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Hanford Site Near-Facility Environmental Monitoring Annual Report, Calendar Year 1996

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RECOGNITION

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HANFORD SITE NEAR-FACILITY ENVIRONMENTAL MONITORING ANNUAL REPORT CALENDAR YEAR 1996

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ABSTRACT

This document summarizes the results of the near-facility environmental monitoring results for 1996 in the 100, 200/600, and 300/400 Areas of the Hanford Site in south-central Washington State. Surveillance activities included sampling and analyses of ambient air, surface water, groundwater, soil, sediments, and biota. Also, external radiation measurements and radiological surveys were taken at waste disposal sites, radiologically controlled areas, and roads. These activities were conducted to assess and control the effects of nuclear facilities and waste sites on the local environment. The monitoring implements applicable portions of DOE Orders 5400.1 (DOE 1988a), 5400.5 (DOE 1990), and 5820.2A (DOE 1988b); Washington Administrative Code (WAC) 246-247; and Title 40 Code of Federal Regulations (CFR) Part 61, Subpart H (EPA 1989). In addition, diffuse sources were monitored to determine compliance with federal, state, and/or local regulations. In general, although effects from nuclear facilities can still be observed on the Hanford Site and radiation levels are slightly elevated when compared to offsite locations, the differences are less than in previous years.

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EXECUTIVE SUMMARY

NEAR-FACILITY ENVIRONMENTAL MONITORING

The near-facility environmental monitoring program provides a means to measure the impacts of operations, waste management, and remediation activities on the environment adjacent to facilities and ensure compliance with local, state, and federal environmental regulations.

Specifically, near-facility environmental monitoring monitors new and existing sites, processes, and facilities for potential impacts and releases; fugitive emissions and diffuse sources from contaminated areas; and surplus facilities before decontaminating or decommissioning. External radiation, ambient air particulates, ground and surface water, soil, sediment, and biota (plants and animals) were sampled or monitored. Parameters included, as appropriate, radionuclides; radiation fields; chemical or physical constituents, such as nitrates; pH; and water temperature.

While the analytical results showed a high degree of variability, in general, the samples collected from media located on or directly adjacent to the waste disposal and other nuclear facilities had significantly higher concentrations than those farther away. As expected, certain radionuclides were found in higher concentrations within different operational areas. Generally speaking, the predominant radionuclides were activation (e.g., ^{60}Co) and fission products/gamma emitters (e.g., ^{90}Sr, ^{137}Cs) in the 100 Areas; fission products (e.g., ^{90}Sr) in the 200/600 Areas; and uranium in the 300 Area.

Air Monitoring. Radioactivity in air was sampled by a network of continuously operated samplers at 58 locations near facilities: 4 in the 100 N Area, 4 in the 100 K Area; 38 in the 200/600 Areas; 1 near the 300 Area Treated Effluent Disposal Facility; 1 station collocated with the Surface Environmental Surveillance Project and the Washington State Department of Health at the Wye Barricade; and 10 new stations associated with environmental restoration contractor (ERC) remediation work, which began in 1996: 3 in the 100 B/C Area, 4 in the 100 D/DR Area, and 3 at the Environmental Restoration Disposal Facility. Air samplers were primarily located at or near sites and/or facilities having the potential for or

history of release, with an emphasis on the prevailing downwind directions. Of the radionuclide analyses performed, ^{90}Sr, ^{137}Cs, $^{239,240}Pu$, and uranium were consistently detectable in the 200 Areas, and ^{60}Co was consistently detectable in the 100 N Area. Air concentrations for these radionuclides were elevated near facilities when compared to the concentrations measured offsite by the Surface Environmental Surveillance Project, but were well below the applicable derived concentration guides used to indicate performance.

Monitoring of Surface-Water Disposal Units and Seeps. Sampling of surface-water disposal units included water, sediment, and aquatic vegetation. Samples collected at river shoreline seeps consisted of water only. Radiological analysis included total alpha; total beta; ^{3}H; ^{90}Sr; $^{239,240}Pu$; and gamma-emitting radionuclides. Nonradiological analyses performed on water samples included pH, temperature, and nitrates.

Radionuclide concentrations in surface-water disposal units were below the applicable Derived Concentration Guides used as indices of performance and, in most cases, were at or below the analytical detection limit. Although some slightly elevated levels were seen in both aquatic vegetation and sediment, in all cases the radiological analytical results were well below the standards for radiological control. The results for pH were well within the range of 2.0 to 12.5, the standard for liquid effluent discharges required by the *Resource Conservation and Recovery Act of 1976*. The analytical results for nitrates were all below the 45-mg/L Drinking Water Standard.

Groundwater seeps along the 100 N Area shoreline were sampled to verify the reported radionuclide releases to the Columbia River from past operations of the N Reactor. By characterizing the radionuclide concentrations in the seeps along the shoreline, the results can be compared to the concentrations measured in the facility effluent monitoring well. In 1996, the concentrations detected in the seep samples were highest in those seeps nearest the facility effluent monitoring well although the seep concentrations were considerably lower than those measured in the well.

Groundwater Monitoring. The groundwater monitoring performed and reported through this near-facility monitoring activity is limited to two wells at the 100 N Area. These wells are located near the 107-N Fuel Storage Basin Recirculation Facility and are sampled to provide an indication of the integrity of the undergound piping system associated with the facility.

Radiological Surveys. In 1996, there were approximately 4,016 ha (9,923 acres) of posted outdoor contamination areas and 1,025 ha (2,532 acres) of posted underground radioactive materials areas at the Hanford Site. These areas were typically associated with cribs, ponds, trenches, burial grounds, tank farms, and covered ditches. The posted contamination areas vary between years because of an ongoing effort to clean, stabilize, and remediate areas of known contamination. During this time, new areas of contamination were being identified. It was estimated that the external dose rate at 80% of the identified outdoor contamination areas was less than 1 mrem/h measured at 1 m (3.28 ft) although isolated, direct dose rate readings from radioactive specks (a diameter less than 0.6 cm [0.25 in.]) could have been considerably higher. Contamination levels of this magnitude did not significantly add to dose rates for the public or Hanford Site workers in 1996.

Soil and Vegetation Monitoring. Soil and vegetation samples were also collected on, or adjacent to, waste disposal units and from locations downwind and within the operating environment of facilities. Special samples were collected where physical or biological transport problems were identified. Soil and vegetation sample concentrations for some radionuclides were elevated near facilities when compared to the concentrations measured offsite. The concentrations show a large degree of variability; in general, samples collected on, or directly adjacent to, waste disposal facilities had significantly higher concentrations than those collected farther away.

External Radiation. External radiation fields were surveyed near facilities and waste handling, storage, and disposal sites to measure, assess, and control the effects of operations.

A hand-held meter (to measure low-level radiation fields) was used in the 100 N Area to survey points near and in the N Springs area. The levels measured in the N Springs area continued to decline in 1996, reflecting the continuing decay of the radionuclide inventory in the nearby 1301-N Liquid Waste Disposal Facility.

Radiation levels measured with thermoluminescent dosimeters were highest near facilities that had contained or received liquid effluent from N Reactor, primarily the 1325-N and the 1301-N Liquid Waste Disposal Facilities. Dose rates for 1996 for these two facilities decreased approximately 12% from 1995.

The highest dose rates measured in the 200/600 Areas were near waste handling facilities, such as tank farms. The average annual dose rate for 1996 in the 200/600 Areas was 120 mrem/yr, which was equal to the average dose rate measured in 1995.

The highest dose rates in the 300 Area were measured near the 340 Waste Handling and Isolation Facility. The average annual dose rate measured in the 300 Area in 1996 was 120 mrem/yr. This represents a 14% decrease from the average dose rate of 140 mrem/yr measured in 1995. The average annual dose rate at the 300 Area Treated Effluent Disposal Facility was 85 mrem/yr, which represents a 5% increase from the average dose rate of 81 mrem/yr measured in 1995.

The average annual dose rate for 1996 in the 400 Area was 83 mrem/yr, an 8% increase from the average annual dose rate of 77 mrem/yr in 1995.

New dosimeter locations were established in 1996 in support of ERC remediation work in the 100 D/DR Area (five sites) and at the Environmental Restoration Disposal Facility (two sites). Annual comparison data is not available, but the yearly average dose rates extrapolated from the data that was collected showed radiation levels similar to those measured offsite.

Investi tive Sampling

ıvestigative sampling was conducted in the operations areas to help resolve questions about the radi ɔgical status of the facilities and waste sites. Such special samples were collected in 1996 where ı ʃsical or biotic radionuclide transport was suspected or identified and included paint chips, soil (includi radioactive specks), vegetation (primarily tumbleweeds), fresh water clams, a caterpillar, a bee nest, dı ling beetles, a harvester ant mound, a Western toad, a gopher snake, rock dove (domestic pigeon) ıces, owl pellets, starlings, northern pocket gophers, mouse feces, and deer mice. In 1996, 53 sam ɛs, comprising approximately 70 individual specimens, were analyzed for radionuclides, and 43 showed ıeasurable levels of contamination. Another 62 contamination incidents were reported and dispose of without isotopic analyses (although field instrument readings were recorded) during cleanup operati s. Predominant radionuclides identified were activation products and ^{90}Sr in the 100 Areas, fission ı ɔducts in the 200 Areas, and ^{90}Sr in the 3000 Area. No investigative samples were collected from th ɔ00 or 400 Area in 1996. Maximum concentrations of radionuclides in 1996 were: ^{60}Co in mouse ɔes from the 200 West Area; ^{90}Sr in deer mice from the 200 East Area, tumbleweeds from the 200 We Area, and deer mouse feces from the 200 West Area, respectively; ^{137}Cs in mouse feces from the 200 ʃest Area and in paint chips from the 200 West Area, respectively; ^{238}Pu in mouse feces from the 200 ʃest Area and a Western toad from the 100 N Area, respectively; $^{239/240}Pu$ in a Western toad from th ɔ00 N Area; and $^{Total}U$ in mouse feces from the 200 West Area and in pigeon feces from the 200 We Area, respectively.

esponsibility for suspect waste site investigations in operations areas has been transferred to the Har rd Site environmental restoration contractor (i.e., Bechtel Hanford, Inc.), and those results are no long reported in this document.

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TERMS

2SEM	two standard error of the mean
ACV	administrative control value
ALARA	as low as reasonably achievable
APHA	American Public Health Association
CAM	continuous air monitor
CA/SC	contamination area/soil contamination area
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
cpm	counts per minute
CRADA	cooperative research and development agreement
D&D	decontamination and decommissioning
DCG	derived concentration guide
DCRT	double-contained receiver tanks
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EDE	effective dose equivalent
ERC	environmental restoration contractor
ERDF	Environmental Restoration Disposal Facility
ESD	Environmental Sites Database
ETF	effluent treatment facility
FFTF	Fast Flux Test Facility
GJPO	U.S. Department of Energy, Grand Junction Project Office
HEHF	Hanford Environmental Health Foundation
HEPA	high-efficiency particulate air
HGP	Hanford Generation Plant
HPGe	high-purity germanium
HSWMR	*Hanford Site Waste Management Units Report*
HVAC	heating, ventilation, and air conditioning
ICF-KH	ICF Kaiser Hanford Company
ITAS-R	International Technologies Analytical Services-Richland
LWDF	Liquid Waste Disposal Facility
MEI	maximally exposed individual
MSCM	mobile surface contamination monitor
MW	mixed waste
NaI	sodium iodide
NFEM	near-facility environmental monitoring
NFM	near-field monitoring
PNNL	Pacific Northwest National Laboratory
PUREX	Plutonium/Uranium Extraction (Plant)
QA	quality assurance
RCRA	*Resource Conservation and Recovery Act of 1976*
RL	U.S. Department of Energy, Richland Operations Office
SALDS	state-approved land disposal structure
SEM	standard error of the mean
TEDF	Treated Effluent Disposal Facility
TLD	thermoluminescent dosimeters
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic
UO_3	uranium trioxide
URM	underground radioactive material
WAC	waste acceptance criteria
WDOH	Washington State Department of Health

WESF	Waste Encapsulation and Storage Facility
WMNW	Waste Management Federal Services, Inc., Northwest Operations
WSCF	Waste Site Characterization Facility

HANFORD SITE NEAR-FACILITY ENVIRONMENTAL MONITORING ANNUAL REPORT CALENDAR YEAR 1996

1.0 INTRODUCTION

1.1 BAC GROUND

e Hanford Site, consisting of 1,450 km^2 (560 mi^2), is located within the Pasco Basin in south-central V shington State, approximately 270 km (170 mi) southeast of Seattle and 200 km (120 mi) southwe of Spokane. As shown in Figure 1-1, the 100 Areas are located in the north-central part of the Site, alo the southern (right) bank of the Columbia River. The locations of facilities within the 100 Are are shown in Figure 1-2. The 200 Areas are almost in the center of the Site, 11 km (7 mi) south of e Columbia River. The locations of facilities, tank farms, solid waste burial grounds, and liquid waste di osal sites in the 200 Areas are shown in Figures 1-3 and 1-4. The 300 and 400 Areas are located i he southwestern part of the Site as shown in Figure 1-5. The areas not associated with any of the liste reas are considered the 600 Area.

I ar-facility environmental monitoring is conducted in the 100, 200, 300, 400, and 600 Areas to monitor fuse sources and the impact of effluent releases and waste management practices at and near the facili s and waste disposal sites.

1.2 NEA -FACILITY MONITORING OBJECTIVES

e objectives of the near-facility monitoring are to evaluate the following:

Compliance with the U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), Washington State Department of Ecology (Ecology), Washington State Department of Health (WDOH), and internal environmental protection requirements and guidelines

Performance of radioactive waste confinement systems

Trends of radioactive materials in the environment at and adjacent to nuclear facilities, waste disposal units, and restoration units so that appropriate control actions can be taken in a timely manner.

is report presents and interprets the results of the near-facility monitoring activities performed at the H ford Site during 1996.

1.3 NEA -FACILITY TRANSPORT PATHWAYS

e Hanford Site consists of semiarid shrub-steppe land, of which approximately 6% has been disturbe ind actively used for processing nuclear material. This disturbed land, about 82.9 km^2 (32 mi^2) is divide nto large operational areas: the 100, 200, 300, 400, and 1100 Areas. Radioactive emissions from the ite are grouped into three broad categories for regulatory purposes: point, diffuse, and fugitive source e issions. Point sources are easily defined and recognized as facilities with effluent emission structure , such as stacks, and are typically equipped with filtering and monitoring systems. Diffuse sources e extremely varied, do not have or cannot have direct monitoring systems, and are measured through e near-facility environmental monitoring systems. Fugitive emissions may occur from doors,

Figure 1-1. The Hanford Site.

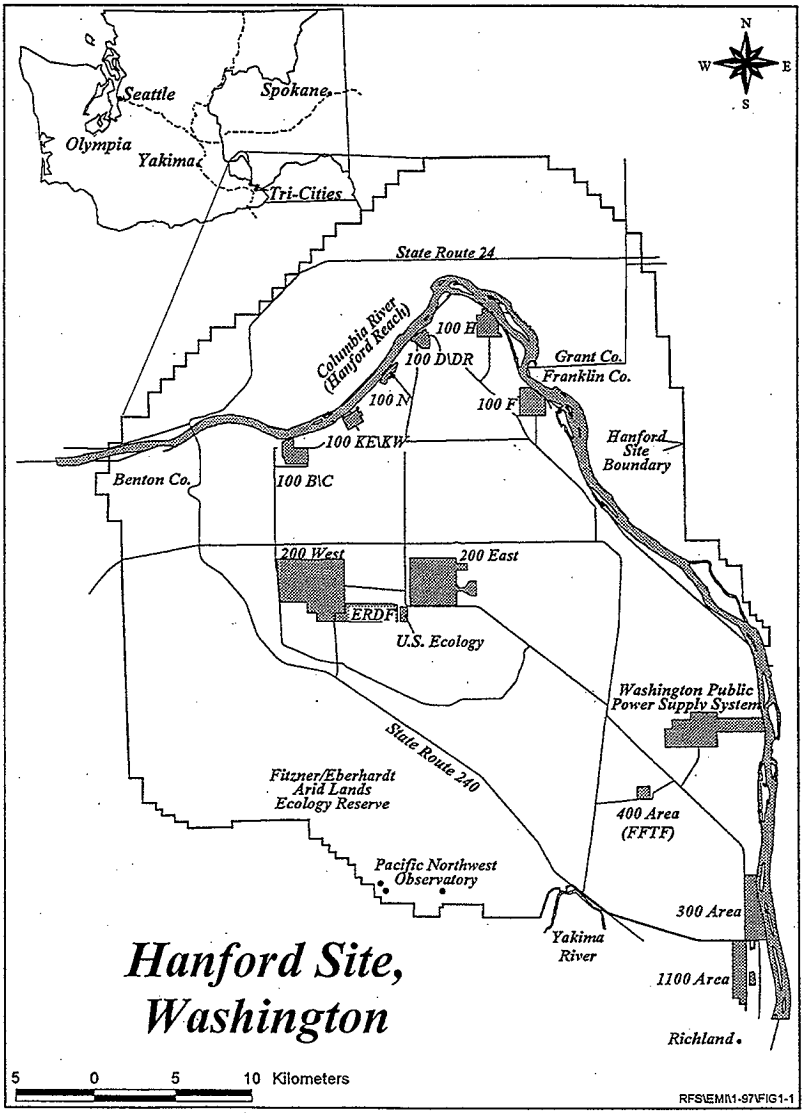


Figure 1-2. 100 Areas.

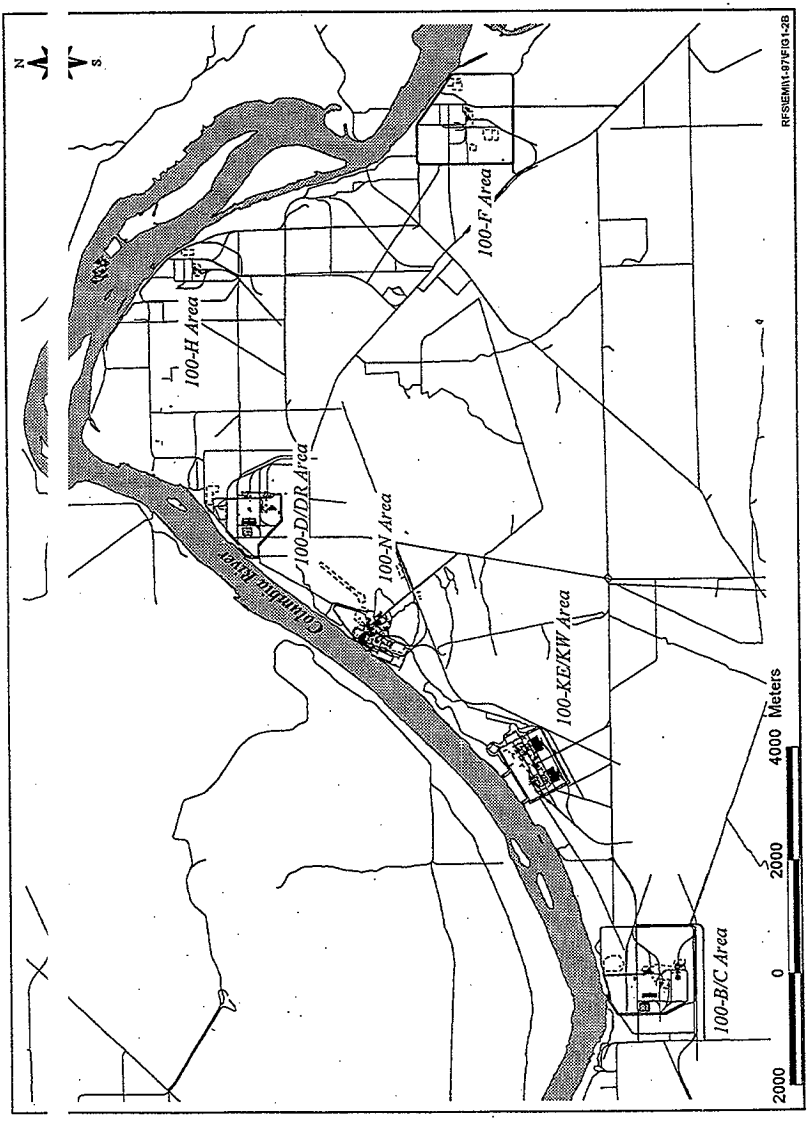


Figure 1-3. 200 East Area.

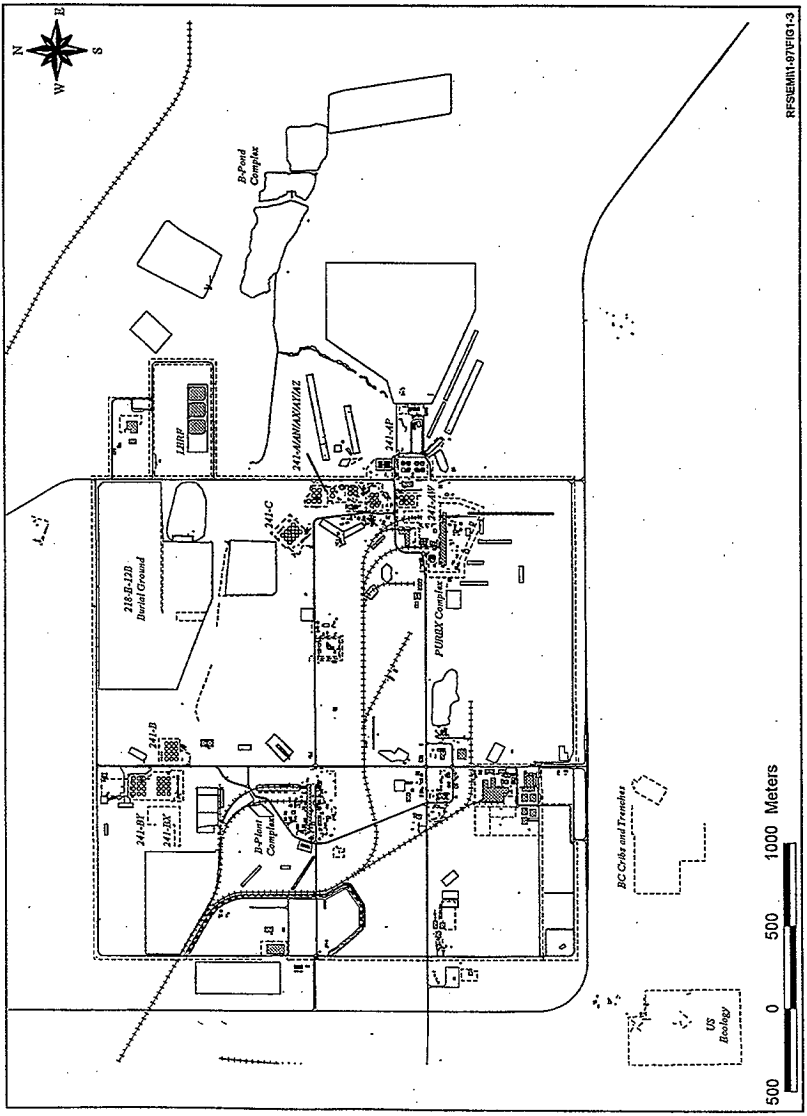


Figure 1-4. 200 West Area.

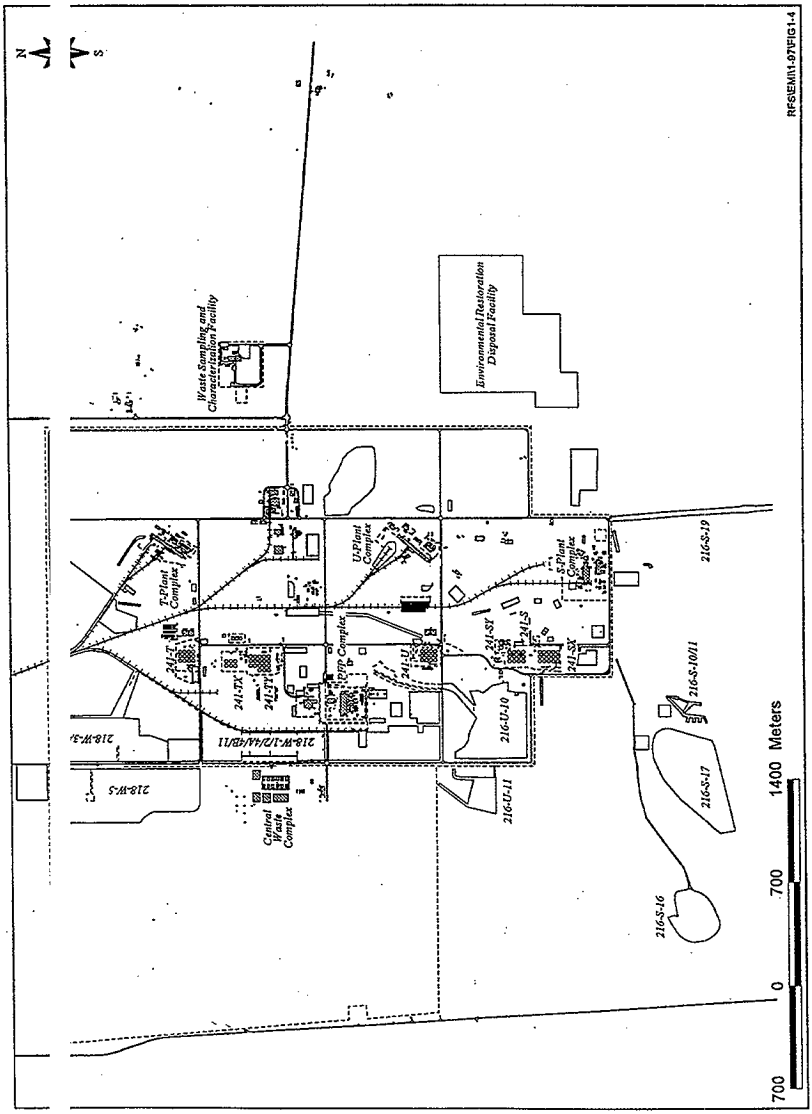
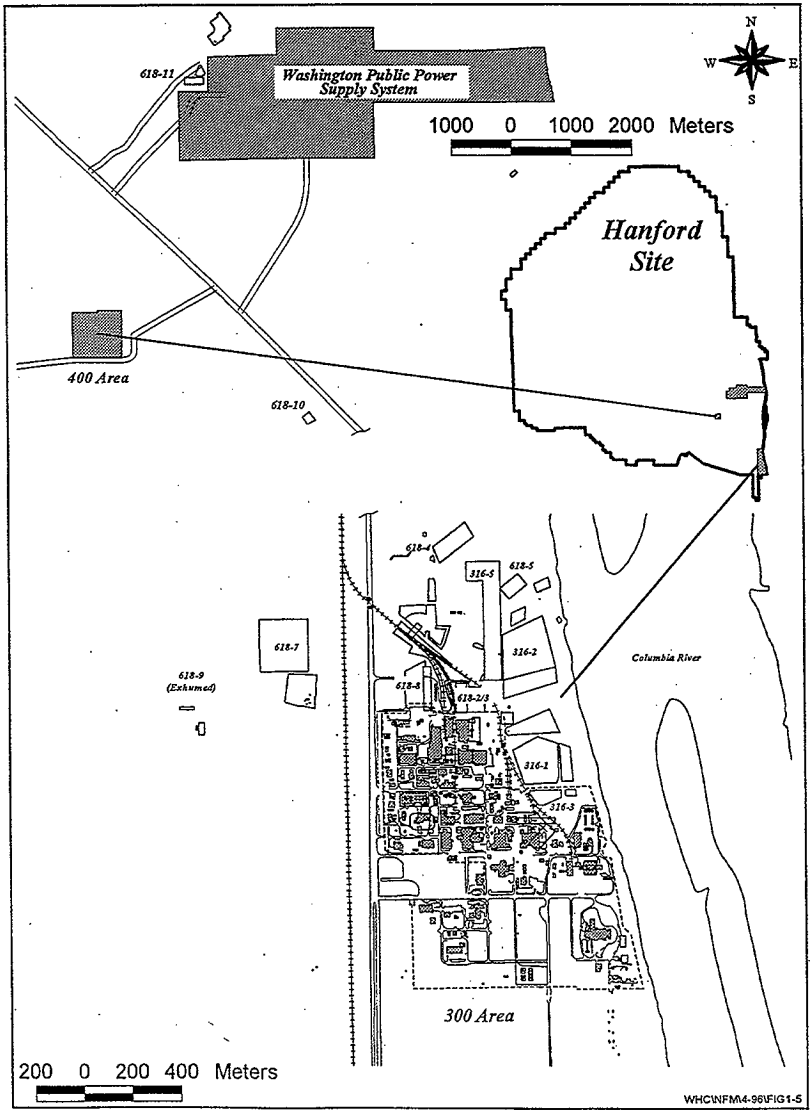


Figure 1-5. 300/400 Areas.



vents, (seams in facilities. A facility may be considered a point source and still contribute to fugitive emissic i. The 600 Area designates the Site land outside the operational areas. Almost all sources of radionu de emissions are within the five operational areas; three minor point sources are in the 600 Ar Emissions from point sources, such as stacks and vents, are measured directly or calculated from pr ess knowledge. Diffuse emissions are measured through a network of monitoring systems near and/or jacent to active and inactive waste sites.

he Hanford Site was acquired in 1943 and dedicated to producing plutonium for national defens nd managing the resulting production wastes. Restoring the Hanford Site environment is the current ission that has largely supplanted the previous operational objectives. The environmental restorat n effort will entail activities such as decontaminating and decommissioning more than 100 fac ies and cleaning up and restoring more than 2,000 waste sites. Until the restoration and cleanu ork is completed, diffuse and fugitive radioactive emissions potentially may be released from hundre of sources besides the 125 point sources (e.g., stacks and vents) registered with the WDOH. Emissic s and offsite doses to the public are reported annually to the EPA and WDOH (see RL 1996).

