNE	0.0495	0.0546	0.0897	0.2538	0.2790	0.2020	0.0000
TOTAL	0.0798	0.1019	0.1989	0.4155	0.1711	0.1176	0.0000

ADDITIONAL WEATHER INFORMATION

Average Air Temperature: 10.0 degrees C
283.16 K
Precipitation: 100.0 cm/y
Humidity: 8.0 g/cu m
Lid Height: 1000 meters
Surface Roughness Length: 0.010 meters
Height Of Wind Measurements: 10.0 meters
Average Wind Speed: 2.660 m/s

Vertical Temperature Gradients:
STABILITY E 0.073 k/m
STABILITY F 0.109 k/m
STABILITY G 0.146 k/m

ATTACHMENT D

Equipment Sketches and Specification Details

(Typical)

Ventilation Air Mover and Filtration System

IONEX

OPERATION AND MAINTENANCE INSTRUCTIONS
SERIES 7000, MODEL 7000A

TABLE OF CONTENTS

www.ionexres.com
P.O. BOX 70
LAFAYETTE, CO 80026
303.666.5550
Fax: 303.666.5560

2. DESIGN AND OPERATING PARAMETERS

Flow Configuration	HEPA Filter/Fan-Motor
Reference Sketch	D6725, Rev. H
Design/Manufacturing Standard	ASME AG-1
Mounting	System mounted on highly portable hand-truck assembly. One swivel and two rigid casters available for both vertical and horizontal portability. Handles available for lifting while horizontal.
Flow Capacity	Total Fan Static Pressure / Flow @ 6000 Ft. 1.8" W.G., VFD at 83%* 1150 CFM 3" W.G., VFD at 83% 1000 CFM 7" W.G., VFD at 100% 840 CFM 9" W.G., VFD at 100% 540 CFM * Speed of VFD is limited by horsepower of motor.
Particle Removal Efficiency	99.97% minimum on 0.3 micron particles
Materials of Construction	Filter mounting, fan enclosure, transitions, and hand truck - stainless steel, type 304 Fan housing and wheel - aluminum HEPA cell sides - galvanized steel, 409 stainless steel, wood, or particle board. *(Customer may provide HEPA element, if desired.)*
HEPA Retention Method	HEPA element is held between inlet transition and mounting frame by means of four bolts and four hand-operated draw clamps. Housing less design reduces overall weight.
HEPA Filter Type	Per Specification MIL-F-51068 (ASME AG-1)
HEPA Filter Size	24" x 24" x 11½"-deep (MIL standard size 5)
HEPA Sealing Method	Closed cell sponge neoprene rubber or silicone on the downstream face of the HEPA filter cell
HEPA Change-out Method	HEPA and inlet transition may be removed as an integral assembly using conventional bag-

Features:

System integrated on heavy duty hand truck for portability. Unit operable in either vertical or horizontal orientation.

Differential pressure gauge (magnahelic-type) to monitor filter dust loading

Elapsed-time meter available to measure operating time (standard)

