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Naval Reactors Laboratory Field Office
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NRLFO:AMO-S:ESH:12-186
June 26, 2012

Mr. Paul A. Giardina, Chief
Radiation and Indoor Air Branch
Division of Environmental Planning and Protection
U. S. Environmental Protection Agency
Region 2
290 Broadway - 25th Floor
New York, New York 10007-1866

Dear Mr. Giardina:

Subject: **DEPARTMENT OF ENERGY KNOLLS SITE REPORT OF RADIONUCLIDE EMISSIONS FOR CALENDAR YEAR 2011**

Enclosed pursuant to 40 CFR 61.94 is the Calendar Year 2011 Radionuclide National Emissions Standards for Hazardous Air Pollutants Report for the Department of Energy (DOE) - Knolls Site in Niskayuna, NY.

In previous years, the Naval Reactors Laboratory Field Office issued annual reports of Knolls Atomic Power Laboratory (KAPL) operations at the DOE - Knolls Site; DOE - Office of Environmental Management issued a separate report for the Separations Process Research Unit (SPRU) Disposition Project and Land Areas at the DOE - Knolls Site. The Environmental Protection Agency, Region 2 has requested all activities at the DOE - Knolls Site be included in a single report. This report includes all activities at the DOE - Knolls Site. DOE - Kesselring Site information is being submitted in a separate report.

Should you have any questions or need additional information, please contact me at (518) 395-4443 or D. A. Delwiche of my staff at (518) 395-6366.

Sincerely,

for T. E. Ketcham
Assistant Manager for Operations

Enclosure:
As Stated

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U. S. Department of Energy
Radionuclide Air Emissions Annual Report
(under Subpart H of 40 CFR 61)
Calendar Year 2011

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U. S. Department of Energy
Radionuclide Air Emissions Annual Report
(under Subpart H of 40 CFR 61)
Calendar Year 2011

Site Name: Department of Energy - Knolls Site

Location: 2401 River Road

Niskayuna, New York 12309

EPA Region 2

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Separations Process Research Unit – Disposition Project Site Information

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Niskayuna, NY 12309

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Section I - Facility Information

Site Description

The Department of Energy (DOE) Knolls Site is located in the Town of Niskayuna, New York, approximately 3.2 kilometers east of the City of Schenectady. The Site is situated on 170 acres of land on the south bank of the Mohawk River. The surrounding area is a mixture of open land, light industry, small farms and suburban residential areas. The annual average temperature is about 8.6°C, and the annual average precipitation is about 98 centimeters per year from the Albany National Weather Service. The prevailing winds are from the west to the northwest with a secondary maximum from the south to the south-southeast. The population residing within 80 kilometers of the Site is about 1.36 million persons based on 2010 census data.

The principal function of the Knolls Atomic Power Laboratory (KAPL) is research and development in the design and operation of naval nuclear propulsion plants. Facilities at the KAPL Knolls Site that handle radioactive materials include chemical, metallurgical and radioactive material laboratories, and a radioactive waste management facility.

The Separations Process Research Unit – Disposition Project (SPRU DP) work area covers 3 acres within the 170 acres of land belonging to DOE-Knolls Site. The SPRU DP is engaged in remediation of buildings and lands contaminated during the 1950's as part of the development of chemical separation processes for the Department of Energy's predecessor agency, the Atomic Energy Commission.

General SPRU Facility Background

SPRU DP is comprised of the H2 and G2 buildings, the G2/H2 tunnel, the tank farm vaults, the Lower Level water processing and container storage area, the Hillside Drain system and defined soil remediation areas. The scope of SPRU DP also includes decontamination of the E1/G1 tunnels, which are under the E1 and G1 Buildings of KAPL. References in this report to SPRU DP's work area or SPRU DP's Site refer to the space occupied by the G2 and H2 buildings and the immediate surrounding fenced area on the Upper Level that is impacted by demolition work.

In 2010, most of the above grade portion of Building H2 was demolished. The major components of the east and west evaporator systems were removed. Due to an unplanned release that occurred in 2010 during demolition of H2 building, the demolition was halted and the debris and remaining intact components were stored on the H2 pad during 2011. In 2011,

SPRU DP began to install engineered enclosures over Buildings H2 and G2. The number of storage tanks in the water treatment system was increased, the water processing system was upgraded, and the water treatment system was moved to the Lower Level. Shipping containers are also stored on the Lower Level.

Source Description

Radioactive Materials Used at the Facility - KAPL:

a. Natural, depleted, and enriched uranium (un-irradiated) is used in several different facilities including chemical and metallurgical/ceramics development laboratories, and a storage vault.

b. Physical, chemical, and metallurgical testing of small quantities of highly radioactive irradiated fissile and non-fissile specimens is conducted in the shielded hot cells of the Radioactive Materials Laboratory. Physical, chemical, and metallurgical testing is also performed on low activity specimens in glove boxes. The specimens analyzed may contain natural, depleted, or enriched uranium, fission products (e.g., Cs-137, Sr-90, Kr-85), transuranic radionuclides, and activated corrosion and wear products (e.g., Co-60).

c. Operations in chemistry laboratories include chemical analyses, radiochemistry analyses, and other related analytical and developmental functions. Calibration sources (e.g., Cs-137, Sr-90, Th-230, and mixed gamma standards) are used in the radiochemistry laboratories to calibrate and check alpha/beta and gamma counting systems.

d. The small volumes of water used in radiological facilities are collected and processed with an adsorbent and shipped off site in an adsorbed form to an approved disposal facility. The processed radioactive water may contain low levels of Sr-90, Cs-137, uranium, plutonium, and tritium.

e. Calibration and check sources are used on radiation survey equipment and dosimetry devices.

f. Sealed sources are used in gamma densitometers (Cs-137) and other miscellaneous instruments. Infrequently a radiography source (Ir-192 or Co-60) may be utilized.

Description of the Handling and Processing that Radioactive Materials Undergo at the Facility - KAPL:

Radioactive materials are handled and processed in several types of facilities including a storage vault, hot cells, chemical and metallurgical laboratories, and as part of decontamination operations of facilities and equipment. Physical, chemical, and metallurgical testing of small quantities of highly radioactive material specimens is performed in the Radioactive Materials Laboratory hot cells. Corrosion testing, chemical analyses, radiochemistry, and other related analytical and developmental functions are conducted in chemical laboratories. Similarly, metallurgical laboratories provide support services related to the testing and development, and inspection of various materials, including radioactive material. Radioactive work is performed in appropriate containment; storage and movement of radioactive materials are under strict control.

As a result of the operations conducted at the facility, some radioactive wastes are generated. The volume of solid radioactive waste that requires disposal is minimized through the use of procedures that limit the amount of materials that become contaminated, and through waste reduction and recycling.

Radioactive Materials Used at the Facility – SPRU DP

The principal radiological hazards associated with SPRU DP are contamination within the G2 and H2 Buildings and associated tunnels and contamination within the tank farm vaults and tank farm tanks. The primary radionuclides are Sr-90, Cs-137, Pu-239, and Am-241. Numerous evaluations have demonstrated that these four radionuclides and their decay products (Ba-137m for Cs-137, Y-90 for Sr-90) or parent (Pu-241 for Am-241) constitute at least 99% of the potential calculated radiation dose to offsite receptors.

Also, Cs-137, Sr-90, Pu-239, and Am-241 are the primary radionuclides identified in the *Nuclear Facility Historical Site Assessment for the Separations Process Research Unit (SPRU) Disposition Project*, which was prepared for the DOE's SPRU Project Office by Environmental Resource Group LLC, dated April 2006. The radionuclide characterization is further described in archived facility hazard categorization documents and radiological engineering documents. In this report, emissions of Pu-238, U-233, U-234, U-235 and U-238 are included for completeness and to verify the relative significance of the four primary radionuclides.

Description of the Handling and Processing that Radioactive Materials Undergo at the Facility-SPRU DP:

The nature of the work performed by SPRU DP during 2011 consisted of operating radioactive water processing systems, maintenance, contamination control and monitoring, disposal of hazardous and radioactive materials, and installation of engineered enclosures in preparation for demolition of the buildings. Removal and packaging of hazardous materials and similar radioactive work efforts were performed with appropriate containment or ventilation. Preparations for installation of the enclosures included excavation, packaging and shipment of contaminated soil.

As a result of the operations conducted at the facility, radioactive wastes are generated. The volume of solid radioactive waste that requires disposal is minimized using procedures that limit the amount of materials that become contaminated, and through waste reduction and recycling.

Section II - Air Emission Data

Point Source

KAPL

Radionuclide emissions from monitored emission points were calculated based on sampling system measurement results, radiochemistry results (gross alpha, gross beta, and gamma spectrometry), and stack flow measurements. Kr-85 emissions were based upon integrated data from a noble gas monitoring system. Estimated emissions from unmonitored emission points were based on annual confirmatory measurements (e.g., radioactive material usage surveys and/or representative air sampling measurements). The KAPL point source emission data are shown in Table 1. The KAPL air emissions data are provided in Table 2.

Table 1 - KAPL Point Source Air Emission Data – 2011

Point Source	Type Control[1]	Efficiency (%)[1]	Distance to Nearest Receptors (meters)[2]			Principal Radionuclides[3]
			Residence	Business	Vegetable Farm	
Building F4	HEPA Filter	99.95	575	450	700	U-234, Sr-90, Cs-137
Building F2	HEPA Filter	99.95	550	450	725	U-234, Sr-90, Cs-137
Building F3 Room 23	HEPA Filter	99.95	550	450	725	U-234, U-238
Building E1	HEPA Filter[4]	99.95	475	600	750	U-234, Sr-90, Cs-137
Building E4[5]	HEPA Filter[6]	99.95	500	525	725	Pu-238, Sr-90, Cs-137
Building E5	HEPA Filter	99.95	500	500	725	Co-60
Building E11	HEPA Filter	99.95	410	575	800	Pu-238, Sr-90, Cs-137
Building G1	HEPA Filter[4]	99.95	400	550	825	U-234, Sr-90, Cs-137
Building C6	HEPA Filter	99.95	400	600	800	U-234
Building D4	HEPA Filter[4]	99.95	375	575	850	U-234
Building D4 Room 161	HEPA Filter	99.95	350	600	875	U-234
*Building E1/G1 Vents[7] (4 vents)	Static HEPA Filter	99.95	425	550	800	U-234, Sr-90, Cs-137
*Building E1/G1 Basement[7]	None	-	400	550	825	U-234, Sr-90, Cs-137
*Building G1 Air Sample Pump Exhaust[7]	Note 8	99.95	400	550	825	U-234, Sr-90, Cs-137
*Building A3[7]	None	-	300	650	900	U-234

Notes for KAPL Point Source Air Emission Data Table 1:

(1) The HEPA filters are tested by the manufacturer to exhibit a minimum collection efficiency of 99.97% for 0.3-micron dioctylphthalate (DOP) or equivalent aerosol particles. Exhaust filters are tested with DOP prior to installation or tested in-place after installation and re-tested in-place on an annual basis, as a minimum, to ensure continued integrity. In-place testing requires a minimum collection efficiency of 99.95% for 0.7 micron aerosol particles. Static HEPA filters are tested only prior to installation and are changed out every six years.

(2) The nearest farm producing meat and/or milk is about 2000 meters, and the nearest school is about 1700 meters from a point, central to the main emission points between KAPL and SPRU DP. The distances for this table were determined using ArcMap GIS software.

(3) Radionuclides that could contribute more than 10% of the potential effective dose equivalent for the release point are listed.

(4) Air from radiological facilities (hoods and glove box containments) is exhausted through HEPA filters. Exhausts for some room air and air from non-radiological hoods are not HEPA-filtered.

(5) Building E4 is the only emission point that has the potential to discharge radionuclides into the air in quantities such that the effective dose equivalent could be ≥ 0.1 mrem/year. The emission point is monitored with an ANSI/HPS N13.1-1999 compliant system.

(6) Charcoal adsorbers, which contain triethylene diamine (TEDA) impregnated carbon, are also used and are tested by the manufacturer to ensure a minimum 99.9% mechanical efficiency.

(7) The estimated emissions from the annual confirmatory measurements are included in the radionuclide total annual emissions in the Point Source KAPL- Knolls Site Air Emission Data – 2011 Table. The asterisk (*) indicates that an emission point is not monitored.

(8) The exhaust air passes through two-inch diameter glass fiber filters with typical collection efficiency, as tested by the manufacturer, of 99.98% or greater for 0.3-micron DOP or equivalent particles.

Table 2 – KAPL-Knolls Site Air Emission Data – 2011

Radionuclide	Annual Quantity Ci[(1)]
H-3	3.45 E-08
Kr-85	2.38 E-01
Co-60	1.63 E-08
Sr-90	2.88 E-06
Y-90	2.88 E-06
Cs-137	2.88 E-06
U-234	4.71 E-07
U-235	7.91 E-09
U-236	1.47 E-09
U-238	8.92 E-12
Pu-238	6.64 E-08

Note: (1) 1 Ci = 3.7E-2 TBq

SPRU DP

The point source release data were obtained from analysis of particulate air samples that were collected from permitted portable ventilation units (PVUs). PVUs were placed into service during the fourth quarter of 2011. There were no point source discharges in the first three quarters of the year. The PVU air samplers operated continuously during the periods when the PVUs were in operation. Glass fiber filters (47 mm) were used to capture particulate samples. The sample flow rates and volumes were recorded from the readout display of volume totalizers. The PVU ventilation exhaust rates were measured with calibrated thermal anemometers.

SPRU DP staff performed daily surveillances of the PVUs to verify operability. The ventilation exhaust run times varied according to the nature of the work. The sample pumps were calibrated annually according to SPRU DP procedures. The PVU air filter sample results did not indicate a failure of any HEPA filter during 2011.

By procedure, HEPA units are tested in-place to verify 99.95% efficiency prior to initial use and annually thereafter. Procedures stipulate that the HEPA filters are not used if efficiency testing expiration date has been reached. The following table lists the SPRU-DP point sources relative to offsite receptors and types of radionuclide measurements.

Table 3 - SPRU DP Point Sources – 2011

Point Source	Type Control[1]	Efficiency (%)[1]	Distances from Point Sources to Nearest Receptors (m)[2]			Radionuclide Measurements
			Residence	Business	Vegetable Farm	
PVUs	HEPA	99.95	550	425	775	Radiochemical analysis of quarterly composite

Notes for Table 3:

(1) The HEPA filters are tested by the manufacturer to exhibit a minimum collection efficiency of 99.97% for 0.3-micron dioctylphthalate (DOP) or equivalent aerosol particles. Filtration units are tested in-place after installation. In-place testing requires a minimum collection efficiency of 99.95% for 0.7-micron aerosol particles.

(2) The nearest farm producing meat and/or milk is about 2000 meters from a point, central to the main emission points between KAPL and SPRU DP, and the nearest school is about 1700 meters away. The distances to receptors in Table 3 are measured from the center of the SPRU DP work area. The location of the nearest receptor to the SPRU DP work area may or may not correspond to the location of the MEOSI for the KAPL site, depending on geometry, dispersion and occupancy factors. The nearest receptor for the KAPL site is 450 meters from a point, central to the main emission points between KAPL and SPRU DP.

Historically, the radionuclides that contribute more than 1% of the effective dose equivalent for the point sources are Cs-137, Sr-90, Pu-239 and Am-241. Other nuclides that were measured in the radiochemical analysis results of the composite PVU filter sample were Th-230, U-234 and U-238. In cases where radiochemical isotopic results were positive but less than the detection level, the emission was reported to be at the detection level. In cases where radiochemical isotopic results were less than zero, isotopic concentrations were set to zero. Cs-137 and Sr-90 are assumed to be in 100% equilibrium with their decay products. The emission quantity of each radionuclide is calculated as the measured activity of the composite filter sample times the ratio of the ventilation flow rate divided by the sample flow rate, which is a factor of 440. The emissions are provided in Table 4.

Table 4 - SPRU DP Point Source Emissions – 2011

Radionuclide	Annual PVU Emission (Ci)
Cs-137	2.0E-09
Sr-90	8.9E-10
Pu-238	7.3E-11
Pu-239	1.3E-10
Am-241	0
Th-230	4.3E-10
U-234	1.7E-10
U-235	8.7E-11
U-238	1.6E-10

Note that 1 Ci = 3.7E-2 TBq.