1.3.1 E vironmental Transport Sources

he presently identified actual or potential sources of diffuse and fugitive radionuclide emissions and bio transport to the environment at the Hanford Site are described in this section. Among the source: at could contribute to biotic transport and diffuse radionuclide emissions are several kinds of waste h dling and disposal facilities, such as cribs, ponds, ditches, trenches, retention basins, valve pits, Fr ch drains, reverse wells, tanks, and burial grounds. Operating facilities or facilities on standby, that are active, or that are being remediated also could contribute diffuse emissions. Each site or facility ually has one or more unique features or characteristics that may influence the contribution to diffuse d fugitive emissions. Features may include structures such as passive vents, risers, equipment access ors, and personnel access doors. Exhausters on facilities are point sources that are monitored at the s ck or main point of effluent release in accordance with state and federal regulations. Charac istics may include an undetected leak, unburied waste, or an absence of intrusion barriers.

arious environmental conditions, such as changing atmospheric pressures, wind speed, erosion vaporation, percolation, biotic intrusion, and/or resuspension, influence rates of diffuse and fugitive nissions.

1.3.2 C neral Types of Facilities

ections 1.3.2.1 through 1.3.2.12 briefly describe general types of sites and facilities and the potentia primary sources of diffuse emissions and environmental transport pathways from each.

1.3.2.1 rib. Low-level liquid waste is discharged to the ground via structures called cribs. These are general subsurface systems, similar to sanitary drain fields, that allow the liquid component of the waste t percolate into the soil. The adsorptive properties of the soil are used to remove radioactive materia rom the effluent through filtration, ion exchange, precipitation reactions, absorption, and adsorpt n.

lany cribs are vented to the atmosphere through vents and pipe risers. These engineered structur promote downward flow of liquids disposed of in the cribs, but also provide a pathway to the surface nd atmosphere. Secondary routes for diffuse emissions include erosion, biotic uptake, and intrusio ollowed by wind-caused resuspension.

1.3.2.2 ond. Ponds were used to manage the large quantities of water (i.e., cooling water and chemic sewer waste water) associated with chemical processing operations. Normally, these liquid effluent are nonradioactive. The ponds allow percolation of the liquid effluent into the soil column. Diffuse nissions from ponds are primarily by wind-caused resuspension.

1.3.2.3 Ditch. A ditch is an open, unlined excavation that was used for disposing of liquid effluents or for transporting liquid effluents to ponds for disposal. Diffuse emissions from ditches are materials resuspended by the wind.

1.3.2.4 Trench. Early disposal practices included disposing of liquid effluents into unlined trenches, then filling the trenches with soil over time. These trenches were replaced with cribs, such as the BC cribs where both cribs and trenches can be found. Diffuse emissions from trenches are primarily the result of erosion, biotic uptake, or intrusion, followed by wind-caused resuspension.

1.3.2.5 Retention Basin. Similar to trenches, retention basins generally were lined with concrete and used to hold liquids before they were routed to ditches or ponds. Diffuse and fugitive emissions from retention basins are primarily wind-caused resuspension.

1.3.2.6 Diversion Box. A diversion box is usually an underground, concrete structure formed around a junction of transfer lines carrying liquid effluent. When diversion boxes are accessed for operation or maintenance, radioactively contaminated material may be released in the form of diffuse and/or fugitive emissions.

1.3.2.7 Valve Pit. A valve pit is similar in structure to a diversion box, but contains piping valves. When valve pits are accessed for operations or maintenance, radioactively contaminated material may be released in the form of diffuse and/or fugitive emissions.

1.3.2.8 French Drain and Reverse or Injection Well. A French drain is a rock-filled encasement inserted into the ground. A reverse or injection well is an ordinary well used for mixing liquid waste with groundwater. These subsurface systems manage potentially contaminated liquid waste by promoting percolation into the soil. The natural filtration properties of the soil remove radionuclide material from effluent water. Diffuse airborne emissions from French drains and reverse wells could occur from erosion, biotic uptake, or intrusion, followed by wind-caused resuspension.

1.3.2.9 Tank. A tank generally is a large, reinforced, metal structure that receives liquid effluent for storage. Examples are the double-shell tanks and single-shell tanks in the 200 Areas, which typically are arrayed in clusters called tank farms. Sources of diffuse and fugitive emissions from tanks include vents and exhausters open to the atmosphere plus deposition and resuspension from surface soil contamination.

1.3.2.10 Burial Ground. Burial grounds are shallow trenches in which contaminated solid waste is buried. This waste is generated by various activities on the Hanford Site. Waste packaging procedures and burial practices depend on the type of waste. Diffuse and fugitive emissions occur at burial grounds through direct release to the atmosphere before the waste is buried, followed by erosion, biotic uptake and intrusion, and wind-caused resuspension.

1.3.2.11 Decontamination and Decommissioning (D&D) Activities. The Project Hanford Management Contractor (PHMC) and the environmental restoration contractor (ERC) activities also involve D&D retired facilities, equipment, and waste disposal sites. These activities are aimed at preventing the release or spread of contamination and reducing the number of acres of surface contamination. In some cases, contaminated material may be exposed to the atmosphere, but as contamination is identified, steps are taken to isolate it and reduce its spread. Diffuse and fugitive emissions may be caused by exposing contaminated surfaces, such as the insides of contaminated structures. Proper planning and controls minimize these exposures. In addition, monitors around demolition sites confirm that controls are effective. To date no significant increases at demolition sites have been observed. The majority of these activities have been transferred to the ERC.

1.3.2.12 Radioactively Contaminated Surface Areas. All radioactive burial grounds, cribs, trenches, retentio asins, and unplanned release sites are surveyed routinely. The surveys are performed at least annuall ut may be done more frequently when needed. The number of surface-contaminated acres varies. e number is not fixed because a continuing effort to clean, stabilize, or remediate known contami ted areas is under way, while new areas of contamination continue to be identified. Newly identifie ontamination may be caused by resuspension or biological intrusion to previously unconta nated areas or because the radiological criteria have become more stringent. Approximately 80% of areas of surface contamination are estimated to have dose rates of less than 1 mrem/h.

e radiologically contaminated areas have been reposted to meet the new requirements outlined HSRCM-1, *Hanford Site Radiological Control Manual*. The postings include "contamination," "high co amination" (activity of >100,000 dpm/100 cm^2 beta/gamma or >10,000 dpm/100 cm^2 alpha), "soil cor mination," "underground radioactive material," "radiological buffer," and "radiation/high radiatio areas. For continuity between annual reports issued in 1994 and 1996, the use of "surface contami tion area" (SCA) in this report includes contamination, high contamination, and soil contami tion areas. If an area has surface and underground contamination, such as the surface above a crib, it ill have both postings. Table 1-1 shows the general location (by area), the approximate area of surface ntamination, and the underground contamination. Sources of diffuse emissions from surface-contami tion areas include erosion, biotic uptake, or intrusion followed by wind-caused resuspension.

more detailed description of specific sites and facilities can be found in *Radionuclide Air Emissio Report for the Hanford Site, Calendar Year 1996* (RL 1997), and in the facility effluent monitori plans for major facilities, which are referenced in this report.

Table 1-1. Hanford Site Surface and Underground Contamination.

	Hanford Site area	Surface contamination,[a] ha (acres)	Underground radioactive material,[b] ha (acres)
100	eas	46 (98)	178 (440)
200	eas[c]	99 (244)	331 (818)
300	ea (north)	20 (49)	14 (35)
600	ea[d]	3,850 (9,513)	28 (69)
Tot		4,016 (9,923)	550 (1,360)

[a] Inc es areas posted as "contamination/soil contamination" or as "radiologically controlled" and areas that had both undergr d and surface/soil contamination.

[b] Inc es areas with only underground contamination. Does not include areas that had surface and underground radioactive material.

[c] Incl es tank farms.

[d] Inc es redesignated BC Controlled Area (historically included in 200 Area acreage estimates) and waste disposal facilities outside t 200 East Area boundary that received waste from 200 East Area facilities (e.g., 216-A-25, 216-B-3) and waste disposal facilities side the 200 West Area boundary that received waste from 200 West Area facilities (e.g., 216-S-19, 216-U-11).

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2.0 AMBIENT AIR MONITORING

2.1 INT ODUCTION

nbient air monitoring is conducted to determine baseline concentrations of radionuclides in the
operatic areas, to assess the impact of operations on the local environment, and to monitor diffuse
emissio from sources located within the operations area. These measurements also provide an
indicati of the PHMC- and ERC-managed facilities' performance and are used to demonstrate
complia e with environmental protection criteria. Location-specific maps and monitoring results \are
located Appendix C of this report.

r monitoring within the 300 and 400 Areas is performed by Pacific Northwest National
Laborat (Pacific Northwest) as part of the Site Surface Environmental Surveillance Project. A more
detailed iscussion of these can be found in the *Hanford Site Environmental Report for Calendar*
Year 19 (Dirkes and Hanf 1997).

ıe air monitoring network takes into consideration potential source terms as well as prevailing
wind dir tion. Meteorological conditions are monitored continuously by Pacific Northwest meteorology
stations hich are strategically positioned in and around the Hanford Site.

anford Site air samplers operate at a flow rate of 0.056 m^3/min (2 ft^3/min), drawing a sample
through 47-mm (2-in.), open-faced filter about 2 m (6 ft) aboveground. All sample filters are
exchan d biweekly, held one week (to allow for decay of the short-lived natural radioactivity), and then
sent to analytical laboratory for initial analysis of total alpha and total beta activity. These initial
analyse erve as an indicator of potential environmental problems.

ıe filters are stored until the end of the 6-month sampling period, then segregated and
compos d by sample location (or as deemed appropriate) for specific radionuclide analysis.
Segreg ıg and compositing air filters by site provides a larger sample size and, thus, a more sensitive
and acc ate measurement of the concentration of airborne radionuclides.

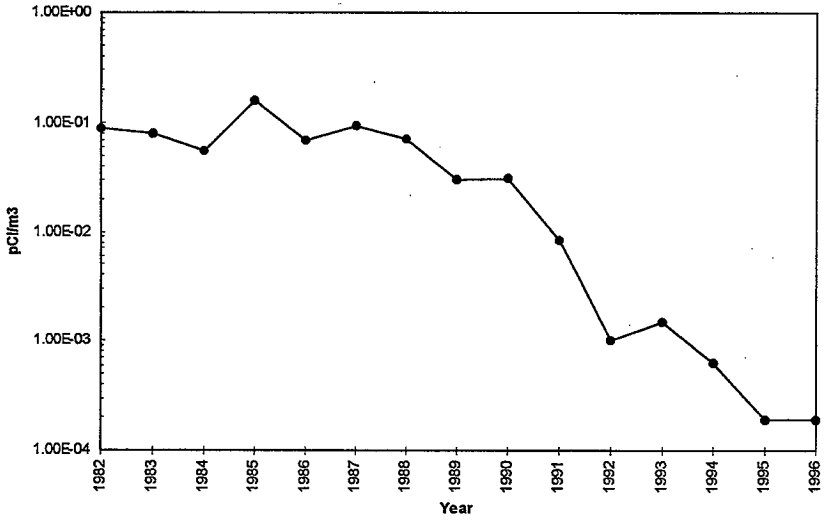
help assess the impact of Site operations, monitoring results are compared to DOE derived
concen tion guides (DCG) and to the results obtained from the distant communities of Yakima and
Sunnys as reported by the Pacific Northwest Site Environmental Surveillance Program. The data
acquire rom distant station N-981 (see Appendix C, Figure C-6) is used to compare to the data from
sample ollected in the operating areas and to data from samples collected by Pacific Northwest, the
WDOH, nd Washington Public Power Supply System. A split sampling site is used for comparability
and pre ion.

2.2 AIF AMPLING RESULTS, 1996

2.2.1 1 N Area

ıe concentrations of airborne radionuclides measured at the 100 N Area were many times less
than the pplicable DOE DCGs. The 1996 air sampling results were comparable to the 1995 results and
are sho in Table C-1. The annual average concentrations of ^{60}Co detected in the 100 N Area ambient
air sam s since 1982 are shown in Figure 2-1. The results of the 1996 isotopic analyses are detailed in
Table C , Appendix C. Sampling locations are shown in Appendix C, Figure C-1.

Figure 2-1. Average Concentrations of ^{60}Co Detected in 100 N Area Ambient Air from 1982 to 1996.



2.2.1.1 ^{60}Co. The maximum annual result was at site N-103 (Table 2-1).

Table 2-1. ^{60}Co in Air, 100 N Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
4.2 E-04 ± 147%	1.9 E-04 ± 90%	8.0 E+01	2.2 E-04 ± 100%

2.2.1.2 ^{90}Sr. The maximum annual result was at site N-101 (Table 2-2).

Table 2-2. ^{90}Sr in Air, 100 N Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
3.1 E-04 ± 34%	1.2 E-04 ± 120%	9.0 E+00	9.2 E-07 ± 49%

2.2.1.3 ^{7}**Cs.** The maximum annual result was at site N-102 (Table 2-3).

Table 2-3. ^{137}Cs in Air, 100 N Area, 1996 (pCi/m^3).

	ximum result ± rerall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	2 E-04 ± 147%	7.0 E-05 ± 92%	4.0 E+02	1.1 E-04 ± 136%

2.2.1.4 ^{6}**U.** The maximum annual result was at site N-105 (Table 2-4).

Table 2-4. ^{234}U in Air, 100 N Area, 1996 (pCi/m^3).

	ximum result ± rerall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	2 E-05 ± 30%	2.1 E-05 ± 79%	9.0 E-02	1.2 E-05 ± 53%

2.2.1.5 ^{5}**U.** The maximum annual result was at site N-103 (Table 2-5).

Table 2-5. ^{235}U in Air, 100 N Area, 1996 (pCi/m^3).

	aximum result ± verall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	1.3 E-05 ± 60%	6.5 E-06 ± 58%	1.0 E-01	-8.4 E-08 ± 166%

gative value indicates result at or near background level of radioactivity.

2.2.1.6 ^{8}**U.** The maximum annual result was at site N-105 (Table 2-6).

Table 2-6. ^{238}U in Air, 100 N Area, 1996 (pCi/m^3).

	aximum result ± verall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	7.7 E-05 ± 30%	1.9 E-05 ± 96%	1.0 E-01	1.2 E-05 ± 21%

2.2.1.7 ^{239,240}Pu. The maximum annual result was at site N-101 (Table 2-7).

Table 2-7. ^{239,240}Pu in Air, 100 N Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
4.8 E-05 ± 40%	1.1 E-05 ± 109%	2.0 E-02	1.1 E-07 ± 100%

2.2.2 100 K Area

Sampling at 100 K Area is conducted in an area surrounding the 105 KE Basin. This is the preferred sampling area since the stack emissions from that facility are the largest emissions source in the 100 K Area. (Stack emissions from the 105 KW Basin are approximately one order of magnitude less than 105 KE Basin.) In general, the concentrations of airborne radionuclides measured at the 100 K Area were many times less than the DOE DCGs. Concentrations of many of the isotopes were negative or had large standard errors of the mean, indicating that the result was at or near background levels of radioactivity. The 1996 results are shown in Table C-1, Appendix C. Sampling locations are shown in Appendix C, Figure C-2.

2.2.2.1 ^{60}Co. The maximum annual result was at site N-403 (Table 2-8).

Table 2-8. ^{60}Co in Air 100 K Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
4.1 E-05 ± ?%	8.5 E-06 ± 198%	8.0 E+01	2.2 E-04 ± 100%

2.2.2.2 ^{90}Sr. The maximum annual result was at site N-401 (Table 2-9).

Table 2-9. ^{90}Sr in Air 100 K Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
4.5 E-04 ± 30%	1.0 E-04 ± 145%	9.0 E+00	9.2 E-07 ± 49%

2.2.2.3 ^{137}Cs. The maximum annual result was at site N-401 (Table 2-10).

Table 2-10. ^{137}Cs in Air 100 K Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant Community ± 2SEM (%)
3.8 E-03 ± 16%	8.1 E-04 ± 115%	4.0 E+02	1.1 E-04 ± 136%

2.2.2.4 $^{}$U. The maximum annual result was at site N-402 (Table 2-11).

Table 2-11. ^{234}U in Air, 100 K Area, 1996 (pCi/m^3).

	aximum result ± verall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.2 E-05 ± 30%	1.9 E-05 ± 40%	9.0 E-02	1.2 E-05 ± 53%

2.2.2.5 $^{}$U. The maximum annual result was at site N-402 (Table 2-12).

Table 2-12. ^{235}U in Air, 100 K Area, 1996 (pCi/m^3).

	aximum result ± verall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.6 E-06 ± 60%	6.1 E-06 ± 43%	1.0 E-01	-8.4 E-08 ± 166%

gative value indicates results at or near background levels of radioactivity.

2.2.2.6 $^{}$U. The maximum annual result was at site N-402 (Table 2-13).

Table 2-13. ^{238}U in Air, 100 K Area, 1996 (pCi/m^3).

	aximum result ± verall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.8 E-05 ± 30%	1.3 E-05 ± 51%	1.0 E-01	1.2 E-05 ± 21%

2.2.2.7 $^{}$, ^{240}Pu. The maximum annual result was at site N-401 (Table 2-14).

Table 2-14. $^{239, 240}$Pu in Air 100 K Area, 1996 (pCi/m^3).

	laximum result ± verall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	2.2 E-05 ± 40%	9.4 E-06 ± 56%	2.0 E-02	1.1 E-07 ± 100%

2.2.2.8 ^{241}Am. The maximum annual result was at site N-403 (Table 2-15).

Table 2-15. ^{241}Am in Air 100 K Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
2.7 E-05 ± 50%	1.4 E-05 ± 43%	2.0 E-02	Not Reported

2.2.3 200 Areas

The concentrations of airborne radionuclides measured in 1996 in the 200 Areas were many times less than the DOE DCG. The 1996 air sampling results for the 200 Areas are shown in Table C-1 (Appendix C). The annual average concentrations since 1979 are illustrated in Figures 2-2 through 2-4. Radionuclide concentrations detected in the ambient air in 1996 are comparable to those observed in 1995. Increasing trends seen in the past are associated with the operation of nuclear facilities, such as the Plutonium/Uranium Extraction (PUREX) Plant. Sampling locations are shown in Appendix C, Figures C-3 and C-4.

2.2.3.1 ^{60}Co. The maximum annual result was at site N-433, southeast of the 218-W-4B Burial Ground in 200 West Area (Table 2-16).

Table 2-16. ^{60}Co in Air, 200 Areas, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
9.0 E-05 ± 66%	1.0 E-05 ± 68%	8.0 E+01	2.2 E-04 ± 100%

2.2.3.2 ^{90}Sr. The maximum annual result was at site N-161, east of T Plant in 200 West Area (Table 2-17).

Table 2-17. ^{90}Sr in Air, 200 Areas, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
1.0 E-03 ± 30%	1.2 E-04 ± 33%	9.0 E+00	9.2 E-07 ± 49%

2.2.3.3 **Cs.** The maximum annual result was at site N-978, north of the 216-BC-Cribs Control area in the 200 ast Area (Table 2-18).

Table 2-18. ^{137}Cs in Air, 200 Areas, 1996 (pCi/m^3).

	ximum result ± erall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	6 E-03 ± 17%	1.7 E-04 ± 33%	4.0 E+02	1.1 E-04 ± 136%

2.2.3.4 **U.** The maximum annual result was at site N-984, east of the 241-C Tank Farm in the 200 East Ar (Table 2-19).

Table 2-19. ^{234}U in Air, 200 Areas, 1996 (pCi/m^3).

	ximum result ± erall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	7 E-05 ± 30%	2.0 E-05 ± 12%	9.0 E-02	1.2 E-05 ± 53%

2.2.3.5 **U.** The maximum annual result was at site N-984, east of the 241-C Tank Farm in the 200 East Ar (Table 2-20).

Table 2-20 . ^{235}U in Air, 200 Areas, 1996 (pCi/m^3).

	ximum result ± erall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	5 E-05 ± 60%	8.0 E-06 ± 18%	1.0 E-01	-8.4 E-08 ± 166%

gative value indicates results at or near background levels of radioactivity.

2.2.3.6 **U.** The maximum annual result was at site N-956, east of the 241-S Tank Farm complex in the 200 /est Area (Table 2-21).

Table 2-21 . ^{238}U in Air, 200 Areas, 1996 (pCi/m^3).

	ximum result ± erall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	3 E-05 ± 40%	1.5 E-05 ± 12%	1.0 E-01	1.2 E-05 ± 21%

2.2.3.7 ^{239,240}Pu. The maximum annual result was at site N-165, near the 216-Z-19 Ditch in the 200 West Area (Table 2-22).

Table 2-22. ^{239,240}Pu in Air, 200 Areas, 1996 (pCi/m^3).

Maximum Result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
7.5 E-05 ± 25%	1.2 E-05 ± 29%	2.0 E-02	1.1 E-07 ± 100%

2.2.3.8 ^{241}Am. The maximum annual result was at site N-165, near the 216-Z-19 Ditch in the 200 West Area (Table 2-23).

Table 2-23. ^{241}Am in Air, 200 Areas, 1996 (pCi/m^3).

Maximum Result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
2.7 E-05 ± 40%	1.6 E-05 ± 39%	2.0 E-02	Not Reported

Figure 2-2. Annual Average ^{137}Cs Concentrations in Air for the 200/600 Areas.

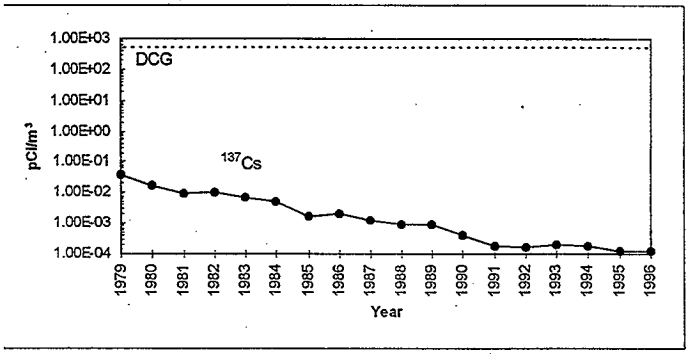


Figure 2-3. Annual Average ^{90}Sr Concentrations in Air for the 200/600 Areas.

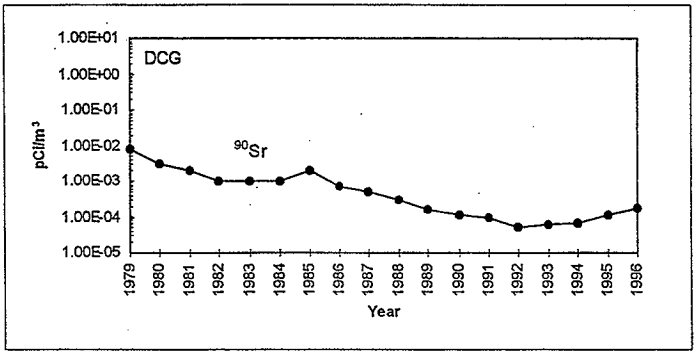
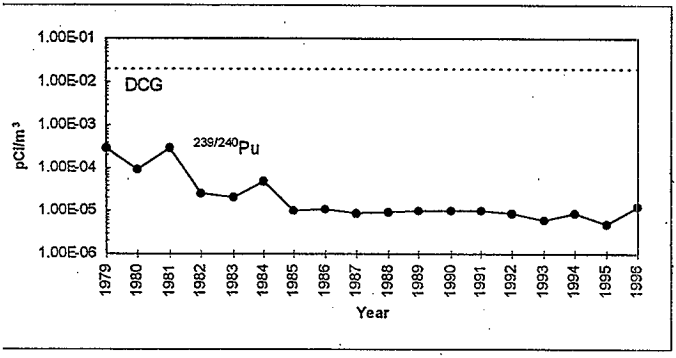


Figure 2-4. Annual Average $^{239, 240}Pu$ Concentrations in Air for the 200/600 Areas.



2.2.4 300/400 Areas

The concentrations of airborne radionuclides measured during 1996 in the 300 and 400 Areas were many times less than the DOE DCG. Air monitoring near the operating facilities in the 300 (300 Area and 300 Area NE) and 400 Areas is provided by Pacific Northwest and the data are transferred to PHMC after review and validation. For a more detailed discussion regarding these monitors, refer to the *Hanford Site Environmental Report for Calendar Year 1996* (Dirkes and Hanf 1997). One ambient air sampler, located at the 300 Area Treated Effluent Disposal Facility (TEDF), is PHMC operated and the data included in this report. This sampling location are shown in Appendix C, Figure C-5.

2.2.4.1 ^{90}Sr. The maximum annual average result in the 300/400 Areas was at the TEDF site, N-130 (Table 2-24).

Table 2-24. ^{90}Sr in Air, 300/400 Areas, 1996 (pCi/m^3).

Area	Annual average overall analytical error (%)	DCG	Distant Community ± 2SEM (%)
300 (Pacific Northwest)	3.1 E-05 ± 41%	9.0 E+00	9.2 E-07 ± 49%
300NE (Pacific Northwest)	1.3 E-05 ± 74%		
300 Area TEDF N-130	1.9 E-04 ± 280%[a]		
400	1.1 E-04 ± 26%		

(a) 2SEM value reported

2.2.4.2 ^{234}U. The maximum annual average result in the 300 Area was at the 300NE composite group site. This analysis was not performed in the 400 Area (Table 2-25).

Table 2-25. ^{234}U in Air, 300/400 Areas, 1996 (pCi/m^3).

Area	Annual average overall analytical error (%)	DCG	Distant Community ± 2SEM (%)
300 (Pacific Northwest)	1.9 E-05 ± 21%	9.0 E-02	1.2 E-05 ± 53%
300NE (Pacific Northwest)	3.3 E-05 ± 22%		
300 Area TEDF N-130	1.9 E-05 ± 142%[a]		

(a) 2SEM value reported

2.2.4.3 **U.** The maximum annual average result in the 300 Area was at the TEDF site, N-130. This analysi: was not performed in the 400 Area (Table 2-26).

Table 2-26. ^{235}U in Air, 300/400 Areas, 1996 (pCi/m^3).

	Area	Annual average ± overall analytical error (%)	DCG	Distant Community ± 2SEM (%)
300 (	icific Northwest)	4.2 E-07 ± 178%	1.0 E-01	-8.4 E-08 ± 166%
300N	(Pacific Northwest)	9.4 E-07 ± 160%		
300 /	a TEDF N-130	7.1 E-06 ± 164%[a]		

(a) SEM value reported
N itive value indicates results at or near background levels of radioactivity.

2.2.4.4 **U.** The maximum annual average result in the 300 Area was at the 300NE composite group site. TI analysis was not performed in the 400 Area (Table 2-27).

Table 2-27. ^{238}U in Air, 300/400 Areas, 1996 (pCi/m^3).

	Area	Annual average ± overall analytical error (%)	DCG	Distant Community ± 2SEM (%)
300 (	icific Northwest)	1.4 E-05 ± 23%	1.0 E-01	1.2 E-05 ± 21%
300N	(Pacific Northwest)	2.3 E-05 ± 25%		
300 /	a TEDF N-130	1.3 E-05 ± 152%[a]		

(a) EM value reported

2.2.4.5 **^{9,240}Pu.** The maximum annual average result in the 300/400 Areas was at the TEDF site, N-130 (ible 2-28).

Table 2-28. $^{239,240}Pu$ in Air, 300/400 Areas, 1996 (pCi/m^3).

	Area	Annual average ± overall analytical error (%)	DCG	Distant Community ± 2SEM (%)
300 (	icific Northwest)	3.1 E-07 ± 124%	2.0 E-02	1.1 E-07 ± 100%
300N	(Pacific Northwest)	9.0 E-08 ± 245%		
300 /	a TEDF N-130	-3.2 E-06 ± 296%[a]		
400		1.5 E-07 ± 117%		

2SEM value reported
gative value indicates results at or near background levels of radioactivity.

2.2.5 1 -B/C Area

ear facility air sampling was conducted for the ERC at the 100B/C remediation site through a networ f three continuous air samplers. Monitoring began in July 1996; therefore, the data provided in this rep : reflect only one set of composite samples. The analytical results indicated that the

concentrations were much less than the DOE DCGs and comparable to levels measured at other locations onsite. Appendix C, Table C-1 provides the 1996 air sampling results. Sampling locations are shown in Appendix C, Figure C-7.

2.2.5.1 ^{60}Co. The maximum annual result was at site N-465 (Table 2-29).

Table 2-29. ^{60}Co in Air 100-B/C Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
3.0 E-05 ± 180%	-9.0 E-06 ± 461%	8.0 E+01	2.2 E-04 ± 100%

Negative value indicates result at or near background level of radioactivity.

2.2.5.2 ^{90}Sr. The maximum annual result was at site N-465 (Table 2-30).

Table 2-30. ^{90}Sr in Air 100-B/C Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
5.3 E-04 ± 30%	3.2 E-04 ± 139%	9.0 E+00	9.2 E-07 ± 49%

2.2.5.3 ^{137}Cs. The maximum annual result was at site N-464 (Table 2-31).

Table 2-31. ^{137}Cs in Air 100-B/C Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant Community ± 2SEM (%)
2.0 E-04 ± 44%	9.9 E-05 ± 133%	4.0 E+02	1.1 E-04 ± 136%

2.2.5.4 ^{234}U. The maximum annual result was at site N-464 (Table 2-32).

Table 2-32. ^{234}U in Air 100-B/C Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
4.3 E-05 ± 30%	3.0 E-05 ± 85%	9.0 E-02	1.2 E-05 ± 53%

2.2.5.5 ^{5}U. The maximum annual result was at site N-466 (Table 2-33).

Table 2-33. ^{235}U in Air 100-B/C Area, 1996 (pCi/m^3).

Ma	num result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.3 E-05 ± 70%	1.1 E-05 ± 86%	1.0 E-01	-8.4 E-08 ± 166%

gative value indicates result at or near background level of radioactivity.