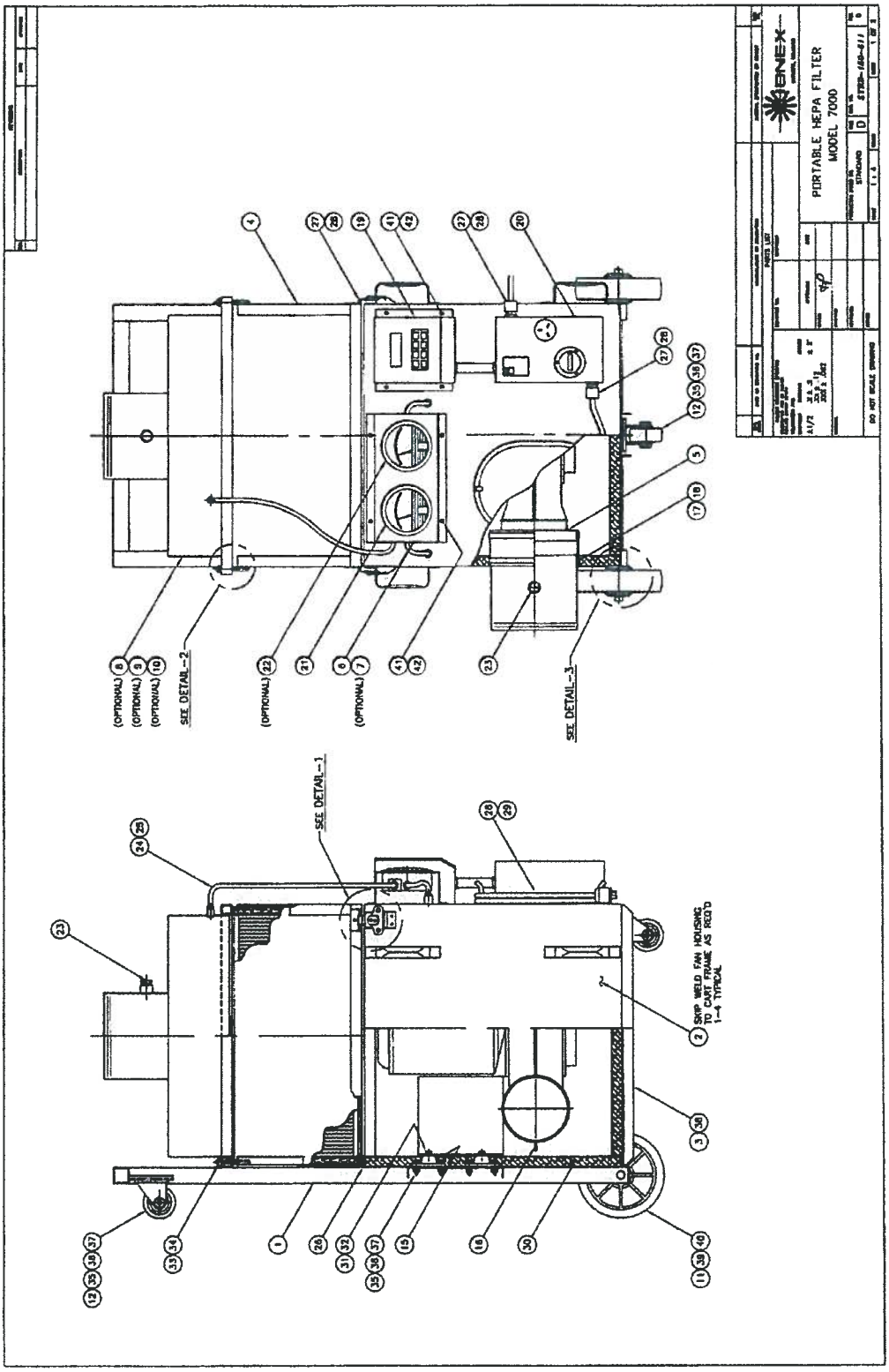
Optional flow indicator available

Optional explosion-proof motor available

Optional remote emergency stop switch available

Ordering Information:

Description	IONEX P/N
Series 7000A portable HEPA filtration unit	01-700
Series 7000A portable HEPA filtration unit with flow indicator	01-701
Series 7000A portable HEPA filtration unit with explosion-proof motor	01-702
Series 7000A portable HEPA filtration unit with remote emergency stop switch	01-703


PORTABLE HEPA FILTER
MODEL 7000
SEE DETAIL -1
SEE DETAIL -2
SEE DETAIL -3
(OPTIONAL)
SKIP WELD FAN HOUSING TO CART FRAME AS REQ'D 1 PLACE TYPICAL

4. ELECTRICAL LOAD INFORMATION

The IONEX Series 7000A Portable HEPA Filtration Unit is designed to operate using 115 volt single phase power. 115 volt circuits are normally protected using 20 amp circuit breakers from a user-protected circuit. The electrical plug on the Series 7000A's power cord is a standard parallel-prong, 15 amp plug which can be accommodated in a standard 115 volt wall receptacle.

The fan in the Series 7000A unit is of a 1.5 Hp size; and its speed is controlled by a 115 volt variable speed motor drive. This motor selection provides for operation at a wide range of flow and pressure conditions. Due to this operational flexibility it is possible to operate the unit under conditions which would draw more than 20 amps thus causing the circuit breaker to trip.

Maximum current draw results from the highest airflow and the lowest static pressure. If the unit is operated with a clean HEPA filter, without any ductwork installed, and the motor speed control set at maximum (60 Hz), the fan will provide a flow of over 1500 CFM and will draw over 30 amps. Therefore, prudent operational practices must be employed to avoid tripping the breaker.