Non-Point Source

KAPL

Historical Soil Contamination

Historical soil contamination is a potential diffuse source at the DOE Knolls Site. The principal nuclide associated with the historical contamination is Cs-137. The soil was contaminated over 45 years ago as a result of various waste handling operations. Prior to 2011, the majority of these contaminated, historical soil areas was transferred to the cognizance of SPRU and was subsequently remediated. The areas, remaining under KAPL cognizance, with potential soil contamination are for the most part, either paved over or are covered with vegetation or clean soil or fill and do not represent a significant source of airborne radionuclides. Conservatively these areas were evaluated for potential emissions from wind-induced soil re-suspension using the techniques presented in "Methods for Estimating Fugitive Air Emissions of Radionuclides for Diffuse Sources at DOE Facilities – Final Report, September 3, 2004."

Additionally, on September 29, 2010, a SPRU DP Site event during demolition of Building H2 resulted in airborne radiological contamination being spread to KAPL property. The majority of this contamination on the KAPL Site was cleaned up during October and November 2010. One area under KAPL cognizance for nearly all of 2011 still contains residual contamination. Surveys were taken to determine the level and the extent of the contamination on the KAPL Knolls Site. The contamination was not distributed uniformly over the area of concern and can best be characterized as spotty. These survey data and results were used as the basis of the evaluation of the contamination spread as a diffuse potential source of airborne radionuclides. Conservatively this area was also evaluated for potential emissions from wind-induced soil re-suspension using the techniques presented in "Methods for Estimating Fugitive Air Emissions of Radionuclides for Diffuse Sources at DOE Facilities – Final Report, September 3, 2004." However, because this contamination was more recently deposited, a higher and more conservative re-suspension factor was used, based on NCRP Report No. 129, "Recommended Screening Limits for Contaminated Surface Soil and Review of Factors relevant to Site-Specific Studies, 1999."

The resultant total potential diffuse source term for wind-induced re-suspension of soil on the KAPL Knolls Site, which includes the contributions from re-suspension of both historical soil areas under KAPL cognizance and the single area containing residual contamination from the September 29, 2010, SPRU DP Site event is as follows:

Table 5 - KAPL Diffuse Source Term

Radionuclide	Diffuse Source Term (Ci)
Sr-90/Y-90	5.68E-08
Cs-137	2.09E-07
Am-241	7.38E-11
Pu-238	7.38E-12
Pu-239	2.97E-10
Pu-240	7.38E-11
Pu-241	1.50E-10
Pu-242	7.38E-15

Using the above as input to CAP88-PC Version 3.0 results in an annual dose of 5.32E-08 mrem to the maximally exposed off-site individual located at a residence in the southwest sector at a distance of 450 meters.

SPRU DP

The diffuse releases from SPRU DP for 2011 resulted from soil excavation, breathing emissions from buildings and systems, working and transfer losses from tanks, activities associated with enclosure installation, and fugitive emissions associated with maintenance actions. The diffuse emissions were calculated according to the available radionuclide inventory for each process, utilizing Appendix D or other EPA methods described in the EPA document *Methods for Estimating Fugitive Emissions of Radionuclides from Diffuse Sources at DOE Facilities* (EPA 2004) and process knowledge of physical and chemical processes. Methods and parameters are described in SPRU DP's archives of radiological and environmental engineering calculations. Diffuse emissions are summarized in Table 6.

Building G2 Loose Contamination Emissions
The generation of airborne radioactive materials occurs from the resuspension of surface contamination incidental to performing work in the building. Following turnover of the building for demolition, parts of the external walls were removed and the contamination was exposed to the environment. The nature of the work performed by the SPRU DP during 2011 in the buildings consisted of general facility maintenance, removal of hazardous and legacy radioactive materials, removal of asbestos and hazardous material, management of storm water intrusion, installation of enclosures, and preparations for demolition of the buildings. Exhaust ventilation was not applied to Building G2 during 2011.

Loose contamination levels were conservatively calculated (i.e. overestimated) based on bounding estimates of the surfaces contamination levels. Building breathing losses were also evaluated.

Building H2
The generation of airborne radioactive materials occurs from the resuspension of surface contamination from the pad and adjacent soil incidental to installing the enclosures. The work performed by the SPRU DP during 2011 consisted of operating the groundwater treatment system adjacent to H2, general facility maintenance, response to hillside slumping, limited removal of hazardous and radioactive materials, and installation of the enclosure. Loose contamination levels were conservatively calculated based on bounding estimates of the surface contamination levels. Building breathing losses were also evaluated.

Installation of the enclosure involved disturbance of debris, movement of equipment, and placement of structural fill to create an equipment travel path across the pad. The emission related to the installation of the equipment travel path was conservatively estimated to be 10% of the emission that occurred on September 29, 2010. This estimate is considered to be a bounding calculation. The result of this conservativeness is that 81% of the total annual dose calculation is associated with this upper bound value.

Sludge Processing
The installation of a weather protection tent over the roof of the tank vaults was completed in 2010. The sludge was consolidated in Tank 509E in 2010 and stored during 2011. Enhancements to the tent in 2011 improved the tightness of the enclosure. A spill of sludge in the summer of 2010 contaminated an area of the floor inside the tent. Decontamination

activities were performed in 2011 inside the tent under the PVU permit and the resulting emissions are reported under the point source emission calculation. This diffuse emission calculation assumes that some leakage occurred during the period prior to the decontamination when the tent was maintained at ambient pressure. Additionally, breathing and working losses (defined below) from waste inside the tanks have been evaluated.

Water Treatment

Fugitive emissions from water transfers occur when water-containing radioactivity fills a collection vessel (tank) and contaminated air is displaced ("working losses") to the environment via vessel vents. Breathing losses occur when air is displaced outward from the vessel during storage as a result of temperature or atmospheric pressure change in the vessel. Building, storage tank, and water transfer emissions were evaluated by applying conservative concentrations and vapor phase partition factors. Representative water samples were analyzed by an offsite laboratory.

During the year, a total of 684,400 gallons of water were collected and processed from H2 and the hillside sump. Of this amount, approximately 18,000 gallons had been previously transferred from G2 to the H2 basement. No water was transferred from or between the high-level tank vaults. The emissions were calculated based on 18,000 gallons of water at the contamination profile of the G2 cells and 666,400 gallons with the contamination profile of the H2 basement. Both profiles are considered to be conservative compared to the actual source term of the water. The emissions, which are modeled as water vapor losses from the tanks, are calculated based on a partition factor of unity between the water in the tanks and the water vapor in the head space. This assumption is likely conservative by at least six orders of magnitude.

Soil Disturbance

The excavation of the soil over the tank farm was completed in early 2010. During 2011, soil was excavated in the proximity of the buildings to support installation of the enclosures. Soil was also excavated or disturbed for crane pads and to support stabilization of the hillside west of H2. Source terms are based on characterization profiles, radcon surveys of intermodal packages and MicroShield calculations of dose-to-curie factors. The radiological inventory of the intermodal packages was generally based on dose-to-curie factors calculated for the ends of the intermodal boxes, which are the most conservative.

Waste Shipping

In 2011, movement and storage of waste containers occurred at the SPRU DP. The containers were sealed after loading and inspection. Therefore, the interim staging of packages prior to transportation did not represent a potential source of airborne emissions and no source term is provided for the shipping actions.

Table 6 SPRU DP Diffuse Emissions by Source – 2011 (Ci)[4]

Radio-Nuclide	G2 & H2 Building Breathing	Soil Disturbance	Tank Farm Decon	Tank Farm Sludge	Debris Pile Disturbance[5]	H2 /Hillside Water (Working)	G2 Water (Working)	Frac Tank Breathing	Total Diffuse Emission
Cs-137[1]	1.0E-09	4.7E-09	4.6E-08	2.2E-07	1.6E-06	4.7E-06	5.1E-06	5.8E-06	1.8E-05[3]
Sr-90[1]	7.5E-10	9.9E-09	1.7E-08	8.2E-08	3.6E-05	7.6E-06	2.6E-06	6.0E-06	5.3E-05[3]
Pu-238[2]	4.9E-14	4.1E-13	7.5E-11	3.6E-10	4.3E-08	3.5E-10	2.1E-10	3.3E-10	4.4E-08
Pu-239[2]	3.7E-12	6.2E-11	5.7E-09	2.7E-08	3.4E-06	6.6E-08	5.1E-09	4.2E-08	3.5E-06
Am-241[2]	2.5E-12	7.7E-12	8.4E-10	4.0E-09	0	4.7E-08	2.6E-09	3.0E-08	8.4E-08
U-233	0	0	1.9E-11	9.0E-11	2.4E-09	6.4E-09	2.2E-10	3.9E-09	1.3E-08
U-234	0	0	5.2E-11	2.5E-10	1.4E-08	3.8E-08	1.3E-09	2.3E-08	7.7E-08
U-235	0	0	4.5E-12	2.1E-11	1.2E-09	3.8E-09	1.0E-10	2.3E-09	7.4E-09
U-238	0	0	5.2E-11	2.5E-10	1.4E-08	3.8E-08	1.5E-09	2.3E-08	7.7E-08

Notes for Table 6:

(1) Cs-137 and Sr-90 scaled from gross beta according to radionuclides reported in laboratory analysis.
(2) Pu-238, Pu-239 and Am-241 scaled from gross alpha according to radionuclides reported in laboratory analysis.
(3) Ba-137m and Y-90 are assumed to be present at 100% equilibrium.
(4) 1 Ci = 3.7E-2 TBq.
(5) Estimated at 10% of the September 29, 2010 release.

SPRU DP Summary of Emissions

The emissions associated with point sources are based on off-site laboratory analysis of PVU filter samples. In assessing the data, zero was applied in place of the observed value if the laboratory measurement was negative. Otherwise, the measured value was reported. In this respect, the point source emissions data are biased conservatively. Exhaust flow rates and sample flow rates were monitored and recorded.

All diffuse (non-point) emission quantities, except the debris pile emissions, are determined using process knowledge, 40 CFR 61, Appendix D or other EPA approved methods described in the EPA document *Methods for Estimating Fugitive Air Emissions of Radionuclides from Diffuse Sources at DOE Facilities* (EPA2004). Emissions from the debris pile are estimated to be 10% of the emission that occurred on September 29, 2010. The Ba-137m and Y-90 decay products of Cs-137 and Sr-90 are assumed to be present in full equilibrium. The abundance of Pu-238 and Am-241 relative to Pu-239 was estimated from characterization samples of building contamination, sludge and water.

Emissions from portable ventilation units in the E1/G1 tunnel were discharged to the basement of the E1 and G1 buildings. Emissions from the SPRU-DP operations in the E1/G1 tunnel and basement are reflected in KAPL's reporting of emissions from the Building E1/G1 Basement.

Section III - Dose Assessment

Description of Dose Model

The dose model used by KAPL and SPRU DP was CAP88-PC Version 3.0.

Summary of Input Parameters

Receptor Identification and Location (KAPL, and SPRU DP)

All point source releases from both KAPL and SPRU DP were considered as originating from a single stack, central to the main emission points between both KAPL and SPRU DP. Diffuse source releases from KAPL and SPRU DP were considered as originating from an area, one meter in height, central to the main emission points between both KAPL and SPRU DP. The distance and direction to the receptor for the maximum potential dose, which is a residence, is approximately 450 meters in the southwest sector. The location was verified by inspecting the CAP88-PC results and comparing doses at the nearest occupied location in each sector. In sectors where a business location is closer than the nearest residence, both the nearest business location and the nearest residence were evaluated. For business locations, an occupancy correction is applied by dividing the doses at business locations by three to account for an occupancy factor of 8 hours per day. Plume rise was modeled as a momentum plume with zero velocity.

Values Used for all Other User-Supplied Input Parameters for the Computer Models and the Source of These Data:

Common Input Data

a. Wind frequency data and average temperature of 10.0°C were reduced from calendar year 2011 on-site meteorological measurements of wind speed, wind direction and standard deviation of horizontal wind direction, and temperature. Data reduction was performed in accordance with EPA-454/R-99-005, "Meteorological Monitoring Guidance for Regulatory Modeling Applications." The calendar year 2011 annual rainfall of 136.3 centimeters was taken from the Albany National Weather Service.

b. The average depth of mixing layer, LID = 1000 meters, is the average of the annual mean morning and afternoon mixing depths from George C. Holzworth, "Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Through the Contiguous United States," U.S. Environmental Protection Agency Office of Air Programs report, 1972.

c. The distances from the centrally modeled emission point to the nearest receptors were determined by KAPL with the use of ArcMap GIS software.

d. The food sources fractions used in the assessment were those listed for rural sites in the CAP88-PC Version 3.0 program when the Rural EPA Food Source Scenario option was selected. In addition, the agricultural data (livestock densities and cultivated land fractions) were default data as specified within the CAP88-PC Version 3.0 program when New York State was selected for the site location.

KAPL Specific Input Data

a. A stack or source height of 1 meter was used to model a ground level release but maintain stack or source height greater than zero per ORNL-5532 (AIRDOS-EPA). A stack diameter of 1.0 meters was entered into the data to ensure the use of a non-zero value as required by Version 3.0.

b. The total radionuclide emissions from point sources were those from the KAPL- Knolls Site Air Emission Data – 2011 Table 2, above. Radionuclide emissions from monitored emission points were calculated based on sampling system measurement results, radiochemistry results (gross alpha, gross beta, and gamma spectrometry), and stack flow measurements. Kr-85 emissions were based upon integrated data from a noble gas monitoring system. Estimated emissions from unmonitored emission points were based on annual confirmatory measurements (e.g., radioactive material usage surveys and/or representative air sample measurements). The diffuse source emissions were those taken from Table 5 and described in the Non-Point Source Section above.

c. With the exception of the cobalt, and uranium radionuclides, the default lung clearance types ("FGR 13 Type") were assumed. For Co-60, U-234, U-235, U-236, and U-238, "Slow" was selected. This selection was based on the higher dose equivalent conversion factors per unit radioactivity compared to the CAP88-PC Version 3.0 default values, with supporting guidance provided in DOE Order 5400.5.

SPRU DP Specific Input Data

a. Per the PVU permit application, a 2-meter stack height has been used. The diameter is based on the 9" diameter of the PVU discharge duct. Plume rise for point sources was modeled as momentum plume rise with zero velocity. The diffuse source area dimensions are taken or calculated from engineering documents and are provided in Appendix B. Diffuse (area) sources are modeled as ground-level releases of one meter height and zero velocity.

KAPL – Compliance Assessment - 2011

Effective Dose Equivalent	Location of Maximally Exposed Off-Site Individual (MEOSI)
2.87E-04 mrem (2.87E-03 µSv)*	A residence at about 450 meters in the southwest sector

** 1 mrem = 10 µSv*

The KAPL CAP88-PC calculations and output are contained in Appendix A.

Table 7 - Summary of KAPL Dose Equivalents for Calendar Year 2011

Sector	Distance to Nearest Receptor (meters)	Point Source Dose Equivalent (mrem/year)	Diffuse Source Dose Equivalent (mrem/year)	Total Dose Equivalent (mrem/year)	Notes
N	1000	9.30E-05	1.30E-08	9.30E-05	
NNW	1300	8.50E-05	1.10E-08	8.50E-05	
NNW	550	(1.03E-04)	(1.93E-08)	(1.03E-04)	Business*
NW	2550	3.40E-05	1.20E-09	3.40E-05	
NW	700	(3.23E-05)	(4.67E-09)	(3.23E-05)	Business*
WNW	1050	4.70E-05	3.60E-09	4.70E-05	
WNW	775	(2.03E-05)	(2.20E-09)	(2.03E-05)	Business*
W	700	6.30E-05	6.90E-09	6.30E-05	
WSW	750	6.20E-05	6.80E-09	6.20E-05	
SW	450	**2.87E-04**	**5.32E-08**	**2.87E-04**	**MEOSI**
SSW	450	2.80E-04	5.30E-08	2.80E-04	
S	550	2.10E-04	3.70E-08	2.10E-04	
SSE	1650	5.70E-05	5.90E-09	5.70E-05	
SE	1650	5.50E-05	5.40E-09	5.50E-05	
ESE	1000	9.60E-05	1.40E-08	9.60E-05	
E	700	1.00E-04	1.50E-08	1.00E-04	
ENE	700	8.10E-05	1.10E-08	8.10E-05	
NE	700	8.20E-05	1.20E-08	8.20E-05	
NNE	950	6.00E-05	6.60E-09	6.00E-05	

*A correction factor of one-third has been applied to the CAP88 PC doses for the nearest receptors at business locations. The adjusted doses are enclosed in parentheses.