2.2.5.6 ^{8}U. The maximum annual result was at site N-466 (Table 2-34).

Table 2-34. ^{238}U in Air 100-B/C Area, 1996 (pCi/m^3).

Ma	num result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.6 E-05 ± 50%	2.0 E-05 ± 90%	1.0 E-01	1.2 E-05 ± 21%

2.2.5.7 $^{9, 240}$Pu. The maximum annual result was at site N-465 (Table 2-35).

Table 2-35. $^{239, 240}$Pu in Air 100-B/C Area, 1996 (pCi/m^3).

Ma	num result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.0 E-05 ± 50%	1.3 E-05 ± 100%	2.0 E-02	1.1 E-07 ± 100%

2.2.6 1 -D/DR Area

ear facility air sampling was conducted for the ERC at the 100D/DR remediation site through a
network f 4 continuous air samplers. Monitoring began in November, 1996, therefore, the data provided
in this r ort reflect only one set of composite samples. The analytical results indicated that the
concent tions were much less than the DOE DCGs and comparable to levels measured at other
location onsite. Appendix C, Table C-1, provides the 1996 air sampling results. Sampling locations are
shown i Appendix C, Figure C-8.

2.2.6.1 Co. The maximum annual result was at site N-467 (Table 2-36).

Table 2-36. ^{60}Co in Air 100-D/DR Area, 1996 (pCi/m^3).

Ma	num result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.3 E-04 ± 120%	2.6 E-05 ± 611%	8.0 E+01	2.2 E-04 ± 100%

2.2.6.2 ^{90}Sr. The maximum annual result was at site N-470 (Table 2-37).

Table 2-37. ^{90}Sr in Air 100-D/DR Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
-3.3 E-04 ± 170%	-9.4 E-04 ± 91%	9.0 E+00	9.2 E-07 ± 49%

Negative value indicates result at or near background level of radioactivity.

2.2.6.3 ^{137}Cs. The maximum annual result was at site N-470 (Table 2-38).

Table 2-38. ^{137}Cs in Air 100-D/DR Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant Community ± 2SEM (%)
-4.7 E-05 ± 320%	-8.5 E-05 ± 77%	4.0 E+02	1.1 E-04 ± 136%

Negative value indicates result at or near background level of radioactivity.

2.2.6.4 ^{234}U. The maximum annual result was at site N-467 (Table 2-39).

Table 2-39. ^{234}U in Air 100-D/DR Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
5.5 E-05 ± 60%	3.6 E-05 ± 69%	9.0 E-02	1.2 E-05 ± 53%

2.2.6.5 ^{235}U. The maximum annual result was at site N-467 (Table 2-40).

Table 2-40. ^{235}U in Air 100-D/DR Area, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
4.7 E-05 ± 60%	3.2 E-05 ± 67%	1.0 E-01	-8.4 E-08 ± 166%

Negative value indicates result at or near background level of radioactivity.

2.2.6.6 **^{238}U.** The maximum annual result was at site N-467 (Table 2-41).

Table 2-41. ^{238}U in Air 100-D/DR Area, 1996 (pCi/m^3).

Ma:	num result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.2 E-05 ± 80%	1.8 E-05 ± 90%	1.0 E-01	1.2 E-05 ± 21%

2.2.6.7 **$^{239, 240}$Pu.** The maximum annual result was at site N-469 (Table 2-42).

Table 2-42. $^{239, 240}$Pu in Air 100-D/DR Area, 1996 (pCi/m^3).

Ma	num result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.9 E-06 ± 120%	5.7 E-07 ± 1300%	2.0 E-02	1.1 E-07 ± 100%

2.2.7 E **ironmental Restoration Disposal Facility (ERDF)**

ear facility air sampling was conducted for the ERC at the ERDF site through a network of five
continu s air samplers. This network utilized two existing Hanford Site air monitors for upwind
samplin and was supplemented by three additional samplers which provided downwind monitoring.
The upv d monitors were N-963 and PNL 200-West, Southeast. Interestingly, several of the
"maxim n" concentrations observed among the five sampling stations were at the upwind sites. The
followin lata summary tables reflect average values from the three downwind stations only. The
individu data results are shown in Appendix C, Table C-1. Monitoring began in June 1996, therefore
the data rovided in this report reflect only on set of composite samples. The analytical results indicated
that the ncentrations were much less than the DOE DCGs and comparable to levels measured at
other lo tions onsite. Sampling locations are shown in Appendix C, Figure C-4.

2.2.7.1 **o.** The maximum annual result was at site PNL-200 (Table 2-43).

Table 2-43. ^{60}Co in Air, ERDF, 1996 (pCi/m^3).

Ma>	ium result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.8 E-04 ± 93%	-1.1 E-05 ± 291%	8.0 E+01	2.2 E-04 ± 100%

gative value indicates result at or near background level of radioactivity.

2.2.7.2 ^{90}Sr. The maximum annual result was at site N-963 (Table 2-44).

Table 2-44. ^{90}Sr in Air, ERDF, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
2.1 E-04 ± 80%	5.2 E-05 ± 174%	9.0 E+00	9.2 E-07 ± 49%

2.2.7.3 ^{137}Cs. The maximum annual result was at site PNL-200 (Table 2-45).

Table 2-45. ^{137}Cs in Air, ERDF, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant Community ± 2SEM (%)
3.2 E-04 ± 31%	5.2 E-05 ± 99%	4.0 E+02	1.1 E-04 ± 136%

2.2.7.4 ^{234}U. The maximum annual result was at site N-482 (Table 2-46).

Table 2-46. ^{234}U in Air, ERDF, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
2.1 E-05 ± 126%	9.5 E-06 ± 160%	9.0 E-02	1.2 E-05 ± 53%

2.2.7.5 ^{235}U. The maximum annual result was at site N-963 (Table 2-47).

Table 2-47. ^{235}U in Air, ERDF, 1996 (pCi/m^3).

Maximum result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
4.4 E-06 ± 70%	8.1 E-07 ± 92%	1.0 E-01	-8.4 E-08 ± 166%

Negative value indicates result at or near background level of radioactivity.

2.2.7.6 ^{8}**U.** The maximum annual result was at site N-963 (Table 2-48).

Table 2-48. ^{238}U in Air, ERDF, 1996 (pCi/m^3).

Ma	num result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.3 E-05 ± 70%	7.9 E-06 ± 202%	1.0 E-01	1.2 E-05 ± 21%

ative value indicates result at or near background level of radioactivity.

2.2.7.7 $^{9, 240}$**Pu.** The maximum annual result was at site Pacific Northwest-200 (Table 2-49).

Table 2-49. $^{239, 240}$Pu in Air, ERDF, 1996 (pCi/m^3).

Ma	num result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.0 E-06 ± 70%	3.6 E-06 ± 18%	2.0 E-02	1.1 E-07 ± 100%

2.2.7.8 ^{1}**Am.** The maximum annual result was at site N-482 (Table 2-50).

Table 2-50. ^{241}Am in Air, ERDF, 1996 (pCi/m^3).

Ma	num result ± overall error (%)	Annual average ± 2SEM (%)	DCG	Distant community ± 2SEM (%)
	.8 E-06 ± 179%	5.0 E-07 ± 317%	2.0 E-02	Not Reported

2.3 CO CLUSIONS

perational activities in the 100, 200/600, and 300/400 Areas contributed to average air
radionu le concentrations that were above background. Over the past 12 years, the average ambient
air conc ıtrations generally have decreased because of overall improvement in the operational
environ ental controls and reduced Site operations. All airborne radionuclide concentrations in air were
below tl DOE DCGs in 1996.

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3.0 GROUNDWATER MONITORING

3.1 INT ODUCTION

urrently the only groundwater wells that are monitored and reported through the near-facility
monitor | effort are wells N-47 and N-48, located in the 100 N Area. Samples are collected monthly
and are alyzed for gamma-emitting radionuclides. Trend analyses provide indications of the integrity
of the u erground piping associated with the 107-N facility. Wells N-47 and N-48 are located adjacent
to the 1 -N Fuel Storage Basin Recirculation Facility. Radionuclide concentrations detected in the
groundv ter samples are consistent with values observed in previous years.

roundwater monitoring at the Hanford Site is an integral part of the *Hanford Site Groundwater*
Protecti Management Plan (RL 1995). This plan integrates monitoring at active waste disposal
facilities) comply with monitoring requirements of the *Resources Conservation and Recovery Act of*
1976 (R RA) and Washington State regulations, as well as requirements for operational monitoring
around actor and chemical processing facilities, and environmental surveillance monitoring. Pacific
Northwe manages these monitoring efforts through the Groundwater Monitoring Project. This project is
respons e for assessing the distribution and movement of existing groundwater contamination,
identifyi potential and emerging groundwater contamination problems, and integrating the various
groundv ter projects to minimize redundancy. Information on contaminant distribution and transport are
integrat into a sidewide evaluation of groundwater quality, which is documented in an annual
groundv ter monitoring report (Hartman and Dresel 1997). Groundwater monitoring is also carried out
during c anup investigations under the *Comprehensive Environmental Response, Compensation, and*
Liability ct of 1980 (CERCLA) (DOE 1992d). These investigations are managed by the ERC.

3.2 100 I AREA RESULTS

amples of groundwater (1.0L) were collected from wells N-47 and N-48 by ERC personnel and
submitt to Quanterra Environmental Services laboratory for radioanalysis. Though the collection
frequen was planned to be monthly, due to mechanical problems in the sampling equipment in each
well, se ral collection periods were missed in 1996.

ell locations and analysis results are provided in Appendix D of this report.

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4.0 SOIL AND VEGETATION MONITORING

4.1 IN' ODUCTION

he radionuclide content of soil and vegetation was measured to evaluate long-term trends in
environ ental accumulation of radioactivity in the 100, 200, and 300/400 Areas. Soil and vegetation
sample vere collected on or near facilities that store, handle, or dispose of radioactive waste. Samples
were cc cted from locations shown in Appendix E, Figures E-1 through E-12. The analytical results of
the dat btained from the samples collected are shown in Tables E-1 through E-2 (Appendix E).

he number of locations for soil and vegetation sampling in the 100 N environs was reduced in
1996. / alyses of the data collected at sites not associated with the 1301-N and 1325-N facilities
indicate decreasing trends for contaminant migration and prompted a determination that sampling at
these lc itions was not cost-effective. For these same reasons, some N Springs sample locations were
also de ed. Locations of all current 100 N sample points are provided in Figures E-1 and E-7
(Appen : E).

ach soil sample represents a composite of five plugs of soil 2.5 cm (1 in.) deep and 10 cm
(4 in.) i liameter collected from each site. Each vegetation sample consists of new-growth leaf cuttings
taken fr n the available species of interest at each sample location. Often, the vegetation sample
consist of a composite of several like members of the sampling site community to avoid decimation of
any ind dual plant through overharvesting.

arly in the summer of each year, soil and vegetation samples are collected and submitted for
radioan /ses. The analyses include those for radionuclides expected to be found in the areas sampled;
i.e., gar na-emitting radionuclides, strontium isotopes, uranium isotopes, and/or plutonium isotopes.
The res s are then compared to levels found at the "distant communities" of Yakima and Sunnyside.
These l els are derived from data reported from the distant communities by the Pacific Northwest
surveill ce program to determine the difference between contributions from Site operations and
contribu ons from natural causes and worldwide fallout. Soil and vegetation samples were not collected
from th listant communities by Pacific Northwest during 1996. For more detail see Section 4.6, "Soil
and Ve tation," *Hanford Site Environmental Report, Calendar Year 1995* (Dirkes and Hanf 1996). The
results e also compared to the soil concentration limits (Appendix J) developed for use at the Hanford
Site.

adioactive soil concentration limits were established to ensure that effective dose equivalents
(EDE) t he public do not exceed the established limits for any reasonable scenario such as direct
exposu inadvertent ingestion, inhalation, and ingestion of food crops, including animal products.
Conser tism inherent in pathway programming ensures that the required degrees of protection are in
place. e concentration limits specified apply to the Hanford Site with respect to onsite disposal
operati s, stabilization and cleanup, D&D operations.

pecial investigative soil and biota (plant and animal) samples are collected for site-specific
monitor g, or whenever radiological contamination is known or suspected to have occurred. These
special mples are discussed in Section 8.0.

4.2 SC SAMPLING

4.2.1 1 N Area

urface soil samples collected near the 1301-N Liquid Waste Disposal Facility (LWDF)
contain radionuclides that were typically present in past effluent stream discharge. There have been
no efflu t discharges to the 1301-N LWDF since. Generally, the samples collected near this facility
exhibite relatively higher radionuclide concentrations than those collected at the other soil sampling

locations at 100 N. Average radionuclide concentrations detected in the surface soil samples near the 1301-N LWDF from 1980 through 1996 are shown in Table 4-1. Average radionuclide concentrations detected in the surface soil samples collected in the 100 N Area from 1980 through 1996 are shown in Table 4-2. The 1996 maximum, average, the distant community average, and the accessible soil concentration limits are shown in Table 4-3. Summaries of radionuclide concentration limits are shown in Appendix E, Table E-1.

4.2.1.1 ^{60}Co. The highest ^{60}Co result in 1996 was found at site Y605 located near the 1301-N LWDF. The ^{60}Co concentration was 4.7 ± 10% pCi/g. The distant community average for ^{60}Co was not reported in Dirkes and Hanf (1995). The average concentration of ^{60}Co in soils in the 100 N Area was 1.5 ± 73% pCi/g.

4.2.1.2 ^{137}Cs. The highest ^{137}Cs result was found at Site Y605, located near the 1301-N LWDF. The ^{137}Cs concentration was 1.5 ± 11% pCi/g, or 3 times the distant community measured concentration of 4.6×10^{-1} ± 7% pCi/g reported in Dirkes and Hanf (1995). The average concentration of ^{137}Cs in soils in the 100 N Area was 7.7×210^{-1} ± 54% pCi/g.

4.2.1.3 ^{90}Sr. The highest ^{90}Sr result was found at Site Y603, located near the 1301-N LWDF. The ^{90}Sr concentration was 3.7 E-01 ± 33% pCi/g, or 4 times the distant community measured concentration of 9.4 E-02 ± 11% pCi/g reported in the Dirkes and Hanf (1995). The average concentration of ^{90}Sr in soil in the 100 N Area was $2.0\ 10^{-1}$ ± 38% pCi/g.

4.2.1.4 $^{239, 240}$Pu. The highest $^{239, 240}$Pu result was found at Site Y603, located near the 1301N LWDF. The $^{239, 240}$Pu concentration was 7.6×10^{-2} ± 37% pCi/g, or 7 times the distant community measured concentration of 1.1×10^{-2} ± 9% pCi/g reported in Dirkes and Hanf (1995). The average concentration of $^{239, 240}$Pu in soil in the 100 N Area was 4.3×10^{-2} ± 37% pCi/g.

4.2.1.5 Uranium. The highest value for total uranium was found at Site Y602 located southeast of the 1301-N LWDF. The uranium concentrations were 7.5×10^{-1} ± 25% pCi/g for ^{234}U, 1.9×10^{-2} ± 116% pCi/g for ^{235}U, and 8.9×10^{-1} ± 25% pCi/g for ^{238}U or 1.7 pCi/g total uranium. The total uranium concentration was twice the distant community concentration of 9.0×10^{-1} ± 133% pCi/g reported in Dirkes and Hanf (1995). The average concentration for total uranium in soil in the 100 N Area was 1.2 E+00 ± 17% pCi/g.

4.2.1.6 Comparison. Comparisons of the maximum, average, and distant community radionuclide concentrations and the accessible soil concentration limits for the 100 Areas are shown in Table 4-3.

4.2.2 200 Areas

Soil samples from 54 of 110 sample locations were collected in 1996. Summaries of radionuclide concentrations are shown in Appendix E, Table E-2. The following sections discuss the highest analytical result for specific radionuclides and compare them to the offsite average as measured by Pacific Northwest. Maximum, average, and distant community radionuclide concentrations and accessible soil concentration limits are shown in Table 4-4.

ble 4-1. Average Radionuclide Concentrations Detected in Soil Samples Near the 1301-N Liquid Waste Disposal Facility from 1980 through 1996 (pCi/g).

ar	^{60}Co	^{90}Sr	^{137}Cs	^{238}Pu	$^{239,240}Pu$
10	1.3 E+01	3.5 E-01	4.1 E+00	NR	2.5 E-02
11	4.0 E+00	7.0 E-01	6.1 E+00	NR	4.4 E-02
12	6.3 E+00	2.7 E-01	2.7 E+00	NR	1.8 E-02
13	5.4 E+00	1.3 E+00	3.8 E+00	NR	4.3 E-02
14	2.8 E+00	2.1 E-01	1.1 E+00	NR	1.7 E-02
15	1.3 E+01	6.5 E-01	3.9 E+00	NR	3.2 E-02
16	4.5 E+00	2.2 E-01	2.5 E+00	NR	1.7 E-02
17	5.1 E+00	3.4 E-01	1.6 E+00	5.4 E-03	2.2 E-02
18	7.8 E+00	3.5 E-01	2.0 E+00	2.3 E-03	1.7 E-02
19	2.3 E+00	1.5 E-01	5.0 E-01	6.4 E-03	4.0 E-02
10	4.7 E+00	3.2 E-01	1.7 E+00	4.6 E-03	3.5 E-02
11	1.3 E+01	2.7 E-01	1.3 E+00	7.7 E-03	5.3 E-02
12	6.7 E+00	2.2 E-01	1.1 E+00	3.5 E-03	2.3 E-02
13	1.0 E+00	8.7 E-01	6.2 E+00	1.3 E-02	6.9 E-02
14	3.7 E+00	3.3 E-01	1.5 E+00	9.3 E-03	2.8 E-02
15	2.1 E+00	1.5 E-01	7.7 E-01	2.0 E-03	1.0 E-02
16	2.5 E+00	2.3 E-01	9.8 E-01	5.4 E-02	4.8 E-02

NF Not Reported

Table 4-2. Average Radionuclide Concentrations Detected in 100 N Area Surface Soil Samples from 1980 through 1996 (pCi/g).

Year	^{60}Co	^{90}Sr	^{137}Cs	^{238}Pu	$^{239,240}Pu$
1980	8.5 E-01	1.8 E-01	5.0 E-01	NR	1.8 E-02
1981	1.3 E+00	2.1 E-01	1.0 E+00	NR	1.1 E-02
1982	1.6 E+00	9.9 E-02	3.4 E-01	NR	5.0 E-03
1983	2.7 E+00	2.9 E-01	4.4 E-01	NR	8.5 E-03
1984	8.8 E-01	2.8 E-01	6.2 E-01	NR	1.4 E-02
1985	1.2 E+00	1.3 E-01	5.2 E-01	NR	1.3 E-02
1986	4.1 E-01	8.3 E-02	5.0 E-01	NR	8.2 E-03
1987	4.1 E-01	1.1 E-01	3.9 E-01	1.1 E-03	6.7 E-03
1988	3.4 E-01	1.6 E-01	3.9 E-01	4.5 E-04	9.5 E-03
1989	1.4 E-01	2.1 E-01	1.3 E-01	1.1 E-03	1.3 E-02
1990	3.0 E-01	1.2 E-01	4.4 E-01	6.7 E-04	1.0 E-02
1991	4.3 E-01	1.1 E-01	4.5 E-01	6.2 E-04	7.8 E-03
1992	8.6 E-02	9.5 E-02	3.6 E-01	5.1 E-04	7.6 E-03
1993	3.0 E-02	1.2 E-01	1.6 E-01	1.8 E-04	3.4 E-03
1994	1.6 E+00	1.9 E-01	8.1 E-01	4.2 E-03	1.6 E-02
1995	9.4 E-01	1.3 E-01	5.1 E-01	1.9 E-03	1.4 E-02
1996	1.5 E+00	2.0 E-01	7.7 E-01	1.2 E-02	4.3 E-02

NR = Not Reported

Table 4-3. 100 N Area Soils (pCi/g).

	^{60}Co	^{137}Cs	^{90}Sr	$^{239,240}Pu$	^{234}U	^{235}U	^{238}U
Maximu	Site Y605	Site Y605	Site Y603	Site Y603	Site Y602	Site Y604	Site Y602
± counti error (%	4.7 E+00 ± 10%	1.5 E+00 ± 11%	3.7 E-01 ± 33%	7.6 E-02 ± 37%	7.5 E-01 ± 25%	1.9 E-02 ± 116%	8.9 E-01 ± 25%
Average ± 2SEM	1.5 E+00 ± 73%	7.7 E-01 ± 54%	2.0 E-01 ± 38%	4.3 E-02 ± 37%	5.7 E-02 ± 14%	2.3 E-02 ± 53%	5.7 E-01 ± 21%
Pacific Northwe distant commu average ± 2SEM	NR	4.6 E-01 ± 7%	9.0 E-02 ± 11%	1.0 E-02 ± 9%	NR	1.7 E-01 ± 92%	8.1 E-01 ± 140%
Accessi concent limits soil ion	7.1 E+00	3.0 E+01	2.8 E+03	1.9 E+02	6.3 E+02	1.7 E+02	3.7 E+02

2 M = 2 standard error of the mean.
N : Not reported.
* es and Hanf (1996)

Table 4-4. 200 Area Soils (pCi/g).

	^{60}Co	^{137}Cs	^{90}Sr	$^{239,240}Pu$	^{234}U	^{235}U	^{238}U
Maximu	Site D026	Site D030	Site D024	Site D024	Site D100	Site D100	Site D100
± counti error(%	7.9 E-02 ± 30%	1.0 E+01 ± 10%	3.0 E+00 ± 17%	2.1 E+01 ± 14%	2.7 E-01 ± 11%	1.2 E-02 ± 24%	2.5 E-01 ± 11%
Average ± 2SEM	3.2 E-03 ± 108%	2.0 E+00 ± 36%	3.5 E-01 ± 42%	1.6 E-01 ± 69%	1.0 E-01 ± 12%	4.4 E-03 ± 13%	1.1 E-01 ± 11%
Pacific Northwe distant commu average ± 2SEM	NR	4.6 E-01 ± 7%	9.0 E-02 ± 11%	1.0 E-02 ± 9%	NR	1.7 E-01 ± 92%	8.1 E-01 ± 140%
Accessi concent limits soil ion	7.1 E+00	3.0 E+01	2.8 E+03	1.9 E+02	6.3 E+02	1.7 E+02	3.7 E+02

SEM = 2 standard error of the mean.
R = Not reported.
Dirkes and Hanf (1996)

4.2.2.1 ^{60}Co. The highest ^{60}Co result was found at Site D026, located southeast of T-Plant. The ^{60}Co concentration was $7.9 \times 10^{-2} \pm 30$ pCi/g. The distant community average for ^{60}Co was not reported in Dirkes and Hanf (1995). The average concentration of ^{60}Co in soils in the 200 Areas was $3.2 \times 10^{-3} \pm 108\%$ pCi/g.

4.2.2.2 ^{137}Cs. The highest ^{137}Cs result was found at Site D030, located southeast of the 241-U Tank Farm. The ^{137}Cs concentration was $1.0 \times 10^{-1} \pm 10\%$ pCi/g, or 22 times the distant community measured concentration of $4.6 \times 10^{-1} \pm 7\%$ pCi/g reported in Dirkes and Hanf (1995). The average concentration of ^{137}Cs in soils in the 200 Areas was $2.0 \pm 36\%$ pCi/g.

4.2.2.3 ^{90}Sr. The highest ^{90}Sr result was found at Site D024, located near the railroad cut northwest of T-Plant. The ^{90}Sr concentration was $3.0 \pm 17\%$ pCi/g, or 33 times the distant community measured concentration of $9.0 \times 10^{-2} \pm 11\%$ pCi/g reported in Dirkes and Hanf (1995). The average concentration of ^{90}Sr in soil in the 200 Areas was $3.5 \times 10^{-1} \pm 42\%$ pCi/g.

4.2.2.4 ^{239,240}Pu. The highest ^{239,240}Pu result was found at Site D024, located near the railroad cut northwest of T-Plant. The ^{239,240}Pu concentration was $2.1 \pm 14\%$ pCi/g, or 210 times the distant community measured concentration of $1.0 \times 10^{-2} \pm 9\%$ pCi/g reported in Dirkes and Hanf (1995). The average concentration of ^{239,240}Pu in soil in the 200 Areas was $1.6 \times 10^{-1} \pm 69\%$ pCi/g.

4.2.2.5 Uranium. The highest total uranium was found at Site D100, located near the cross-site transfer line at the western fence line of the 200 East Area. The uranium concentrations were $2.7 \times 10^{-1} \pm 11\%$ pCi/g for ^{234}U, $1.2 \times 10^{-2} \pm 27\%$ pCi/g for ^{235}U, and $2.5 \times 10^{-1} \pm 11\%$ pCi/g for ^{238}U or 5.3×10^{-1} pCi/g total uranium. The total uranium concentration was less than the distant community concentration of 9.0×10^{-1} pCi/g reported in Dirkes and Hanf (1995). The average concentration for total uranium in soil in the 200 Areas was $2.1 \times 10^{-1} \pm 10\%$ pCi/g.

4.2.2.6 Comparison. Comparisons of the maximum, average, and distant community radionuclide concentrations and the accessible soil concentration limits for the 200 Areas are shown in Table 4-4.

4.2.3 300/400 Areas

This was the fifth year of sampling from locations established to monitor the near-field in the 300/400 Areas. Soil samples from 17 sample locations were collected in 1996: 14 from the 300 Area and 3 from the 400 Area. Radionuclide concentrations are shown in Appendix E, Table E-3. Comparisons of maximum, average, distant community, and accessible soil concentration limits are shown in Table 4-5.

4.2.3.1 ^{60}Co. The highest ^{60}Co result that was above the overall counting error was found at Site D130, located near the 400 Area Process Pond. The ^{60}Co concentration was 2.2 E-02 ± 73% pCi/g. The distant community concentration of ^{60}Co was not reported in Dirkes and Hanf (1995). The average concentration of ^{60}Co in soil in the 300/400 Areas was 1.7 E-03 ± 329% pCi/g.

4.2.3.2 ^{137}Cs. The highest ^{137}Cs result was found at Site D125, located southwest of the 618-3 Burial Ground. The ^{137}Cs concentration was 5.9 E-01 ± 13% pCi/g, and was not different from the distant community measured concentration of 4.6 E-01 ± 7% pCi/g reported in Dirkes and Hanf (1995). The average concentration of ^{137}Cs in soil in the 300/400 Areas was 1.5 E-01 ± 47% pCi/g.

Table 4-5. 300/400 Areas Soils (pCi/g).

		^{60}Co	^{137}Cs	^{90}Sr	$^{239,240}Pu$	^{234}U	^{235}U	^{238}U
Maximur		Site D130	Site D125	Site D131	Site D119	Site D119	Site D119	Site D119
± countir error (%)		2.2 E-02 ± 73%	5.9 E-01 ± 13%	7.8 E-02 ± 22%	2.9 E-01 ± 14%	9.1 E+00 ± 11%	4.0 E-01 ± 12%	9.1 E+00 ± 11%
Average ± 2SEM (	)	1.7 E-03 ± 329%	1.5 E-01 ± 47%	3.7 E-02 ± 34%	2.5 E-02 ± 131%	1.3 E+00 ± 78%	7.8 E-02 ± 72%	1.2 E+00 ± 84%
Pacific Northwes distant commun average ± 2SEM (	)*	NR	4.6 E-01 ± 7%	9.0 E-02 ± 11%	1.0 E-02 ± 9%	NR	1.7 E-01 ± 92%	8.1 E-01 ± 140%
Accessib concentr limits	soil on	7.1 E+0	3.0 E+1	2.8 E+3	1.9 E+2	6.3 E+2	1.7 E+2	3.7 E+2

2: M = 2 standard error of the mean.
N : Not reported.
*[es and Hanf (1996)

4.2.3.3 Sr. The highest ^{90}Sr result was a duplicate sample collected at site D119, located northeast of the 316 Process Pond. The ^{90}Sr concentration was $7.8 \times 10^{-2} \pm 22\%$ pCi/g, and was not different from the dist community measured concentration of $9.0 \times 10^{-2} \pm 11\%$ pCi/g reported in Dirkes and Hanf (1995). he average concentration of ^{90}Sr in soil in the 300/400 Areas was $3.7 \times 10^{-2} \pm 34\%$ pCi/g.

4.2.3.4 $^{239,240}Pu$. The highest $^{239,240}Pu$ result was found at site D119, located northeast of the 316-2 P cess Pond. The $^{239,240}Pu$ concentration was $2.9 \times 10^{-1} \pm 14\%$ pCi/g, or 29 times the distant commu y measured concentration of $1.0 \times 10^{-2} \pm 9\%$ pCi/g reported in Dirkes and Hanf (1995). The ave ge concentration of $^{239,240}Pu$ in soil in the 300/400 Areas was $2.5 \times 10^{-2} \pm 131\%$ pCi/g.

4.2.3.5 ranium. The highest uranium result was found at site D119, located northeast of the 316-2 P cess Pond. The uranium concentrations were 9.1 ± 11% pCi/g for ^{234}U, 4.0 x 10^{-1} ± 12% pCi/g for ^{235}U, nd $9.1 \times 10^{-1} \pm 11\%$ pCi/g for ^{238}U or 1.9×10^{-1} pCi/g total uranium. The total uranium concent lion was 21 times the distant community concentration of 9.0×10^{-1} pCi/g reported in Dirkes and Hai (1995). ^{234}U was not reported by Pacific Northwest. The average concentration of total uranium i soil in the 300/400 Areas was 2.6 ± 79% pCi/g.

4.2.3.6 omparison. Comparisons of the maximum, average, and distant community radionuclide concent lions and the accessible soil concentration limits for the 300/400 Areas are shown in Table 4-5.