The Series 7000A unit is designed to provide 1000 CFM of airflow at up to 3" W.G. static pressure. This condition is achieved with the speed control set at 52 Hz. Operation with 3" W.G. static pressure at higher than 52 Hz will likely exceed the circuit breaker's 20 amp rating and it will trip. As the static pressure goes up (as it would if the delivery hose gets longer, contains more bends, or is attached to louvers or baffled inlet assemblies), the fan speed can be gradually increased to compensate for the reduced flow that results. If the static pressure is as high as 8" W.G. the flow will be approximately 700 CFM with the speed control at 60 Hz. This operating condition will not exceed the circuit breaker's amperage rating and continuous operation is permitted.

The following table provides a rule of thumb for operating conditions which should not exceed your circuit breaker's rating:

Flow	External Static Pressure	Speed Control Setting
1200 CFM	1.3" W.G.	45 Hz
1150 CFM	1.8" W.G.	52 Hz
1000 CFM	3" W.G.	52 Hz
800 CFM	7.4" W.G.	59 Hz
840 CFM	7" W.G.	60 Hz
700 CFM	8.2" W.G.	60 Hz
600 CFM	8.7" W.G.	60 Hz
500 CFM	9.2" W.G.	60 Hz
400 CFM	9.3" W.G.	60 Hz

For operation in the high flow – low static pressure range, the operator should verify flow and/or pressure conditions with a flow meter and/or pressure conditions with a flow meter and/or manometer to select the proper speed setting and avoid operating at excessive electrical current conditions.

In-place Testing of Systems Provided with a HEPA Filter Element

Each HEPA filter cartridge has been factory tested to assure that it exhibits the minimum removal efficiency requirements as specified. It may be necessary that you test the filter system for proper installed system filtration efficiency. If so, you need to install an upstream DOP injection port in the duct-work leading to the Portable HEPA Filter Unit. This consists simply of a penetration in the duct-work providing a 1" diameter hole through which test agent may be injected. Test sample penetrations for obtaining upstream downstream concentrations are located immediately upstream of the inlet connection and downstream of the fan outlet connection.

In-place testing should follow the procedure outlined in ANSI-N510-1989, or other customer-approved standard.

In the event of failure to meet or exceed in-place testing criteria, we suggest that all gaskets be re-tightened. The vast majority of test failures can be attributed to improper gasket tightening.

If the levels of contamination dictate it, the removal of the filter/transition/mounting frame assembly may be done by enclosing the assembly in a filter disposal bag prior to releasing the quick-acting draw clamps so, that any possibility of dislodging contaminate material during transport can be minimized.

Also, you may wish to replace the filter/transition/mounting frame with a separate replacement assembly in order to get the filter system back on-line as quickly as possible. The contaminated assembly can then be handled, decontaminated and readied for future replacement, as required.

In order to maintain a negative pressure on the contaminated filter and attached components during filter replacement, the assembly can continue to operate albeit at a much reduced flow during the entire filter change operation.

The silicone rubber sealing gaskets between the HEPA frame and the fan section may require periodic maintenance, such as removing dirt from the surface, or replacement if they became damaged.

Lubrication:

Since permanently sealed motor bearings are used, no routine lubrication is required.

Sampling Section and Sampler/Withdrawal Location

A mixing box and sampling duct apparatus according to Figure 15.11 K of Radioactive Air Sampling Methods by Maiello and Hoover (2011) will be provided. Off-the-shelf air sample pumps, filter holders, and ANSI N13.1 sample probes with custom designed air mixers and sample ducts that match the required flow rates of the portable ventilation systems will be installed. The mixer boxes, ducting and structural frame (cart) are fabricated of galvanized metal. The sample probes are stainless steel. Nominal parameters for the mixer and sampling systems are:

1. For a portable HEPA filtered air handler rated at 2,000 ACFM:
    a. Overall length, width and height - 6 feet, 1.5 feet, and 3 feet
    b. Sampling duct diameter - 10 inches
    c. Duct inlet connection - 10 inches
    d. Delta P at maximum flow rate - 0.67 inches H_2O
    e. Mixer, duct, air sampler and protective "doghouse" mounted on a structural frame "cart."
2. Vendor testing prior to delivery will certify the following:
    a. A certificate of conformance for each air sampling system attesting that the sampling system has been tested and/or analyzed as required to satisfy ANSI N13.1 Section 5.2.2.2. Testing of individual systems for gas or particulate COV is not required if suitable prototype testing is documented and the Vendor certifies that the item sold to buyer conforms to the tested unit and/or configuration.
    b. The vendor will perform velocity COV testing on each unit.
    c. Calibration certificates for the air sample pump and air flow instruments will be provided with each air monitoring system.