SPRU DP Compliance Assessment - 2011

Effective Dose Equivalent	Location of Maximally Exposed Off-Site Individual
0.0053 mrem (0.053 μSv)*	A residence at about 450 meters in the southwest sector

** 1 mrem = 10 μSv*

The CAP88-PC calculation output is attached (see Appendix B.) A correction factor of three has been applied to the CAP88 PC doses for the nearest receptors at business locations. The adjusted doses are enclosed in parentheses.

Table 8 - Summary of SPRU DP Doses from Releases in 2011 (mrem/yr)

Sector / Distance to Nearest Receptor (m)	Point Source	Diffuse Source	Total	Note
N / 1000	4.3E-11	1.6E-03	1.6E-03	
NNW / 1300	3.6E-11	1.5E-03	1.5E-03	
NNW / 550	(6.0E-11)	(1.9E-03)	(1.9E-03)	Business*
NW / 2550	4.0E-12	5.3E-04	5.3E-04	
NW / 700	(1.5E-11)	(5.7E-04)	(5.7E-04)	Business*
WNW / 1050	1.2E-11	7.5E-04	7.5E-04	
WNW / 775	(7.7E-12)	(3.7E-04)	(3.7E-04)	Business*
W / 700	2.2E-11	1.1E-03	1.1E-03	
WSW / 750	2.2E-11	1.0E-03	1.0E-03	
SW / 450	**1.7E-10**	**5.3E-03**	**5.3E-03**	**MEOSI**
SSW / 450	1.7E-10	5.2E-03	5.2E-03	
S / 550	1.2E-10	3.8E-03	3.8E-03	
SSE / 1650	1.9E-11	9.5E-04	9.5E-04	
SE / 1650	1.7E-11	9.1E-04	9.1E-04	
ESE/ 1000	4.3E-11	1.7E-03	1.7E-03	
E / 700	4.8E-11	1.8E-03	1.8E-03	
ENE / 700	3.7E-11	1.4E-03	1.4E-03	
NE / 700	3.8E-11	1.4E-03	1.4E-03	
NNE / 950	2.2E-11	1.0E-03	1.0E-03	

*A correction factor of one-third has been applied to the CAP88 PC doses for the nearest receptors at business locations. The adjusted doses are enclosed in parentheses.

DOE Knolls Site – Combined Compliance Assessment - 2011

Effective Dose Equivalent	Location of Maximally Exposed Individual
5.59E-03 mrem (5.59E-02 μSv)*	A residence at about 450 meters in the southwest sector

** 1 mrem = 10 μSv*

Table 9 – DOE Knolls Site Combined Compliance Assessment - 2011

Sector	Distance to Nearest Receptor (meters)	KAPL Total Dose Equivalent (mrem/year)	SPRU DP Total Source Dose Equivalent (mrem/year)	Knolls Site Total Equivalent (mrem/year)	Notes
N	1000	9.30E-05	1.6E-03	1.69E-03	
NNW	1300	8.50E-05	1.5E-03	1.59E-03	
NNW	550	(1.03E-04)	(1.9E-03)	(2.00E-03)	Business*
NW	2550	3.40E-05	5.3E-04	5.64E-04	
NW	700	(3.23E-05)	(5.7E-04)	(6.02E-04)	Business*
WNW	1050	4.70E-05	7.5E-04	7.97E-04	
WNW	775	(2.03E-05)	(3.7E-04)	(3.90E-04)	Business*
W	700	6.30E-05	1.1E-03	1.16E-03	
WSW	750	6.20E-05	1.0E-03	1.06E-03	
SW	450	**2.87E-04**	**5.3E-03**	**5.59E-03**	**MEOSI**
SSW	450	2.80E-04	5.2E-03	5.48E-03	
S	550	2.10E-04	3.8E-03	4.01E-03	
SSE	1650	5.70E-05	9.5E-04	1.01E-03	
SE	1650	5.50E-05	9.1E-04	9.65E-04	
ESE	1000	9.60E-05	1.7E-03	1.80E-03	
E	700	1.00E-04	1.8E-03	1.90E-03	
ENE	700	8.10E-05	1.4E-03	1.48E-03	
NE	700	8.20E-05	1.4E-03	1.48E-03	
NNE	950	6.00E-05	1.0E-03	1.06E-03	

*A correction factor of one-third has been applied to the CAP88 PC doses for the nearest receptors at business locations. The adjusted doses are enclosed in parentheses.

Section IV - Additional Information

In accordance with 40 CFR 61.94(b)(8), DOE sites are required to report on all construction and modifications which were completed in CY 2011 but for which the requirement to apply for approval to construct or modify was waived under 40 CFR 61.96.

KAPL

During 2011, there were no new construction projects or modifications to existing operations for which approval to construct or modify was waived under 40 CFR 61.96.

On May 31, 2011, EPA provided a draft Compliance Order on Consent to DOE regarding radionuclide NESHAPs compliance at the KAPL Knolls Site, including SPRU. This draft Compliance Order removed the availability of the above exemption to both KAPL and SPRU. On November 9, 2011, the DOE Naval Reactors Laboratory Field Office submitted to EPA Region 2 for approval three applications to construct/modify stationary sources of radionuclides. These applications were for Building D2 Room 124 Ventilation Duct Removal, Building F4 Full Core Physics Core Dolly Decontamination, and Building D3 Ventilation Duct Removal. Methods detailed in Appendix D of 40 CFR 61 were used to calculate potential source terms and used as input to the CAP88-PC, Version 3.0 computer model to evaluate potential dose equivalents to the MEOSI. In the Building D2 Room 124 Ventilation Duct Removal and the Building D3 Ventilation Duct Removal evaluation, the dose equivalents to the MEOSI were 0.0 mrem/year. In the Building F4 Full Core Physics Core Dolly Decontamination, the annual effective dose equivalent to the MEOSI calculated using the EPA approved computer code was 1.98E-09 mrem. In the EPA Region 2 letter to U.S. Department of Energy, dated January 04, 2012, EPA Region 2 approved the three applications to construct or modify: KAPL-2012-001 for the Building D2 Room 124 Ventilation Duct Removal, KAPL-2012-002 for Building F4 Full Core Physics Experiment Core Dolly Decontamination and KAPL-2012-003 for the Building D3 Ventilation Duct Removal.

Additionally, on September 9, 2011, the DOE Naval Reactors Laboratory Field Office issued to EPA Region 2 notification of anticipated startup of the Building E4 Telemanipulator Decontamination Glovebox. EPA was provided a demonstration of the operation of the glove box on a non-radiological telemanipulator on October 13, 2011. The Building E4 Telemanipulator Decontamination Glovebox startup with radiologically contaminated telemanipulators is pending.

On March 1, 2012, U.S. EPA Region 2 issued the signed Compliance Order on Consent #CAA-02-2012-1002.

SPRU DP

In 2011 there were no construction or modifications completed for which a waiver under 40 CFR 61.96 was taken.

Unplanned Releases

KAPL

There were no unplanned releases to the atmosphere.

SPRU DP

There were no unplanned releases to the atmosphere.

Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. See, 18 U.S.C. 1001.

Signature: _____ Date: 6/26/12

for T. E. Ketcham,
Assistant Manager for Operations
Naval Reactors Laboratory Field Office - Schenectady

Signature: _____ Date: 6/25/12

J. R. Craig
Director
Consolidated Business Center
DOE - Office of Environmental Management

APPENDIX A

Knolls Atomic Power Laboratory

(KAPL)

CAP88-PC OUTPUT REPORTS

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CAP88-PC

KAPL Point Source

Calculation

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
Apr 4, 2012 02:33 pm

Facility: KAPL - KNOLLS SITE
Address: 2401 RIVER ROAD
City: NISKAYUNA
State: NY Zip: 12309

Source Category: DOE FACILITY
Source Type: Stack
Emission Year: 2011

Comments: KAPL KNOLLS 2011 EMISSIONS
MAXIMALLY EXPOSED INDIVIDUAL

Effective Dose Equivalent
(mrem/year)

2.87E-04

At This Location: 450 Meters Southwest

Dataset Name: KNOMEI2011
Dataset Date: 4/4/2012 2:14:00 PM
Wind File: C:\Program Files\CAP88-PC30\WindLib\KAPL2011

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 450 Meters Southwest
Lifetime Fatal Cancer Risk: 1.54E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
Adrenals	5.88E-05
B Surfac	1.56E-03
Breasts	4.91E-05
St Wall	5.74E-05
ULI Wall	7.86E-05
Kidneys	5.76E-05
Lungs	9.89E-05
Ovaries	6.07E-05
R Marrow	6.80E-04
Spleen	5.70E-05
Thymus	5.56E-05
Uterus	6.03E-05
Bld Wall	6.34E-05
Brain	5.08E-05
Esophagu	7.08E-05
SI Wall	6.03E-05
LLI Wall	1.43E-04
Liver	7.41E-05
Muscle	5.38E-05
Pancreas	6.01E-05
Skin	3.32E-04
Testes	5.49E-05
Thyroid	5.58E-05
EFFEC	2.87E-04

RADIONUCLIDE EMISSIONS DURING THE YEAR 2011

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
Kr-85	G	0	2.4E-01	2.4E-01
H-3	V	0	3.5E-08	3.5E-08
Co-60	S	1	1.6E-08	1.6E-08
Pu-238	M	1	6.6E-08	6.6E-08
U-238	S	1	8.9E-12	8.9E-12
U-236	S	1	1.5E-09	1.5E-09
U-235	S	1	7.9E-09	7.9E-09
U-234	S	1	4.7E-07	4.7E-07
Sr-90	M	1	2.9E-06	2.9E-06
Y-90	M	1	2.9E-06	2.9E-06
Cs-137	F	1	2.9E-06	2.9E-06
Ba-137m	M	1	2.9E-06	2.9E-06

SITE INFORMATION

Temperature: 10 degrees C
Precipitation: 136 cm/y
Humidity: 8 g/cu m
Mixing Height: 1000 m

User specified location of max exposed individual.
(ILOC, JLOC): 7, 1

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 1.00
Diameter (m): 1.00

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

450	550	700	750	775	950	1000
1050	1300	1650	2550	80000		

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
Apr 4, 2012 02:33 pm

Facility: KAPL - KNOLLS SITE
Address: 2401 RIVER ROAD
City: NISKAYUNA
State: NY Zip: 12309

Source Category: DOE FACILITY
Source Type: Stack
Emission Year: 2011

Comments: KAPL KNOLLS 2011 EMISSIONS
MAXIMALLY EXPOSED INDIVIDUAL

Dataset Name: KNOMEI2011
Dataset Date: 4/4/2012 2:14:00 PM
Wind File: . C:\Program Files\CAP88-PC30\WindLib\KAPL2011.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
Adrenals	5.88E-05
B Surfac	1.56E-03
Breasts	4.91E-05
St Wall	5.74E-05
ULI Wall	7.86E-05
Kidneys	5.76E-05
Lungs	9.89E-05
Ovaries	6.07E-05
R Marrow	6.80E-04
Spleen	5.70E-05
Thymus	5.56E-05
Uterus	6.03E-05
Bld Wall	6.34E-05
Brain	5.08E-05
Esophagu	7.08E-05
SI Wall	6.03E-05
LLI Wall	1.43E-04
Liver	7.41E-05
Muscle	5.38E-05
Pancreas	6.01E-05
Skin	3.32E-04
Testes	5.49E-05
Thyroid	5.58E-05
EFFEC	2.87E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.48E-04
INHALATION	1.32E-04
AIR IMMERSION	4.59E-06
GROUND SURFACE	1.94E-06
INTERNAL	2.80E-04
EXTERNAL	6.53E-06
TOTAL	2.87E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
Kr-85	4.59E-06
H-3	1.94E-11
Co-60	8.74E-09
Pu-238	5.27E-05
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
U-238	0.00E+00
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
U-236	2.21E-07
Th-232	0.00E+00
Ra-228	0.00E+00
Ac-228	0.00E+00
Th-228	0.00E+00
U-235	1.15E-06
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Th-227	0.00E+00
Fr-223	0.00E+00
U-234	7.76E-05
Sr-90	9.74E-05
Y-90	3.95E-07
Cs-137	5.13E-05
Ba-137m	1.61E-06
TOTAL	2.87E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
Esophagu	6.32E-13
Stomach	2.31E-12
Colon	1.37E-11
Liver	4.13E-12
LUNG	6.88E-11
Bone	3.00E-12
Skin	3.31E-13
Breast	2.00E-12
Ovary	9.28E-13
Bladder	1.68E-12
Kidneys	3.91E-13
Thyroid	1.60E-13
Leukemia	4.79E-11
Residual	8.29E-12
Total	1.54E-10
TOTAL	3.08E-10

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	8.24E-11
INHALATION	6.95E-11
AIR IMMERSION	1.38E-12
GROUND SURFACE	9.07E-13
INTERNAL	1.52E-10
EXTERNAL	2.29E-12
TOTAL	1.54E-10

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
Kr-85	1.38E-12
H-3	1.10E-17
Co-60	6.57E-15
Pu-238	9.17E-12
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
U-238	0.00E+00
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
U-236	1.67E-13
Th-232	0.00E+00
Ra-228	0.00E+00
Ac-228	0.00E+00
Th-228	0.00E+00
U-235	8.73E-13
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Th-227	0.00E+00
Fr-223	0.00E+00
U-234	5.83E-11
Sr-90	5.73E-11
Y-90	1.17E-13
Cs-137	2.60E-11
Ba-137m	8.69E-13
TOTAL	1.54E-10

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

Direction	Distance (m) 450	550	700	750	775	950	1000
N	3.3E-04	2.3E-04	1.6E-04	1.4E-04	1.3E-04	9.9E-05	9.3E-05
NNW	4.4E-04	3.1E-04*	2.0E-04	1.8E-04	1.7E-04	1.3E-04	1.2E-04
NW	1.9E-04	1.4E-04	9.7E-05*	8.8E-05	8.4E-05	6.6E-05	6.2E-05
WNW	1.2E-04	9.3E-05	6.9E-05	6.4E-05	6.1E-05*	5.0E-05	4.8E-05
W	1.1E-04	8.4E-05	6.3E-05	5.8E-05	5.7E-05	4.7E-05	4.5E-05
WSW	1.2E-04	9.1E-05	6.7E-05	6.2E-05	6.0E-05	5.0E-05	4.8E-05
SW	2.9E-04	2.0E-04	1.4E-04	1.3E-04	1.2E-04	9.0E-05	8.5E-05
SSW	2.8E-04	2.0E-04	1.4E-04	1.2E-04	1.2E-04	8.7E-05	8.1E-05
S	2.9E-04	2.1E-04	1.4E-04	1.2E-04	1.2E-04	8.8E-05	8.3E-05
SSE	3.6E-04	2.6E-04	1.7E-04	1.5E-04	1.4E-04	1.1E-04	9.9E-05
SE	3.3E-04	2.3E-04	1.6E-04	1.4E-04	1.3E-04	9.9E-05	9.2E-05
ESE	3.3E-04	2.4E-04	1.6E-04	1.4E-04	1.4E-04	1.0E-04	9.6E-05
E	2.0E-04	1.4E-04	1.0E-04	9.1E-05	8.7E-05	6.8E-05	6.4E-05
ENE	1.6E-04	1.1E-04	8.1E-05	7.5E-05	7.2E-05	5.7E-05	5.4E-05
NE	1.6E-04	1.2E-04	8.2E-05	7.6E-05	7.2E-05	5.8E-05	5.5E-05
NNE	1.7E-04	1.2E-04	8.6E-05	7.9E-05	7.5E-05	6.0E-05	5.6E-05

Direction	Distance (m) 1050	1300	1650	2550	80000
N	8.7E-05	6.9E-05	5.5E-05	4.0E-05	2.7E-05
NNW	1.1E-04	8.5E-05	6.6E-05	4.6E-05	2.7E-05
NW	5.9E-05	5.0E-05	4.2E-05	3.4E-05	2.7E-05
WNW	4.7E-05	4.1E-05	3.6E-05	3.1E-05	2.7E-05
W	4.4E-05	3.9E-05	3.5E-05	3.1E-05	2.7E-05
WSW	4.6E-05	4.0E-05	3.6E-05	3.1E-05	2.7E-05
SW	8.0E-05	6.4E-05	5.2E-05	3.9E-05	2.7E-05
SSW	7.7E-05	6.2E-05	5.0E-05	3.8E-05	2.7E-05
S	7.8E-05	6.2E-05	5.0E-05	3.8E-05	2.7E-05
SSE	9.3E-05	7.3E-05	5.7E-05	4.1E-05	2.7E-05
SE	8.7E-05	6.9E-05	5.5E-05	4.0E-05	2.7E-05
ESE	9.0E-05	7.1E-05	5.7E-05	4.1E-05	2.7E-05
E	6.1E-05	5.1E-05	4.3E-05	3.5E-05	2.7E-05
ENE	5.2E-05	4.4E-05	3.8E-05	3.2E-05	2.7E-05
NE	5.2E-05	4.5E-05	3.9E-05	3.2E-05	2.7E-05
NNE	5.4E-05	4.6E-05	3.9E-05	3.3E-05	2.7E-05

* For business locations, an occupancy factor of eight hours per day is used. Therefore, the calculated doses for business locations are to be divided by a factor of three.