4.3 VE(:TATION SAMPLING

4.3.1 1(Areas

egetation samples collected near the 1301-N and 1325-N LWDFs contain radionuclides that were ty ally present in the past effluent stream discharges. The levels of contaminant concentrations near the 301-N facility were elevated compared to historic levels. Unusually high levels of ^{60}Co, ^{90}Sr, and ^{137}C were detected in the vegetation sample collected from site Y705. This site is within a radiolog ally controlled area (contamination area/surface contamination area), near the tail-end of the

1301-N LWDF. Biotransport (root uptake) of the residual contaminants in the soil column is the suspected mechanism of transport. Average radionuclide concentrations detected in the vegetation samples near the 1301-N LWDF from 1980 through 1996 are shown in Table 4-6. Average radionuclide concentrations detected in the vegetation samples collected in the 100 N Area, excluding 1301-N and N-Springs, from 1980 through 1996 are shown in Table 4-7. Radionuclide concentrations are shown in Appendix E, Table E-4.

Vegetation samples collected along the 100 N Area shoreline (N Springs) contain radionuclides that were not completely retained in the soil columns beneath the 1301-N/1325-N LWDFs. Biotransport via root uptake of ^{60}Co, ^{90}Sr, and ^{137}Cs was evident in the reed canary grass samples collected from this region. Most notable were the average levels of ^{90}Sr and ^{137}Cs, which exhibited concentrations orders of magnitude higher than the offsite averages. Average radionuclide concentrations detected in the vegetation samples collected along the N Springs from 1980 through 1996 are shown in Table 4-8.

Comparisons of the maximum, average, and distant community radionuclide concentrations and the accessible soil concentration limits for the 100 N Area are shown in Table 4-9.

4.3.1.1 ^{60}Co. The highest ^{60}Co result was found at site Y705, located near the 1325-N LWDF. The ^{60}Co concentration was $2.4 \times 10^{-1} \pm 20\%$ pCi/g. The distant community average for ^{60}Co was not reported in Dirkes and Hanf (1995). The average concentration of ^{60}Co in vegetation in the 100 N Area was 2.4 ± 187% pCi/g, two orders of magnitude higher than the previous year.

4.3.1.2 ^{137}Cs. The highest ^{137}Cs result was found at site Y705, located near the 1301-N LWDF. The ^{137}Cs concentration was $1.1 \times 10^{-4} \pm 10\%$ pCi/g or 1,528,000 times the distant community average concentration of $7.2 \times 10^{-3} \pm 116\%$ pCi/g for ^{137}Cs reported in Dirkes and Hanf (1995). The average concentration of ^{137}Cs in vegetation in the 100 N Area was $1.1 \times 10^{-3} \pm 189\%$ pCi/g, four orders of magnitude higher than the previous year.

Table 4-6. Average Radionuclide Concentrations Detected in Vegetation Samples Near the 1301-N Liquid Waste Disposal Facility from 1980 to 1996 (pCi/g).

Year	^{60}Co	^{90}Sr	^{137}Cs	^{238}Pu	$^{239,240}Pu$
1980	1.0 E+00	NR	1.1 E+00	NR	NR
1981	2.5 E+01	1.8 E+00	1.8 E+00	NR	7.1 E-03
1982	1.5 E+00	1.2 E-01	2.6 E-01	NR	2.6 E-03
1983	1.0 E+00	6.0 E-01	3.9 E-01	NR	3.2 E-03
1984	4.6 E+01	1.2 E-01	8.3 E-02	NR	8.5 E-04
1985	1.4 E+00	1.9 E+00	1.0 E-01	NR	1.5 E-03
1986	9.5 E+01	7.3 E-02	6.5 E-01	NR	2.6 E-03
1987	7.0 E+01	6.3 E-02	2.0 E-01	1.2 E-03	5.6 E-03
1988	8.0 E+01	1.2 E-01	1.3 E-01	4.3 E-04	1.7 E-03
1989	3.2 E+01	3.8 E-02	1.5 E-01	2.8 E-04	2.0 E-03
1990	1.1 E+01	3.1 E-02	1.2 E-01	2.7 E-04	1.1 E-03
1991	1.3 E-01	1.5 E-02	6.0 E-01	8.1 E-05	1.2 E-03
1992	5.6 E-02	6.5 E-03	2.0 E-01	-2.8 E-05	1.6 E-04
1993	1.0 E-01	5.7 E-02	2.1 E-01	-7.8 E-04	4.1 E-04
1994	6.1 E+01	4.8 E+00	1.8 E+00	3.3 E-02	2.0 E-01
1995	2.9 E-02	6.4 E-02	1.2 E-01	1.3 E-03	8.6 E-03
1996	1.8 E+02	5.8 E+02	2.8 E+03	-1.8 E-02	-9.6 E-03

NR = Not reported.
Negative value indicates results at or below background levels of radioactivity.

Table 4-7. Average Radionuclide Concentrations Detected in 100 N Vegetation Samples from 1980 to 1996 (pCi/g).

Year	^{60}Co	^{90}Sr	^{137}Cs	^{238}Pu	$^{239,240}Pu$
1980	1.0 E+00	NR	2.8 E-01	NR	NR
1981	2.5 E+01	5.8 E-01	7.1 E-01	NR	2.1 E-02
1982	1.5 E+00	2.0 E-01	1.3 E-01	NR	7.8 E-03
1983	1.0 E+00	2.9 E-01	9.0 E-02	NR	8.6 E-03
1984	4.6 E-01	8.1 E-02	9.0 E-02	NR	1.3 E-03
1985	1.4 E+00	5.1 E-02	1.6 E-01	NR	8.7 E-04
1986	9.5 E-01	2.2 E-01	7.9 E-01	NR	1.1 E-03
1987	7.0 E-01	2.6 E-01	9.4 E-02	1.3 E-04	5.7 E-04
1988	8.0 E-01	2.5 E-01	1.6 E-01	1.7 E-04	6.6 E-04
1989	3.2 E-01	6.8 E-02	1.5 E-01	1.1 E-04	8.7 E-04
1990	1.1 E-01	9.3 E-03	3.6 E-02	-9.6 E-05	1.7 E-04
1991	1.3 E-01	9.4 E-03	3.4 E-03	1.6 E-04	2.5 E-03
1992	5.6 E-02	5.6 E-02	7.8 E-02	-5.2 E-06	1.3 E-04
1993	1.0 E-01	3.6 E-02	6.5 E-02	-5.2 E-05	3.3 E-04
1994	6.5 E-00	5.7 E-01	1.7 E-01	1.0 E-03	3.4 E-03
1995	3.0 E-02	3.3 E-02	2.7 E-02	3.4 E-04	2.3 E-04
1996	2.4 E-00	1.1 E-01	8.1 E-02	-6.8 E-04	2.0 E-04

NR = Not reported.
Negative value indicates results at or below background levels of radioactivity.

Table 4-8. Average Radionuclide Concentrations Detected in N Springs Vegetation Samples from 1980 to 1996 (pCi/g).

Year	^{60}Co	^{90}Sr	^{137}Cs	^{238}Pu	$^{239,240}Pu$
1980	5.6 E+00	NR	4.4 E-01	NR	NR
1981	3.3 E+00	2.0 E+02	NR	NR	3.7 E-03
1982	2.8 E+00	4.8 E+02	NR	NR	8.3 E-03
1983	3.0 E+00	3.3 E+02	4.0 E-02	NR	8.0 E-03
1984	NS	NS	NS	NS	NS
1985	1.2 E+00	4.2 E+02	1.7 E-01	NR	4.4 E-04
1986	1.1 E+00	2.2 E+02	2.1 E-01	NR	4.2 E-04
1987	9.0 E-01	2.9 E+02	1.1 E-01	-1.3 E-04	7.6 E-04
1988	1.4 E+00	1.2 E+02	2.0 E-01	8.5 E-05	2.0 E-04
1989	4.3 E-01	8.0 E+01	1.5 E-01	1.1 E-03	4.5 E-04
1990	NS	NS	NS	NS	NS
1991	1.5 E-01	3.1 E+01	1.6 E-01	1.2 E-04	2.9 E-03
1992	4.2 E-02	7.8 E+01	3.0 E-01	1.5 E-04	2.9 E-04
1993	4.5 E-01	2.6 E+02	2.0 E-01	2.3 E-03	-8.5 E-04
1994	1.4 E-01	6.0 E+01	1.5 E-01	3.6 E-04	2.0 E-03
1995	1.4 E-02	1.3 E+01	9.4 E-02	5.9 E-04	2.8 E-03
1996	1.2 E-02	2.9 E+00	3.7 E-02	3.2 E-03	-1.5 E-03

NR = Not reported.
NS = No sample results.
Negative value indicates results at or below background levels of radioactivity.

4.3.1.3 ^{90}Sr. The highest ^{90}Sr result was found at site Y705, located near the 1301-N LWDF area. The ^{90}Sr concentration was $4.3 \times 10^{-3} \pm 24\%$ pCi/g, or 143,750 times the distant community measured concentration of $1.6 \times 10^{-2} \pm 19\%$ pCi/g reported in Dirkes and Hanf (1995). The average concentration of ^{90}Sr in vegetation in the 100 N Area was $2.3 \times 10^{-2} \pm 189\%$ pCi/g, two orders of magnitude higher than the previous year.

4.3.1.4 $^{239,240}Pu$. The highest $^{239,240}Pu$ result was found at site Y703, located near the 1301-N LWDF. The $^{239,240}Pu$ concentration was $6.4 \times 10^{-3} \pm 220\%$ pCi/g, or 36 times greater than the distant community measured concentration of $1.8 \times 10^{-4} \pm 72\%$ pCi/g reported in Dirkes and Hanf (1995). The average concentration of $^{239,240}Pu$ in vegetation in the 100 N Area was $-5.1 \times 10^{-3} \pm 0\%$ pCi/g.

4.3.1.5 Uranium. The highest total uranium was found at site Y719, located along the N Springs shoreline area. The uranium concentrations were $1.6 \times 10^{-2} \pm 166\%$ pCi/g for ^{234}U, $1.6 \times 10^{-3} \pm 138\%$ pCi/g for ^{235}U, and $5.7 \times 10^{-2} \pm 79\%$ pCi/g for ^{238}U or 8.8×10^{-2} pCi/g uranium total. The concentration of total U was 10 times the distant community concentration of 9.0×10^{-3} pCi/g reported in Dirkes and Hanf (1995). The average concentration for total uranium in vegetation in the 100 N Area was $2.9 \times 10^{-2} \pm 52\%$ pCi/g.

4.3.1.6 Comparisons. Comparisons of the maximum, average, and distant community radionuclide concentration and accessible soil concentration limits are shown in Table 4-9.

4.3.2 200/600 Areas

In 1996, 49 vegetation samples were collected. Radionuclide concentrations for all sites sampled are shown in Table E-5 (Appendix E). The following sections provide more detailed discussions of the highest results for specific radionuclides.

4.3.2.1 ^{60}Co. The highest ^{60}Co result above the counting error was found at site V022, located near the T-34 Crib. The ^{60}Co concentration was $3.3 \times 10^{-1} \pm 38\%$ pCi/g. The distant community concentration of ^{60}Co was not reported in Dirkes and Hanf (1995). The average concentration of ^{60}Co in vegetation in the 200 Areas was $2.6 \times 10^{-2} \pm 93\%$ pCi/g.

4.3.2.2 ^{137}Cs. The highest ^{137}Cs result was found at site V034, located northeast of the 241-U Tank Farm. The ^{137}Cs concentration was $4.9 \times 10^{-1} \pm 29\%$ pCi/g, or 68 times the distant community concentration of $7.2 \times 10^{-3} \pm 117\%$ reported in Dirkes and Hanf (1995). The average concentration of ^{137}Cs in vegetation in the 200 Areas was $6.9 \times 10^{-2} \pm 44\%$ pCi/g.

4.3.2.3 ^{90}Sr. The highest ^{90}Sr result was found at site V032, located northwest of the 241-U Tank Farm. The ^{90}Sr concentration was $3.7 \pm 27\%$ pCi/g, or 231 times the distant community measured concentration of $1.6 \times 10^{-2} \pm 19\%$ pCi/g reported in Dirkes and Hanf (1995). The average concentration of ^{90}Sr in vegetation in the 200 Areas was $3.7 \times 10^{-1} \pm 49\%$ pCi/g.

4.3.2.4 $^{239,240}Pu$. The highest $^{239,240}Pu$ result was found at site V034, located northeast of the 241-U Tank Farm. The $^{239,240}Pu$ concentration was $7.5 \times 10^{-2} \pm 13\%$ pCi/g, or 416 times the distant community measured concentration of $1.8 \times 10^{-4} \pm 72\%$ pCi/g reported in Dirkes and Hanf (1995). The average concentration of $^{239,240}Pu$ in vegetation in the 200 Areas was $4.1 \times 10^{-3} \pm 76\%$ pCi/g.

Table 4-9. Radionuclide Concentrations in 100 N Area Vegetation, All Locations (pCi/g).

	^{60}Co	^{137}Cs	^{90}Sr	$^{239,240}Pu$	^{234}U	^{235}U	^{238}U
Maximum	Site 705	Site 705	Site 705	Site 703	Site 705	Site 702	Site 719
± counting error(%)	2.4 E+01 ± 20%	1.1 E+04 ± 56%	2.3 E+03 ± 24%	6.4 E-03 ± 220%	1.7 E-01 ± 266%	4.7 E-03 ± 387%	5.7 E-02 ± 79%
Average ± 2SEM(%)	2.4 E+00 ± 187%	2.3 E+02 ± 89%	2.3 E+02 ± 189%	-5.1 E-03 ± 0%	2.6 E-02 ± 122%	-3.0 E-04 ± 0%	2.2 E-02 ± 764%
Pacific Northwest distant community average ± 2SEM (%)*	NR	7.2 E-03 ± 116%	1.6 E-02 ± 19%	1.8 E-04 ± 72%	3.9 E-03 ± 99%	NR	5.1 E-03 ± 60%
Accessible soil concentration limits	7.1 E+00	3.0 E+01	2.8 E+03	1.9 E+02	6.3 E+02	1.7 E+02	3.7 E+02

2SEM = 2 standard error of the mean.
NR = Not reported.
*Dirkes and Hanf 1996

4.3.2.5 Uranium. The highest total uranium result was found at site V080, located southwest of B-Plant near the cross-site transfer line. The uranium concentrations were $2.0 \times 10^{-2} \pm 24\%$ pCi/g for ^{234}U, $1.7 \times 10^{-3} \pm 75\%$ pCi/g for ^{235}U, and $1.7 \times 10^{-2} \pm 25\%$ pCi/g for ^{238}U or 3.5×10^{-2} pCi/g total uranium. The total isotopic uranium concentration was 4 times the distant community measured concentration of 9.0×10^{-3} pCi/g reported in Dirkes and Hanf (1995). The average concentration of total uranium in vegetation in the 200 Areas was $1.0 \times 10^{-2} \pm 52\%$ pCi/g.

4.3.2.6 Comparisons. Comparisons of the maximum, average, and distant community radionuclide concentrations and accessible soil concentration limits for 200 Areas vegetation are shown in Table 4-10.

4.3.3 300/400 Areas

This was the sixth year of sampling from locations established to more directly monitor facilities and active/inactive waste sites. In 1996, 16 vegetation samples were collected from 14 locations in the 300 Area and 3 in the 400 Area. Radionuclide concentrations for all sites sampled are shown in Appendix E, Table E-6. The following sections provide more detailed discussions of the highest results for specific radionuclides.

4.3.3.1 ^{60}Co. The highest ^{60}Co result was found at site V123, located near the 316-3 Process Pond. The ^{60}Co concentration was $8.4 \times 10^{-2} \pm 68\%$ pCi/g. The distant community measured concentration for ^{60}Co was not reported in Dirkes and Hanf (1995). The average concentration of ^{60}Co in vegetation in the 300/400 Areas was $7.1 \times 10^{-3} \pm 299\%$ pCi/g.

4.3.3.2 ^{137}Cs. The highest ^{137}Cs result, $8.7 \times 10^{-2} \pm 62\%$, was found at site V122, located near the southwest corner of the 316-1 Process Pond. The ^{137}Cs concentration was 12 times the value of $7.2 \times 10^{-3} \pm 117\%$ reported for the distant community in Dirkes and Hanf (1995). The average concentration of ^{137}Cs in vegetation in the 300/400 Areas was $1.6 \times 10^{-2} \pm 99\%$ pCi/g.

4.3.3.3 ^{90}Sr. The highest ^{90}Sr result was found at site V123, located near the 316-3 Process Pond. The ^{90}Sr concentration was $2.5 \times 10^{-1} \pm 21\%$ pCi/g, or 16 times the distant community measured concentration of $1.6 \times 10^{-2} \pm 19\%$ pCi/g reported in Dirkes and Hanf (1995). The average concentration of ^{90}Sr in vegetation in the 300/400 Areas was $6.3 \times 10^{-2} \pm 40\%$ pCi/g.

4.3.3.4 $^{239, 240}$Pu. The highest $^{239, 240}Pu$ result was found at site V127, located near the 618-7 Burial Ground. The $^{239, 240}Pu$ concentration was $1.5 \times 10^{-3} \pm 49\%$ pCi/g, or 8 times the distant community measured concentration of $1.8 \times 10^{-4} \pm 72\%$ pCi/g reported in Dirkes and Hanf (1995). The average concentration of $^{239, 240}Pu$ in vegetation in the 300/400 Areas was $3.8 \times 10^{-4} \pm 50\%$ pCi/g.

4.3.3.5 Uranium. The highest uranium result was found at site V122, located south of the 316-1 Process Pond. The uranium concentrations were $3.3 \times 10^{-1} \pm 12\%$ pCi/g of ^{234}U, $1.6 \times 10^{-2} \pm 30\%$ pCi/g of ^{235}U, and $3.2 \times 10^{-1} \pm 13\%$ pCi/g of ^{238}U or 7.0×10^{-1} pCi/g total isotopic uranium. The total isotopic uranium concentration was 78 times the distant community measured concentration of 9.0×10^{-3} pCi/g reported in Dirkes and Hanf (1995). The average concentration of total uranium in vegetation in the 300/400 Areas was $9.8 \times 10^{-2} \pm 81\%$ pCi/g.

4.3.3.6 Comparisons. Comparisons of the maximum, average, and distant community radionuclide concentrations and the accessible soil standards for 300/400 Areas vegetation are shown in Table 4-11.

Table 4-10. 200 Areas Vegetation (pCi/g).

	^{60}Co	^{137}Cs	^{90}Sr	$^{239,240}Pu$	^{234}U	^{235}U	^{238}U
Maximum	Site V022	Site V034	Site V032	Site V034	Site V080	Site V080	Site V048
± counting error(%)	3.3 E-01 ± 38%	4.9 E-01 ± 29%	3.7 E+00 ± 27%	7.5 E-02 ± 13%	2.0 E-02 ± 24%	1.7 E-03 ± 75%	1.7 E-02 ± 25%
Average ± 2SEM(%)	2.6 E-02 ± 93%	6.9 E-02 ± 44%	3.7 E-01 ± 49%	4.1 E-03 ± 76%	5.0 E-03 ± 21%	2.3 E-04 ± 55%	5.0 E-03 ± 21%
Pacific Northwest distant community average ± 2SEM (%)*	NR	7.2 E-03 ± 116%	1.6 E-02 ± 19%	1.8 E-04 ± 72%	3.9 E-03 ± 99%	NR	5.1 E-03 ± 60%
Accessible soil concentration limits	7.1 E+00	3.0 E+01	2.8 E+03	1.9 E+02	6.3 E+02	1.7 E+02	3.7 E+02

2SEM = 2 standard error of the mean.
NR = Not reported.
*Dirkes and Hanf 1996

Table 4-11. 300/400 Areas Vegetation (pCi/g).

	^{60}Co	^{137}Cs	^{90}Sr	$^{239,240}Pu$	^{234}U	^{235}U	^{238}U
Maximum	Site V123	Site V122	Site V123	Site V127	Site V122	Site V122	Site V122
± counting error(%)	8.4 E-02 ± 68%	8.7 E-02 ± 62%	2.5 E-01 ± 21%	1.5 E-03 ± 49%	3.3 E-01 ± 13%	1.6 E-02 ± 30%	3.2 E-01 ± 13%
Average ± 2SEM (%)	7.1 E-03 ± 299%	1.6 E-02 ± 99%	6.3 E-02 ± 40%	3.8 E-04 ± 50%	4.9 E-02 ± 80%	2.3 E-02 ± 81%	4.7 E-02 ± 80%
Pacific Northwest distant community measured average ± 2SEM (%)*	NR	7.2 E-03 ± 116%	1.6 E-02 ± 19%	1.8 E-04 ± 72%	3.9 E-03 ± 99%	NR	5.1 E-03 ± 60%
Accessible soil concentration limits	7.1 E+00	3.0 E+01	2.8 E+03	1.9 E+02	6.3 E+02	1.7 E+02	3.7 E+02

2SEM = 2 standard error of the mean.
NR = Not reported.
*Dirkes and Hanf 1996

4.4 CONCLUSIONS

The impacts of past and current operations on the near-facility environment, were consistently above the concentrations in distant communities reported by Pacific Northwest. Except for the notable exception of the vegetation sample collected from the 100 N Area, radionuclide concentrations observed for the soil and vegetation samples were below the accessible soil concentration limits (Appendix J, Table J-4).

As the data indicate, the concentrations have a large degree of variance. In general, the samples collected on, or directly adjacent to, the waste disposal facilities had higher concentrations of radionuclides than those further away. The data also show, as expected, that certain radionuclides had higher concentrations within different operating areas. Generally speaking, the predominant radionuclides are activation and fission products in the 100 Areas, fission products and plutonium in the 200 Areas, and uranium in the 300 Areas. Facility monitoring sites are selected to maximize detection of radionuclides in the near-facility environment, and the results do not necessarily represent the entire operating area.

5.0 EXTERNAL RADIATION MONITORING

5.1 INTRODUCTION

A network of thermoluminescent dosimeters (TLD) was positioned in and around the 100, 200, and 300/300 TEDF/400 Areas to monitor dose rates from external radiation sources (primarily gamma rays). The TLD measurements were taken to determine dose rates in the operations area environment. From these data, the contribution of Hanford Site activities to the dose rates in these areas can be discerned. Figures showing these sites and the TLD results are in Appendix F.

The environmental TLDs measure dose rates from all types of external radiation sources. These include cosmic radiation, naturally occurring radioactivity in air and soil, and fallout from nuclear weapons testing, as well as any contribution from Hanford Site activities. These outside radiation sources cause an estimated ± 20% deviation in TLD analyses. The results are reported in units of millirems per year (mrem/yr).

The Hanford Site uses the Harshaw TLD system which includes the Harshaw 8807 dosimeter and the Harshaw 8800 TLD reader. The TLD reader has a better signal-to-noise ratio than those used in the past. The TLD packaging, which uses an "O ring" seal, protects the TLDs from light, heat, moisture, and dirt. The TLDs were placed 1 m (3 ft) aboveground at each location. The TLDs were placed near active and inactive surface-water disposal sites and near facilities (tank farms, active cribs, and the facility fence line). Changing conditions in the vicinity of the TLD sample locations, such as remediation activities, removal, or storage of radioactive material, and tank farm operations may also cause fluctuations in TLD analyses over time. The TLDs were exchanged and analyzed each calendar quarter. The Pacific Northwest Radiation Calibration Laboratory has calibrated the response of the chips; results were reported in terms of external dose (mrem).

5.2 RESULTS

5.2.1 100 Area

5.2.1.1 100-N. The 1996 TLD results indicate that the DOE exposure guidelines for nonradiation area workers (100 mrem/yr) were not exceeded in any nonradiologically controlled area except near the N Springs shoreline. Reasons for this elevated radiation level are discussed later in this section. The overall trend is that dose rates at most locations continue to decrease. Eight TLD monitoring locations were removed from areas of little or no historical impact to the environment after the second quarter of 1996.

Direct radiation levels were predictably higher near facilities that had contained or received liquid effluents from N Reactor or where mixed (radiological and hazardous) waste was stored. These facilities included the 1301-N LWDF, the 1325-N LWDF, the 1304-N emergency dump tank, and 116-N-8 (the 163-N Mixed Waste and Hazardous Waste Container Storage Pad).

Dose rates measured near the 1301-N LWDF in 1996 showed an annual average decrease of approximately 13% from 1995 levels. This decline represents a continuing trend of decreased dose rates at this facility, primarily caused by the decay of ^{60}Co (5.3-year half life).

The average environmental dose rates measured near the 1325-N LWDF in 1996 were approximately 10% lower than those measured in 1995. All four TLD sites at this facility showed decreases in 1996. This decline represents a trend of decreased dose rates at this facility, similar to that of the 1301-N LWDF, primarily caused by the decay of ^{60}Co.

Dose rates were measured at the N Springs shoreline to determine potential external radiation doses to the public as well as to a Hanford Site worker. Because of the "skyshine" effect from the 1301-N LWDF, dose rates at the N Springs were elevated above 100 mrem/year, the DOE annual external dose limit to members of the public. However, neither a member of the public nor a Hanford worker would conceivably spend an entire year at the N Springs; therefore, the values shown in Figure 5-1 are for comparison only. N Springs dose reduction measures are currently being studied.

The TLD measurements from the 100 N Area for 1987 through 1996 are shown in Figure 5-2; they are compared for 1995 and 1996 in Table 5-1.

5.2.1.2 100 K Area. This is the fourth year of external radiation monitoring at the 100 K Area. Dose rates observed were generally at typical Hanford Site background levels with a few exceptions. Sites K-8 and K-10 are near staged, low-level wastes awaiting shipment, while site K-9 is near radioactive rail equipment storage. Changes noted in the levels at these three sites are consistent with the changes in the waste configuration.

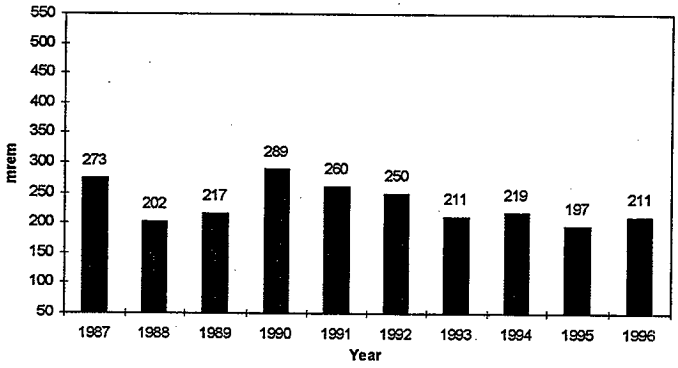
Results were compared to the 1995 averages at each site as shown in Table 5-1. The largest increase was at K-10 and can be related to changes to the waste storage configuration near this TLD at 105-K East.

5.2.2 200 Areas

The 1996 TLD results for the 200 Areas indicated that the DOE exposure guidelines for nonradiation area workers (100 mrem/yr) were not exceeded in any nonradiologically controlled areas. Figure 5-3 shows the external radiation monitoring results for 1987 through 1996.

Results indicated that operations in the 200 Areas did not contribute significantly to the external radiation dose rates of the general environment (Table 5-2). The overall annual dose rate in the 200 Areas showed a 2% decrease from 1995 to 1996. The exposure rate in the general 200 Areas environment was not significantly different from the exposure rate received offsite from natural radiation sources. As expected, external radiation levels were elevated at certain sites, radiological control areas, and facilities, reflecting the proximity to radioactive waste management activities; e.g., site 235 near the 241-C Tank Farm and Sites 250 and 255 near the 241-A Tank Farm complex. Site 268 also showed a significant increase due to waste storage activities at the Central Waste Complex. TLDs are positioned to measure facilities of higher impact as was the case in 1989 when the average annual dose rate increased from 106 to 241 mrem per year. TLDs were removed from the grid configuration, where many were located in remote areas, to a configuration closer to operations facilities.

Figure 5-1. Annual Average Dose Rate at N Springs.



Note: DOE Limits were reduced from 500 mrem/yr in 1992. The lower value was selected in recognition of the International Commission of Radiation Protection (ICRP) recommendation to limit the long term average effective dose equivalence to 100 mrem (1mSv) per year or less. (DOE 5400.5)

Figure 5-2. Comparison of TLD Results at 100 N Area.

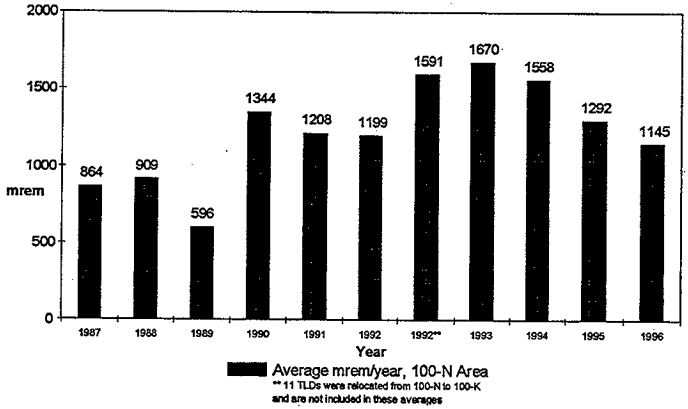


Table 5-1. 100 Areas Thermoluminescent Dosimeter Exposure Results (mrem/yr).