RADēCO
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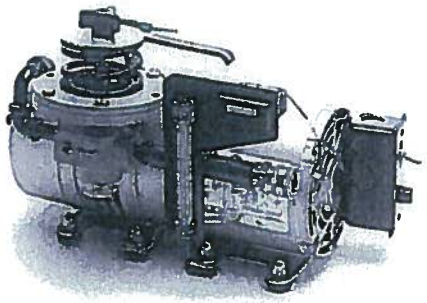
TEL: (860) 564-1220 FAX (860) 564-6631 www.radecoinc.com

PORTABLE CONSTANT FLOW AIR SAMPLER MODEL AVS-28A

- CONSTANT AIRFLOW MAINTAINED WITH ΔP ACROSS THE FILTER OF UP TO 17" Hg (FLOW RATE DEPENDENT)
- BALANCED, EASY TO CARRY COMPACT SYSTEM
- FLOW RATE INDICATION ON ROTOMETER, CFM OR LPM
- RATED FOR CONTINUOUS DUTY
- LOW NOISE LEVEL
- MINIMUM MAINTENANCE
- OPTIONAL ELAPSED TIME INDICATOR
- ALL UNITS INDIVIDUALLY CALIBRATED AND TRACEABLE TO NIST



Industry Workhorse Continues to Lead the Field

The Model AVS-28A Portable Constant Flow Air Sampler is a continuous duty, constant flow device. It can be used with filters and cartridges in the collection of airborne contaminates, or as a regulated, positive displacement vacuum supply for continuous air monitors and stack sampling systems.

The ability of the AVS-28A to maintain a preset sample flow rate is controlled by the unique side-mounted regulator valve. The RADēCO regulator valve is not a bypass design, and therefore the exhaust contains only sampled air. The AVS-28A has the superior ability to compensate for added ΔP across sampling media.

The sampling flow rate is read out on a side-mounted rotometer which measures the differential pressure across the in-line anodized aluminum venturi. All units are individually calibrated and traceable to NIST.

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PORTABLE CONSTANT FLOW AIR SAMPLER MODEL AVS-28A

Specifications

Air Flow Rate: Adjustable from 0.5 to 3.5 CFM (10 to 100 LPM).

Air Flow Regulation: ±5% of set air flow rate up to maximum capability of pump.

Dimensions/Weight: 12" Long x 14" Wide 9" High, (30.5 cm x 35.6 cm x 22.9 cm), 38 lbs (17.27 kg).

Power Requirement/Cable: 115V, 60Hz, 4.6 Amps; 230V, 50hz, 2.3 Amps. Three wire, (6) six feet (10) Ten Amp rating; British and European available.

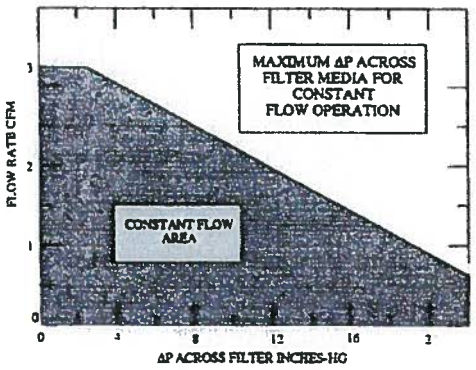
Air Flow Indicator: Venturi mounted rotometer.

Air Mover/Motor: Self-adjusting carbon vane type. Pump is designed for continuous operation at 26" Hg vacuum. Rated at 1/4 horsepower with thermal overload protection.

Input Connection: 3/8" Female Quick Disconnect.

Re-settable Elapsed Time Meter: 99999 hours and 59 minutes, pushbutton re-

Sample Holders Available	
Model No.	**Description**
2500-04	2" diameter filter, open face
2500-42	47 mm diameter filter, open face
2500-21	2" diameter filter/RADECO cartridge, open face
2500-46	47 mm diameter filter/RADECO cartridge, open face
2500-45	2" diameter filter/RADECO cartridge, in-line
2500-44	47 mm diameter filter/RADECO cartridge, in-line
Other style holders available. Please call for selection information.	