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

Direction	Distance (m) 450	550	700	750	775	950	1000
N	1.8E-10	1.3E-10	8.4E-11	7.6E-11	7.2E-11	5.4E-11	5.0E-11
NNW	2.4E-10	1.7E-10	1.1E-10	9.9E-11	9.4E-11	6.9E-11	6.4E-11
NW	1.0E-10	7.4E-11	5.2E-11	4.8E-11	4.6E-11	3.6E-11	3.4E-11
WNW	6.7E-11	5.0E-11	3.7E-11	3.5E-11	3.3E-11	2.8E-11	2.6E-11
W	5.9E-11	4.5E-11	3.4E-11	3.2E-11	3.1E-11	2.6E-11	2.5E-11
WSW	6.5E-11	4.9E-11	3.7E-11	3.4E-11	3.3E-11	2.7E-11	2.6E-11
SW	1.5E-10	1.1E-10	7.5E-11	6.8E-11	6.5E-11	4.9E-11	4.6E-11
SSW	1.5E-10	1.1E-10	7.3E-11	6.6E-11	6.3E-11	4.7E-11	4.4E-11
S	1.6E-10	1.1E-10	7.5E-11	6.7E-11	6.4E-11	4.8E-11	4.5E-11
SSE	2.0E-10	1.4E-10	9.2E-11	8.2E-11	7.8E-11	5.7E-11	5.3E-11
SE	1.8E-10	1.2E-10	8.4E-11	7.5E-11	7.2E-11	5.3E-11	5.0E-11
ESE	1.8E-10	1.3E-10	8.7E-11	7.8E-11	7.4E-11	5.5E-11	5.2E-11
E	1.1E-10	7.7E-11	5.4E-11	4.9E-11	4.7E-11	3.7E-11	3.5E-11
ENE	8.4E-11	6.1E-11	4.4E-11	4.0E-11	3.9E-11	3.1E-11	2.9E-11
NE	8.5E-11	6.2E-11	4.5E-11	4.1E-11	3.9E-11	3.1E-11	3.0E-11
NNE	9.0E-11	6.5E-11	4.7E-11	4.3E-11	4.1E-11	3.2E-11	3.1E-11

Direction	Distance (m) 1050	1300	1650	2550	80000
N	4.7E-11	3.7E-11	3.0E-11	2.2E-11	1.5E-11
NNW	6.0E-11	4.6E-11	3.6E-11	2.5E-11	1.5E-11
NW	3.2E-11	2.7E-11	2.3E-11	1.9E-11	1.5E-11
WNW	2.5E-11	2.2E-11	2.0E-11	1.7E-11	1.5E-11
W	2.4E-11	2.1E-11	1.9E-11	1.7E-11	1.5E-11
WSW	2.5E-11	2.2E-11	2.0E-11	1.7E-11	1.5E-11
SW	4.3E-11	3.5E-11	2.8E-11	2.1E-11	1.5E-11
SSW	4.2E-11	3.4E-11	2.7E-11	2.1E-11	1.5E-11
S	4.2E-11	3.4E-11	2.7E-11	2.1E-11	1.5E-11
SSE	5.0E-11	3.9E-11	3.1E-11	2.3E-11	1.5E-11
SE	4.7E-11	3.7E-11	3.0E-11	2.2E-11	1.5E-11
ESE	4.9E-11	3.9E-11	3.1E-11	2.3E-11	1.5E-11
E	3.3E-11	2.8E-11	2.3E-11	1.9E-11	1.5E-11
ENE	2.8E-11	2.4E-11	2.1E-11	1.8E-11	1.5E-11
NE	2.9E-11	2.4E-11	2.1E-11	1.8E-11	1.5E-11
NNE	2.9E-11	2.5E-11	2.2E-11	1.8E-11	1.5E-11

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
Apr 4, 2012 02:33 pm

Facility: KAPL - KNOLLS SITE
Address: 2401 RIVER ROAD
City: NISKAYUNA
State: NY
Zip: 12309

Source Category: DOE FACILITY
Source Type: Stack
Emission Year: 2011

Comments: KAPL KNOLLS 2011 EMISSIONS
MAXIMALLY EXPOSED INDIVIDUAL

Dataset Name: KNOMEI2011
Dataset Date: 4/4/2012 2:14:00 PM
Wind File: C:\Program Files\CAP88-PC30\WindLib\KAPL2011.WND

HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

Pasquill Stability Class

Dir	A	B	C	D	E	F	G	Wind Freq
N	1.173	1.821	2.912	2.286	1.082	0.863	0.000	0.083
NNW	1.238	2.062	3.434	2.810	1.163	0.981	0.000	0.147
NW	0.897	1.121	1.794	2.341	0.891	0.863	0.000	0.047
WNW	0.821	0.871	0.990	3.565	0.931	0.789	0.000	0.030
W	0.782	0.801	0.789	0.892	0.772	0.772	0.000	0.026
WSW	0.772	0.772	0.814	0.953	0.806	0.772	0.000	0.027
SW	0.861	1.112	1.261	2.036	0.925	0.865	0.000	0.083
SSW	0.828	1.065	1.343	1.704	0.918	0.853	0.000	0.054
S	0.846	1.009	2.572	0.772	0.813	0.790	0.000	0.043
SSE	0.910	1.169	1.361	0.843	0.840	0.808	0.000	0.058
SE	1.137	1.678	2.570	2.606	1.027	0.841	0.000	0.078
ESE	1.381	2.882	4.277	4.146	1.559	0.887	0.000	0.186
E	1.263	2.576	3.710	3.584	1.179	0.847	0.000	0.059
ENE	1.146	2.844	4.460	2.556	1.410	0.827	0.000	0.027
NE	0.954	2.021	2.872	2.939	0.945	0.794	0.000	0.026
NNE	1.146	1.493	2.090	1.530	0.885	0.797	0.000	0.025

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

Pasquill Stability Class

Dir	A	B	C	D	E	F	G
N	1.652	2.596	3.916	3.393	1.524	1.044	0.000
NNW	1.741	2.911	4.140	3.624	1.666	1.320	0.000
NW	1.132	1.767	3.090	3.499	1.117	1.045	0.000
WNW	0.925	1.065	1.482	3.790	1.212	0.827	0.000
W	0.806	0.865	0.830	1.119	0.772	0.772	0.000
WSW	0.772	0.772	0.906	1.261	0.880	0.772	0.000
SW	1.038	1.596	1.976	3.034	1.199	1.050	0.000
SSW	0.947	1.557	1.962	2.428	1.181	1.016	0.000
S	0.996	1.376	2.572	0.772	0.901	0.830	0.000
SSE	1.163	1.954	2.572	1.044	0.980	0.886	0.000
SE	1.598	2.440	3.724	3.527	1.412	0.982	0.000
ESE	1.906	3.250	4.637	4.836	2.085	1.106	0.000
E	1.773	3.193	4.217	4.239	1.687	1.000	0.000
ENE	1.612	3.328	4.642	3.386	1.936	0.945	0.000
NE	1.264	2.774	3.799	3.850	1.244	0.843	0.000
NNE	1.612	2.214	3.338	2.393	1.100	0.855	0.000

FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	0.1237	0.1073	0.1266	0.2174	0.1347	0.2902	0.0000
NNW	0.2137	0.1609	0.1026	0.1717	0.1188	0.2323	0.0000
NW	0.5408	0.0914	0.0168	0.0143	0.0505	0.2861	0.0000
WNW	0.5425	0.1425	0.0384	0.0115	0.0152	0.2500	0.0000
W	0.4610	0.1695	0.1303	0.0217	0.0130	0.2046	0.0000
WSW	0.4035	0.1504	0.1158	0.0470	0.0684	0.2147	0.0000
SW	0.2963	0.1645	0.1522	0.0728	0.1098	0.2045	0.0000
SSW	0.3482	0.0822	0.0316	0.0253	0.0928	0.4199	0.0000
S	0.3158	0.0316	0.0025	0.0078	0.0738	0.5685	0.0000
SSE	0.2103	0.0577	0.0259	0.0516	0.1547	0.4998	0.0000
SE	0.1247	0.1013	0.0851	0.2351	0.1526	0.3011	0.0000
ESE	0.0613	0.1240	0.2240	0.4202	0.0614	0.1092	0.0000
E	0.1045	0.1066	0.1799	0.2784	0.1023	0.2282	0.0000
ENE	0.1262	0.1008	0.0924	0.1008	0.1428	0.4369	0.0000
NE	0.1423	0.0774	0.1034	0.1381	0.0992	0.4396	0.0000
NNE	0.1365	0.0681	0.0681	0.1361	0.1003	0.4908	0.0000
TOTAL	0.2135	0.1162	0.1159	0.1796	0.0983	0.2766	0.0000

ADDITIONAL WEATHER INFORMATION

Average Air Temperature: 10.0 degrees C
283.16 K
Precipitation: 136.3 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: 2.134 m/s

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

C A P 8 8 - P C

Version 3.0

Clean Air Act Assessment Package - 1988

G E N E R A L D A T A

Non-Radon Individual Assessment
Apr 4, 2012 02:33 pm

Facility: KAPL - KNOLLS SITE
Address: 2401 RIVER ROAD
City: NISKAYUNA
State: NY Zip: 12309

Source Category: DOE FACILITY
Source Type: Stack
Emission Year: 2011

Comments: KAPL KNOLLS 2011 EMISSIONS
MAXIMALLY EXPOSED INDIVIDUAL

Dataset Name: KNOMEI2011
Dataset Date: 4/4/2012 2:14:00 PM
Wind File: C:\Program Files\CAP88-PC30\WindLib\KAPL2011.WND

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

Nuclide	Clearance Type	Particle Size (microns)	Scavenging Coefficient (per second)	Dry Deposition Velocity (m/s)
Kr-85	G	0	0.00E+00	0.00E+00
H-3	V	0	0.00E+00	0.00E+00
Co-60	S	1	1.36E-05	1.80E-03
Pu-238	M	1	1.36E-05	1.80E-03
U-234	M	1	1.36E-05	1.80E-03
Th-230	S	1	1.36E-05	1.80E-03
Ra-226	M	1	1.36E-05	1.80E-03
Rn-222	G	0	0.00E+00	0.00E+00
Po-218	M	1	1.36E-05	1.80E-03
Pb-214	M	1	1.36E-05	1.80E-03
Bi-214	M	1	1.36E-05	1.80E-03
Po-214	M	1	1.36E-05	1.80E-03
Pb-210	M	1	1.36E-05	1.80E-03
At-218	M	1	1.36E-05	1.80E-03
U-238	S	1	1.36E-05	1.80E-03
Th-234	S	1	1.36E-05	1.80E-03
Pa-234m	M	1	1.36E-05	1.80E-03
Pa-234	M	1	1.36E-05	1.80E-03
U-236	S	1	1.36E-05	1.80E-03
Th-232	S	1	1.36E-05	1.80E-03
Ra-228	M	1	1.36E-05	1.80E-03
Ac-228	M	1	1.36E-05	1.80E-03
Th-228	S	1	1.36E-05	1.80E-03
U-235	S	1	1.36E-05	1.80E-03
Th-231	S	1	1.36E-05	1.80E-03
Pa-231	M	1	1.36E-05	1.80E-03
Ac-227	M	1	1.36E-05	1.80E-03
Th-227	S	1	1.36E-05	1.80E-03
Fr-223	M	1	1.36E-05	1.80E-03
U-234	S	1	1.36E-05	1.80E-03
Sr-90	M	1	1.36E-05	1.80E-03
Y-90	M	1	1.36E-05	1.80E-03
Cs-137	F	1	1.36E-05	1.80E-03
Ba-137m	M	1	1.36E-05	1.80E-03

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

Radio-Nuclide	DECAY CONSTANT (PER DAY) active (1)	TRANSFER COEFFICIENT Surface	Water	Milk (2)	Meat (3)
Kr-85	1.77E-04	5.48E-05	0.00E+00	0.00E+00	0.00E+00
H-3	1.54E-04	5.48E-05	0.00E+00	0.00E+00	0.00E+00
Co-60	3.60E-04	5.48E-05	0.00E+00	2.00E-03	3.00E-02
Pu-238	2.16E-05	5.48E-05	0.00E+00	1.00E-06	1.00E-04
U-234	7.76E-09	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-230	2.46E-08	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Ra-226	1.19E-06	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Rn-222	1.81E-01	5.48E-05	0.00E+00	0.00E+00	0.00E+00
Po-218	3.27E+02	5.48E-05	0.00E+00	4.00E-04	5.00E-03
Pb-214	3.72E+01	5.48E-05	0.00E+00	3.00E-04	8.00E-04
Bi-214	5.02E+01	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Po-214	3.64E+08	5.48E-05	0.00E+00	4.00E-04	5.00E-03
Pb-210	8.51E-05	5.48E-05	0.00E+00	3.00E-04	8.00E-04
At-218	2.99E+04	5.48E-05	0.00E+00	1.00E-02	1.00E-02
U-238	4.25E-13	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-234	2.88E-02	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Pa-234m	8.53E+02	5.48E-05	0.00E+00	5.00E-06	5.00E-06
Pa-234	2.48E+00	5.48E-05	0.00E+00	5.00E-06	5.00E-06
U-236	8.10E-11	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-232	1.35E-13	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Ra-228	3.30E-04	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Ac-228	2.71E+00	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Th-228	9.92E-04	5.48E-05	0.00E+00	5.00E-06	1.00E-04
U-235	2.70E-12	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-231	6.52E-01	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Pa-231	5.79E-08	5.48E-05	0.00E+00	5.00E-06	5.00E-06
Ac-227	8.71E-05	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Th-227	3.70E-02	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Fr-223	4.58E+01	5.48E-05	0.00E+00	8.00E-03	3.00E-02
U-234	7.76E-09	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Sr-90	6.52E-05	5.48E-05	0.00E+00	2.00E-03	1.00E-02
Y-90	2.60E-01	5.48E-05	0.00E+00	6.00E-05	2.00E-03
Cs-137	6.32E-05	5.48E-05	0.00E+00	1.00E-02	5.00E-02
Ba-137m	3.91E+02	5.48E-05	0.00E+00	5.00E-04	2.00E-04

FOOTNOTES:

(1) Fraction of animal's daily intake of nuclide which appears in each L of milk (days/L)
(2) Fraction of animal's daily intake of nuclide which appears in each kg of meat (days/kg)