100 N Area site I.D.	1995 average	1996 average	96 vs 95 % change
1	9.2 E+02	8.3 E+02	-10
2	9.2 E+02	8.3 E+02	-10
3	4.1 E+02	3.7 E+02	-10
4	1.6 E+03	1.7 E+03	7
5	5.9 E+02	5.6 E+02	-6
6	3.0 E+02	2.3 E+02	-23
7	7.6 E+02	4.0 E+02	-47
8	1.0 E+02	9.0 E+01	-10
10	9.2 E+01	8.7 E+01	-5
12	9.4 E+01	1.0 E+02	6
13	1.6 E+02	1.6 E+02	0
14	3.7 E+02	3.6 E+02	-4
15	7. 0 E+02	6.7 E+02	-6
16	5.8 E+02	2.9 E+02	-50
17	2.0 E+02	2.2 E+02	10
18	5.2 E+02	7.0 E+02	34
22	4.8 E+02	4.3 E+02	-9
26	2.3 E+02	2.1 E+02	-8
28	1.4 E+03	1.9 E+02	-86
29	1.4 E+03	6.7 E+01	-51
30	5.8 E+03	5.4 E+03	-7
31	4.3 E+02	4.2 E+02	-1
32	3.0E+02	3.0 E+02	-3
33	2.3 E+02	1.7 E+02	-24
34	9.9 E+03	9.6 E+03	-8
35	1.0 E+04	8.8 E+03	-13
36	3.5 E+02	3.3 E+02	-6
37	3.6 E+02	3.3 E+02	-9
38	1.5 E+02	1.5 E+02	-3
41	3.4 E+02	3.1 E+02	-10
Average	1.3 E+03	1.1 E+03	-13

1301-N site I.D.	96 vs 95 % change
1	-10
2	-10
3	-10
4	7
5	-6
6	-23
15	-6
18	34
22	-9
32	-3
33	-24
Average	-12

1325-N site I.D.	96 vs 95 % change
30	-7
34	-8
35	-13
36	-6
Average	-10

100 K site I.D.	96 vs 95 % change
1	-22
2	-17
3	-13
4	-15
5	-3
6	-7
7	-69
8	-92
9	-69
10	1300
11	-15
Average	-58

Figure 5-3. Comparison of TLD Results at the 200 Areas.

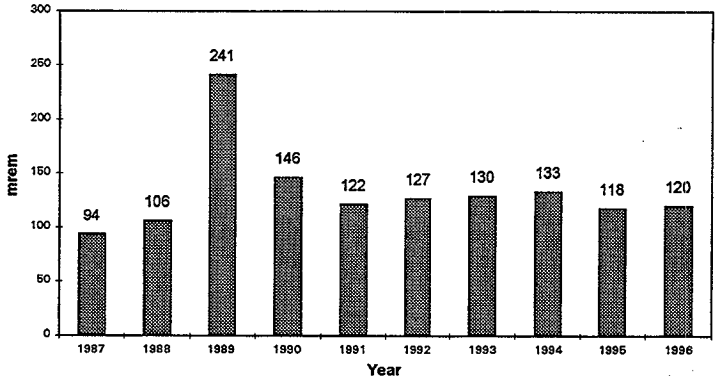


Table 5-2. 200 Area Thermoluminescent Dosimeter Comparisons for 1995 and 1996 (mrem/yr). (2 sheets total)

Site I.D.	1995 Average	1996 Average	% Change
202	8.7 E+01	9.1 E+01	3.7
203	9.0 E+01	1.0 E+02	10.2
204	1.4 E+02	1.4 E+02	0.5
205	8.2 E+01	8.5 E+01	3.2
206	1.2 E+02	1.1 E+02	-8.9
207	9.5 E+01	9.9 E+01	3.3
208	1.6 E+02	1.6 E+02	3.7
209	8.3 E+01	8.9 E+01	6.9
210	9.8 E+01	1.0 E+02	2.4
211	8.7 E+01	1.0 E+02	21.1
212	1.2 E+02	1.2 E+02	4.1
213	2.0 E+02	2.0 E+02	1.5
214	7.8 E+01	8.2 E+01	5.3
215	9.0 E+01	9.3 E+01	3.4
216	9.7 E+01	1.0 E+02	4.1
217	8.3 E+01	8.6 E+01	3.1
218	7.7 E+01	8.2 E+01	6.5
219	9.2 E+01	9.5 E+01	3.7
220	9.2 E+01	9.6 E+01	4.6
221	8.7 E+01	9.3 E+01	6.9
222	1.1 E+02	1.2 E+02	5.7
223	1.4 E+02	1.4 E+02	0.3
224	8.1 E+01	9.0 E+01	11.1
226	8.3 E+01	8.9 E+01	6.5
227	8.0 E+01	8.6 E+01	7.7
228	8.2 E+01	8.6 E+01	3.8
229	9.2 E+01	9.3 E+01	1.1
230	1.2 E+02	1.2 E+02	3.1
231	9.0 E+01	9.4 E+01	5.0
232	1.3 E+02	1.5 E+02	10.1
233	8.7 E+01	9.1 E+01	3.8

Table 5-2. 200 Area Thermoluminescent Dosimeter Comparisons for 1995 and 1996 (mrem/yr).

Site I.D.	1995 Average	1996 Average	% Change
234	1.2 E+02	1.1 E+02	-7.9
235	6.1 E+01	8.9 E+01	44.5
236	9.6 E+01	1.0 E+02	6.6
237	7.7 E+01	8.3 E+01	7.1
238	8.8 E+01	9.5 E+01	8.3
239	8.7 E+01	9.3 E+01	5.8
240	7.8 E+01	8.2 E+01	5.4
241	9.6 E+01	9.3 E+01	-3.7
242	8.7 E+01	9.4 E+01	8.2
243	8.0 E+01	8.5 E+01	6.0
244	1.1 E+02	1.3 E+02	11.3
245	8.2 E+01	8.4 E+01	2.7
246	8.2 E+01	8.5 E+01	3.0
247	8.2 E+01	8.5 E+01	3.8
249	1.5 E+02	1.2 E+02	-18.4
250	1.3 E+02	2.0 E+02	50.1
251	1.8 E+02	1.5 E+02	-16.6
252	1.4 E+02	1.2 E+02	-8.1
253	1.0 E+02	1.2 E+02	17.5
254	2.8 E+02	2.0 E+02	-28.8
255	1.2 E+02	1.6 E+02	35.5
256	4.4 E+02	3.6 E+02	-17.2
258	7.0 E+02	4.9 E+02	-29.0
259	1.8 E+02	1.8 E+02	3.6
260	7.9 E+01	8.1 E+01	2.4
261	1.0 E+02	1.0 E+02	2.1
262	8.2 E+01	8.4 E+01	2.2
263	7.6 E+01	8.1 E+01	5.6
264	8.2 E+01	9.0 E+01	10.6
267	7.7 E+01	8.9 E+01	16.0
268	8.5 E+01	1.2 E+02	38.2
269	8.5 E+01	9.7 E+01	13.4
All	1.2 E+02	1.2 E+02	-1.6

5.2.3 300/300 TEDF/400 Areas

This was the fifth year of external radiation monitoring in the 300/400 Areas and the third year of external radiation monitoring at the 300 TEDF. Figure 5-4 shows the external radiation monitoring results for 1991 through 1996. The 1996 TLD results for the 300/400 Areas indicate that the DOE exposure guidelines were not exceeded in any nonradiologically controlled area.

Comparing the results of external monitoring for 1996 and 1995 indicates that the 300/400 Areas did not contribute significantly to the external radiation dose rates of the general environment, as shown in Table 5-3. Consequently, the dose rate in the general 300/400 Areas environment was not significantly different from the dose rate received offsite from natural radiation sources. The overall annual dose rate in the 300/300 TEDF/400 Areas showed no change from 1995 to 1996.

5.2.4 Environmental Restoration Disposal Facility

TLDs were established at two fixed locations around the ERDF during the fourth quarter of 1996. Because these TLDs were only in place for one sample period (one quarter), it was necessary to extrapolate the analyses to one year to make adequate comparisons to the rest of the Hanford Site. Overall, the dose rate in the general ERDF area was not significantly different from the dose rate received offsite from natural radiation sources. Table 5-4 shows the results of the fourth quarter, extrapolated to one year.

5.2.5 100-D/DR Remediation Activities

TLDs were established at five fixed locations around the 116-D-7 and 116-DR-9 LWDF, during the fourth quarter of 1996. Since these TLDs were only in place for one sample period (one quarter), it was necessary to extrapolate the analyses to one year to make adequate comparisons to the rest of the Hanford Site. Overall, the dose rate in the general area was not significantly different from the dose rate received offsite from natural radiation sources. Table 5-6 shows the results of the fourth quarter, extrapolated to one year.

Figure 5-4. Comparison of TLD Results at the 300/300 TEDF/400 Areas.

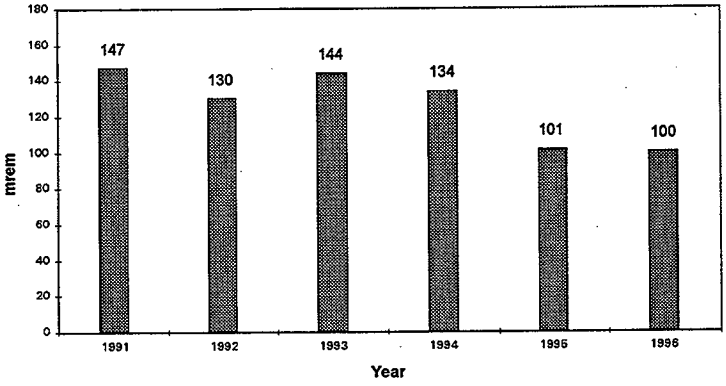


Table 5-3. 300/300 TEDF/400 Areas Thermoluminescent Dosimeter Comparisons for 1995 and 1996 (mrem/yr).

Site I.D.	1995 average	1996 average	96 vs 95 % change
300 Area			
1	8.1 E+01	8.5 E+01	4.9
2	8.6 E+01	9.1 E+01	5.4
3	8.6 E+01	8.6 E+01	-0.4
4	2.3 E+02	2.4 E+02	3.0
5	8.1 E+01	8.7 E+01	7.7
6	9.6 E+01	1.0 E+02	8.1
7	3.0 E+02	2.1 E+02	-31.2
8	1.2 E+02	1.0 E+02	-19.2
All	1.2 E+02	1.4 E+02	-8.2
TEDF (300 Area)			
301	8.1 E+01	8.5 E+01	4.5
302	8.0 E+01	8.3 E+01	4.8
303	8.3 E+01	8.7 E+01	4.6
304	7.9 E+01	8.6 E+01	8.5
305	8.2 E+01	8.3 E+01	1.3
306	8.2 E+01	8.6 E+01	4.8
All	8.9 E+01	9.1 E+01	1.9
400 Area			
1	8.0 E+01	8.3 E+01	4.2
2	7.5 E+01	7.9 E+01	5.7
3	8.1 E+01	9.2 E+01	134.7
4	7.5 E+01	8.1 E+01	7.9
5	7.6 E+01	8.1 E+01	5.9
6	7.9 E+01	8.3 E+01	5.0
7	7.7 E+01	8.2 E+01	5.4
All	7.8 E+01	8.3 E+01	6.9

Table 5-4. Environmental Restoration Disposal Facility Thermoluminescent Dosimeter Results for 1996 (mrem/yr).

ERDF site I.D.	Location description	mrem/yr
ERDF-1	Southeast side of ERDF	1.0 E+02
ERDF-2	Northeast side of ERDF	1.0 E+02

Table 5-6. 100 D/DR Thermoluminescent Dosimeter (TLD) Results for 1996 (mrem/yr).

100 D/DR site I.D.	Location description	mrem/yr
100-D TLD 001	West of 116-D-7	9.0 E+01
100-D TLD 002	Northwest of 116-D-7	8.2 E+01
100-D TLD 003	South of extraction well	8.7 E+01
100-D TLD 004	North of 116-DR-9	9.2 E+01
100-D TLD 005	Northeast of 116-DR-9	8.9 E+01

6.0 SURFACE WATER DISPOSAL UNITS AND SEEPAGES

6.1 INTRODUCTION

Water, vegetation, and sediment samples were collected from the active ponds and ditches and the N Springs in 1996. Springs, ponds, and ditches in the 100, 200, and 300/400 Areas receive or have received waste water from the chemical and waste processing plants, reactors, and other facilities. All water was sampled at the point of discharge to ensure compliance with internal contractor standards and applicable DOE standards. As an additional operational check, water samples are collected from the ponds and ditches. Sampling locations are shown in Appendix G.

One-liter water samples were collected weekly from the active ponds and ditches. The pH was determined each week, then the samples were composited and analyzed monthly for gamma-emitting radionuclides, ^{238}Pu; $^{239,240}Pu$; ^{90}Sr; and uranium. Each site has replicate samples collected for 1 month (4 weeks) on a rotating basis. In addition, a 1-L sample was collected quarterly from each site for nitrate and ^{3}H analyses. Samples of aquatic vegetation were collected from ponds and ditches yearly to determine root uptake of radionuclides from potentially contaminated sediments. Along with vegetation samples, surface sediment samples were collected at ponds and ditches to measure the accumulation of radionuclides. Surface sediment samples consisted of a composite of five plugs, each 10 cm (4 in.) in diameter by 2.5 cm (1 in.) deep. The vegetation and sediments were analyzed for gamma-emitting radionuclides, ^{90}Sr; $^{239,240}Pu$; and uranium.

6.2 RESULTS

6.2.1 Water

6.2.1.1 100 Areas. Seepage wells along the 100 N Area shoreline (N Springs) are sampled annually to verify that the reported radionuclide releases to the Columbia River via the N Springs are credible. After characterizing the radionuclide concentrations in the seep wells, the results are compared to the radionuclide concentrations measured in the effluent monitoring well (199-N-46) during the time period that included the seepage well sample collection. Historically, the highest concentrations of radionuclides have been shown to be in the area of the effluent monitoring well. Release reporting uses the conservatively based radionuclide concentrations as measured in the effluent monitoring well, multiplied by the estimated groundwater flow into the river, to thereby provide conservatively high release values.

With the shutdown of N Reactor in January 1987 and the resultant decreased effluent flow to the 1325-N LWDF, concentrations of most of the radionuclides that were typically present in the N Springs discharge during reactor operation have significantly decreased. The noteworthy exception to this has been and continues to be ^{90}Sr.

The shoreline seepage well samples were collected using a bailer, carefully lowered into each well water column to avoid sediment suspension. A 4-L sample was collected. Samples were collected on September 19, 1996 (for sample locations, see Figure G-1). At the time of sample collection, four sampling locations (wells 9, 10, 12 and 13) were either immersed or partially immersed in, and therefore diluted by, the river. No samples were collected at these locations.

The ^{90}Sr concentration exceeded the DOE DCG value at seepage well 3, the sample location nearest the effluent monitoring well. The tritium concentration at seepage well 3, although notably higher than in the recent past, was well below the DCG value.

The results obtained from the 1996 characterization indicated that the seepage wells with the highest concentrations of both tritium and ^{90}Sr were near the effluent monitoring well, signifying that this well continues to monitor N Springs discharge in the region that provides conservatively high readings.

Tables 6-1 and 6-2 shows the historic concentrations for tritium and ^{90}Sr from samples collected from the N Springs shoreline wells, including effluent monitoring well 199-N-46. Because of river fluctuations and groundwater discharge rates, some wells may not have been sampled; results from those wells are not shown. Radioanalytical results are shown in Appendix G, Table G-1.

6.2.1.2 200 Area. Water, aquatic vegetation, and surface sediment samples were collected from one active pond and one active ditch located in the 200 East Area. The 216-B-3C Pond and the 200 East Area Powerhouse Ditch are the two remaining surface water discharge locations in the 200 Areas. This pond and ditch in the 200 East Area receive waste water from the waste processing plants and other facilities. All water is sampled at the point of discharge to ensure compliance with applicable DOE standards. As an additional check, the NFEMP collects water samples are collected at the ponds and ditches used to dispose of this waste water.

Radioanalytical results from water sampling of ponds and ditches are shown in Appendix G, Tables G-2 through G-5.

6.2.1.3 300/400 Areas. No surface water was sampled in the 300 Area. The 400 Area Fast Flus Test Facility (FFTF) Process Pond is sampled by Pacific Northwest and the results are reported in the Hanford Site Environmental Report (Dirkes and Hanf 1996). The data are shared with PHMC after they have been validated by Pacific Northwest. Total beta concentrations in the FFTF Pond water were within the range observed in previous years. The concentrations of ^{3}H were comparable to those measured in the FFTF Pond in the past. However, the tritium concentration in the July sample was 16,400 pCi/L, which is much higher than that observed previously. During this time, backup water supply well 499-S0-7 was in use. Tritium levels in Well 499-S0-7 are typically above 20,000 pCi/L. The use of backup water supply well 499-S0-7 is most likely responsible for the high levels of tritium observed in the 400 Area FFTF Pond in July because the primary source of water to FFTF Pond is sanitary water. For a more detailed discussion, see Section 4.2, "Surface Water and Sediment Surveillance," *Hanford Site Environmental Report for Calendar Year 1996* (Dirkes and Hanf 1996).

Table 6-1. N Springs Shoreline Tritium Concentrations, 1987 to 1996 (pCi/L)

Year	Site 1	Site 2	Effluent Monitoring Well	Site 3	Site 4	Site 5	Site 6
1987	6.8 E+04	7.6 E+04	9.5 E+04	9.2 E+04	9.4 E+04	8.8 E+04	7.9 E+04
1988	5.7 E+03	2.8 E+04	7.5 E+04	6.9 E+04	7.4 E+04	NR	NR
1989	2.5 E+04	2.8 E+04	3.9 E+04	3.6 E+04	5.0 E+04	NR	6.8 E+04
1990	2.9 E+04	3.2 E+04	3.8 E+04	3.6 E+04	NR	NR	3.4 E+03
1991	2.2 E+02	8.4 E+01	3.7 E+04	2.6 E+03	3.4 E+04	NR	4.0 E+02
1992	7.2 E+02	NR	5.0 E+04	9.5 E-01	NR	NR	1.5 E+02
1993	2.8 E+02	1.3 E+02	2.7 E+04	1.4 E+02	5.6 E+02	1.0 E+02	1.8 E+02
1994	NR	NR	2.6 E+04	4.0 E+01	NR	NR	1.2 E+02
1995	NR	NR	5.2 E+03	<-1.2 E+01	NR	NR	<-4.4 E+01
1996	2.5 E+02	8.5 E+02	2.0 E+04	1.6 E+04	4.2 E+03	1.6 E+02	2.2 E+02
Year	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13
1987	7.3 E+04	4.6 E+04	7.5 E+04	4.0 E+03	5.8 E+04	2.1 E+04	1.3 E+03
1988	1.1 E+04	3.0 E+04	1.0 E+04	NR	2.9 E+04	1.9 E+04	3.0 E+03
1989	NR	7.7 E+04	7.0 E+04	3.5 E+04	4.2 E+04	NR	NR
1990	NR	1.4 E+04	3.5 E+03	9.7 E+03	3.8 E+04	2.0 E+04	NR
1991	8.1 E+02	2.1 E+03	6.5 E+03	7.9 E+02	7.1 E+02	2.4 E+03	9.3 E+00
1992	NR	NR	3.0 E+02	4.3 E+02	6.5 E+02	1.7 E+02	NR
1993	NR	NR	NR	NR	NR	NR	NR
1994	8.5 E+01	1.3 E+02	8.4 E+01	4.0 E+02	4.5 E+02	2.9 E+02	NR
1995	< -2.1	< -2.3 E+01	< -3.1 E+01	< -1.2	3.2 E+02	5.0 E+02	NR
1996	1.9 E+02	2.4 E+02	NR	NR	2.2 E+02	NR	NR

NR = Not Reported
< = Analytical results were less than the overall counting error
Negative value indicates results at or near background levels of radioactivity.

Table 6-2. N Springs Shoreline ^{90}Sr Concentrations, 1987 to 1996 (pCi/L)

Year	Site 1	Site 2	Effluent Monitoring Well	Site 3	Site 4	Site 5	Site 6
1987	1.7 E+03	2.7 E+03	6.1 E+03	8.3 E+03	4.1 E+03	9.5 E+02	7.2 E+02
1988	8.7 E+02	3.0 E+03	7.9 E+03	9.1 E+03	3.5 E+03	NR	NR
1989	9.8 E+02	2.1 E+03	6.5 E+03	5.4 E+03	3.8 E+03	NR	8.9 E+02
1990	2.4 E+03	2.9 E+03	4.9 E+03	7.1 E+03	NR	NR	1.5 E+02
1991	1.6 E+01	2.4 E+01	6.9 E+03	1.4 E+03	3.2 E+03	NR	8.6 E+01
1992	NR	NR	6.3 E+03	1.5 E+02	NR	NR	9.6 E+00
1993	1.2 E+01	8.3 E+01	7.4 E+03	1.2 E+02	4.1 E+03	4.1 E+01	1.3 E+01
1994	NR	NR	6.6 E+03	1.2 E+02	NR	NR	6.4 E+00
1995	NR	NR	5.7 E+03	3.0 E+02	NR	NR	7.0 E+00
1996	5.8 E+01	2.6 E+02	1.4 E+04	5.8 E+03	9.5 E+02	3.7 E+01	1.6 E+01
Year	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13
1987	1.3 E+01	4.2 E+01	2.4 E+02	5.7 E+01	6.6 E+02	5.8 E+01	5.0 E+01
1988	1.5 E+01	3.2 E+01	4.1 E+01	NR	3.4 E+02	4.0 E+01	5.8 E+01
1989	NR	7.8 E+01	2.9 E+02	1.6 E+02	9.5 E+02	NR	NR
1990	NR	9.0 E+01	4.4 E+01	3.1 E+01	5.8 E+02	5.4 E+01	NR
1991	1.4 E+01	2.8 E+01	1.0 E+02	1.5 E+01	4.0 E+02	8.9 E+00	8.1 E+00
1992	NR	NR	8.1 E+00	6.7 E+00	1.1 E+02	7.1 E+00	NR
1993	NR	NR	NR	NR	NR	NR	NR
1994	3.8 E+00	1.2 E+01	3.4 E+00	3.8 E+00	5.1 E+01	1.8 E+01	NR
1995	3.8 E+00	1.4 E+01	5.5 E+00	7.0 E+00	7.1 E+01	1.9 E+01	NR
1996	6.5 E+00	2.2 E+01	NR	NR	1.7 E+02	NR	NR

NR = Not Reported

6.2.2 Nonradiological Parameters

6.2.2.1 100 Areas. No samples were analyzed for nonradioactive parameters in the 100 Areas during 1996.

6.2.2.2 200 Areas. Results of pH and nitrate determinations are summarized in Table G-2. The pH annual averages ranged from neutral to slightly basic. The highest annual average pH of 9.3 was found at the 216-B-3C Pond. The results for pH were well within the RCRA corrosivity designation limits of 2.0 to 12.5. Both 216-B-3C Pond and the 200 East Area Powerhouse Ditch exhibited maximum annual nitrate results of 0.32 mg/L.. All nitrate sample analyses were below the drinking water standard (40 CFR 141) for nitrates (45 mg/L).

6.2.2.3 300/400 Area. Currently, no surface water is sampled in the 300 Area. The 400 Area Process Pond is sampled by Pacific Northwest and the 1996 results are reported in the Hanford Site Environmental Report (Dirkes and Hanf 1996). The data are also included in this report after they have been validated by Pacific Northwest.

6.2.3 Aquatic Vegetation

6.2.3.1 100 Areas. No aquatic vegetation samples were collected in the 100 Areas during 1996.

6.2.3.2 200 Areas. Aquatic vegetation samples are collected from ponds and ditches that have growing aquatic vegetation. One vegetation sample each was collected from the 216-B-3C Pond and 200 East Area Powerhouse Ditch in 1996. Each sample consisted of growing stems and leaves from the predominant plant species at each location. The vegetation was analyzed for gamma-emitting radionuclides, as well as ^{90}Sr, $^{239,240}Pu$, and uranium with the results reported in Table G-3.

6.2.3.3 300/400 Area. No aquatic vegetation was sampled in the 300 and 400 Areas.

6.2.4 Sediment (Surface Samples)

6.2.4.1 100 Areas. No samples were analyzed for radioactive parameters in the 100 Areas during 1996.

6.2.4.2 200 Areas. The results of pond and ditch sediment sampling are provided in Table G-4. The highest ^{137}Cs result was 7.9 pCi/g at the 216-B-3C Pond near the 200 East Area. The highest plutonium result was 4.3 pCi/g, found at the 200 East Area Powerhouse Pond. Both pond and ditch that received water effluents were within posted radiological control areas.

6.2.4.3 300/400 Areas. Currently, no surface water sediment is sampled in the 300 or 400 Area.

6.3 CONCLUSIONS

No significant changes in radioactivity were observed in surface water samples from ponds and ditches in 1996. All surface waters associated with separations-area operations were below the DOE DCG for all radionuclides. The analytical results of vegetation samples collected at the ponds and ditches revealed that, while some physiological uptake of radionuclides occurred, the amounts were relatively low. Sediment samples collected demonstrated elevated levels (above background) of mainly ^{137}Cs and plutonium.

The decrease in the number of seep sampling points at N Springs indicates the cessation of discharge of liquid effluents to the soil column via LWDFs 1301N and 1325N. Historical trending of these seep samples reveals an overall decrease in radionuclide concentrations in the seeps. However, as in past years, the seepage wells with the highest radionuclide concentrations were in the vicinity of the effluent monitoring well, indicating that this well continues to monitor N Springs discharges into the region of the highest concentrations.

7.0 RADIOLOGICAL SURVEYS

7.1 INTRODUCTION

Radiological surveys are conducted to determine changes in the radiological status of the 100, 200, 300, 400, and 600 Areas outdoor waste sites. These sites include surface-water disposal units, cribs, trenches, burial grounds, French drains, and reverse wells. The *Routine Environmental Monitoring Schedule, Calendar Year 1996*, WHC-SP-0098-7 (Markes and McKinney 1995), lists the waste sites and the survey frequency. Trends in radiation levels or radiological contamination may aid in assessing the adequacy of waste containment by detecting the movement of radioactive material away from radiological control areas, or detecting releases that might otherwise go unrecognized. The *Quarterly Environmental Radiological Survey Summaries* (WHC-SP-0665-20 through -22 and HNF-SP-0065-23, McKinney and Markes 1996a through 1996c and 1997) contains a summary of the radiological surveys that were performed. The radiological survey locations are shown in Figures H-1 through H-10 (Appendix H).

Activity in this report is shown in counts per minute (cpm) to accurately describe the contamination found in the field. The thin-window, pancake-type Geiger-Mueller probe is the principal instrument used in these surveys. The radiological survey records show the activity in disintegrations per minute (dpm). The radiological control technicians use the Hanford Site standard correction factor of 10 to convert the field instrument readings taken in cpm to the dpm reported on the radiological survey record.

7.2 ROADS AND RAILROADS

7.2.1 Roads

Road surveys are performed using a vehicle equipped with sodium iodide detectors mounted on the undercarriage. The detector height is adjustable. The average survey height is 15 cm (6 in.) above the road or pavement.

The vehicle is driven at approximately 3 km/h (2 mi/h). When activity is detected, the vehicle is stopped, and a thorough survey is performed using a portable count rate meter equipped with a thin-window, pancake-type probe. The appropriate managers are notified if contamination is identified and corrective actions are then initiated.

Frequently traveled blacktop and improved roads and parking lots in and around the 200 Areas are surveyed bimonthly to detect the presence of radioactive material. Roads less frequently traveled or with low contamination potential are surveyed either quarterly or semiannually.

Three spots of contamination, up to 400 cpm, were detected on the paved roads inside the BC controlled area in 1996 and were removed for proper disposal.

7.2.2 Railroads

Radiological surveys of railroads are conducted with a vehicle equipped with "high railers" that allow the vehicle to travel on both roads and railroad tracks, and adjustable-height sodium iodide detectors. The average survey height is 15 cm (6 in.) The vehicle is driven at less than 8 km/hr (5 mi/hr). When activity is detected, the vehicle is stopped and portable hand-held survey instruments are used to thoroughly survey the area and identify the extent of the contamination. The appropriate managers are notified when contamination is identified. Corrective actions are then initiated.

The rail lines between the 300 Area and the 400 Area and inside the 200 East and West Areas, including spurs and sidings, are surveyed semiannually. All other railroad tracks outside the facilities are surveyed annually, including spurs and sidings and up to Columbia Center.

Contamination up to 200 cpm was discovered on a railroad tie in the 200 West Area. The railroad tie was located on the T-Plant railroad spur between the 218-W-1A and 218-W-4 burial grounds. The area was posted and Site Support Services was notified for further disposition.

Contamination with readings up to 20,000 cpm, was detected in the ballast at the 204-T Waste Unloading Station. This area was stabilized and down posted from CA to URM.

7.3 SURFACE-WATER DISPOSAL UNITS

Surface-water disposal units (pond and ditch banks) are routinely surveyed to identify potential contamination. Special survey plots are designated around the perimeters of these sites. They are marked with metal posts and numbered. The 216-B-3 Pond C Lobe and the 200 East Power House Ditch are the only active surface-water disposal units remaining. The contamination levels remained at less than detectable values and no apparent changes were noted for 1996.

A portion on the east end of the 200-E Power House Ditch was backfilled, stabilized and down posted form CA/SC to URM.

7.4 SOLID-WASTE DISPOSAL SITES

The retired solid-waste disposal sites are surveyed semiannually or annually to detect radiological changes, primarily via biological intrusion. Solid-waste disposal sites are located in the 100-B, -C, -D, -DR, -F, -K reactor areas; 200 East and 200 West; and the 600 Areas. (See Appendix H, Figures H-1 through H-10.)

Contaminated vegetation and specks were identified at the 118-C-4, 118-D-3, 118-D-4, 118-N-1, 218-W-2, 218-W-2A, 218-E-4, and 218-E-12B Burial Grounds in 1996 with a maximum contamination level greater than 100,000 cpm. The contamination, in most cases, was removed and/or backfilled shortly after it was identified. The Specks found at 118-N-1 and the contaminated ant hill at 218-E-12B were posted and await final disposition.

The 126-F-1 (100-F) Ash Disposal Pit was stabilized/release surveyed and down posted from CA/SC to URM or released.

7.5 200 AREAS LOW-LEVEL LIQUID-WASTE DISPOSAL SITES

Low-level liquid-waste disposal sites, other than open ponds and ditches, consist of cribs, French drains, reverse or injection wells, trenches, covered ponds and ditches, and unplanned release sites. As with solid-waste disposal sites, liquid-waste sites are surveyed at least annually, and as often as quarterly, to detect changes in surface radiological conditions. The most significant survey results in 1996 are listed in Paragraphs 7.5.1 through 7.5.8. Sites remediated or backfilled to meet radiological down-posting requirements are listed in Section 7.12.