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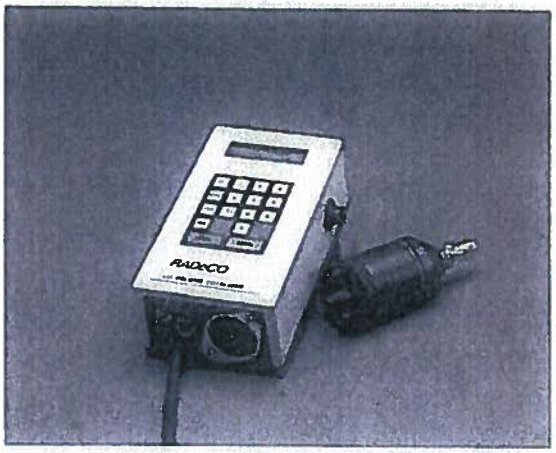
CONTINUOUS AIR VOLUME TOTALIZER MODEL AVT-100

- EASILY ADAPTS TO MOST POSITIVE DISPLACEMENT PUMPS
- RUGGED TURBINE MONITORS FLOW
- LCD DISPLAYS:
  - -Elapsed Sample Time
  - -Flow Rate
  - -Total Volume
- BATTERY-BACKED DATA MEMORY
- MICROPROCESSOR BASED
- CIRCUIT BREAKER
- EASE OF CALIBRATION



The **Model AVT-100** has been designed for use in continuous air sampling applications. This microprocessor based unit is a reliable alternative to the use of rotometers, venturi and mechanical time meters, simplifying air sampling procedures while adding significantly higher accuracy to air sampling data.

The **Model AVT-100** is composed of two assemblies—the display chassis assembly and the remote air turbine assembly. The two assemblies are interconnected by an 18" cable with locking connectors. The remote air turbine assembly can be attached to the exhaust of any non-lubricated positive displacement pump. The air turbine rotates at speeds proportional to the air velocity of the pump's inlet (sampled air). The turbine's rotation is sensed by a reflective sensor/breaker disc. The microprocessor converts the signal to volume and displays the FLOW RATE, TOTAL VOLUME, and ELAPSED TIME on the LCD readout.

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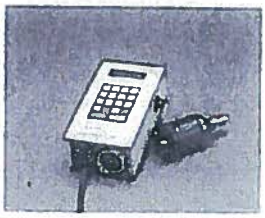
MODEL AVT-100 CONTINUOUS AIR VOLUME TOTALIZER

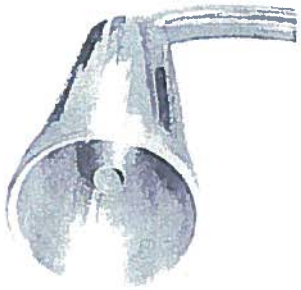


When the sampling pump is plugged into the **AVT-100**, the **AVT-100** will control the AC power applied to the pump, should the AC power be interrupted, the **AVT-100** will store all sampling data and restart the sampler when the AC power is restored

Specifications

Operational Range:	Up to 999,999 cubic feet or 999,999 cubic meters
Accuracy of Totalizer:	± 5% FS
Timer Circuit:	Microprocessor-controlled crystal oscillator
Operational Voltage:	95 to 135V, 50 to 60 Hz, 1 Phase, or 205—240V, 50 Hz, 1 Phase
Chassis Dimensions:	8" Long x4.75" Wide x 4" High 203mm x 121mm x 102mm
Turbine Dimensions:	4" Long x 2" Diameter, with 18" Cable 102mm x 51mm, with 457mm Cable
Weight:	3 Pounds (1.4 Kg)
Turbine Inlet:	1/4" NPT (Female Thread)
Turbine outlet:	1/8" NPT (Female Thread)
Readout of Totalizer:	LCD; Two lines 16 characters, backlit. Continuous display of cumulative volume + flowrate + elapsed time. Toggles between CFM and LPM
Controls:	ON/OFF Switch (circuit breaker) Keypad, 16 key controls function and calibration

SHROUDED SAMPLING PROBE



The Shrouded Sampling Probe is anisokinetic probe manufactured by Lab Impex Systems (LIS) under licence from Texas A & M University. The probe is designed for high efficiency extraction of aerosols from ventilation stacks, and for the nuclear industry is most commonly used in radioactive effluent sampling and measurement systems.

This probe design has several advantages over non-shrouded probes (such as the traditional isokinetic variety): lower internal wall losses, better off-angle performance, lower sensitivity to flow stream turbulence, and the ability to operate in either a fixed flow or variable flow rate mode.