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

	CONCENTRATION UPTAKE FACTOR		GI UPTAKE FRACTION	
Nuclide	Forage (1)	Edible (2)	Inhalation	Ingestion
Kr-85	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H-3	0.00E+00	0.00E+00	1.00E+00	1.00E+00
Co-60	2.00E+00	8.00E-02	1.00E-01	1.00E-01
Pu-238	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-234	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-230	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Ra-226	2.00E-01	4.00E-02	2.00E-01	2.00E-01
Rn-222	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Po-218	1.00E-01	1.00E-03	1.00E-01	1.00E-01
Pb-214	1.00E-01	4.00E-03	2.00E-01	2.00E-01
Bi-214	5.00E-01	1.00E-01	5.00E-02	5.00E-02
Po-214	1.00E-01	1.00E-03	1.00E-01	1.00E-01
Pb-210	1.00E-01	4.00E-03	2.00E-01	2.00E-01
At-218	9.00E-01	2.00E-01	1.00E+00	1.00E+00
U-238	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-234	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pa-234m	1.00E-01	1.00E-02	5.00E-04	5.00E-04
Pa-234	1.00E-01	1.00E-02	5.00E-04	5.00E-04
U-236	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-232	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Ra-228	2.00E-01	4.00E-02	2.00E-01	2.00E-01
Ac-228	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Th-228	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-235	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-231	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pa-231	1.00E-01	1.00E-02	5.00E-04	5.00E-04
Ac-227	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Th-227	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Fr-223	1.00E-01	3.00E-02	1.00E+00	1.00E+00
U-234	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Sr-90	4.00E+00	3.00E-01	3.00E-01	3.00E-01
Y-90	1.00E-01	2.00E-03	1.00E-04	1.00E-04
Cs-137	1.00E+00	2.00E-01	1.00E+00	1.00E+00
Ba-137m	1.00E-01	1.00E-02	2.00E-01	2.00E-01

FOOTNOTES:
(1) Concentration factor for uptake of nuclide from soil for pasture and forage (in pCi/kg dry weight per pCi/kg dry soil)
(2) Concentration factor for uptake of nuclide from soil by edible parts of crops (in pCi/kg wet weight per pCi/kg dry soil)

DECAY CHAIN ACTIVITIES

Nuclide	Stack	Activity at 500. seconds	Activity at 100.00 years
Kr-85	1	2.3800E-01	1.0760E-01
H-3	1	3.4500E-08	0.0000E+00
Co-60	1	1.6300E-08	0.0000E+00
Pu-238	1	6.6400E-08	0.0000E+00
U-234	1	0.0000E+00	0.0000E+00
Th-230	1	0.0000E+00	0.0000E+00
Ra-226	1	0.0000E+00	0.0000E+00
Rn-222	1	0.0000E+00	0.0000E+00
Po-218	1	0.0000E+00	0.0000E+00
Pb-214	1	0.0000E+00	0.0000E+00
Bi-214	1	0.0000E+00	0.0000E+00
Po-214	1	0.0000E+00	0.0000E+00
Pb-210	1	0.0000E+00	0.0000E+00
At-218	1	0.0000E+00	0.0000E+00
U-238	1	0.0000E+00	0.0000E+00
Th-234	1	0.0000E+00	0.0000E+00
Pa-234m	1	0.0000E+00	0.0000E+00
Pa-234	1	0.0000E+00	0.0000E+00
U-236	1	1.4700E-09	0.0000E+00
Th-232	1	0.0000E+00	0.0000E+00
Ra-228	1	0.0000E+00	0.0000E+00
Ac-228	1	0.0000E+00	0.0000E+00
Th-228	1	0.0000E+00	0.0000E+00
U-235	1	7.9100E-09	0.0000E+00
Th-231	1	0.0000E+00	0.0000E+00
Pa-231	1	0.0000E+00	0.0000E+00
Ac-227	1	0.0000E+00	0.0000E+00
Th-227	1	0.0000E+00	0.0000E+00
Fr-223	1	0.0000E+00	0.0000E+00
U-234	1	4.7100E-07	2.1710E-07
Sr-90	1	2.8800E-06	1.3180E-06
Y-90	1	2.8800E-06	1.3190E-06
Cs-137	1	2.8800E-06	1.3190E-06
Ba-137m	1	2.7410E-06	1.2470E-06

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

HUMAN INHALATION RATE	
Cubic centimeters/hr	9.17E+05
SOIL PARAMETERS	
Effective surface density (kg/sq m, dry weight) (Assumes 15 cm plow layer)	2.15E+02
BUILDUP TIMES	
For activity in soil (years)	1.00E+02
For radionuclides deposited on ground/water (days)	3.65E+02
DELAY TIMES	
Ingestion of pasture grass by animals (hr)	0.00E+00
Ingestion of stored feed by animals (hr)	2.16E+03
Ingestion of leafy vegetables by man (hr)	3.36E+02
Ingestion of produce by man (hr)	3.36E+02
Transport time from animal feed-milk-man (day)	2.00E+00
Time from slaughter to consumption (day)	2.00E+01
WEATHERING	
Removal rate constant for physical loss (per hr)	2.90E-03
CROP EXPOSURE DURATION	
Pasture grass (hr)	7.20E+02
Crops/leafy vegetables (hr)	1.44E+03
AGRICULTURAL PRODUCTIVITY	
Grass-cow-milk-man pathway (kg/sq m)	2.80E-01
Produce/leafy veg for human consumption (kg/sq m)	7.16E-01
FALLOUT INTERCEPTION FRACTIONS	
Vegetables	2.00E-01
Pasture	5.70E-01
GRAZING PARAMETERS	
Fraction of year animals graze on pasture	4.00E-01
Fraction of daily feed that is pasture grass when animal grazes on pasture	4.30E-01

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

ANIMAL FEED CONSUMPTION FACTORS	
Contaminated feed/forage (kg/day, dry weight)	1.56E+01
DAIRY PRODUCTIVITY	
Milk production of cow (L/day)	1.10E+01
MEAT ANIMAL SLAUGHTER PARAMETERS	
Muscle mass of animal at slaughter (kg)	2.00E+02
Fraction of herd slaughtered (per day)	3.81E-03
DECONTAMINATION	
Fraction of radioactivity retained after washing for leafy vegetables and produce	5.00E-01
FRACTIONS GROWN IN GARDEN OF INTEREST	
Produce ingested	1.00E+00
Leafy vegetables ingested	1.00E+00
INGESTION RATIOS:	
IMMEDIATE SURROUNDING AREA/TOTAL WITHIN AREA	
Vegetables	7.00E-01
Meat	4.40E-01
Milk	4.00E-01
MINIMUM INGESTION FRACTIONS FROM OUTSIDE AREA	
(Minimum fractions of food types from outside area listed below are actual fixed values.)	
Vegetables	0.00E+00
Meat	0.00E+00
Milk	0.00E+00
HUMAN FOOD UTILIZATION FACTORS	
Produce ingestion (kg/y)	1.76E+02
Milk ingestion (L/y)	1.12E+02
Meat ingestion (kg/y)	8.50E+01
Leafy vegetable ingestion (kg/y)	1.80E+01
SWIMMING PARAMETERS	
Fraction of time spent swimming	0.00E+00
Dilution factor for water (cm)	1.00E+00

CAP88-PC

KAPL Diffuse Source

Calculation

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
Mar 26, 2012 07:43 am

Facility: KAPL - KNOLLS SITE
Address: 2401 RIVER RAOD
City: NISKAYUNA
State: NY Zip: 12309

Source Category: DIFFUSE SOIL
Source Type: Area
Emission Year: 2011

Comments: KAPL KNOLLS SITE 2011 SOIL
SOIL DIFFUSE EVALUATION

Effective Dose Equivalent (mrem/year)
5.32E-08

At This Location: 450 Meters Southwest

Dataset Name: KNOSOIL2011
Dataset Date: 3/26/2012 7:40:00 AM
Wind File: C:\Program Files\CAP88-PC30\WindLib\KAPL2011

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual:	450 Meters Southwest
Lifetime Fatal Cancer Risk:	3.54E-14

RADIONUCLIDE EMISSIONS DURING THE YEAR 2011

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
Pu-242	M	1	7.4E-15	7.4E-15
Pu-241	M	1	1.5E-10	1.5E-10
Pu-240	M	1	7.4E-11	7.4E-11
Pu-239	M	1	3.0E-10	3.0E-10
Pu-238	M	1	7.4E-12	7.4E-12
Am-241	M	1	7.4E-11	7.4E-11
Cs-137	F	1	2.1E-07	2.1E-07
Ba-137m	M	1	2.1E-07	2.1E-07
Sr-90	M	1	5.7E-08	5.7E-08
Y-90	M	1	5.7E-08	5.7E-08

SITE INFORMATION

Temperature:	10 degrees C
Precipitation:	136 cm/y
Humidity:	8 g/cu m
Mixing Height:	1000 m

User specified location of max exposed individual.
(ILOC, JLOC): 7, 1

SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.00
Area (sq m): 10000.00

Plume Rise
Buoyant (cal/s): 0.00
(Heat Release Rate)

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

450	550	700	750	775	950	1000
1050	1300	1650	2550	80000		

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
Mar 26, 2012 07:43 am

Facility: KAPL - KNOLLS SITE
Address: 2401 RIVER RAOD
City: NISKAYUNA
State: NY Zip: 12309

Source Category: DIFFUSE SOIL
Source Type: Area
Emission Year: 2011

Comments: KAPL KNOLLS SITE 2011 SOIL
SOIL DIFFUSE EVALUATION

Dataset Name: KNOSOIL2011
Dataset Date: 3/26/2012 7:40:00 AM
Wind File: . C:\Program Files\CAP88-PC30\WindLib\KAPL2011.WND

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	0.00E+00
INHALATION	5.28E-08
AIR IMMERSION	3.64E-10
GROUND SURFACE	0.00E+00
INTERNAL	5.28E-08
EXTERNAL	3.64E-10
TOTAL	5.32E-08

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
Pu-242	0.00E+00
U-238	0.00E+00
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
U-234	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
Th-229	0.00E+00
Ra-225	0.00E+00
Ac-225	0.00E+00
Fr-221	0.00E+00
At-217	0.00E+00
U-237	0.00E+00
Pu-240	0.00E+00
U-236	0.00E+00
Th-232	0.00E+00
Ra-228	0.00E+00
Ac-228	0.00E+00
Pu-239	0.00E+00
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Pu-238	0.00E+00
Cs-137	1.67E-08
Ba-137m	3.60E-10
Sr-90	3.47E-08
Y-90	1.36E-09
TOTAL	5.32E-08

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
Esophagu	1.76E-16
Stomach	5.95E-16
Colon	3.07E-15
Liver	2.50E-16
LUNG	2.27E-14
Bone	1.86E-16
Skin	1.22E-17
Breast	5.34E-16
Ovary	2.27E-16
Bladder	4.41E-16
Kidneys	8.44E-17
Thyroid	4.17E-17
Leukemia	4.83E-15
Residual	2.13E-15
Total	3.54E-14
TOTAL	7.07E-14

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	0.00E+00
INHALATION	3.52E-14
AIR IMMERSION	1.97E-16
GROUND SURFACE	0.00E+00
INTERNAL	3.52E-14
EXTERNAL	1.97E-16
TOTAL	3.54E-14

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
Pu-242	0.00E+00
U-238	0.00E+00
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
U-234	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
Th-229	0.00E+00
Ra-225	0.00E+00
Ac-225	0.00E+00
Fr-221	0.00E+00
At-217	0.00E+00
U-237	0.00E+00
Pu-240	0.00E+00
U-236	0.00E+00
Th-232	0.00E+00
Ra-228	0.00E+00
Ac-228	0.00E+00
Pu-239	0.00E+00
U-235	0.00E+00
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Pu-238	0.00E+00
Cs-137	7.85E-15
Ba-137m	1.97E-16
Sr-90	2.59E-14
Y-90	1.45E-15
TOTAL	3.54E-14

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

	Distance (m)						
Direction	450	550	700	750	775	950	1000
N	6.4E-08	4.3E-08	2.7E-08	2.3E-08	2.2E-08	1.5E-08	1.3E-08
NNW	8.6E-08	5.8E-08*	3.6E-08	3.2E-08	3.0E-08	2.0E-08	1.8E-08
NW	3.3E-08	2.2E-08	1.4E-08*	1.2E-08	1.1E-08	7.4E-09	6.7E-09
WNW	2.0E-08	1.3E-08	8.1E-09	7.0E-09	6.6E-09*	4.4E-09	3.9E-09
W	1.7E-08	1.1E-08	6.9E-09	6.0E-09	5.6E-09	3.7E-09	3.3E-09
WSW	1.9E-08	1.3E-08	7.8E-09	6.8E-09	6.4E-09	4.2E-09	3.8E-09
SW	5.3E-08	3.6E-08	2.2E-08	1.9E-08	1.8E-08	1.2E-08	1.1E-08
SSW	5.3E-08	3.6E-08	2.2E-08	1.9E-08	1.8E-08	1.2E-08	1.1E-08
S	5.6E-08	3.7E-08	2.3E-08	2.0E-08	1.9E-08	1.2E-08	1.1E-08
SSE	7.1E-08	4.8E-08	3.0E-08	2.6E-08	2.4E-08	1.6E-08	1.4E-08
SE	6.3E-08	4.3E-08	2.7E-08	2.3E-08	2.2E-08	1.4E-08	1.3E-08
ESE	6.4E-08	4.3E-08	2.7E-08	2.4E-08	2.2E-08	1.5E-08	1.4E-08
E	3.6E-08	2.4E-08	1.5E-08	1.3E-08	1.2E-08	8.2E-09	7.4E-09
ENE	2.7E-08	1.8E-08	1.1E-08	9.9E-09	9.2E-09	6.1E-09	5.5E-09
NE	2.8E-08	1.9E-08	1.2E-08	1.0E-08	9.4E-09	6.2E-09	5.6E-09
NNE	3.0E-08	2.0E-08	1.2E-08	1.1E-08	1.0E-08	6.6E-09	6.0E-09

	Distance (m)				
Direction	1050	1300	1650	2550	80000
N	1.2E-08	8.3E-09	5.4E-09	2.5E-09	2.9E-12
NNW	1.6E-08	1.1E-08	7.4E-09	3.4E-09	5.4E-12
NW	6.1E-09	4.2E-09	2.7E-09	1.2E-09	1.3E-12
WNW	3.6E-09	2.4E-09	1.6E-09	6.9E-10	7.6E-13
W	3.0E-09	2.1E-09	1.3E-09	5.8E-10	6.0E-13
WSW	3.5E-09	2.4E-09	1.5E-09	6.8E-10	6.4E-13
SW	1.0E-08	6.8E-09	4.4E-09	2.0E-09	2.5E-12
SSW	9.8E-09	6.7E-09	4.3E-09	2.0E-09	1.6E-12
S	1.0E-08	7.0E-09	4.5E-09	2.0E-09	1.1E-12
SSE	1.3E-08	9.0E-09	5.9E-09	2.7E-09	1.7E-12
SE	1.2E-08	8.2E-09	5.4E-09	2.5E-09	2.8E-12
ESE	1.2E-08	8.5E-09	5.6E-09	2.6E-09	5.5E-12
E	6.8E-09	4.7E-09	3.0E-09	1.4E-09	1.9E-12
ENE	5.1E-09	3.5E-09	2.3E-09	1.0E-09	9.8E-13
NE	5.1E-09	3.5E-09	2.3E-09	1.0E-09	7.4E-13
NNE	5.5E-09	3.7E-09	2.4E-09	1.1E-09	7.2E-13

* For business locations, an occupancy factor of eight hours per day is used. Therefore, the calculated doses for business locations are to be divided by a factor of three.