The ERC and Tank Waste Remediation Systems develop individual annual schedules for remediation of identified contamination. Sites are cleaned or stabilized as soon as possible, but, because of previously scheduled remediation and prioritization of the sites, contamination may not always be stabilized in the same year it is found.

7.5.1 216-A Sites

Contaminated vegetation and specks (e.g., single grains of soil, rust particles, feces, or pieces of vegetation) were found at the 216-A-30 Crib with a maximum reading of 15,000 cpm. The specks were removed and placed in the low-level waste burial grounds.

A contaminated section of pipe (10 inch X 3 feet) was found on top of the 216-A-8 Crib. The area was posted and operations were notified.

An area to the northwest of the 216-A-25 overflow pond was identified from the airborne radiological survey conducted by Bechtel Nevada. This new area covered 0.8 hectares (1.9 acres) and was posted CA/SC.

7.5.2 216-B Sites

Spotty contamination was noted at the 216-B-14 through -19, 216-B-21 through -34, 216-B-51, 216-B-52 through -54, 216-B-58, and 216-B-63 Cribs, and contaminated tumbleweed fragments were discovered at the 216-B-2-1 covered ditch. The maximum reading was greater than 100,000 cpm at the 216-B-2-1 covered ditch. The contamination was picked up and placed in the low-level waste burial grounds.

7.5.3 216-C Sites

A contaminated speck with a maximum reading of 50,000 cpm was found at the 216-C-7 Crib. The contamination was removed and placed in the low-level burial grounds.

Five specks were found fixed in the asphalt at the 216-C-2 Crib. This area was posted a CA.

7.5.4 216-N Sites

A contaminated speck reading 4,000 cpm was found on the 216-N-7 Crib. The contaminated speck was removed and placed in the low-level burial grounds.

7.5.5 216-S Sites

Contaminated soil reading up to 400 cpm was discovered at the 216-S-21 Crib. The soil was removed and placed in the low-level burial ground.

An area eight inches by eight inches of contaminated soil, with readings up to 400 cpm, was discovered at the 204-S UNH Lag Storage area. The contaminated soil was removed and placed in the low-level burial grounds.

7.5.6 216-T Sites

Contaminated soil was found on the 216-T-21 through 216-T-28 Cribs with readings up to 1,200 cpm. The contamination was removed and placed in the low-level burial grounds.

The 207-T Retention Basin was backfilled, stabilized and down posted from CA/SC to URM.

7.5.7 216-U Sites

Contaminated tumbleweeds and soil specks with readings of up to 600 cpm were found in the 216-U-1, 216-U-2, and 216-U-8 Cribs and the 216-U-10 Pond. The contamination was removed and placed in the low-level burial grounds.

7.5.8 216-Z Sites

No contamination was found during the routine radiological surveys of the 216-Z waste sites.

7.5.9 Unplanned Release Sites

UN-216-E-30. Contamination reading 1,500 cpm was found fixed in the concrete at this unplanned release site.

UN-216-E-41. The recontaminated areas to the north and south of the 241-EW-151 Vent Station were stabilized and down posted from CA/SC to URM.

UN-216-W-6. Contamination reading 1,000 cpm was found on the concrete at the UN-216-W-6 unplanned release site. The contamination was fixed with paint and labeled.

UN-216-W-31. This unplanned release site was stabilized along with the 207-T Retention Basin and down posted from CA/SC to URM.

UN-216-W-35. This unplanned release site was stabilized and down posted from CA/SC to URM.

7.5.10 Underground Pipe Lines

Soil contamination reading 2,000 cpm was found on the surface of the underground pipeline leading from Gate 810 to 216-A-25 Gable Mountain Pond. The contaminated soil was removed and placed in the low-level burial grounds.

Contaminated soil and tumbleweeds with readings up to 10,000 cpm were found on the underground pipeline right of way at the 216-A-42C Diversion Box. The area was posted and awaits final disposition.

Contaminated soil and tumbleweeds with readings up to 10,000 cpm were found on the underground pipeline right of way between the 241-T and 241-U Tank Farms. The contaminated material was removed and placed in the low-level burial grounds.

Contaminated specks with readings up to 20,000 cpm were found at the 241-EW-151 Vent Station and on the east portion of the underground pipeline between the vent station and 200-East. The specks were removed and placed in the low-level burial grounds.

7.6 TANK FARM PERIMETERS

Tank farm perimeters and associated facilities are surveyed semiannually to detect any migration of contamination. Tank farms and related facilities are sources of environmental contamination migration. Recontamination along the same fence lines from year to year appears to be associated with the prevailing wind direction and the contamination located within the tank farms and associated with tank farm activities.

Areas adjacent to and south of the 241-C Farm and 271-CR Vault, including a portion of 7th Street, found to be contaminated in 1994 and 1995 (up to 5,000 cpm) remained posted as a contamination area in 1996. The contamination appeared to be from animal intrusion and wind-borne activity both inside and outside the tank farm. Efforts to prevent further animal activity in these areas is on going.

Several areas of speck and soil contamination, with a maximum reading of 15,000 cpm, were discovered in the 200 East Area (by the 241-A, and 241-C Tank Farms, and by the 244-CR Vault and the

244-A lift station) while performing the semiannual tank farm perimeter surveys. The specks consisted of tumbleweed fragments, soil, and rabbit and mice feces. The areas were decontaminated.

The area near the 241-ER-152 Diversion Box southwest of B Plant was the focus of radiological contamination. A total of nine deer mice were captured in three days of which five were contaminated. The contaminated mice ranged from 2,500 counts per minute beta/gamma, no alpha, up to 440 millirads per hour beta/gamma (a second mouse was 400 millirads per hour), no alpha. These radioactivity levels are prior to calculating the conversion factor for source size and geometry. Two harvester ant mounds were found to be contaminated, one at 10,000 counts per minute, beta/gamma, and one at 100 millirads per hour. The ants are known to burrow down to approximately seven meters but also forage widely on the surface, so the source of contamination could be from a nearby area or from below grade. Other contaminated material identified included mouse nests in two pickup trucks, one front end loader, and one outdoor soft drink dispenser. The ground surface, contaminated by animal/insect intrusion, was stabilized by the placement of clean gravel fill on top of the contamination and the area was down posted from CA/SC to URM, 0.5 hectares (1.2 acres).

Portions of the 241-S Tank Farm and the 244-CR Vault were stabilized during 1996 and down posted from CA/SC to URM.

7.7 BC CRIBS AND CONTROLLED AREA

Speck contamination was found along the BC-controlled-area roads with readings up to 400 cpm. The specks were picked up at the time of survey, and disposed of in the low-level burial grounds.

The BC cribs and trenches (Figure H-9) are a series of liquid-waste disposal sites that were active in the mid-1950's. In 1958, animal intrusion was determined to have caused radioactivity to be transported over an area estimated to exceed 1,000 ha (2,500 acres). In 1979, special survey plots were established throughout the controlled area to monitor for contaminant migration. Data accumulated during the 10-year period indicate that no significant additional migration of contamination away from the area has occurred. The cribs and trenches were surface stabilized in 1982.

In 1996, an investigative radiological survey was scheduled to specifically identify the boundary definition for the BC Control Area. Contamination was discovered outside the original posted BC Control Area and the survey was continued over open land directly south of the 200 East area. Eight areas of contamination with levels up to 20,000 dpm beta/gamma have been identified to date. From the results of this survey, the BC Control Area (UN-216-E-11) was significantly enlarged to a size of approximately 3,849 hectares (9,511 acres) and reclassified as a 600 Area site.

7.8 100 AREAS SITES

In October of 1990, contamination of the shoreline below 100-N Reactor was posted as a surface contamination area near the N Springs seeps. In 1991, the discovery of contaminated vegetation and mulberry trees resulted in the zone being expanded. The contaminated trees were removed and a herbicide spray program was implemented in December 1991 and continued through 1996.

An area of speck contamination (e.g., a single grain of soil, rust particle, or piece of feces or vegetation) on the riverbank below the 107-KE and KW Retention Basins remains posted as a contamination area. The area is approximately 8.0 ha (20 acres) with contamination levels ranging from 200 to 20,000 cpm.

The 116-H-1 Trench extension and the 116-F-4 Pluto Crib were stabilized and down posted from CA/SC to URM.

7.9 100 N Area RADIATION SURVEYS

Direct radiation levels are measured annually along the 100 N Area portion of the Columbia River shoreline. Annual environmental radiation surveys historically conducted at intersecting points of survey grids established around the 1301-N and 1325-N LWDFs to monitor radiation levels associated with the disposal facilities were discontinued in 1995. Data obtained from the TLD stations located around the perimeters of these facilities provide adequate radiation assessment because neither facility is active.

A hand-held micro-rem meter was used to survey points along the N Springs area. In previous years, the instrument used for this survey was a micro-R meter. This instrument, which measures exposure rates, was known to "over respond" to low-energy gamma radiation. The micro-rem meter more accurately measures the true dose rate.

All readings were taken at a height of 1 m (3 ft) at 15-m (50-ft) intervals. The readings obtained for the survey reflect dose rates that are relative only to each other.

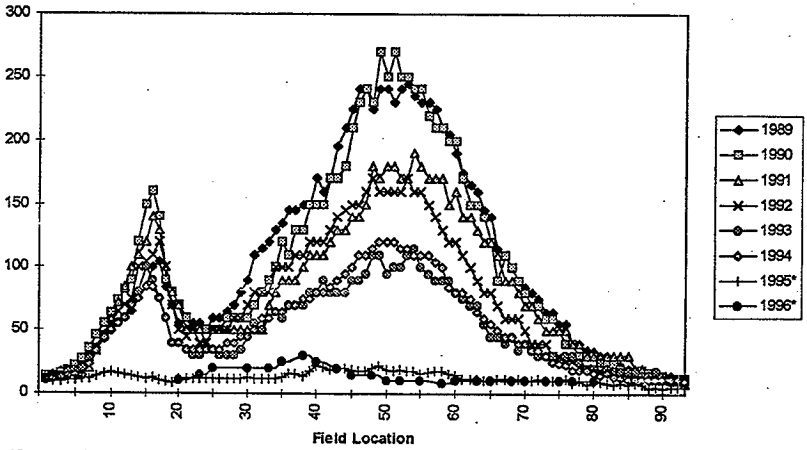
7.10 COLUMBIA RIVER SHORELINE SURVEY

Relative dose rates were measured along the Columbia River shoreline starting near the N Area outfall (field location 5) and proceeding downstream past the N Springs. A graph of the shoreline survey data is presented in Figure 7-1. The locations of the 100 N Area facilities that potentially contribute to dose rates measured near the river shoreline are shown. At the time of the survey, N Reactor was shut down. The 1304-N Emergency Dump Tank was empty and there was no flow to the 1325-N LWDF. The 1310-N Radioactive Chemical Waste Storage Facility also was empty.

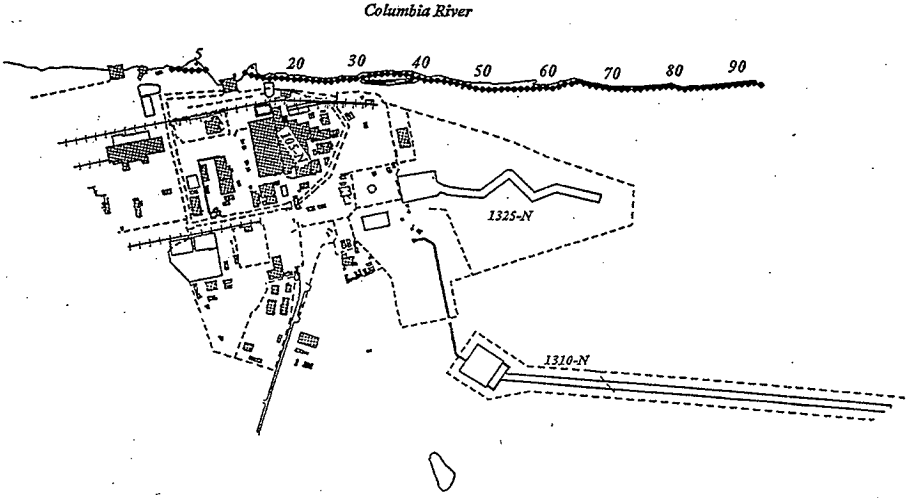
The overall shape of the curve shown on the graph (Figure 7-1) for 1996 indicates that the area along the N Springs shoreline with the highest exposure rate is, as in the past, along the area juxtapositional with the 1301-N LWDF. The radiation levels measured this year are not directly comparable to previous years, though the overall shape of the curve derived by graphing the results shows the region of highest exposure to again agree with historic survey results.

Results of the shoreline survey are presented in Table H-1 (Appendix H).

Figure 7-1. 100-N Shoreline Survey Results.



*Surveys since 1995 utilized a micro-rem/h meter, as opposed to a micro-R/h meter used in previous surveys.



7.11 Retired 100 Area Waste Disposal Facilities

Routine environmental surveillance was performed semiannually on the retired 100 Area waste disposal facilities in 1996. The contamination levels remained at less than detectable values except as listed in Table 7-1. Contamination has been noted in previous radiation surveys in most of these areas.

Table 7-1. Samples with Contamination above Detectable Levels.

Waste Site/Location	Activity (cpm)	Type
100-B/C URM Area	8,000	Soil
105-C Exclusion Area	16 mrad/hr	Speck
105-K Exclusion Area	2,000	Speck
107-KE	2,250	Soil
116-F-1 Lewis Canal	>100,000	Specks
116-K-1	600	Soil
116-K-2	150	Soil
118-C-4	5,000	Speck
118-D-3	>100,000	Speck
118-D-4	>100,000	Speck
118-N-1	50,000	Specks

7.12 STABILIZATION AND SITE REMEDIATION

In 1996, several contaminated sites were interim surface stabilized by scraping the contaminated top soil and consolidating the contamination into smaller areas. These smaller areas were covered with 15 cm (6 in.) of clean dirt. Other sites were backfilled with 15 cm to 0.6 m (6 in. to 2 ft) of clean dirt. Both methods resulted in surface contamination area postings being reduced to underground radioactive material areas or being released from radiological control. The sites remediated and/or radiologically reposted in 1996 are shown in Table 7-2.

Table 7-2. Sites Remediated or Radiologically Reposted in 1996 [approximate surface area in hectares (acres)].

Site Designation	Status change	Area in hectares (acres)
126-F-1 (100-F) Ash Disposal Pit	CA/SC to URM	7.3 (18)
204-T Waste Unloading Station	CA/SC to URM	0.04 (0.1)
East End of 200-E Power House Ditch	CA/SC to URM	0.2 (0.4)
Area near 241-ER-152 Vault	None to URM	0.5 (1.2)
East of the 216-A-25 Gable Mountain Overflow Pond	None to CA/SC	0.8 (1.9)
116-H-1 Trench Extension	CA/SC to URM	4.0 (10.0)
116-F-4 Pluto Crib	CA/SC to URM	0.04 (0.1)
207-T Retention Basin	CA/SC to URM	0.4 (0.9)
UN-216-W-31	CA/SC to URM	1.4 (3.6)
UN-216-W-35	CA/SC to URM	0.8 (1.9)
241-SY Tank Farm (Portion)	CA/SC to URM	0.5 (1.2)
244-CR Vault	CA/SC to URM	0.25 (0.6)
241-EW-151 Vent Station (North Lobe)	CA/SC to URM	1.4 (3.5)
241-EW-151 Vent Station (South Lobe)	CA/SC to URM	4.7 (11.7)
BC Control Area (UN-216-E-11)	None to CA/SC	3,849 (9,511)

CA/SC = contamination/soil contamination area.
URM = underground radioactive material.

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8.0 INVESTIGATIVE SAMPLING

8.1 INTRODUCTION

Investigative sampling was conducted in the operations areas to confirm the absence or presence of radioactive and/or hazardous contaminants. Investigative sampling took place near facilities such as storage and disposal sites for at least one of the following reasons:

- to follow-up radiological surface surveys that had indicated radioactive contamination was present,
- to conduct preoperational surveys that quantify the radiological/chemical conditions at a site before facility construction or operation,
- to quantify the radiological condition of a site before remediation,
- to determine if biotic intrusion (e.g., animal burrows or deep-rooted vegetation) had created a potential for contaminants to spread, and
- to determine the integrity of waste containment systems.

The maximum concentrations of radioactive isotopes from samples collected during these investigations are included in this report. Complete results, including counting errors, for these investigations, including field instrument and dose readings where appropriate, are provided in this document.

Generally, the predominant radionuclides discovered during these efforts were activation products and strontium-90 in the 100 Areas, fission products in the 200 Areas, and uranium in the 300 Area. Hazardous chemicals generally have not been identified above background levels in preoperational environmental monitoring samples.

8.2 COLLECTION AND ANALYSES OF INVESTIGATIVE SAMPLES

Investigative samples collected in 1996 included paint chips, soil (including radioactive specks), vegetation (primarily tumbleweeds), fresh water clams, a caterpillar, a bee hive, darkling beetles, a harvester ant mound, a Western toad, a gopher snake, rock dove (domestic pigeon) feces, owl pellets, starlings, northern pocket gophers, mouse feces, and deer mice.

Methods for collecting or otherwise obtaining investigative samples are described in the manual *Operational Environmental Monitoring* (WHC 1991b). Field monitoring was conducted to detect radioactivity before samples were collected. Field monitoring results are expressed as counts per minute when a Geiger-Mueller detector is used or as millirad per hour when an ion chamber is used. Laboratory sample analysis results are generally expressed in picocuries per gram (pCi/g) except for extremely small samples and then in pCi per sample (pCi/sample). Maximum concentrations, rather than averages, are presented in this subsection; however, because of the high error values which result in less than (<) values, these "less than" numbers are not cited in the text when maximum values are being discussed.

8.3 RADIOLOGICAL RESULTS FOR INVESTIGATIVE SAMPLES

Investigative samples were collected where known or suspected radioactive contamination was present, or to verify radiological conditions at project sites. In 1996, 53 samples, comprising approximately 70 individual specimens, were analyzed for radionuclides at the 222-S Laboratory and 43 showed measurable levels of contamination. Analytical results are provided in Appendix I, Table I-1. Another 62 contamination incidents were reported and disposed without isotopic analyses (although field instrument readings were recorded) during clean-up operations. These results are provided in Appendix I, Table I-2.

8.3.1 Paint Chips

In 1996, two instances occurred where contaminated paint chips, one from the east perimeter fence of 241-TX Tank Farm and another from the southeast perimeter fence of 241-SX Tank Farm, both in the 200 West Area, were found during routine radiation surveys. The 241-TX sample was submitted for radionuclide analyses. The highest radionuclide concentrations were ^{137}Cs and ^{90}Sr.

8.3.2 Soil

In 1996, five investigative soil samples were collected, one being from a slightly contaminated ant mound near the 241-ER-152 Diversion Box in 200 East Area. The highest radionuclide concentrations were ^{137}Cs in a sample collected above the inactive pipeline to the decommissioned 216-A-25 Pond (Gable Mountain Pond) north of 200 East Area; and ^{90}Sr collected near the Central Waste Complex in the 200 West Area. In addition, 32 incidents of contaminated soil or specks were found during cleanup operations and disposed of in low-level burial grounds.

In 1996, the number of contamination incidents, the range of radiation dose levels, and radionuclide concentrations generally were within historical ranges. Areas of special soil sampling that were outside radiological control areas and had radiation levels greater than radiological control limits (WHC 1991a) were posted as surface contamination areas.

8.3.3 Vegetation

In 1996, four tumbleweed samples, one unidentified vegetation sample, and two cryptogam samples were analyzed for radionuclide concentrations. The maximum radionuclide concentration consisted primarily of ^{90}Sr. The cryptogam samples contained a measurable quantity of $^{239,240}Pu$ which bears further investigation to determine if cryptogams act as environmental "sinks" for radionuclides. In addition, 14 instances of contaminated vegetation (mostly tumbleweeds) were recorded in the operational areas in 1996. This vegetation was discovered during remedial operations, surveyed with field instruments, and disposed to low-level burial grounds. The field-instrument readings for the vegetation ranged from less than less than 1 mrad/h (~ 100 cpm) to 210 mrad/h (>1,000,000 cpm). During 1996, the numbers of contaminated vegetation samples, radioactivity levels, and range of radionuclide concentrations were all within historical ranges (Schmidt et al. 1996). Historically the greatest number of contaminated vegetation samples (42) were submitted for analyses in 1978.

8.3.4 Wildlife

In 1996, 41 wildlife and wildlife-related samples (e.g., feces, nests, etc.) were collected either as part of the Integrated Pest Management program designed to limit the exposure to and potential contamination of animals with radioactive material, or as a result of finding a radiologically contaminated animal. Animals were collected directly from, or near, facilities to identify potential problems with preventive measures designed to deter animal intrusion. Surveys were performed after collection to determine whether an animal was radioactively contaminated. If a live animal was found to be free of contamination, it was taken to an area of suitable habitat and released. If an animal was contaminated, a decision was made based on the level of contamination, sampling facility, and frequency of occurrence either to collect the animal as a sample or to dispose of the animal in a low-level burial ground.

There were 37 of the 41 special animal samples (50 of the 54 individuals) analyzed in 1996 which showed detectable levels of contamination. This compares to 22 contaminated samples (of 25) that were analyzed in 1995 and 16 (of 27) in 1994. This is not considered an unusual increase because the numbers of samples submitted depended on opportunity (i.e., increased human activity to decommission an inactive facility) rather than exact numbers submitted from established sample points. The maximum radionuclide concentrations in 1996 were for ^{60}Co in mouse feces from 241-S-151 Diversion Box in 200 West Area; ^{90}Sr from a deer mouse captured at 241-ER-152 Diversion Box in 200 East Area and in mouse feces from 241-S-151 Vent Station in 200 West Area; ^{137}Cs in mouse feces from the 200 East Area and in mouse feces from 241-S-151 Diversion Box in 200 West Area; ^{238}Pu in a deer mouse captured at PUREX in 200 East Area and mouse feces from 241-S-151 Diversion Box in 200 West Area and in a Western toad collected at 105-N Basin in 100 N Area; and $^{239,240}Pu$ in a deer mouse from PUREX and in the mouse feces at 241-S-151 Diversion Box, and in the Western toad collected at the 105-N Basin in 100 N Area. The increased numbers of animals submitted for analyses were primarily because of an investigation of contaminated deer mice at the 241-ER-152 Diversion Box in the 200 East Area. There were 16 contaminated mice at this facility alone which were captured and analyzed, with the analytical results indicating elevated concentrations of strontium and cesium. Pest control operations continued for ten days after the last contaminated mouse was captured and the area was cleaned up and resurfaced with clean gravel.

A contaminated deer mouse captured at the 1301 Building was notable because the building had been transferred to the Port of Benton and was being used as a food bank and is not near any potential radionuclide source. Pest control operations at the facility led to the capture of the mouse which was submitted for a radiological survey as a routine precaution. It was determined that the contaminated mouse may have relocated with food collected from one of the operations areas. Extensive trapping found no other mice, contaminated or otherwise, in the building. The building no longer serves as a food bank.

Contaminated animal samples which were somewhat atypical for the special sample program included a caterpillar, a honey bee comb, darkling beetles, long-eared owl pellets, and the Western toad. Samples of fresh water clams, even though not contaminated according to field instrument measurements, were submitted for analyses because they were located in a potentially contaminated waste water basin. The analytical results indicated very low levels of strontium-90 (10 pCi/g).

Because of increased interest in northern pocket gopher activity raised during a lawsuit against former Hanford contractors by people living downwind of the Hanford Site, two pocket gophers (one captured near the stabilized 216-T-4 Pond, and the other in the 218-W-4A Burial Ground Complex, both in the 200 West Area) were submitted to the 222- S Laboratory for

radionuclide analyses. Whole body analytical results for both pocket gophers indicated measurable levels of strontium-90 (3,020 and 6,030 pCi/g, respectively). Other radionuclide concentrations were either "less than" values or well below background.

Additionally, there were 8 cases of contaminated wildlife or related samples (e.g., nests or feces) found during cleanup operations, which were disposed of without being analyzed.

8.3.5 Special Characterization Sampling

Special characterization projects were conducted or completed 1996 to verify the radiological, and in some cases, potential hazardous chemical status of several operations. These included the following:

- Continued monitoring of ambient air to determine the levels of diffuse fugitive air emissions at 116-B-1, 116-B-4, 116-B-5, 116-C-1, 183-H Solar Evaporation Basin, all in the 100 Areas. The preliminary analytical data and that from the nearby routinely monitored 1301-N Liquid Waste Disposal Facility indicated that emissions from these facilities were below levels of regulatory concern. Results are presented in the air section.

- Completed preoperational monitoring support of Solid Waste Operations Complex projects (Waste Receiving and Packaging and the Central Waste Complex) in the 200 West Area. Issued the *Preoperational/Operational Environmental Survey Report: Solid Waste Operations Complex* (Mitchell and Johnson, 1996) completing the 2-year preoperational environmental monitoring survey for these projects. The analytical data did not identify any environmental concerns that would delay startup of the facilities .

9.0 SUMMARY

9.1 NEAR-FACILITY ENVIRONMENTAL MONITORING

Several types of environmental media are sampled near nuclear facilities to monitor the effectiveness of waste management and restoration activities and effluent treatment and control practices. These media include air, surface water and springs, groundwater, surface contamination, soil, vegetation, sediments, biota, and external radiation. Sampling and analysis information and analytical results for 1996 for each of these media are summarized in the following section.

9.1.1 Near-Facility Environmental Monitoring at the Hanford Site

Near-facility environmental monitoring is defined as routine monitoring near facilities that have potential to discharge or have discharged, stored, or disposed of radioactive or hazardous contaminants. Monitoring locations are associated mostly with major nuclear facilities, such as the PUREX and N Reactor, and waste storage or disposal facilities, such as burial grounds, tank farms, ponds, cribs, trenches, and ditches.

Much of the monitoring consists of collecting and analyzing environmental samples and methodically surveying areas near facilities releasing effluents and waste streams. The program also evaluates acquired analytical data, determines the effectiveness of facility effluent monitoring and controls, measures the adequacy of containment at waste disposal units, and detects and monitors unusual conditions. The monitoring implements applicable portions of DOE Orders 5400.1 (DOE 1988a), 5400.5 (DOE 1990), and 5820.2A (DOE 1988b); *Washington Administrative Code* (WAC) 246-247; and Title 40 *Code of Federal Regulations* (CFR) Part 61, Subpart H (EPA 1989).

Routine monitoring activities include sampling and monitoring ambient air, water from surface-water disposal units, external radiation, soil, sediment, vegetation, and animals. Some of the parameters typically monitored are pH, radionuclide concentrations, and radiation fields. Samples are collected from known or expected effluent pathways. These pathways are generally downwind of potential or actual airborne releases and downgradient of liquid discharges. The routine activities of near-facility monitoring in 1996 are shown in Table 9-1, including the type, quantity, and location of samples collected.

Waste disposal sites and the terrain surrounding them are surveyed to detect and characterize any radioactive surface contamination. Routine survey locations include cribs; trenches; retention basin perimeters; pond perimeters; ditch banks; solid waste disposal sites (e.g., burial grounds or trenches); unplanned release sites; tank farm perimeters; stabilized waste disposal sites; roads; and firebreaks in and around the Site operational areas.

Table 9-1. Near-Facility Routine Environmental Samples and Locations, 1996.

Sample type	No. of sampling locations	100 Areas	200/600 Areas	300/400 Areas
Air	58	18	39[a]	1
Surface water	11	9	2	0
External radiation	156	72[b]	63	21
Soil	78	7	54	17
Vegetation	76	10	49	17

[a]Includes one station located at the Wye Barricade
[b]48 TLDs and 24 survey points

9.1.2 Air Monitoring

Near-facility air sampling systems monitor the effectiveness of waste management environmental remediation and effluent treatment and controls in reducing effluents and emissions; these systems also monitor diffuse source emissions.

9.1.3 Sample Collection and Analysis

Radioactivity in the air was sampled by a network of continuously operating samplers at 58 locations near nuclear facilities: 4 were located in the 100 N Area, 4 were in the 100 K Area, 38 were in the 200 Areas, 1 was located near the 300 Area Treated Effluent Disposal Facility, 1 station was collocated with samplers operated by the Pacific Northwest National Laboratory and the Washington State Department of Health at the Wye Barricade, 3 were in the 100 B/C Area, 4 were in the 100 D/DR Area, and 3 were at the ERDF. To avoid duplicate sampling, the near-facility environmental monitoring program used existing Pacific Northwest National Laboratory air samplers in the 300 and 400 Areas. Air samplers were primarily located within approximately 500 m (1,500 ft) of sites and/or facilities having the potential for, or history of, environmental releases, with an emphasis on the prevailing downwind directions.

Samples were collected according to a schedule established before the monitoring year. Airborne particles were sampled at each station by drawing air through a glass-fiber filter. The filters were collected biweekly, field-surveyed for gross radioactivity to detect any unusual trends or off-normal occurrences, held for at least 7 days, and then analyzed for total alpha and beta activity. The 7-day holding period was necessary to allow for the decay of naturally occurring radionuclides that would otherwise obscure detection of longer lived radionuclides associated with emissions from nuclear facilities. The total radioactivity measurements were used to indicate changes in trends in the near-facility environment.

For most radionuclides, the amount of radioactive material collected on a single filter during a 2-week sampling period was too small to be measured accurately. The accuracy of the sample analysis was increased by compositing the samples into biannual samples for each location. Each composite sample was then analyzed for ^{238}Pu; $^{239,240}Pu$; ^{90}Sr; ^{234}U; ^{235}U; ^{238}U; and gamma-emitting (e.g., ^{137}Cs, ^{60}Co) radionuclides.