Information & specifications may change without notice

- **Meets requirements for ANSI N13.1-1999 and ISO 2889 2008**
- **Available for 1.0 inch or 1.5 inch sample lines**
- **Improved transmission efficiency over range of flow velocities**
- **Improved transmission efficiency over range of flow angles**
- **Lower internal wall losses than isokinetic sample probes**
- **Less sensitive to flow turbulence**
- **Use in fixed or variable sample flow systems**

Another significant benefit is that a single probe design may be used for a range of stack velocities and geometries, thereby allowing a single shrouded sampling probe design to be used for a variety of different stack applications (diameters and flow rates). Shrouded probes are typically less expensive than a custom sampling rake designed for a single stack.

Optimal Efficiency

In a stack installation, the shrouded probe will be used with a transport system specifically designed to ensure that aerosol losses within the sample probe and transport lines are kept to a minimum. Typically a system will comprise a shrouded probe, an in-stack transport line, a mounting flange, and an external transport line that conveys the aerosol sample from the stack to the sampling or monitoring system.

Transport system design is an important step in optimizing overall sampling efficiency, and Lab Impex Systems can assist clients in the design process by using software modelling to determine the transmission efficiency of aerosol through the transport system.

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SHROUDED SAMPLING PROBE

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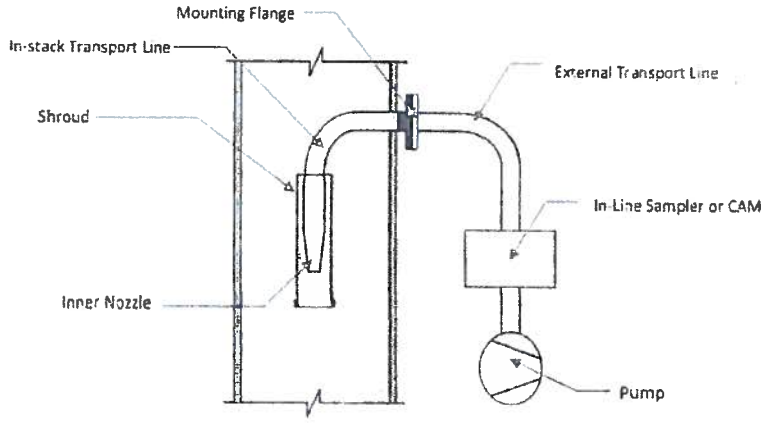
Principle of Operation

A vacuum pump (installed downstream of the sampling or monitoring system) will draw a continuous sample of stack gas through the probe and transport system.

At the entrance to the probe, the stack gas will be decelerated by the shroud to a velocity about one third that of the free stream in the stack. The inner nozzle will sample the central core of the gas stream which enters the shroud, while the remainder of the gas is exhausted at the rear of the shroud via the annular gap between the shroud and the inner nozzle.



The Advantages of Using the Shrouded Probe

1) A single probe design is suitable for the majority of stacks. Custom probe design is not required for each stack.
2) The shrouded probe can sample over a range of stack velocities. Isokinetic sampling is only valid when the draw off velocity is equal to free-stream velocity.
3) In ventilation systems where the stack velocity does change, the variation of transmission with velocity is lower than a traditional isokinetic probe.
4) The shrouded probe allows representative sampling to be achieved through a single point measurement. A sampling rake is not required to achieve representative sampling.

Performance Characteristics

ANSI N13.1-1999 specifies that over the range of anticipated operating conditions (sampling flow rate and stack velocity) an acceptable aerosol sampling probe must have a transmission ratio * between 80% and 130% and an aspiration ratio** less than 150% for 10 µm aerodynamic diameter aerosol particles.

*The transmission ratio is the concentration of aerosol at the exit plane of a probe divided by the concentration in the stack at the probe location.

**The aspiration ratio is the aerosol concentration at the probe entrance plane divided by the concentration in the stack at the probe location.

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SHROUDED SAMPLING PROBE

Shrouded Sampling Probe

PHYSICAL CHARACTERISTICS

The shrouded probes are manufactured to close tolerances using 304 stainless steel.

DIMENSIONS (Height x Depth x Width)

The shrouded probes use the same external shroud (and dimensions) but have different internal dimensions based on the application.