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

	Distance (m)						
Direction	450	550	700	750	775	950	1000
N	4.2E-14	2.9E-14	1.8E-14	1.5E-14	1.5E-14	9.7E-15	8.7E-15
NNW	5.7E-14	3.9E-14	2.4E-14	2.1E-14	2.0E-14	1.3E-14	1.2E-14
NW	2.2E-14	1.5E-14	9.1E-15	7.9E-15	7.4E-15	4.9E-15	4.5E-15
WNW	1.3E-14	8.7E-15	5.4E-15	4.7E-15	4.4E-15	2.9E-15	2.6E-15
W	1.1E-14	7.4E-15	4.6E-15	4.0E-15	3.7E-15	2.5E-15	2.2E-15
WSW	1.3E-14	8.4E-15	5.2E-15	4.5E-15	4.2E-15	2.8E-15	2.5E-15
SW	3.5E-14	2.4E-14	1.5E-14	1.3E-14	1.2E-14	8.0E-15	7.2E-15
SSW	3.5E-14	2.4E-14	1.5E-14	1.3E-14	1.2E-14	7.9E-15	7.1E-15
S	3.7E-14	2.5E-14	1.5E-14	1.3E-14	1.2E-14	8.3E-15	7.4E-15
SSE	4.7E-14	3.2E-14	2.0E-14	1.7E-14	1.6E-14	1.1E-14	9.6E-15
SE	4.2E-14	2.8E-14	1.8E-14	1.5E-14	1.4E-14	9.6E-15	8.7E-15
ESE	4.3E-14	2.9E-14	1.8E-14	1.6E-14	1.5E-14	9.9E-15	9.0E-15
E	2.4E-14	1.6E-14	1.0E-14	8.7E-15	8.2E-15	5.5E-15	4.9E-15
ENE	1.8E-14	1.2E-14	7.5E-15	6.6E-15	6.1E-15	4.1E-15	3.7E-15
NE	1.8E-14	1.2E-14	7.6E-15	6.7E-15	6.2E-15	4.1E-15	3.7E-15
NNE	2.0E-14	1.3E-14	8.1E-15	7.1E-15	6.6E-15	4.4E-15	4.0E-15

	Distance (m)				
Direction	1050	1300	1650	2550	80000
N	8.0E-15	5.5E-15	3.6E-15	1.6E-15	1.9E-18
NNW	1.1E-14	7.5E-15	4.9E-15	2.3E-15	3.6E-18
NW	4.1E-15	2.8E-15	1.8E-15	8.1E-16	8.6E-19
WNW	2.4E-15	1.6E-15	1.0E-15	4.6E-16	5.0E-19
W	2.0E-15	1.4E-15	8.8E-16	3.9E-16	4.0E-19
WSW	2.3E-15	1.6E-15	1.0E-15	4.5E-16	4.2E-19
SW	6.6E-15	4.5E-15	2.9E-15	1.3E-15	1.7E-18
SSW	6.5E-15	4.5E-15	2.9E-15	1.3E-15	1.1E-18
S	6.8E-15	4.6E-15	3.0E-15	1.4E-15	7.4E-19
SSE	8.8E-15	6.0E-15	3.9E-15	1.8E-15	1.1E-18
SE	8.0E-15	5.5E-15	3.6E-15	1.6E-15	1.8E-18
ESE	8.2E-15	5.7E-15	3.7E-15	1.7E-15	3.6E-18
E	4.5E-15	3.1E-15	2.0E-15	9.3E-16	1.3E-18
ENE	3.4E-15	2.3E-15	1.5E-15	6.9E-16	6.5E-19
NE	3.4E-15	2.3E-15	1.5E-15	6.9E-16	4.9E-19
NNE	3.6E-15	2.5E-15	1.6E-15	7.4E-16	4.8E-19

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
Mar 26, 2012 07:43 am

Facility: KAPL - KNOLLS SITE
Address: 2401 RIVER RAOD
City: NISKAYUNA
State: NY Zip: 12309
Source Category: DIFFUSE SOIL
Source Type: Area
Emission Year: 2011
Comments: KAPL KNOLLS SITE 2011 SOIL
SOIL DIFFUSE EVALUATION
Dataset Name: KNOSOIL2011
Dataset Date: 3/26/2012 7:40:00 AM
Wind File: C:\Program Files\CAP88-PC30\WindLib\KAPL2011.WND

HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class							
Dir	A	B	C	D	E	F	G	Wind Freq
N	1.173	1.821	2.912	2.286	1.082	0.863	0.000	0.083
NNW	1.238	2.062	3.434	2.810	1.163	0.981	0.000	0.147
NW	0.897	1.121	1.794	2.341	0.891	0.863	0.000	0.047
WNW	0.821	0.871	0.990	3.565	0.931	0.789	0.000	0.030
W	0.782	0.801	0.789	0.892	0.772	0.772	0.000	0.026
WSW	0.772	0.772	0.814	0.953	0.806	0.772	0.000	0.027
SW	0.861	1.112	1.261	2.036	0.925	0.865	0.000	0.083
SSW	0.828	1.065	1.343	1.704	0.918	0.853	0.000	0.054
S	0.846	1.009	2.572	0.772	0.813	0.790	0.000	0.043
SSE	0.910	1.169	1.361	0.843	0.840	0.808	0.000	0.058
SE	1.137	1.678	2.570	2.606	1.027	0.841	0.000	0.078
ESE	1.381	2.882	4.277	4.146	1.559	0.887	0.000	0.186
E	1.263	2.576	3.710	3.584	1.179	0.847	0.000	0.059
ENE	1.146	2.844	4.460	2.556	1.410	0.827	0.000	0.027
NE	0.954	2.021	2.872	2.939	0.945	0.794	0.000	0.026
NNE	1.146	1.493	2.090	1.530	0.885	0.797	0.000	0.025

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	1.652	2.596	3.916	3.393	1.524	1.044	0.000
NNW	1.741	2.911	4.140	3.624	1.666	1.320	0.000
NW	1.132	1.767	3.090	3.499	1.117	1.045	0.000
WNW	0.925	1.065	1.482	3.790	1.212	0.827	0.000
W	0.806	0.865	0.830	1.119	0.772	0.772	0.000
WSW	0.772	0.772	0.906	1.261	0.880	0.772	0.000
SW	1.038	1.596	1.976	3.034	1.199	1.050	0.000
SSW	0.947	1.557	1.962	2.428	1.181	1.016	0.000
S	0.996	1.376	2.572	0.772	0.901	0.830	0.000
SSE	1.163	1.954	2.572	1.044	0.980	0.886	0.000
SE	1.598	2.440	3.724	3.527	1.412	0.982	0.000
ESE	1.906	3.250	4.637	4.836	2.085	1.106	0.000
E	1.773	3.193	4.217	4.239	1.687	1.000	0.000
ENE	1.612	3.328	4.642	3.386	1.936	0.945	0.000
NE	1.264	2.774	3.799	3.850	1.244	0.843	0.000
NNE	1.612	2.214	3.338	2.393	1.100	0.855	0.000

FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	0.1237	0.1073	0.1266	0.2174	0.1347	0.2902	0.0000
NNW	0.2137	0.1609	0.1026	0.1717	0.1188	0.2323	0.0000
NW	0.5408	0.0914	0.0168	0.0143	0.0505	0.2861	0.0000
WNW	0.5425	0.1425	0.0384	0.0115	0.0152	0.2500	0.0000
W	0.4610	0.1695	0.1303	0.0217	0.0130	0.2046	0.0000
WSW	0.4035	0.1504	0.1158	0.0470	0.0684	0.2147	0.0000
SW	0.2963	0.1645	0.1522	0.0728	0.1098	0.2045	0.0000
SSW	0.3482	0.0822	0.0316	0.0253	0.0928	0.4199	0.0000
S	0.3158	0.0316	0.0025	0.0078	0.0738	0.5685	0.0000
SSE	0.2103	0.0577	0.0259	0.0516	0.1547	0.4998	0.0000
SE	0.1247	0.1013	0.0851	0.2351	0.1526	0.3011	0.0000
ESE	0.0613	0.1240	0.2240	0.4202	0.0614	0.1092	0.0000
E	0.1045	0.1066	0.1799	0.2784	0.1023	0.2282	0.0000
ENE	0.1262	0.1008	0.0924	0.1008	0.1428	0.4369	0.0000
NE	0.1423	0.0774	0.1034	0.1381	0.0992	0.4396	0.0000
NNE	0.1365	0.0681	0.0681	0.1361	0.1003	0.4908	0.0000
TOTAL	0.2135	0.1162	0.1159	0.1796	0.0983	0.2766	0.0000

ADDITIONAL WEATHER INFORMATION

Average Air Temperature: 10.0 degrees C
283.16 K
Precipitation: 136.3 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: 2.134 m/s
Vertical Temperature Gradients:
STABILITY E 0.073 k/m
STABILITY F 0.109 k/m
STABILITY G 0.146 k/m

C A P 8 8 - P C
Version 3.0
Clean Air Act Assessment Package - 1988

G E N E R A L D A T A
Non-Radon Individual Assessment
Mar 26, 2012 07:43 am

Facility: KAPL - KNOLLS SITE
Address: 2401 RIVER RAOD
City: NISKAYUNA
State: NY Zip: 12309
Source Category: DIFFUSE SOIL
Source Type: Area
Emission Year: 2011
Comments: KAPL KNOLLS SITE 2011 SOIL
SOIL DIFFUSE EVALUATION
Dataset Name: KNOSOIL2011
Dataset Date: 3/26/2012 7:40:00 AM
Wind File: C:\Program Files\CAP88-PC30\WindLib\KAPL2011.WND

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

Nuclide	Clearance Type	Particle Size (microns)	Scavenging Coefficient (per second)	Dry Deposition Velocity (m/s)
Pu-242	M	1	1.36E-05	1.80E-03
U-238	M	1	1.36E-05	1.80E-03
Th-234	S	1	1.36E-05	1.80E-03
Pa-234m	M	1	1.36E-05	1.80E-03
Pa-234	M	1	1.36E-05	1.80E-03
U-234	M	1	1.36E-05	1.80E-03
Pu-241	M	1	1.36E-05	1.80E-03
Am-241	M	1	1.36E-05	1.80E-03
Np-237	M	1	1.36E-05	1.80E-03
Pa-233	M	1	1.36E-05	1.80E-03
U-233	M	1	1.36E-05	1.80E-03
Th-229	S	1	1.36E-05	1.80E-03
Ra-225	M	1	1.36E-05	1.80E-03
Ac-225	M	1	1.36E-05	1.80E-03
Fr-221	M	1	1.36E-05	1.80E-03
At-217	M	1	1.36E-05	1.80E-03
U-237	M	1	1.36E-05	1.80E-03
Pu-240	M	1	1.36E-05	1.80E-03
U-236	M	1	1.36E-05	1.80E-03
Th-232	S	1	1.36E-05	1.80E-03
Ra-228	M	1	1.36E-05	1.80E-03
Ac-228	M	1	1.36E-05	1.80E-03
Pu-239	M	1	1.36E-05	1.80E-03
U-235	M	1	1.36E-05	1.80E-03
Th-231	S	1	1.36E-05	1.80E-03
Pa-231	M	1	1.36E-05	1.80E-03
Ac-227	M	1	1.36E-05	1.80E-03
Pu-238	M	1	1.36E-05	1.80E-03
Cs-137	F	1	1.36E-05	1.80E-03
Ba-137m	M	1	1.36E-05	1.80E-03
Sr-90	M	1	1.36E-05	1.80E-03
Y-90	M	1	1.36E-05	1.80E-03

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

	DECAY CONSTANT (PER DAY)		TRANSFER COEFFICIENT		
Nuclide	Radio-active (1)	Surface	Water	Milk (2)	Meat (3)
Pu-242	5.04E-09	5.48E-05	0.00E+00	1.00E-06	1.00E-04
U-238	4.25E-13	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-234	2.88E-02	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Pa-234m	8.53E+02	5.48E-05	0.00E+00	5.00E-06	5.00E-06
Pa-234	2.48E+00	5.48E-05	0.00E+00	5.00E-06	5.00E-06
U-234	7.76E-09	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Pu-241	1.32E-04	5.48E-05	0.00E+00	1.00E-06	1.00E-04
Am-241	4.39E-06	5.48E-05	0.00E+00	2.00E-06	5.00E-05
Np-237	8.87E-10	5.48E-05	0.00E+00	1.00E-05	1.00E-03
Pa-233	2.57E-02	5.48E-05	0.00E+00	5.00E-06	5.00E-06
U-233	1.20E-08	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-229	2.58E-07	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Ra-225	4.68E-02	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Ac-225	6.93E-02	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Fr-221	2.08E+02	5.48E-05	0.00E+00	8.00E-03	3.00E-02
At-217	1.85E+06	5.48E-05	0.00E+00	1.00E-02	1.00E-02
U-237	1.03E-01	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Pu-240	2.90E-07	5.48E-05	0.00E+00	1.00E-06	1.00E-04
U-236	8.10E-11	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-232	1.35E-13	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Ra-228	3.30E-04	5.48E-05	0.00E+00	1.00E-03	2.00E-03
Ac-228	2.71E+00	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Pu-239	7.88E-08	5.48E-05	0.00E+00	1.00E-06	1.00E-04
U-235	2.70E-12	5.48E-05	0.00E+00	4.00E-04	8.00E-04
Th-231	6.52E-01	5.48E-05	0.00E+00	5.00E-06	1.00E-04
Pa-231	5.79E-08	5.48E-05	0.00E+00	5.00E-06	5.00E-06
Ac-227	8.71E-05	5.48E-05	0.00E+00	2.00E-06	2.00E-05
Pu-238	2.16E-05	5.48E-05	0.00E+00	1.00E-06	1.00E-04
Cs-137	6.32E-05	5.48E-05	0.00E+00	1.00E-02	5.00E-02
Ba-137m	3.91E+02	5.48E-05	0.00E+00	5.00E-04	2.00E-04
Sr-90	6.52E-05	5.48E-05	0.00E+00	2.00E-03	1.00E-02
Y-90	2.60E-01	5.48E-05	0.00E+00	6.00E-05	2.00E-03

FOOTNOTES:

(1) Fraction of animal's daily intake of nuclide which appears in each L of milk (days/L)

(2) Fraction of animal's daily intake of nuclide which appears in each kg of meat (days/kg)

VALUES FOR RADIONUCLIDE-DEPENDENT PARAMETERS

Nuclide	CONCENTRATION UPTAKE FACTOR		GI UPTAKE FRACTION	
	Forage (1)	Edible (2)	Inhalation	Ingestion
Pu-242	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-238	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-234	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pa-234m	1.00E-01	1.00E-02	5.00E-04	5.00E-04
Pa-234	1.00E-01	1.00E-02	5.00E-04	5.00E-04
U-234	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Pu-241	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Am-241	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Np-237	1.00E-01	2.00E-02	5.00E-04	5.00E-04
Pa-233	1.00E-01	1.00E-02	5.00E-04	5.00E-04
U-233	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-229	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Ra-225	2.00E-01	4.00E-02	2.00E-01	2.00E-01
Ac-225	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Fr-221	1.00E-01	3.00E-02	1.00E+00	1.00E+00
At-217	9.00E-01	2.00E-01	1.00E+00	1.00E+00
U-237	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Pu-240	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-236	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-232	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Ra-228	2.00E-01	4.00E-02	2.00E-01	2.00E-01
Ac-228	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pu-239	1.00E-01	1.00E-03	5.00E-04	5.00E-04
U-235	1.00E-01	2.00E-03	2.00E-02	2.00E-02
Th-231	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pa-231	1.00E-01	1.00E-02	5.00E-04	5.00E-04
Ac-227	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Pu-238	1.00E-01	1.00E-03	5.00E-04	5.00E-04
Cs-137	1.00E+00	2.00E-01	1.00E+00	1.00E+00
Ba-137m	1.00E-01	1.00E-02	2.00E-01	2.00E-01
Sr-90	4.00E+00	3.00E-01	3.00E-01	3.00E-01
Y-90	1.00E-01	2.00E-03	1.00E-04	1.00E-04

FOOTNOTES:
(1) Concentration factor for uptake of nuclide from soil for pasture and forage (in pCi/kg dry weight per pCi/kg dry soil)
(2) Concentration factor for uptake of nuclide from soil by edible parts of crops (in pCi/kg wet weight per pCi/kg dry soil)