9.1.4 Results

Of the radionuclide analyses performed, ^{137}Cs, $^{239,240}Pu$, ^{90}Sr, and uranium were consistently detectable in the 200 Areas. ^{60}Co and, infrequently, $^{239,240}Pu$ were detectable in the 100 N Area. Air concentrations for these radionuclides were elevated near facilities compared to the concentrations measured offsite. Figure 9-1 shows average values for 1996 and the preceding 5 years for selected radionuclides compared to Derived concentration guides, DOE Order 5400.5, and the background air concentration as measured by the Pacific Northwest National Laboratory. The Derived concentration guides are reference values that are used to indicate performance. The data indicate a large degree of variability. In general, samples collected from air samplers located at or directly adjacent to nuclear facilities had significantly higher concentrations than did those samples collected farther away. The data also show, as expected, that concentrations of certain radionuclides were higher in different operational areas. Generally, the predominant radionuclides are activation products (i.e., gamma emitters) in the 100 Areas and fission products in the 200 Areas.

9.1.4.1 100 N Area. Analytical results from air samples collected in the 100 N Area continued to be at or near background concentrations for most radionuclides as a result of facility shutdowns and improved effluent controls and waste management practices. Concentrations were much less than the Derived concentration guides; however, they were greater than levels measured offsite. Section 2.0 describes the 100 N Area ambient air monitoring program in more detail.

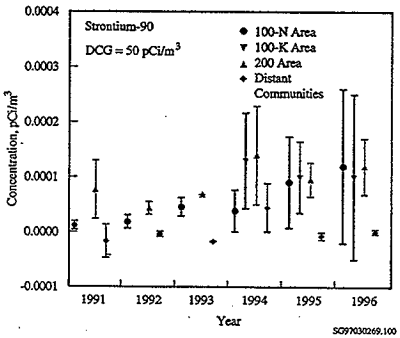
9.1.4.2 100 K Area. Analytical results from air samples show quantities of $^{239,240}Pu$, ^{241}Pu, ^{241}Am, and ^{137}Cs that were slightly above detection levels. These levels were much less than the Derived concentration guides; however, they were greater than levels measured offsite. The 1996 results did not differ significantly from the 1995 values. Section 2.0 describes the 100 K Area ambient air monitoring program in more detail.

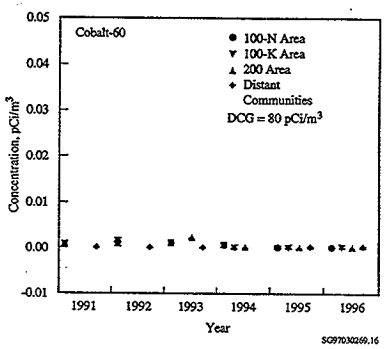
9.1.4.3 200 Areas. Analytical results from air samples collected in the 200 Areas showed levels on a downward trend for most radionuclides as a result of facility shutdowns, better effluent controls, and improved waste management practices (Figure 9-1). These levels, although much less than the DOE Derived concentration guides, were greater than levels measured offsite and were higher for $^{239,240}Pu$, ^{90}Sr, and uranium than levels measured in the 100 N Area. Section 2.0 describes the 200 Areas ambient air monitoring program in more detail.

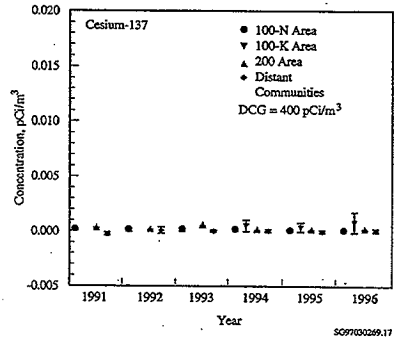
9.1.4.4 ERDF. Near -facility air sampling was conducted at the ERDF remediation site through a network of 5 continuous air samplers. This network utilized two existing Hanford Site air monitors for upwind monitoring and was supplemented by three additional air monitors which provided downwind monitoring. Monitoring began in June, and the analytical results indicated that the concentrations were much less than the DOE Derived concentration guides and only slightly greater than levels measured offsite.

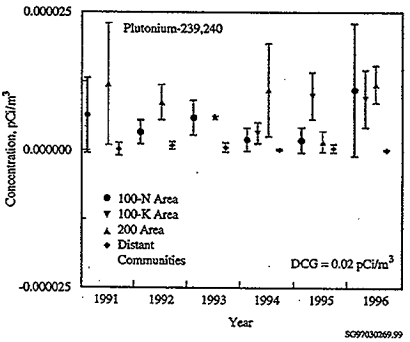
9.1.4.5 100 B/C Area. Near-facility air sampling was conducted at the 100 B/C remediation site through a network of 3 continuous air samplers. Monitoring began in July, and the analytical results indicated that the concentrations were much less than the DOE Derived concentration guides and only slightly greater than levels measured offsite.

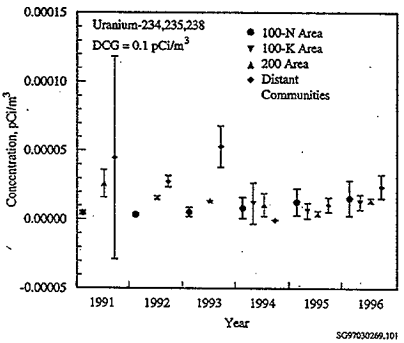
Figure 9-1. Concentrations (± 2 standard error of the mean) of Selected Radionuclides in Near-Facility Air Samples Compared to Those in Distant Communities, 1990 through 1996. As a result of figure scale, some uncertainties (error bars) are concealed by point symbol.











9.1.4.6 100 D/DR Area. Near-facility air sampling was conducted at the 100 D/DR remediation site through a network of 4 continuous air samplers. Monitoring began in November, and the analytical results indicated that the concentrations were much less than the DOE Derived concentration guides and only slightly greater than levels measured offsite.

9.2 SURFACE-WATER DISPOSAL UNITS AND RIVERBANK SPRINGS MONITORING

Surface-water disposal units (200 East Area Powerhouse Ditch and the 216-B-3C Pond) used by the operating facilities and springs located along the Columbia River shoreline in the 100 N Area are monitored to assess the effectiveness of effluent and contamination controls. Section 6.0 describes surface-water disposal units and riverbank springs monitoring in more detail.

9.2.1 Sample Collection and Analysis

Samples from surface-water disposal units were collected from various locations in the operational areas. Samples also were collected from Columbia River shoreline springs in the 100 N Area. Section 6.0 describes the sampling locations in more detail. Samples collected from surface-water disposal units included water, sediment, and aquatic vegetation. Water and vegetation samples were collected at the 100-N river shoreline springs. The sampling methods are discussed in detail in WHC-CM-7-4. To avoid duplicate sampling, the near-facility environmental monitoring program used surface-water sample data collected by the Surface Environmental Surveillance Project for the 400 Area. Results for the 400 Area sampling may be found in Section 4.2, "Surface-Water and Sediment Surveillance," of the *Hanford Site Environmental Report, 1996* (Dirkes and Hanf 1997).

Radiological analyses of water samples from surface-water disposal units were performed onsite by the Waste Sampling and Characterization Facility (WSCF) in 1996. Analyses included ^{238}Pu; $^{239,240}Pu$; uranium; tritium; ^{90}Sr; and gamma-emitting radionuclides. Radiological analyses of sediment and aquatic vegetation samples were performed for $^{239,240}Pu$; ^{90}Sr; uranium; and gamma-emitting radionuclides. Nonradiological analyses were performed for pH, temperature, and nitrates. Analytes of interest were selected based on their presence in effluent discharges and their importance in verifying effluent control and determining compliance with applicable effluent discharge standards. Surface-water disposal units that received potentially radioactively contaminated effluents were within posted radiological control areas.

9.2.2 Radiological Results

9.2.2.1 Surface-Water Disposal Units. Results of radiological analyses for liquid samples from surface-water disposal units located in the 200 Areas are shown in Table 9-2. In all cases, radionuclide concentrations in surface-water disposal units were less than the DOE Derived concentration guides and in most cases were equal to or less than the analytical detection limit.

Radiological analytical results for aquatic vegetation and sediment samples collected from surface-water disposal units located in the 200 Areas are shown in Tables 9-3 and 9-4, respectively. Although both aquatic vegetation and sediment showed some elevated levels compared to the Derived concentration guide for water and the accessible soil concentration limits, in all cases the radiological analytical results were much less than the PHMC standards used for radiological control. Section 6.0 provides a more detailed data summary of samples collected to monitor surface-water disposal units.

9.2.2.2 Riverbank Springs. In the past, radioactive effluent streams sent to the 1301-N and 1325-N LNDFs in the 100 N Area contributed to the release of radionuclides to the Columbia River through their

migration with the groundwater. Radionuclides enter the Columbia River along the riverbank region known as the N Springs. Releases into the river at N Springs are calculated based on analysis of weekly samples collected from a monitoring well (well 199-N-46) located near the shoreline. *Environmental Releases for Calendar Year 1996* (Gleckler 1997) discusses the release calculations in more detail.

Groundwater springs along the 100 N Area shoreline are sampled annually to verify that the reported radionuclide releases to the Columbia River are conservative (i.e., not underreported). Release reporting uses conservatively high radionuclide concentrations in samples collected from well 199-N-46, multiplied by the estimated groundwater discharge into the river. The N Springs groundwater flow rate was estimated using a computer model developed by Gilmore et al. (1992). The estimated groundwater flow rate used to calculate 1996 releases from N Springs was 43 L/ min (10 gal/min). By characterizing the radionuclide concentrations in the springs along the shoreline, these results can then be compared to the concentrations measured in well 199-N-46, ensuring that the well is located in the groundwater migration route that contains the highest concentrations of radionuclides.

In 1996, the concentrations detected in shoreline springs samples were highest in the springs nearest well 199-N-46. The data from shoreline springs sampling are summarized in Table 9-5. Section 6.0 covers these data in more detail.

9.2.3 Nonradiological Results for Surface-Water Disposal Units

Nonradiological analytical results for water samples collected from surface-water disposal units located in the 200 Areas are shown in Table 9-6. The results for pH were well within the *Resource Conservation and Recovery Act of 1976* corrosivity designation limits of 2.0 to 12.5. The analytical results for nitrates were all less than the 45-mg/L Drinking Water Standard for public water supplies.

Table 9-2. Radiological Results for Liquid Samples from Surface-Water Disposal Units, 200 Areas, 1996 (pCi/L).

Sample location[a]	Number of samples		^{238}Pu	$^{239/240}Pu$	$^{Total}U$	^{3}H[b]	^{90}Sr	^{137}Cs
200 East Area Ditch	12	Mean	ND[c]	<3.7E-05	3.8E-04	1.7E+02	1.2E-04	ND
		Max	ND	2.0E-04	7.7E-04	3.8E+02	1.2E-03	ND
200 East Area Pond	12	Mean	2.0E-04	1.7E-05	2.0E-04	2.0E+02	1.5E-03	ND
		Max	2.0E-04	1.7E-05	5.2E-04	4.7E+02	1.5E-03	ND
		DCG[d]	40	30	500[e]	2E+6	1,000	3,000

[a] 200 East Area Ditch: powerhouse Ditch
200 East Area Pond: 216-B-3C Pond
[b] The detection limit for ^{3}H is 300 pCi/L
[c] ND = Not detected
[d] DCG = DOE Derived concentration guide
[e] Using ^{234}U as the most limiting DCG

Table 9-3. Radiological Results for Aquatic Vegetation Samples from Surface-Water Disposal Units (pCi/g, dry wt), 200 Areas, 1996.

Sample Location[1]	Number of Samples	^{90}Sr	^{137}Cs	$^{239,240}Pu$	$^{Total}U$ (g/g)
200 East Area Pond	1	3.5E-01	4.7E-01	2.3E-01	2.4E-09
200 East Area Ditch	1	7.3E-01	ND	4.8E-01	3.4E-09

[1] 200 East Area Pond - 216-B-3C Pond.
200 East Area Ditch - powerhouse Ditch.
ND = Not detected.

Table 9-4. Radiological Results for Sediment Samples from Surface-Water Disposal Units (pCi/g, dry wt), 200 Areas, 1996.

Sample location[1]	Number of Samples	^{90}Sr	^{137}Cs	$^{239,240}Pu$	$^{Total}U$ (g/g)
200 East Area Pond	1	3.8E+00	7.9E+00	7.8E-01	1.9E-10
200 East Area Ditch	1	2.6E-01	7.6E-02	4.3E+00	3.0E-09

[1] 200 East Area Pond - 216-B-3C Pond.
200 East Area Ditch - Powerhouse Ditch.

Table 9-5. Concentration of Radionuclides in 100 N Area Columbia River Shoreline Springs, 1996 (pCi/L).

Radionuclide	Facility effluent monitoring well (10/03/96)	Springs		
		Maximum	Mean	DCG[1]
^{3}H	2.0E+04	1.6E+04	2.5E+03	2.0E+06
^{90}Sr	1.4E+04	5.8E+03	8.1E+02	1.0E+03

[1] DCG= Derived concentration guide.

Table 9-6. Nonradiological Results for Water Samples from Surface Water Disposal Units, 200 Areas, 1996.

Sample Locations[a]	Number of Samples	pH			Number of Samples	Nitrate (NO_3), mg/L	
		Mean	Max	Min.		Mean	Max
200 East Area Ditch	52	8.2	8.7	6.6	4	1.7E-01	3.2E-01
200 East Area Pond	52	8.9	9.3	7.8	4	1.6E-01	3.2E-01

[a] 200 East Area Ditch - Powerhouse Ditch
200 East Area Pond - 216-B-32

9.2.4 Radiological Surveys

Radiological surveys are used to monitor and detect radiological contamination on the Hanford Site. The two main types of posted radiological controlled areas are underground radioactive materials and contamination areas. Contamination areas include contamination areas, soil contamination areas, and high contamination areas.

Underground radioactive material areas are posted areas with contamination contained below the soil surface. These areas are typically at stabilized cribs, burial grounds, covered ponds, trenches, and ditches. Barriers over the contamination sources are used to inhibit radionuclide transport to the surface environs. These areas are surveyed at least annually to document the current radiological status.

Contamination/soil contamination areas may or may not be associated with an underground radioactive material structure. A breech in the barrier of an underground radioactive materials area may result in the growth of contaminated vegetation. Insects or animals may burrow into an underground radioactive materials area and bring contamination to the surface. Vent pipes or risers from an underground structure may be a source of speck contamination. Fallout from stacks or unplanned releases from previously operating facilities may cause an area of contamination that is not related to a subsurface structure. All types of contamination areas may be susceptible to contamination migration. All known contamination areas were surveyed at least annually to document the current radiological status.

In 1996 the Hanford Site had approximately 4,016 ha (9,923 acres) of posted outdoor contamination areas and 550 ha (1,360 acres) of posted underground radioactive materials areas, not including active facilities. The number of hectares (acres) of contamination areas is approximately eight times larger than the underground radioactive materials areas. This is primarily because of the BC controlled area located south of the 200 East Area. This area was initially posted as a radiologically controlled area in 1958 because of widespread speck contamination and encompassed approximately 1,000 ha (2,500 acres). Additional investigative surveys were conducted adjacent to the BC controlled area in 1996, and the area was enlarged to 3,849 ha (9,511 acres) and reclassified as a 600 Area site. Table 9-7 shows the acreage for contamination areas and underground radioactive material areas and the net change from 1995 to 1996. A global positioning system was used in 1996 to measure the surface areas more accurately than in past years. Area measurements for 1996 have been entered into the Hanford Geographical Information System, maintained by the ERC.

Table 9-7. Outdoor Contamination Status, 1996 (approximate surface area in hectares [acres])

Hanford Site area	Contamination area[a]	Net change[b]	Underground radioactive material[c]	Net change
100 B/C	8 (20)	0	39 (96)	0
100 KE/KW	8 (20)	5 (12)	53 (131)	-7 (17)
100 N	29 (73)	0	0.2 (0.5)	0
100 D/DR	0.1 (0.2)	-3 (7)	39 (96)	3 (7)
100 H	0.4 (1)	0	14 (35)	1 (2)
100 F	0.7 (1.7)	-7 (17)	33 (82)	3 (7)
200 East[d]	64 (158)	-2,194 (5,421)	137 (339)	-14 (35)
200 West[e]	35 (86)	-166 (410)	194 (479)	-483 (1,193)
300	20 (49)	-1 (2)	14 (35)	1 (2)
400	0	0	0	0
600[f]	3,850 (9,513)	3,850 (9,513)	28 (69)	22 (54)
Total	4,016 (9,923)	1,484 (3,667)	550 (1,360)	-474 (1,171)

[a]Includes areas posted as "contamination/soil contamination" or as "Radiologically Controlled" and areas that had both underground and contamination/soil contamination.
[b]- = decreases.
[c]Includes areas with only underground contamination. Does not include areas that had contamination/soil contamination as well as underground radioactive material.
[d]Includes tank farms.
[e]Includes tank farms.
[f]Includes redesignated BC Controlled Area (historically included in 200 Area acreage estimates), waste disposal facilities outside the 200 East Area boundary that received waste from 200 East Area facilities (e.g., 216-A-25, 216-B-3); and waste disposal facilities outside the 200 West Area boundary that received waste from 200 West Area facilities (e.g., 216-9-19, 216-U-11).

The posted contamination areas vary between years because of an ongoing effort to clean, stabilize, and remediate areas of known contamination. During this time, new areas of contamination are also being identified. Table 9-8 shows the changes resulting from stabilization activities during 1996. Approximately 21 ha (52 acres) were reclassified from contamination/soil contamination areas to underground radioactive materials areas, and 3,850 ha (9,510 acres) were posted as soil contamination areas. Newly identified areas may have resulted from contaminant migration or an increased effort to investigate outdoor areas for radiological contamination. Vehicles equipped with radiation detection devices and an ultrasonic ranging and data system have identified areas of contamination that were previously undetected.

The external dose rate at 80% of the identified outdoor contamination areas was estimated at less than 1 mrem/h although direct dose rate readings from isolated radioactive specks (a diameter less than 0.6 cm or [0.25 in.]) could have been considerably higher. Contamination levels of this magnitude did not significantly add to dose rates for the public or Hanford Site workers in 1996.

Table 9-8. Zone Status Change of Posted Contamination Areas, 1996.

Location	Zone change	Area, hectares (acres)
100 Areas	CA to URM area	11 (27)
200 East Area	CA to URM area	0.5 (1)
200 West Area	CA to URM area	3 (11)
300 Area	CA to URM area	0
400 Area	CA to URM area	0
600 Area	CA to URM area	7 (17)
600 Area	NONE to CA	2,831 (6,995)

CA = Contamination/soil contamination area.
URM = Underground radioactive materials area.

9.3 SOIL AND VEGETATION SAMPLING FROM OPERATIONAL AREAS

Soil and vegetation samples were collected on or adjacent to waste disposal units and from locations downwind and near or within the boundaries of the operating facilities. Samples were collected to detect potential migration and deposition of facility effluents. Special samples were also collected where physical or biological transport problems were identified. Migration can occur as the result of resuspension from radioactively contaminated surface areas, absorption of radionuclides by the roots of vegetation growing on or near underground and surface-water disposal units, or by waste-site intrusion by animals.

In 1993, routine annual soil and vegetation sampling was eliminated in the 100 Areas except for the 100 N Area. Historical data indicated that the 100 Area sites previously monitored exhibited no signs of contamination migration, and continued monitoring would not be cost effective. Soil sampling in the 200 Areas also was modified in 1994 to be more cost effective. Fifty-five soil samples will be collected at alternating locations each year. In 1996, 53 samples were collected. Two samples were not collected because the sample locations were destroyed by construction activity. The results of the sampling effort are discussed in the following paragraphs.

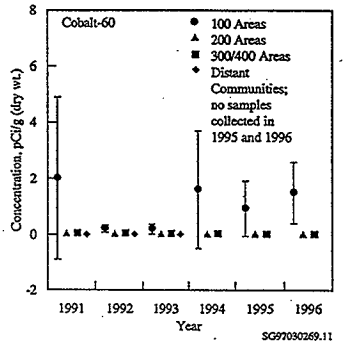
9.3.1 Sample Collection and Analysis

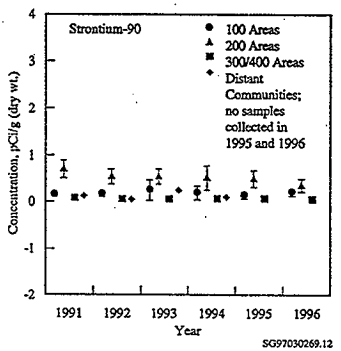
The sampling methods and locations used are discussed in detail in WHC-CM-7-4. Radiological analyses of soil and vegetation samples included $^{239,240}Pu$, ^{90}Sr, uranium, and gamma-emitting radionuclides.

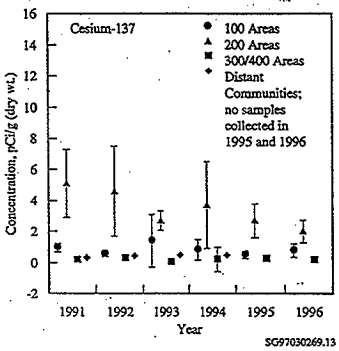
9.3.2 Soil Results

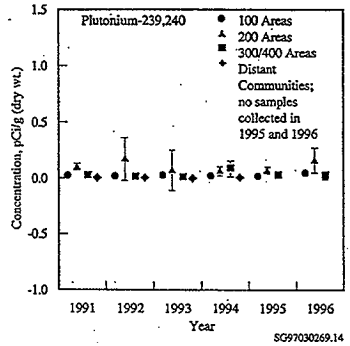
Of the radionuclide analyses performed, ^{137}Cs; ^{60}Co; $^{239,240}Pu$; ^{90}Sr; and uranium were consistently detectable. Soil concentrations for these radionuclides were elevated near and within facility boundaries when compared to the concentrations measured offsite. Figure 9-2 shows average values for 1996 and the preceding 5 years. The concentrations show a large degree of variability. In general, concentrations in samples collected on or directly adjacent to waste disposal facilities were significantly higher than concentrations in samples collected farther away. The data also show, as expected, that concentrations of certain radionuclides were higher within different operational areas. Generally, the predominant radionuclides were activation products and ^{90}Sr in the 100 N Area, fission products in the 200 Areas, and uranium in the 300 Area. Section 4.0 summarizes these data in more detail.

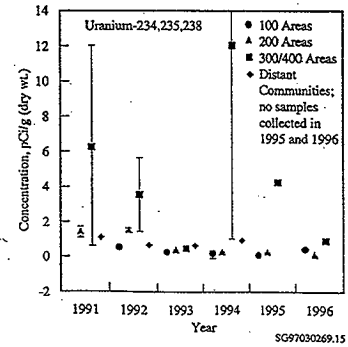
Figure 9-2. Average Concentrations (± 2 standard error of the mean) of Selected Radionuclides in Near-Facility Soil Samples Compared to Those in Samples in Distant Communities, 1990 through 1996. As a result of figure scale, some uncertainties (error bars) are concealed by point symbols. The 1994 and 1996 100 Areas data include the 100 N Area only.











9.3.2.1 **100 N Area.** Analytical results from soil samples collected in the 100 N Area in 1996 generally exhibited concentrations at or near background levels as a result of the shutdown of the 105-N Reactor and associated facilities and the implementation of more effective effluent controls. However, contamination levels were greater than those measured offsite, and the concentrations of ^{60}Co were greater than those measured in the 200 and 300/400 Areas. The ^{60}Co in the 100 N Area soils resulted from past discharges to waste disposal structures, primarily the 1301-N LWDF.

9.3.2.2 200 Areas. Analytical results from soil samples collected in the 200 Areas were on a downward trend for most radionuclides because of facility shutdowns and improved effluent controls and waste management practices. However, the results were higher than those for samples collected offsite and were shown to be higher for ^{137}Cs; $^{239,240}Pu$; and ^{90}Sr when compared to values from the 100 and 300/400 Areas.

9.3.2.3 300/400 Areas. Analytical results from soil samples collected in the 300/400 Areas were compared to results for other operational areas and to those from samples collected offsite. The levels of uranium for the 300/400 Areas were higher than those measured from the 100 Area and the 200 Areas. Uranium was expected in these samples because it was used during past fuel fabrication operations conducted in the 300 Area.

9.3.3 Vegetation Results

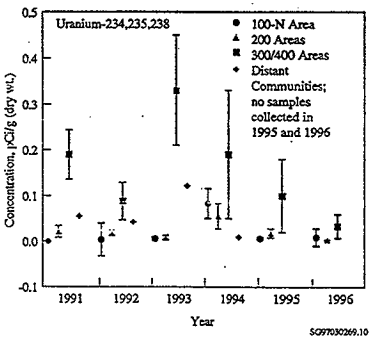
Of the radionuclide analyses performed for vegetation, ^{137}Cs; ^{60}Co; $^{239,240}Pu$; ^{90}Sr; and uranium were consistently detectable. Concentrations of these radionuclides in vegetation were elevated near and within facility boundaries compared to the concentrations measured in samples collected offsite. Figure 9-3 shows average values for 1996 and the preceding 5 years. The concentrations show a large degree of variability. In general, concentrations in samples collected on or directly adjacent to the waste disposal facilities were higher than concentrations in samples collected farther away. As with the soil samples, the data show that certain radionuclides were found in higher concentrations in vegetation in different operational areas. The predominant radionuclides are activation and fission products in the 100 Areas, fission products in the 200 Areas, and uranium in the 300 Area. Section 4.0 summarizes the data in more detail.

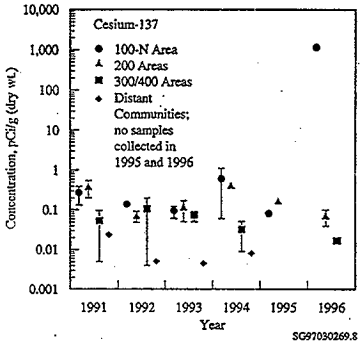
9.3.3.1 100 N Area. Analytical results from vegetation samples collected in the 100 N Area in 1996 were comparable to those seen in 1995, with one notable exception observed at a sampling location near the retired 1301-N Liquid Waste Disposal Facility. This sample displayed significantly elevated concentrations of ^{60}Co, ^{90}Sr, and ^{137}Cs, and slightly elevated concentration of ^{238}Pu and $^{239,240}Pu$. Otherwise, the values observed for ^{90}Sr in samples collected near the N Springs were typically higher than those seen in the remaining locations at 100 N Area. Generally, 1996 radionuclide levels in 100 N vegetation were greater than those measured offsite, and levels for ^{60}Co and ^{90}Sr were higher than compared to the 200 and 300/400 Areas.

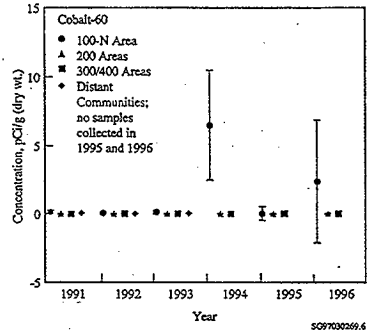
9.3.3.2 200 Areas. Analytical results from vegetation samples collected in the 200 Areas have been on a downward trend for most radionuclides because of facility shutdowns, better effluent controls, and improved waste management practices. Before 1992, radionuclide levels in these areas were higher than those measured in samples collected offsite and were higher for ^{137}Cs and $^{239,240}Pu$ than in the 100 and 300/400 Areas. During 1996, the average concentrations for ^{137}Cs and $^{239,240}Pu$ were similar onsite, offsite, and in the operational areas.

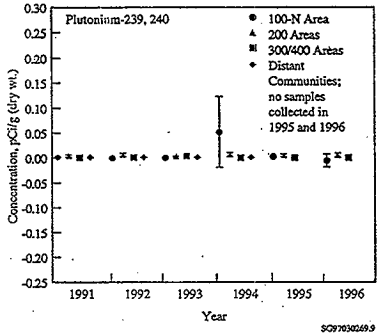
9.3.3.3 300/400 Areas. Generally, the levels of most radionuclides measured in the 300 Area were higher than those measured in samples collected offsite and levels for uranium were higher than in the 100 and 200 Areas. The higher uranium levels were expected because uranium was released during past fuel fabrication operations in the 300 Area. The levels measured in the 400 Area were at or near those measured offsite.

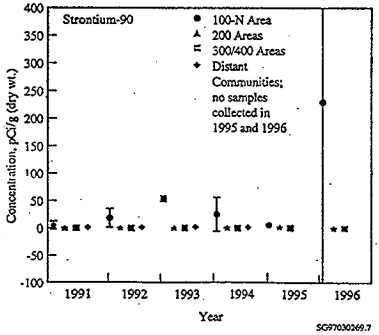
Figure 9-3. Average Concentrations (± 2 standard error of the mean) of Selected Radionuclides in Near-Facilities Vegetation Samples Compared to Those in Samples in Distant Communities, 1990 through 1996. As a result of figure scale, some uncertainties (error bars) are concealed by point symbols. The 1994 and 1996 100 Areas data include the 100 N Area only.











9.4 EXTERNAL RADIATION

External radiation fields were measured near facilities and waste handling, storage, and disposal sites to measure, assess, and control the impacts of operations.

9.4.1 Field Measurements and Analysis

Two methods are used to measure external radiation fields. Hand-held meters are used at individual points of interest to give real-time assessments. TLDs are used at numerous fixed locations over longer periods of time. TLD results can be used individually or averaged to determine dose rates in a given area for a particular sampling period. Specific information about external radiation sampling methods and locations can be found in WHC-CM-7-4.

9.4.2 Results

Radiation Measurements

A hand-held micro-rem meter was used to survey points along the N Springs area. These radiation measurements were taken at a height of approximately 1 m (3.28 ft).

In previous years, the instrument used for this survey was a micro-R meter. This instrument is known to over respond to low-energy gamma radiation. In 1995, a micro-rem meter, which more accurately measures the true dose rate, was used.