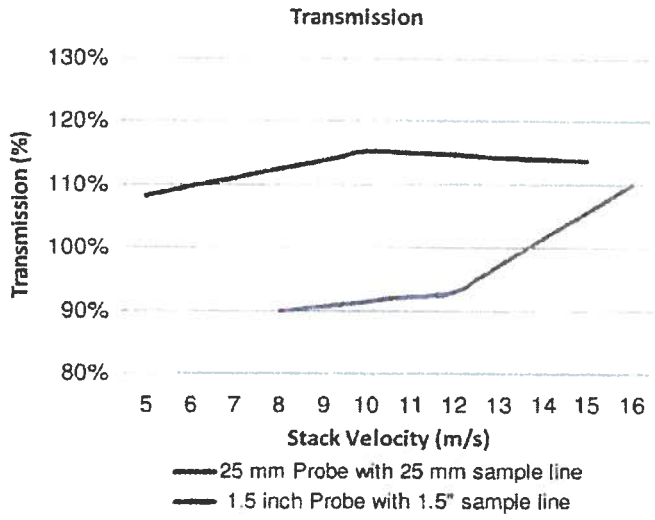
- Overall Length: 242 mm (probe only - without sample lines)
- Diameter: 60 mm diameter (at widest point, lip on inlet)
- Connection: 25 mm ID, 1.0-inch ID, or 1.5-inch ID depending on the model of probe selected

Information & specifications may change without notice

ISO-2889 2009 Requirements

While not a comprehensive list of requirements, the bullet points listed below summarize the primary requirements of ISO-2889 *Sampling Airborne Radioactive Materials from the Stacks and Ducts of Nuclear Facilities* as issued in 2009.

- Sampling location provides the ability to extract a representative sample.
- Determine the properties of the sampling location through a series of tests.
- Determine penetration of contaminants though the system.
- Penetration 10-µm AD particles greater than 50%
- Actual penetration should be measured.
- Extract, deliver, and collect ≥ 50% of gases or vapours etc.
- Demonstrate performance of multi-nozzle probes in the same way as a single nozzle.



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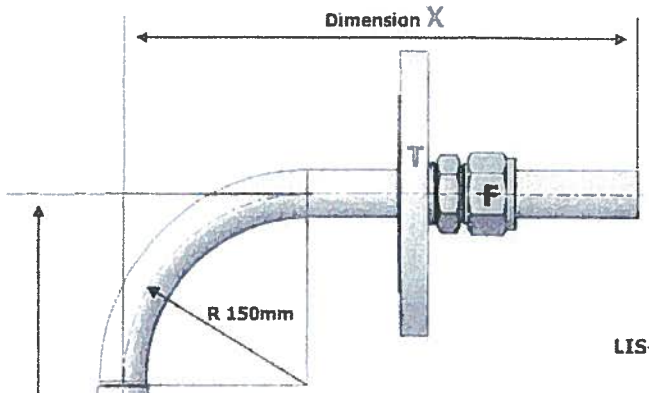
SHROUDED SAMPLING PROBE



Information & specifications may change without notice

Part Numbering

The shrouded probe is available as a standard assembly with probe, in-stack transport line, flange and couplings. However Dimension X will change with stack diameter. For non-standard applications, please contact Lab Impex Systems.

LIS-SP2000-A-B-X-T-F-75

A = Shrouded Probe Model

1	RF2-111 1.5-inch pipe, Gas Velocity 0 to 24 m/s
2	RF2-112 1.5-inch pipe, Gas Velocity 0 to 16 m/s
3	RF37-007 25 mm pipe, Gas Velocity 0 to 15 m/s
4	RF37-007 1.0- inch pipe, Gas Velocity 0 to 15 m/s

B = Draw Off or Sampling rate

28	Draw off rate 1 cfm	37	Draw off rate 37 liters/min
57	Draw off rate 2 cfm	50	Draw off rate 50 liters/min

X = Length of Pipe

Probe depth into the duct + 75 mm (duct stand-off distance) + 190 mm (minimum is 340 mm)

T = Mounting Flange

0	DIN 2527 PN6 100 mm Flange Tapped 1" BSP
1	BS4504 Table 6 Class 150 4" Flange Tapped 1" BSP
2	ANSI B16.5 Class 150 4" Flange Tapped 1.5" NPT
3	1" BSP universal Flange Mounting
4	1.5" NPT Universal Flange Mounting

F = Flange Coupling

0	1.5" NPT Stud Coupling for 1.5" Pipe
1	1" BSP Stud Coupling for 25 mm pipe
W	Probe length fixed , probe welded to flange

75mm = Standoff distance between the outside of the duct and the mounting surface of the flange

References:

ANSI/HPS N13.1-1999 *"Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities"*
ISO 2889 *"Sampling Airborne Radioactive Materials from the Stacks and Ducts of Nuclear Facilities"* issued in 2009
Chandra, S.; McFarland, A. R. (1995) Comparison of aerosol sampling with shrouded probe and unshrouded probes. *Am. Ind. Hyg. Assoc. J.* 56:459-466
Chandra, S.; McFarland, A. R. (1997) Shrouded probe performance: Variable flow operation and effect of free stream turbulence. *Aerosol Sci. Technol.* 26:111-126