DECAY CHAIN ACTIVITIES

Nuclide	Stack	Activity at 500. seconds	Activity at 100.00 years
Pu-242	1	0.0000E+00	0.0000E+00
U-238	1	0.0000E+00	0.0000E+00
Th-234	1	0.0000E+00	0.0000E+00
Pa-234m	1	0.0000E+00	0.0000E+00
Pa-234	1	0.0000E+00	0.0000E+00
U-234	1	0.0000E+00	0.0000E+00
Pu-241	1	0.0000E+00	0.0000E+00
Am-241	1	0.0000E+00	0.0000E+00
Np-237	1	0.0000E+00	0.0000E+00
Pa-233	1	0.0000E+00	0.0000E+00
U-233	1	0.0000E+00	0.0000E+00
Th-229	1	0.0000E+00	0.0000E+00
Ra-225	1	0.0000E+00	0.0000E+00
Ac-225	1	0.0000E+00	0.0000E+00
Fr-221	1	0.0000E+00	0.0000E+00
At-217	1	0.0000E+00	0.0000E+00
U-237	1	0.0000E+00	0.0000E+00
Pu-240	1	0.0000E+00	0.0000E+00
U-236	1	0.0000E+00	0.0000E+00
Th-232	1	0.0000E+00	0.0000E+00
Ra-228	1	0.0000E+00	0.0000E+00
Ac-228	1	0.0000E+00	0.0000E+00
Pu-239	1	0.0000E+00	0.0000E+00
U-235	1	0.0000E+00	0.0000E+00
Th-231	1	0.0000E+00	0.0000E+00
Pa-231	1	0.0000E+00	0.0000E+00
Ac-227	1	0.0000E+00	0.0000E+00
Pu-238	1	0.0000E+00	0.0000E+00
Cs-137	1	2.0850E-07	0.0000E+00
Ba-137m	1	1.9840E-07	0.0000E+00
Sr-90	1	5.6790E-08	0.0000E+00
Y-90	1	5.6790E-08	0.0000E+00

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

HUMAN INHALATION RATE	
Cubic centimeters/hr	9.17E+05
SOIL PARAMETERS	
Effective surface density (kg/sq m, dry weight) (Assumes 15 cm plow layer)	2.15E+02
BUILDUP TIMES	
For activity in soil (years)	1.00E+02
For radionuclides deposited on ground/water (days)	3.65E+02
DELAY TIMES	
Ingestion of pasture grass by animals (hr)	0.00E+00
Ingestion of stored feed by animals (hr)	2.16E+03
Ingestion of leafy vegetables by man (hr)	3.36E+02
Ingestion of produce by man (hr)	3.36E+02
Transport time from animal feed-milk-man (day)	2.00E+00
Time from slaughter to consumption (day)	2.00E+01
WEATHERING	
Removal rate constant for physical loss (per hr)	2.90E-03
CROP EXPOSURE DURATION	
Pasture grass (hr)	7.20E+02
Crops/leafy vegetables (hr)	1.44E+03
AGRICULTURAL PRODUCTIVITY	
Grass-cow-milk-man pathway (kg/sq m)	2.80E-01
Produce/leafy veg for human consumption (kg/sq m)	7.16E-01
FALLOUT INTERCEPTION FRACTIONS	
Vegetables	2.00E-01
Pasture	5.70E-01
GRAZING PARAMETERS	
Fraction of year animals graze on pasture	4.00E-01
Fraction of daily feed that is pasture grass when animal grazes on pasture	4.30E-01

VALUES FOR RADIONUCLIDE-INDEPENDENT PARAMETERS

ANIMAL FEED CONSUMPTION FACTORS	
Contaminated feed/forage (kg/day, dry weight)	1.56E+01
DAIRY PRODUCTIVITY	
Milk production of cow (L/day)	1.10E+01
MEAT ANIMAL SLAUGHTER PARAMETERS	
Muscle mass of animal at slaughter (kg)	2.00E+02
Fraction of herd slaughtered (per day)	3.81E-03
DECONTAMINATION	
Fraction of radioactivity retained after washing for leafy vegetables and produce	5.00E-01
FRACTIONS GROWN IN GARDEN OF INTEREST	
Produce ingested	1.00E+00
Leafy vegetables ingested	1.00E+00
INGESTION RATIOS:	
IMMEDIATE SURROUNDING AREA/TOTAL WITHIN AREA	
Vegetables	7.00E-01
Meat	4.40E-01
Milk	4.00E-01
MINIMUM INGESTION FRACTIONS FROM OUTSIDE AREA (Minimum fractions of food types from outside area listed below are actual fixed values.)	
Vegetables	0.00E+00
Meat	0.00E+00
Milk	0.00E+00
HUMAN FOOD UTILIZATION FACTORS	
Produce ingestion (kg/y)	1.76E+02
Milk ingestion (L/y)	1.12E+02
Meat ingestion (kg/y)	8.50E+01
Leafy vegetable ingestion (kg/y)	1.80E+01
SWIMMING PARAMETERS	
Fraction of time spent swimming	0.00E+00
Dilution factor for water (cm)	1.00E+00

Appendix B

Separations Process Research Unit – Disposition Project

(SPRU DP)

ATTACHMENTS A through E

CAP88-PC OUTPUT REPORTS

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ATTACHMENT A

CAP88-PC OUTPUT

SPRU Point Sources

Synopsis

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 29, 2012 04:45 pm

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

Source Category: PVUs
Source Type: Stack
Emission Year: 2011

Comments: 2011 MEOSI dose from PVU emissions
standard parameters

Effective Dose Equivalent (mrem/year)
1.68E-10

At This Location: 450 Meters Southwest

Dataset Name: 2011 Point R1
Dataset Date: 5/29/2012 4:43:00 PM
Wind File: C:\Program Files\CAP88-PC30\WindLib\KAPL2011

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 450 Meters Southwest
Lifetime Fatal Cancer Risk: 7.92E-17

RADIONUCLIDE EMISSIONS DURING THE YEAR 2011

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
Cs-137	F	1	2.0E-09	2.0E-09
Ba-137m	M	1	2.0E-09	2.0E-09
Sr-90	M	1	8.9E-10	8.9E-10
Y-90	M	1	8.9E-10	8.9E-10
Pu-239	M	1	1.3E-10	1.3E-10
Pu-238	M	1	7.3E-11	7.3E-11
U-234	M	1	1.7E-10	1.7E-10
U-235	M	1	8.7E-11	8.7E-11
U-238	M	1	1.6E-10	1.6E-10
Th-230	S	1	4.3E-10	4.3E-10

SITE INFORMATION

Temperature: 10 degrees C
Precipitation: 136 cm/y
Humidity: 8 g/cu m
Mixing Height: 1000 m

User specified location of max exposed individual.
(ILOC, JLOC): 7, 1

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 2.00
Diameter (m): 0.25

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

450	550	700	750	775	950	1000
1050	1300	1650	2550			

ATTACHMENT B

CAP88-PC-OUTPUT

SPRU POINT SOURCES

DOSE & RISK EQUIVALENT

SUMMARY

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 29, 2012 04:45 pm

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

Source Category: PVUs
Source Type: Stack
Emission Year: 2011

Comments: 2011 MEOSI dose from PVU emissions
standard parameters

Dataset Name: 2011 Point R1
Dataset Date: 5/29/2012 4:43:00 PM
Wind File: C:\Program Files\CAP88-PC30\WindLib\KAPL2011.WND

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	0.00E+00
INHALATION	1.65E-10
AIR IMMERSION	3.55E-12
GROUND SURFACE	0.00E+00
INTERNAL	1.65E-10
EXTERNAL	3.55E-12
TOTAL	1.68E-10

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
Cs-137	1.65E-10
Ba-137m	3.54E-12
Sr-90	0.00E+00
Y-90	0.00E+00
Pu-239	0.00E+00
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
Fr-223	0.00E+00
Pu-238	0.00E+00
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
At-218	0.00E+00
U-238	0.00E+00
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
TOTAL	1.68E-10

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
Esophagu	1.70E-18
Stomach	5.57E-18
Colon	1.53E-17
Liver	2.39E-18
LUNG	1.23E-17
Bone	1.52E-19
Skin	1.15E-19
Breast	5.11E-18
Ovary	2.19E-18
Bladder	4.17E-18
Kidneys	8.15E-19
Thyroid	4.00E-19
Leukemia	8.46E-18
Residual	2.05E-17
Total	7.92E-17
TOTAL	1.58E-16

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	0.00E+00
INHALATION	7.73E-17
AIR IMMERSION	1.94E-18
GROUND SURFACE	0.00E+00
INTERNAL	7.73E-17
EXTERNAL	1.94E-18
TOTAL	7.92E-17

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
Cs-137	7.73E-17
Ba-137m	1.94E-18
Sr-90	0.00E+00
Y-90	0.00E+00
Pu-239	0.00E+00
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
Fr-223	0.00E+00
Pu-238	0.00E+00
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
At-218	0.00E+00
U-238	0.00E+00
Th-234	0.00E+00
Pa-234m	0.00E+00
Pa-234	0.00E+00
TOTAL	7.92E-17

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

	Distance (m)						
Direction	450	550	700	750	775	950	1000
N	2.0E-10	1.4E-10	8.6E-11	7.5E-11	7.1E-11	4.7E-11	4.3E-11
NNW	2.7E-10	1.8E-10*	1.2E-10	1.0E-10	9.5E-11	6.4E-11	5.7E-11
NW	1.1E-10	7.1E-11	4.4E-11*	3.9E-11	3.6E-11	2.4E-11	2.2E-11
WNW	6.3E-11	4.2E-11	2.6E-11	2.3E-11*	2.1E-11	1.4E-11	1.3E-11
W	5.3E-11	3.6E-11	2.2E-11	1.9E-11	1.8E-11	1.2E-11	1.1E-11
WSW	6.0E-11	4.1E-11	2.5E-11	2.2E-11	2.1E-11	1.4E-11	1.2E-11
SW	1.7E-10	1.1E-10	7.1E-11	6.2E-11	5.8E-11	3.9E-11	3.5E-11
SSW	1.7E-10	1.1E-10	7.1E-11	6.2E-11	5.8E-11	3.9E-11	3.5E-11
S	1.8E-10	1.2E-10	7.5E-11	6.6E-11	6.1E-11	4.1E-11	3.7E-11
SSE	2.3E-10	1.5E-10	9.6E-11	8.4E-11	7.9E-11	5.3E-11	4.7E-11
SE	2.0E-10	1.4E-10	8.6E-11	7.5E-11	7.0E-11	4.7E-11	4.3E-11
ESE	2.0E-10	1.4E-10	8.7E-11	7.6E-11	7.1E-11	4.8E-11	4.3E-11
E	1.1E-10	7.7E-11	4.8E-11	4.2E-11	4.0E-11	2.7E-11	2.4E-11
ENE	8.7E-11	5.9E-11	3.7E-11	3.2E-11	3.0E-11	2.0E-11	1.8E-11
NE	8.9E-11	6.0E-11	3.8E-11	3.3E-11	3.1E-11	2.0E-11	1.8E-11
NNE	9.5E-11	6.4E-11	4.0E-11	3.5E-11	3.3E-11	2.2E-11	2.0E-11

	Distance (m)			
Direction	1050	1300	1650	2550
N	3.9E-11	2.7E-11	1.8E-11	8.1E-12
NNW	5.3E-11	3.6E-11	2.4E-11	1.1E-11
NW	2.0E-11	1.4E-11	8.8E-12	4.0E-12
WNW	1.2E-11	7.9E-12	5.1E-12	2.3E-12
W	9.9E-12	6.7E-12	4.3E-12	1.9E-12
WSW	1.1E-11	7.7E-12	5.0E-12	2.2E-12
SW	3.2E-11	2.2E-11	1.4E-11	6.5E-12
SSW	3.2E-11	2.2E-11	1.4E-11	6.5E-12
S	3.4E-11	2.3E-11	1.5E-11	6.8E-12
SSE	4.3E-11	3.0E-11	1.9E-11	8.8E-12
SE	3.9E-11	2.7E-11	1.7E-11	8.0E-12
ESE	4.0E-11	2.7E-11	1.8E-11	8.3E-12
E	2.2E-11	1.5E-11	9.9E-12	4.6E-12
ENE	1.7E-11	1.1E-11	7.4E-12	3.4E-12
NE	1.7E-11	1.2E-11	7.5E-12	3.4E-12
NNE	1.8E-11	1.2E-11	8.0E-12	3.7E-12

Underlined values indicate the location of the nearest receptor in the designated direction.

* For business locations, an occupancy factor of eight hours per day is used. Therefore, the calculated doses for business locations are to be divided by a factor of three.

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

Direction	Distance (m) 450	550	700	750	775	950	1000
N	9.5E-17	6.5E-17	4.0E-17	3.5E-17	3.3E-17	2.2E-17	2.0E-17
NNW	1.3E-16	8.7E-17	5.4E-17	4.8E-17	4.5E-17	3.0E-17	2.7E-17
NW	4.9E-17	3.4E-17	2.1E-17	1.8E-17	1.7E-17	1.1E-17	1.0E-17
WNW	2.9E-17	2.0E-17	1.2E-17	1.1E-17	1.0E-17	6.7E-18	6.0E-18
W	2.5E-17	1.7E-17	1.0E-17	9.1E-18	8.5E-18	5.7E-18	5.1E-18
WSW	2.8E-17	1.9E-17	1.2E-17	1.0E-17	9.7E-18	6.5E-18	5.8E-18
SW	7.9E-17	5.4E-17	3.4E-17	2.9E-17	2.7E-17	1.8E-17	1.7E-17
SSW	7.9E-17	5.4E-17	3.4E-17	2.9E-17	2.7E-17	1.8E-17	1.6E-17
S	8.4E-17	5.7E-17	3.5E-17	3.1E-17	2.9E-17	1.9E-17	1.7E-17
SSE	1.1E-16	7.3E-17	4.5E-17	4.0E-17	3.7E-17	2.5E-17	2.2E-17
SE	9.5E-17	6.5E-17	4.0E-17	3.5E-17	3.3E-17	2.2E-17	2.0E-17
ESE	9.5E-17	6.5E-17	4.1E-17	3.6E-17	3.3E-17	2.3E-17	2.0E-17
E	5.4E-17	3.6E-17	2.3E-17	2.0E-17	1.9E-17	1.3E-17	1.1E-17
ENE	4.1E-17	2.8E-17	1.7E-17	1.5E-17	1.4E-17	9.5E-18	8.5E-18
NE	4.2E-17	2.8E-17	1.8E-17	1.5E-17	1.4E-17	9.6E-18	8.7E-18
NNE	4.4E-17	3.0E-17	1.9E-17	1.6E-17	1.5E-17	1.0E-17	9.2E-18

Direction	Distance (m) 1050	1300	1650	2550
N	1.8E-17	1.3E-17	8.3E-18	3.8E-18
NNW	2.5E-17	1.7E-17	1.1E-17	5.2E-18
NW	9.4E-18	6.4E-18	4.1E-18	1.9E-18
WNW	5.5E-18	3.7E-18	2.4E-18	1.1E-18
W	4.7E-18	3.2E-18	2.0E-18	9.0E-19
WSW	5.3E-18	3.6E-18	2.3E-18	1.0E-18
SW	1.5E-17	1.0E-17	6.7E-18	3.1E-18
SSW	1.5E-17	1.0E-17	6.7E-18	3.1E-18
S	1.6E-17	1.1E-17	7.0E-18	3.2E-18
SSE	2.0E-17	1.4E-17	9.1E-18	4.1E-18
SE	1.8E-17	1.3E-17	8.2E-18	3.8E-18
ESE	1.9E-17	1.3E-17	8.4E-18	3.9E-18
E	1.0E-17	7.1E-18	4.7E-18	2.1E-18
ENE	7.8E-18	5.4E-18	3.5E-18	1.6E-18
NE	7.9E-18	5.4E-18	3.5E-18	1.6E-18
NNE	8.5E-18	5.8E-18	3.8E-18	1.7E-18

ATTACHMENT C

CAP88-PC OUTPUT

SPRU Diffuse Sources

Synopsis

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 29, 2012 05:16 pm

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

Source Category: Total Diffuse
Source Type: Area
Emission Year: 2011

Comments: 2011 MEOSI dose from diffuse emissions
standard parameters

Effective Dose Equivalent (mrem/year)
5.27E-03

At This Location: 450 Meters Southwest

Dataset Name: 2011 Diff R1
Dataset Date: 5/29/2012 5:15:00 PM
Wind File: C:\Program Files\CAP88-PC30\WindLib\KAPL2011

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 450 Meters Southwest
Lifetime Fatal Cancer Risk: 1.72E-09

RADIONUCLIDE EMISSIONS DURING THE YEAR 2011

Nuclide	Type	Size	Source #1 Ci/y	TOTAL Ci/y
Cs-137	F	1	1.8E-05	1.8E-05
Ba-137m	M	1	1.8E-05	1.8E-05
Sr-90	M	1	5.3E-05	5.3E-05
Y-90	M	1	5.3E-05	5.3E-05
Pu-239	M	1	3.5E-06	3.5E-06
Am-241	M	1	8.4E-08	8.4E-08
Pu-238	M	1	4.4E-08	4.4E-08
U-234	M	1	7.7E-08	7.7E-08
U-235	M	1	7.4E-09	7.4E-09
U-238	M	1	7.7E-08	7.7E-08
U-233	M	1	1.3E-08	1.3E-08

SITE INFORMATION

Temperature: 10 degrees C
Precipitation: 136 cm/y
Humidity: 8 g/cu m
Mixing Height: 1000 m

User specified location of max exposed individual.
(ILOC, JLOC): 7, 1

SOURCE INFORMATION

Source Number: 1

Source Height (m): 1.00
Area (sq m): 1305.00

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

450 550 700 750 775 950 1000 1050
1300 1650 2550

ATTACHMENT D

CAP88-PC OUTPUT

SPRU Diffuse Sources
Dose & Risk Equivalent

Summary

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 29, 2012 05:16 pm

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

Source Category: Total Diffuse
Source Type: Area
Emission Year: 2011

Comments: 2011 MEOSI dose from diffuse emissions
standard parameters

Dataset Name: 2011 Diff R1
Dataset Date: 5/29/2012 5:15:00 PM
Wind File: C:\Program Files\CAP88-PC30\WindLib\KAPL2011.WND

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.10E-03
INHALATION	3.16E-03
AIR IMMERSION	3.44E-08
GROUND SURFACE	1.57E-05
INTERNAL	5.26E-03
EXTERNAL	1.57E-05
TOTAL	5.27E-03

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
Cs-137	3.17E-04
Ba-137m	9.77E-06
Sr-90	1.77E-03
Y-90	7.10E-06
Pu-239	3.06E-03
U-235	3.92E-07
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Th-227	0.00E+00
Fr-223	0.00E+00
Am-241	6.12E-05
Np-237	0.00E+00
Pa-233	0.00E+00
Pu-238	3.49E-05
U-234	4.84E-06
Th-230	0.00E+00
Ra-226	0.00E+00
Rn-222	0.00E+00
Po-218	0.00E+00
U-238	4.00E-06
Th-234	5.50E-09
Pa-234m	6.03E-09
Pa-234	0.00E+00
U-233	7.93E-07
Th-229	0.00E+00
Ra-225	0.00E+00
TOTAL	5.27E-03

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
Esophagu	5.34E-12
Stomach	1.90E-11
Colon	1.83E-10
Liver	1.93E-10
LUNG	2.70E-10
Bone	8.93E-11
Skin	9.76E-13
Breast	1.54E-11
Ovary	1.60E-11
Bladder	1.48E-11
Kidneys	3.75E-12
Thyroid	1.32E-12
Leukemia	8.39E-10
Residual	6.62E-11
Total	1.72E-09
TOTAL	3.43E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.18E-09
INHALATION	5.27E-10
AIR IMMERSION	1.76E-14
GROUND SURFACE	5.97E-12
INTERNAL	1.71E-09
EXTERNAL	5.98E-12
TOTAL	1.72E-09

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
Cs-137	1.61E-10
Ba-137m	5.27E-12
Sr-90	1.04E-09
Y-90	2.12E-12
Pu-239	4.85E-10
U-235	3.27E-13
Th-231	0.00E+00
Pa-231	0.00E+00
Ac-227	0.00E+00
Th-227	0.00E+00
Fr-223	0.00E+00
Am-241	9.63E-12
Np-237	0.00E+00
Pa-233	0.00E+00
Pu-238	6.08E-12
U-234	3.92E-12
Th-230	0.00E+00
Ra-226	0.00E+00
Rn-222	0.00E+00
Po-218	0.00E+00
U-238	3.22E-12
Th-234	7.79E-15
Pa-234m	9.65E-16
Pa-234	0.00E+00
U-233	6.61E-13
Th-229	0.00E+00
Ra-225	0.00E+00
TOTAL	1.72E-09

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

	Distance (m)						
Direction	450	550	700	750	775	950	1000
N	6.1E-03	4.3E-03	2.8E-03	2.5E-03	2.4E-03	1.7E-03	1.6E-03
NNW	8.2E-03	5.7E-03*	3.7E-03	3.3E-03	3.1E-03	2.3E-03	2.1E-03
NW	3.4E-03	2.5E-03	1.7E-03*	1.5E-03	1.5E-03	1.1E-03	1.0E-03
WNW	2.2E-03	1.6E-03	1.2E-03	1.1E-03*	1.0E-03	8.2E-04	7.8E-04
W	1.9E-03	1.4E-03	1.1E-03	9.7E-04	9.4E-04	7.6E-04	7.3E-04
WSW	2.1E-03	1.6E-03	1.1E-03	1.0E-03	1.0E-03	8.1E-04	7.7E-04
SW	5.3E-03	3.7E-03	2.5E-03	2.2E-03	2.1E-03	1.6E-03	1.5E-03
SSW	5.2E-03	3.6E-03	2.4E-03	2.2E-03	2.1E-03	1.5E-03	1.4E-03
S	5.4E-03	3.8E-03	2.5E-03	2.2E-03	2.1E-03	1.5E-03	1.4E-03
SSE	6.8E-03	4.7E-03	3.1E-03	2.7E-03	2.6E-03	1.9E-03	1.7E-03
SE	6.1E-03	4.3E-03	2.8E-03	2.5E-03	2.4E-03	1.7E-03	1.6E-03
ESE	6.2E-03	4.4E-03	2.9E-03	2.6E-03	2.5E-03	1.8E-03	1.7E-03
E	3.6E-03	2.6E-03	1.8E-03	1.6E-03	1.5E-03	1.2E-03	1.1E-03
ENE	2.8E-03	2.0E-03	1.4E-03	1.3E-03	1.2E-03	9.6E-04	9.0E-04
NE	2.9E-03	2.1E-03	1.4E-03	1.3E-03	1.2E-03	9.7E-04	9.1E-04
NNE	3.0E-03	2.2E-03	1.5E-03	1.4E-03	1.3E-03	1.0E-03	9.5E-04

	Distance (m)			
Direction	1050	1300	1650	2550
N	1.5E-03	1.2E-03	9.1E-04	6.4E-04
NNW	1.9E-03	1.5E-03	1.1E-03	7.4E-04
NW	9.9E-04	8.1E-04	6.7E-04	5.3E-04
WNW	7.5E-04	6.4E-04	5.6E-04	4.7E-04
W	7.0E-04	6.1E-04	5.4E-04	4.6E-04
WSW	7.4E-04	6.3E-04	5.5E-04	4.7E-04
SW	1.4E-03	1.1E-03	8.4E-04	6.1E-04
SSW	1.3E-03	1.0E-03	8.2E-04	5.9E-04
S	1.3E-03	1.0E-03	8.2E-04	5.9E-04
SSE	1.6E-03	1.2E-03	9.5E-04	6.6E-04
SE	1.5E-03	1.2E-03	9.1E-04	6.4E-04
ESE	1.6E-03	1.2E-03	9.4E-04	6.6E-04
E	1.0E-03	8.3E-04	6.9E-04	5.3E-04
ENE	8.6E-04	7.2E-04	6.1E-04	4.9E-04
NE	8.7E-04	7.2E-04	6.1E-04	5.0E-04
NNE	9.0E-04	7.4E-04	6.2E-04	5.0E-04

Underlined values indicate the location of the nearest receptor in the designated direction.

* For business locations, an occupancy factor of eight hours per day is used. Therefore, the calculated doses for business locations are to be divided by a factor of three.

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

Direction	Distance (m) 450	550	700	750	775	950	1000
N	1.9E-09	1.4E-09	9.7E-10	8.8E-10	8.4E-10	6.4E-10	6.0E-10
NNW	2.6E-09	1.8E-09	1.2E-09	1.1E-09	1.1E-09	8.0E-10	7.5E-10
NW	1.2E-09	8.6E-10	6.3E-10	5.8E-10	5.6E-10	4.5E-10	4.3E-10
WNW	7.8E-10	6.1E-10	4.7E-10	4.4E-10	4.2E-10	3.6E-10	3.5E-10
W	7.0E-10	5.5E-10	4.3E-10	4.1E-10	4.0E-10	3.4E-10	3.3E-10
WSW	7.6E-10	5.9E-10	4.6E-10	4.3E-10	4.2E-10	3.6E-10	3.5E-10
SW	1.7E-09	1.2E-09	8.8E-10	8.0E-10	7.6E-10	6.0E-10	5.6E-10
SSW	1.7E-09	1.2E-09	8.4E-10	7.7E-10	7.3E-10	5.7E-10	5.4E-10
S	1.7E-09	1.2E-09	8.6E-10	7.8E-10	7.5E-10	5.8E-10	5.4E-10
SSE	2.1E-09	1.5E-09	1.0E-09	9.4E-10	9.0E-10	6.8E-10	6.4E-10
SE	1.9E-09	1.4E-09	9.6E-10	8.7E-10	8.3E-10	6.4E-10	6.0E-10
ESE	2.0E-09	1.4E-09	9.9E-10	9.0E-10	8.6E-10	6.6E-10	6.2E-10
E	1.2E-09	8.9E-10	6.4E-10	5.9E-10	5.7E-10	4.6E-10	4.4E-10
ENE	9.5E-10	7.2E-10	5.3E-10	4.9E-10	4.8E-10	4.0E-10	3.8E-10
NE	9.7E-10	7.3E-10	5.4E-10	5.0E-10	4.8E-10	4.0E-10	3.8E-10
NNE	1.0E-09	7.6E-10	5.6E-10	5.2E-10	5.0E-10	4.1E-10	3.9E-10

Direction	Distance (m) 1050	1300	1650	2550
N	5.7E-10	4.7E-10	3.9E-10	3.0E-10
NNW	7.1E-10	5.6E-10	4.5E-10	3.4E-10
NW	4.2E-10	3.6E-10	3.1E-10	2.7E-10
WNW	3.4E-10	3.0E-10	2.8E-10	2.5E-10
W	3.2E-10	2.9E-10	2.7E-10	2.5E-10
WSW	3.4E-10	3.0E-10	2.8E-10	2.5E-10
SW	5.4E-10	4.4E-10	3.7E-10	3.0E-10
SSW	5.1E-10	4.3E-10	3.6E-10	2.9E-10
S	5.2E-10	4.3E-10	3.6E-10	2.9E-10
SSE	6.0E-10	4.9E-10	4.0E-10	3.1E-10
SE	5.7E-10	4.6E-10	3.8E-10	3.0E-10
ESE	5.9E-10	4.8E-10	4.0E-10	3.1E-10
E	4.2E-10	3.6E-10	3.2E-10	2.7E-10
ENE	3.7E-10	3.2E-10	2.9E-10	2.6E-10
NE	3.7E-10	3.2E-10	2.9E-10	2.6E-10
NNE	3.8E-10	3.3E-10	2.9E-10	2.6E-10

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ATTACHMENT E

CAP88-PC OUTPUT

SPRU

Weather Data
For Point and Diffuse Sources
for
2011

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 29, 2012 05:16 pm

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

Source Category: Total Diffuse
Source Type: Area
Emission Year: 2011

Comments: 2011 MEOSI dose from diffuse emissions
standard parameters

Dataset Name: 2011 Diff R1
Dataset Date: 5/29/2012 5:15:00 PM
Wind File: C:\Program Files\CAP88-PC30\WindLib\KAPL2011.WND

HARMONIC AVERAGE WIND SPEEDS (WIND TOWARDS)

Pasquill Stability Class

Dir	A	B	C	D	E	F	G	Wind Freq
N	1.173	1.821	2.912	2.286	1.082	0.863	0.000	0.083
NNW	1.238	2.062	3.434	2.810	1.163	0.981	0.000	0.147
NW	0.897	1.121	1.794	2.341	0.891	0.863	0.000	0.047
WNW	0.821	0.871	0.990	3.565	0.931	0.789	0.000	0.030
W	0.782	0.801	0.789	0.892	0.772	0.772	0.000	0.026
WSW	0.772	0.772	0.814	0.953	0.806	0.772	0.000	0.027
SW	0.861	1.112	1.261	2.036	0.925	0.865	0.000	0.083
SSW	0.828	1.065	1.343	1.704	0.918	0.853	0.000	0.054
S	0.846	1.009	2.572	0.772	0.813	0.790	0.000	0.043
SSE	0.910	1.169	1.361	0.843	0.840	0.808	0.000	0.058
SE	1.137	1.678	2.570	2.606	1.027	0.841	0.000	0.078
ESE	1.381	2.882	4.277	4.146	1.559	0.887	0.000	0.186
E	1.263	2.576	3.710	3.584	1.179	0.847	0.000	0.059
ENE	1.146	2.844	4.460	2.556	1.410	0.827	0.000	0.027
NE	0.954	2.021	2.872	2.939	0.945	0.794	0.000	0.026
NNE	1.146	1.493	2.090	1.530	0.885	0.797	0.000	0.025

ARITHMETIC AVERAGE WIND SPEEDS (WIND TOWARDS)

Pasquill Stability Class

Dir	A	B	C	D	E	F	G
N	1.652	2.596	3.916	3.393	1.524	1.044	0.000
NNW	1.741	2.911	4.140	3.624	1.666	1.320	0.000
NW	1.132	1.767	3.090	3.499	1.117	1.045	0.000
WNW	0.925	1.065	1.482	3.790	1.212	0.827	0.000
W	0.806	0.865	0.830	1.119	0.772	0.772	0.000
WSW	0.772	0.772	0.906	1.261	0.880	0.772	0.000
SW	1.038	1.596	1.976	3.034	1.199	1.050	0.000
SSW	0.947	1.557	1.962	2.428	1.181	1.016	0.000
S	0.996	1.376	2.572	0.772	0.901	0.830	0.000
SSE	1.163	1.954	2.572	1.044	0.980	0.886	0.000
SE	1.598	2.440	3.724	3.527	1.412	0.982	0.000
ESE	1.906	3.250	4.637	4.836	2.085	1.106	0.000
E	1.773	3.193	4.217	4.239	1.687	1.000	0.000
ENE	1.612	3.328	4.642	3.386	1.936	0.945	0.000
NE	1.264	2.774	3.799	3.850	1.244	0.843	0.000
NNE	1.612	2.214	3.338	2.393	1.100	0.855	0.000

FREQUENCIES OF STABILITY CLASSES (WIND TOWARDS)

	Pasquill Stability Class						
Dir	A	B	C	D	E	F	G
N	0.1237	0.1073	0.1266	0.2174	0.1347	0.2902	0.0000
NNW	0.2137	0.1609	0.1026	0.1717	0.1188	0.2323	0.0000
NW	0.5408	0.0914	0.0168	0.0143	0.0505	0.2861	0.0000
WNW	0.5425	0.1425	0.0384	0.0115	0.0152	0.2500	0.0000
W	0.4610	0.1695	0.1303	0.0217	0.0130	0.2046	0.0000
WSW	0.4035	0.1504	0.1158	0.0470	0.0684	0.2147	0.0000
SW	0.2963	0.1645	0.1522	0.0728	0.1098	0.2045	0.0000
SSW	0.3482	0.0822	0.0316	0.0253	0.0928	0.4199	0.0000
S	0.3158	0.0316	0.0025	0.0078	0.0738	0.5685	0.0000
SSE	0.2103	0.0577	0.0259	0.0516	0.1547	0.4998	0.0000
SE	0.1247	0.1013	0.0851	0.2351	0.1526	0.3011	0.0000
ESE	0.0613	0.1240	0.2240	0.4202	0.0614	0.1092	0.0000
E	0.1045	0.1066	0.1799	0.2784	0.1023	0.2282	0.0000
ENE	0.1262	0.1008	0.0924	0.1008	0.1428	0.4369	0.0000
NE	0.1423	0.0774	0.1034	0.1381	0.0992	0.4396	0.0000
NNE	0.1365	0.0681	0.0681	0.1361	0.1003	0.4908	0.0000
TOTAL	0.2135	0.1162	0.1159	0.1796	0.0983	0.2766	0.0000

ADDITIONAL WEATHER INFORMATION

Average Air Temperature: 10.0 degrees C
283.16 K
Precipitation: 136.3 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: 2.134 m/s

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