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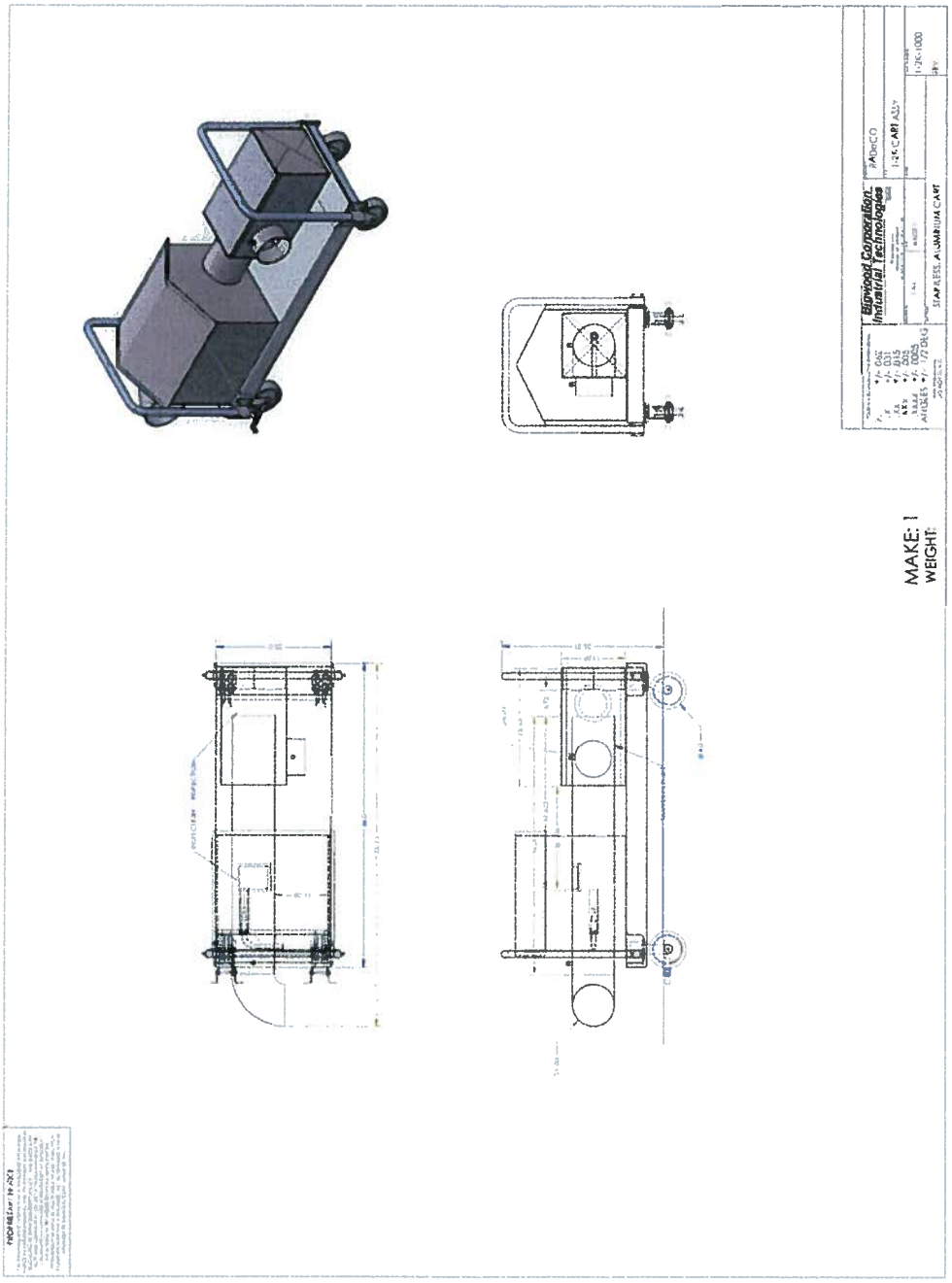
PVU Representative Sampling Mixing Device (Preliminary Design)



Ganged Portable Ventilation Unit Monitoring Diagram

Two units shown ganged to a single monitored exhaust system:

- Allows independent work area contamination control
- Reduces the number of monitoring filters required
- Allows better detection levels due to higher total sample flow