The overall shape of the curve shown on the graph (Figure 9-4) for 1996 indicates that the area along the N Springs shoreline with the highest dose rate is still along the area juxtapositional with the 1301-N LWDF.

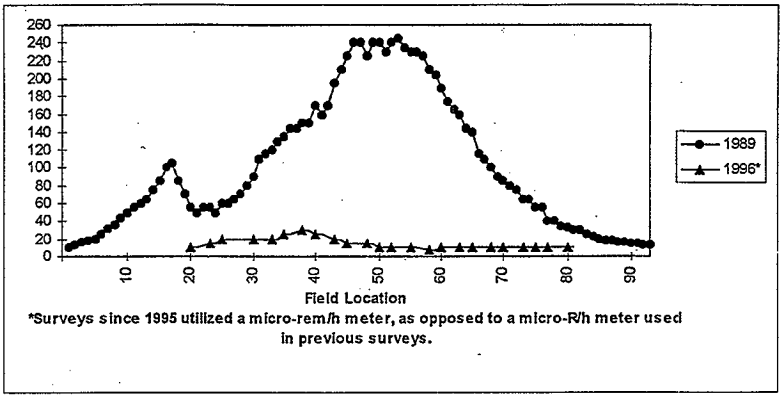
Surveys conducted in previous years at the 1301-N and 1325-N LWDFs were discontinued this year. Data obtained from the TLD stations located around the perimeters of these facilities provide adequate radiation assessment because neither facility is active. Section 7.0 covers radiation surveys in more detail.

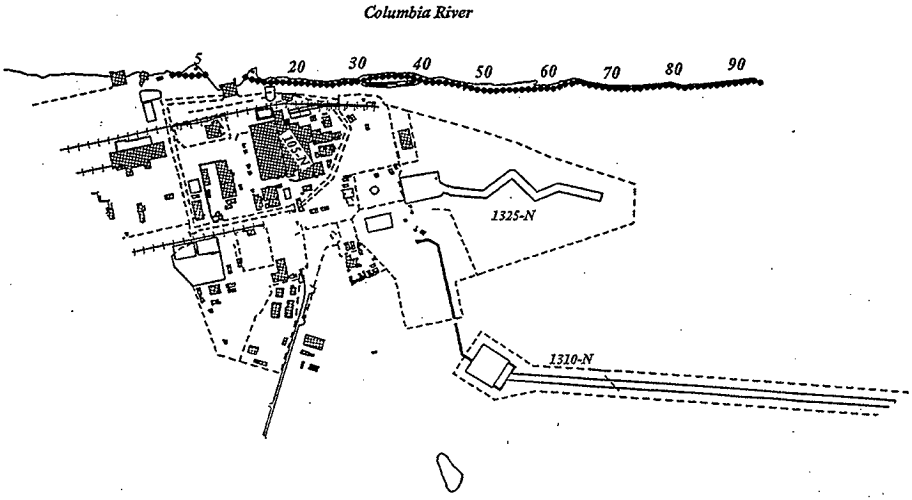
9.4.3 TLDs

9.4.3.1 100D/DR Areas. Five new TLD locations were established in the 100-D/DR Area during the fourth quarter of 1996 to evaluate the environmental restoration activities currently in progress at 116-D-7 and 116-DR9 LWDFs. Although no comparative data is available due to the recent placement of these TLDs, the fourth quarter analyses indicate readings comparable to offsite background levels.

9.4.3.2 100 N Area. The results from the 100-N TLDs are presented in Table 9-9. The 1996 results indicated that direct radiation levels are highest near facilities that had contained or received liquid effluent from the N Reactor. These facilities primarily included the 1301-N and 1325-N LWDFs. While the results for these two facilities were noticeably higher than those for other 100 N Area dosimeter locations, they were approximately 12% lower than exposure levels measured at these locations in 1995. Section 5.0 contains a historical summary of the dose rates measured around the LWDFs. Decreases are attributable to the decay of the radionuclide inventories in the facilities.

Figure 9-4. Radiation Survey Measurement Locations at the 100 N Area Shoreline





9.4.3.3 100 K Area. This is the fourth year that TLDs have been placed in the 100 K Area surrounding the 105-K East and West fuel storage basins and adjacent reactor buildings. Three of the dosimeters have consistently shown elevated readings because of their proximity to radioactive waste storage areas or stored radioactive rail equipment. Section 5.0 describes these data in more detail.

9.4.3.4 200 Areas. Table 9-9 summarizes the results for the 60 TLD locations used in both 1995 and 1996 in the 200/600 Areas. The highest dose rates were measured near waste handling facilities such as tank farms. The highest dose rate was measured at the 241-A tank farm complex located in the 200 East Area. The average annual dose rate measured in 1996 by TLDs was 120 mrem/yr, which was equal to the average dose rate measured in 1995. Section 5 summarizes these data in more detail.

9.4.3.5 ERDF. Two new TLD locations were established in the ERDF during the fourth quarter of 1996 to evaluate the environmental restoration disposal activities currently in progress. Although no comparative data is available due to the recent placement of these TLDs, the fourth quarter analyses indicate readings comparable to offsite background levels.

9.4.3.6 300/300 TEDF/400 Areas. Table 9-9 shows 1996 dosimeter results compared to those of 1995 for the 300 and 400 Areas. The average annual dose rate measured in the 300 Area in 1996 was 120 mrem/yr. This represents a decrease of 14% compared to the average dose rate of 140 mrem/yr measured in 1995. The average annual dose rate in the 300 Area TEDF in 1996 was 85 mrem/yr, which represents an increase of 5% compared to the average dose rate of 81 mrem/yr measured in 1995.

The average annual dose rate measured in the 400 Area in 1996 was 83 mrem/yr, which represents an increase of 8% compared to the average dose rate of 77 mrem/yr measured in 1995.

Table 9-9. TLD Results for Waste handling Facilities in the Operations Areas (mrem/yr, based on 24 h/day), 1995 and 1996.

Area	Number of Locations, 1996	1995 Maximum	Mean	1996		
				Maximum	Mean	% Change[a]
100-D[b]	5	NA	NA	79	75	NA
100-K	11	2,800	390	2,250	480	23
100-N	30 (23)[c]	13,000	1,300	9200	1150	-13
200/600	63	700	120	500	120	0
ERDF[b][d]	2	NA	NA	100	100	NA
300	8	310	140	240	120	-14
300 TEDF[e]	6	84	81	87	85	5
400	7	81	77	92	83	8

[a] Numbers indicate a decrease (-) or increase from the 1995 mean
[b] TLD network was established for the fourth quarter of 1996
[c] Seven TLDs were removed from the 100-N network prior to the third quarter of 1996
[d] ERDF = Environmental Restoration Disposal Facility
[e] TEDF = Treated Effluent Disposal Facility

9.5 INVESTIGATIVE SAMPLING

Investigative sampling was conducted in the operations areas to confirm the absence or presence of radioactive and/or hazardous contaminants. Investigative sampling took place near facilities, such as storage and disposal sites, for at least one of the following reasons:

- To followup radiological surface surveys that had indicated that radioactive contamination was present
- To conduct preoperational surveys that quantify the radiological/chemical conditions at a site before facility construction or operation
- To quantify the radiological condition of a site before remediation
- To determine if biotic intrusion (e.g., animal burrows or deep-rooted vegetation) had created a potential for the spread of contaminants
- To determine the integrity of waste containment systems.

The maximum concentrations of radioactive isotopes from samples collected during these investigations are included in this report.

Generally, the predominant radionuclides discovered during these efforts were activation products and ^{90}Sr in the 100 Areas, fission products in the 200 Areas, and uranium in the 300 Area. Hazardous chemicals generally have not been identified above background levels in preoperational environmental monitoring samples.

Investigative samples collected in 1996 included paint chips; soil (including sediment and radioactive specks); vegetation (e.g., cryptogams and tumbleweeds); fresh water clams; a caterpillar; a bee hive; darkling beetles; a harvester ant mound; a Western toad; a gopher snake; rock dove (domestic pigeon) feces; owl pellets; starlings; northern pocket gophers; mouse feces; and deer mice.

Investigative samples were collected where known or suspected radioactive contamination was present or to verify radiological conditions at project sites. In 1996, 53 samples, comprised of approximately 70 individual specimens, were analyzed for radionuclides, and 43 showed measurable levels of contamination. In addition, 54 contamination incidents were reported and the samples disposed of during cleanup operations without isotopic analyses although field instrument readings were recorded. Detailed results, including field instrument values and dose reading, where applicable, are in this document.

9.5.1 Paint Chips

In 1996, two instances occurred where contaminated paint chips, one from the east perimeter fence of 241-TX tank farm and another from the southeast perimeter fence of 241-SX tank farm, both in the 200 West Area, were found during routine radiation surveys. The 241-TX sample was submitted for radionuclide analyses. The highest radionuclide concentrations were ^{137}Cs (782,000 pCi/g) and ^{90}Sr (2,370 pCi/g). Analytical results are shown in Table 9-10.

9.5.2 Soil

In 1996, five investigative soil samples were collected, one being from a slightly contaminated ant mound near the 241-ER-152 Diversion Box in 200 East Area. The highest radionuclide concentrations were ^{137}Cs (7,230 pCi/g) in a sample collected above the inactive pipeline to the decommissioned 216-A-25 Pond (Gable Mountain Pond) north of 200 East Area and ^{90}Sr (370 pCi/g) collected near the Central Waste Complex in the 200 West Area. Analytical results are provided in Table 9-10. In addition, 32 incidents of contaminated soil or specks were found during cleanup operations and disposed of in low-level burial grounds.

In 1996, the number of contamination incidents, the range of radiation dose levels, and radionuclide concentrations generally were within historical ranges. Areas of special soil sampling that were outside radiologically controlled areas and had radiation levels greater than radiologically controlled limits (WHC 1991a) were posted as surface contamination areas.

9.5.3 Vegetation

In 1996, four tumbleweed samples, one unidentified vegetation sample, and two cryptogram samples were analyzed for radionuclide concentrations. Maximum concentrations are shown in Table 9-10. The maximum radionuclide concentration consisted primarily of ^{90}Sr (1,250,000 pCi/g). The cryptogram samples contained a measurable quantity of ^{239,240Pu} (124 pCi/g), which bears further investigation to determine if cryptograms act as environmental "sinks" for radionuclides. In addition, 14 instances of contaminated vegetation (mostly tumbleweeds) were recorded in the operational areas in 1996. This vegetation was discovered during remedial operations, surveyed with field instruments, and disposed to low-level burial grounds. The field instrument readings for the vegetation ranged from less than less than 1 mrad/h (~ 100 cpm) to 210 mrad/h (>1,000,000 cpm). During 1996, the number of contaminated vegetation samples, radioactivity levels, and range of radionuclide concentrations were all within historical ranges. Historically, the greatest number of contaminated vegetation samples (42) were submitted for analyses in 1978.

9.5.4 Wildlife

In 1996, 41 wildlife and wildlife-related samples (e.g., feces, nests) were collected either as part of the Integrated Pest Management Program designed to limit the exposure to and potential contamination of animals with radioactive material or as a result of finding a radiologically contaminated animal. Animals were collected directly from, or near, facilities to identify potential problems with preventive measures designed to deter animal intrusion. Surveys were performed after collection to determine whether an animal was radioactively contaminated. If a live animal was found to be free of contamination, it was taken to an area of suitable habitat and released. If an animal was contaminated, a decision was made, based on the level of contamination, sampling location, and frequency of occurrence, either to collect the animal as a sample or to dispose of the animal in a low-level burial ground.

There were 37 of the 41 special animal samples (50 of the 54 individuals) analyzed in 1996 that showed detectable levels of contamination (Table 9-10). This compares to 22 contaminated samples (of 25) that were analyzed in 1995 and 16 (of 27) in 1994. This is not considered an unusual increase because the numbers of samples submitted depended on opportunity (i.e., increased human activity to decommission an inactive facility) rather than exact numbers submitted from established sample points. The maximum radionuclide concentrations in 1996 were for ^{60}Co (62,200 pCi/g in mouse feces from 241-9-151 Diversion Box in 200 West Area); ^{90}Sr (1,030,000 pCi/g from a deer mouse captured at 241-ER-152 Diversion Box in 200 East Area and 7,800,000 pCi/g in mouse feces from 241-9-151 vent station in 200 West Area); ^{137}Cs (51,300 pCi/g in mouse feces from the 200 East Area and 490,000 pCi/g in mouse feces from 241-9-151 Diversion Box in 200 West Area); ^{238}Pu (4,190 pCi/g in a deer mouse captured at PUREX in 200 East Area, 18,000 pCi/g in mouse feces from 241-9-151 Diversion Box in 200 West Area, and 62,300 pCi/g in a Western toad collected at 105-N Basin in 100 N Area); and ^{239,240}Pu (12,800 in a deer mouse from PUREX, 82,000 pCi/g in the mouse feces at 241-9-151 Diversion Box, and 123,000 pCi/g in the Western toad collected at the 105-N Basin in 100 N Area). The increased numbers of animals submitted for analyses were primarily because of an investigation of contaminated deer mice at the 241-ER-152 Diversion Box in the 200 East Area. There were 16 contaminated mice at this facility alone that were captured and analyzed, with the analytical results indicating elevated concentrations of strontium (1,030,000 pCi/g) and cesium (51,300 pCi/g). Pest control operations continued for ten days after the last contaminated mouse was captured and the area was cleaned up and resurfaced with clean gravel.

A contaminated deer mouse captured at the 1301 Building was notable because the building had been transferred to the Port of Benton, was being used as a food bank, and is not near any potential radionuclide source. Pest control operations at the facility led to the capture of the mouse, which was submitted for a radiological survey as a routine precaution. It was determined that the contaminated mouse may have relocated with food collected from one of the operations areas. Extensive trapping found no other mice, contaminated or otherwise, in the building. The building no longer serves as a food bank.

Contaminated animal samples, which were somewhat atypical for the special sample program, included a caterpillar, a honey bee comb, darkling beetles, long-eared owl pellets, and the Western toad. Samples of fresh water clams, even though not contaminated according to field instrument measurements, were submitted for analyses because they were located in a potentially contaminated waste water basin. The analytical results indicated very low levels of ^{90}Sr (10 pCi/g). Sample results are shown in Table 9-10. Because of increased interest in northern pocket gopher activity raised during a lawsuit against former Hanford contractors by people living downwind of the Hanford Site, two pocket gophers (one captured near the stabilized 216-T-4 Pond and the other in the 218-W-4A burial ground complex, both in the 200 West Area) were submitted to the 222-S Laboratory for radionuclide analyses. Whole body analytical results for both pocket gophers indicated measurable levels of ^{90}Sr only.

Additionally, there were 8 cases of contaminated wildlife or related samples (e.g., nests or feces) found during cleanup operations, which were disposed of without being analyzed. The numbers of animals found to be contaminated with radioactivity, the radioactivity levels, and the range of radionuclide concentrations were within historical ranges.

9.5.5 Special Characterization Sampling

Special characterization projects were conducted or completed in 1996 to verify the radiological, and in some cases, potential hazardous chemical status of several operations. These included the following:

Monitoring of ambient air was continued to determine the levels of diffuse fugitive air emissions at 116-B-1, 116-B-4, 116-B-5, 116-C-1, and 183-H Solar Evaporation Basin, all in the 100 Areas. The preliminary analytical data and that from the nearby, routinely monitored 1301-N LWDF indicated that emissions from these facilities were below levels of regulatory concern. Results are presented in the air section.

Preoperational monitoring support of Solid Waste Operations Complex projects (Waste Receiving and Packaging and the Central Waste Complex) was completed in the 200 West Area. Issued the *Preoperational/Operational Environmental Survey Report: Solid Waste Operations Complex* (Mitchell and Johnson 1996) completing the 2-year preoperational environmental monitoring survey for these projects. The analytical data did not identify any environmental concerns that would delay startup of the facilities.

9.5.6 Suspect Waste Sites

Responsibility for suspect waste site investigations in operations areas has been transferred to the Hanford Site ERC (i.e., Bechtel Hanford, Inc.), and those results are no longer reported in this document.

Table 9-10. Maximum Radionuclide Concentrations in Investigative Samples Collected from the Operations Areas, 1996.

Sample type	Location (number of samples)	Radionuclides	Maximum concentration (pCi/g)
Paint chips	200 West Area (1 x 10 g)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<7.8E+01 2.4E+03 7.8E+05 <5.3E+01 <5.3E+01 3.3E-01
Soil	600 Area sites associated with the 200 East Area (2)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<2.3E+00 5.3E+01 7.2E+03 <7.9E+00 <7.9E+00 1.5E-01
Soil	200 West Area (2)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<4.7E-02 3.7E+02 2.3E-01 <2.3E+02 <2.3E+02 3.0E-02
Cryptogams (moss and lichens)	200 West Area (2)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<6.7E-02 7.4E-01 5.5E-01 <1.8E+02 1.2E+02 1.9E-02
Vegetation	200 East Area (1)	^{60}Co ^{90}Sr ^{137}Cs $^{Total}U$	<4.1E+00 7.0E+03 <4.6E+00 6.5E-02
Tumbleweeds	200 East Area (2)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<8.4E+00 8.1E+03 <1.0E+01 <5.5E+00 <5.5E+00 7.8E-02
Tumbleweeds	200 West Area (2)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$	<2.6E+00 1.3E+06 6.7E-01 <1.0E+00 <1.0E+00

Table 9-10. Maximum Radionuclide Concentrations in Investigative Samples Collected from the Operations Areas, 1996.

Sample type	Location (number of samples)	Radionuclides	Maximum concentration (pCi/g)
		$^{Total}U$	9.0E-02
Fresh water clams	200 East Area (1 x 50 g)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<9.0E+00 1.0E+01 <1.3E+01 <2.6E-01 <2.6E-01 1.8E-02
Caterpillar (moth or butterfly larva)	200 East Area (1)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<3.4E+02 3.3E+03 <4.6E+02 <1.5E+02 <1.5E+02 2.9E-02
Ant mound (soil/gravel/vegetation particles)	200 East Area (1)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<2.1E-01 4.2E+01 2.8E+01 <5.9E-02 1.2E-01 9.0E-03
Honey bee comb	200 East Area (1)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<4.9E-02 1.8E+03 1.6E+01 <8.4E-01 <8.4E-01 1.0E-02
Darkling beetles	200 West Area (1 x 10 g)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<1.1E+02 1.6E+02 <1.8E+02 <4.4E+01 <4.4E+01 4.7E-02
Western toad	100 N Area (1)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	4.6E+01 3.1E+02 8.5E+02 6.2E+04 1.2E+05 5.7E-02

Table 9-10. Maximum Radionuclide Concentrations in Investigative Samples Collected from the Operations Areas, 1996.

Sample type	Location (number of samples)	Radionuclides	Maximum concentration (pCi/g)
Gopher snake	200 East Area (1)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<7.3E-01 2.3E+02 6.1E+01 <5.6E-01 <5.6E-01 1.3E-04
Pigeon feces	200 West Area (1 x 0.2 kg)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<9.5E-02 3.0E+00 5.4E+00 <7.0E-02 <7.0E-02 3.8E+02
Owl pellets	200 West Area (1 x 1.0 kg)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<1.6E-01 8.4E+00 2.2 E+00 <7.0E-01 <7.0E-01 4.3E+01
Starlings	100 K Area (6 individuals in 2 samples)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	1.6E-01 9.6E+01 8.4E+01 6.5E-01 1.0E+03 4.0E-04
Northern pocket gopher	200 West Area (2)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<6.2E-01 6.0E+03 <1.5E+00 9.4E-01 6.3E-01 2.0E-03
Mouse feces	200 East Area (2 x 10 g/sample)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<1.1E+03 6.4E+05 1.5E+04 <6.6E+02 <6.6E+02 1.6E-01

Table 9-10. Maximum Radionuclide Concentrations in Investigative Samples Collected from the Operations Areas, 1996.

Sample type	Location (number of samples)	Radionuclides	Maximum concentration (pCi/g)
Mouse feces	200 West Area (1 x 10 g/sample)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	6.2E+04 7.8E+06 4.9E+05 1.8E+04 8.2E+04 1.3E+02
Mouse urine [a] (wipes from trap)	3000 Area (2)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<3.0E+01 7.7E+03 <6.8E+01 <1.6E+01 <1.6E+01 2.0E-03
Mouse nest	200 East Area (1)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<1.3E+00 3.5E+05 8.1E+02 1.7E+00 5.6E+00 1.0E-02
Mouse nest	600 Area (1)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	4.4E-01 7.4E+04 1.7E+02 <5.0E-01 <5.0E-01 1.0E-02
Deer mice	200 East Area (25 individuals in 16 samples)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<9.1E+00 1.0E+06 5.1E+04 4.2E+03 1.3E+04 3.7E-01
Deer mice	200 West Area (2)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$	<1.7E+00 9.3E+03 3.9E+02 <2.8E+00 3.0E+00

Table 9-10. Maximum Radionuclide Concentrations in Investigative Samples Collected from the Operations Areas, 1996.

Sample type	Location (number of samples)	Radionuclides	Maximum concentration (pCi/g)
		$^{Total}U$	1.9E-03
Deer mice	600 Area (2)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<1.1E+00 1.1E+04 2.7E+01 <2.0E+00 <2.0E+00 4.0E-04
Deer mouse and wash [a]	3000 Area (1)	^{60}Co ^{90}Sr ^{137}Cs ^{238}Pu $^{239/240}Pu$ $^{Total}U$	<2.0E+01 1.2E+03 <3.1E+01 <9.4E+00 <9.4E+00 2.0E-04

[a] = picocuries per sample (pCi/sample)

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10.0 REFERENCES

40 CFR 61 1997, Subpart H, "National Emissions Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, as amended.

40 CFR 141 1997, "National Primary Drinking Water Regulations," *Code of Federal Regulations*, as amended.

AEC, 1974, *Measurements of Radionuclides in the Environment, Sampling and Analysis of Plutonium in Soil*, Nuclear Regulatory Guide 4.5, U.S. Atomic Energy Commission, Washington, D.C.

ANSI, 1975, *Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Application*, ANSI-N545-1975, American National Standards Institute, Washington, D.C.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq.

Conklin, A. W., R. E. Elder, D. D. Brekke, G. W. Egert, and W. L. Osborne, 1985, *Rockwell Hanford Operations Environmental Surveillance Annual Report*, RHO-SR-84-13P, Rockwell Hanford Operations, Richland, Washington.

Dirkes, R. L., and R. W. Hanf, 1996, *Hanford Site Environmental Report for Calendar Year 1995*, PNNL-11139, Pacific Northwest National Laboratory, Richland, Washington.

Dirkes, R. L., and R. W. Hanf, 1997, *Hanford Site Environmental Report for Calendar Year 1996*, PNNL-11472, Pacific Northwest National Laboratory, Richland, Washington.

DOE, 1994, *Personnel Selection, Qualification, and Training Requirements for Nuclear Facilities*, DOE Order 5480.20A, U.S. Department of Energy, Washington, D.C.

DOE, 1991, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, DOE/EH-0173T, U.S. Department of Energy, Washington, D.C.

DOE, 1990, *Radiation Protection of the Public and the Environment*, DOE Order 5400.5, U.S. Department of Energy, Washington, D.C.

DOE, 1988a, *General Environmental Protection Program*, DOE Order 5400.1, U.S. Department of Energy, Washington, D.C.

DOE, 1988b, *Radioactive Waste Management*, DOE Order 5820.2A, U.S. Department of Energy, Washington, D.C.

DOE, 1981, *Environmental Protection, Safety, and Health Protection Information Reporting Requirements*, DOE Order 5484.1, U.S. Department of Energy, Washington, D.C.

RL, 1997, *Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 1996*, DOE/RL-97-43, Draft 2.0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

RL, 1996, *Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 1995*, DOE/RL-96-37, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

RL, 1994b, *Hanford Site Ground Water Protection Management Plan*, DOE/RL-89-12, Rev. 2, U.S. Department of Energy, Richland, Washington.

RL, 1994a, *Hanford Environmental Monitoring Plan, United States Department of Energy, Richland Operations Office*, DOE/RL-91-50, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology and EPA, 1986, *Consent Agreement and Compliance Order*, Ecology No. DE 86-133, Washington State Department of Ecology and U.S. Environmental Protection Agency, Olympia, Washington.

Ecology, DOE, and EPA, 1996, *Hanford Federal Facility Agreement and Consent Order*, as amended, Washington State Department of Ecology, U.S. Department of Energy, and U.S. Environmental Protection Agency, Olympia, Washington.

EML, 1972, *HASL-300 Procedures*, Environmental Measurements Laboratory, New York, New York.

EPA, 1979, *EPA Methods for Chemical Analysis of Water and Wastes*, EPA 600/4-79-020, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio.

Gilmore, T. J., D. R. Newcomer, S. K. Wurstner, and F. A. Spane, 1992, *Calculation of Groundwater Discharge to the Columbia River in the 100 Area*, PNL-0857, Pacific Northwest Laboratory, Richland, Washington.

Gleckler, B. P., 1996, *Environmental Releases for Calendar Year 1996*, HNF-EP-0527-05, Waste Management Federal Services of Hanford, Inc., Richland, Washington.

HSRCM-1, *Hanford Site Radiological Control Manual*, Pacific Northwest Laboratory, Richland, Washington.

Johnson, A. R., 1996, *Ambient Air Monitoring During Pilot Retrieval and Inspection of Stored Transuranic Waste Drums* (internal memo 8H131-96-005r1 to J. A. Demiter, January 26), Westinghouse Hanford Company, Richland, Washington.

Johnson, A. R., R. M. Mitchell, S. J. Guzek, and M. A. Juguilon, 1995, *Preoperational Environmental Survey Report: 200 Areas Effluent Treatment Facility, State Approved Land Disposal Site, and Liquid Effluent Retention Facility (C-018H)*, WHC-SD-C018H-RPT-004, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Johnson, A. R., R. M. Mitchell, and C. A. Rowley, 1996, *Preoperational Environmental Survey Report: 200 Areas Cross-Site Transfer Line Replacement (W-058)*, WHC-SD-W058-RPT-001, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Markes, B. M., and S. M. McKinney, 1995, *Routine Environmental Monitoring Schedule, CY 1996*, WHC-SP-0098-7, Westinghouse Hanford Company, Richland, Washington.

Markes, B. M., and S. M. McKinney, 1994, *Routine Environmental Monitoring Schedule, CY 1995*, WHC-SP-0098-6, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

McKinney, S. M., and B. M. Markes, 1996a, *Quarterly Environmental Radiological Survey Summary*, WHC-SP-0665-20, Westinghouse Hanford Company, Richland, Washington.

McKinney, S. M., and B. M. Markes, 1996b, *Quarterly Environmental Radiological Survey Summary*, WHC-SP-0665-21, Westinghouse Hanford Company, Richland, Washington.

McKinney, S. M., and B. M. Markes, 1996c, *Quarterly Environmental Radiological Survey Summary*, WHC-SP-0665-22, Westinghouse Hanford Company, Richland, Washington.

McKinney, S. M., and B. M. Markes, 1997, *Quarterly Environmental Radiological Survey Summary*, HNF-SP-0665-23, Westinghouse Hanford Company, Richland, Washington.

Mitchell, R. M., and A. R. Johnson, 1996, *Preoperational/Operational Environmental Survey Report: Solid Waste Operations Complex*. WHC-SD-WM-TI-778, Rev 0. Westinghouse Hanford Company. Richland, WA 99352.

NCRPM, 1976, *Environmental Radiation Measurements*, Report No. 50, National Council on Radiation Protection and Measurements, Washington, D.C. (December).

Perkins, C. J., 1994, *Operational Environmental Monitoring Program Quality Assurance Project Plan*, WHC-EP-0538-2, Westinghouse Hanford Company, Richland, Washington.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

Schmidt, J. W., A. R. Johnson, B. M. Markes, S. M. McKinney, and C. J. Perkins, 1996, *Westinghouse Hanford Company Environmental Surveillance Annual Report, Calendar Year 1995*, WHC-EP-0573-4, Westinghouse Hanford Company, Richland, Washington.

Schmidt, J. W., and B. P. Gleckler, 1995, *Final Report of Fugitive and Diffuse Emissions Evaluations at the Hanford Site, Calendar Year 1994, etc.*, WHC-SD-WM-TRP-227, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WHC-CM-7-4, *Operational Environmental Monitoring*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-7-5, *Environmental Compliance Manual*, Westinghouse Hanford Company, Richland, Washington.

WHC-CM-7-7, *Environmental Investigations and Site Characterization Manual*, Westinghouse Hanford Company, Richland, Washington.

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APPENDIX A

QUALITY ASSURANCE

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QUALITY ASSURANCE

Quality Assurance (QA) may be defined as the actions necessary to ensure the accuracy of a program. The near-facility environmental monitoring QA program consists of procedures and guides to demonstrate that environmental monitoring techniques and analyses are performed within established limits of acceptance. This is documented in the Operational Environmental Monitoring Program (OEMP) QA Project Plan (Perkins 1994).

Written operating procedures are an integral part of near-facility environmental monitoring QA. Procedures for field operations are provided in an internal WMNW manual. This appendix briefly describes the essential components of the near-facility environmental monitoring QA program.

DOCUMENTATION

Record keeping is a vital part of any environmental monitoring program. Maintenance of environmental data is important from a QA standpoint, from a regulatory standpoint, and for trend analyses and optimization of environmental monitoring procedures. For these reasons, each phase of near-facility environmental monitoring is documented. This documentation includes sampling logs, annual reports, and occurrence reports.

SAMPLE REPLICATION

Replicate sampling and subsequent analysis are the primary means of assessing sample variability. Duplicate samples of air, water, soil, sediment, and vegetation are collected.

DATA ANALYSIS

Environmental data are reviewed to determine compliance with applicable Federal and company guides. The data are analyzed both graphically and by standard statistical tests to determine trends and impacts on the environment. Newly acquired data are compared with historical data and natural background levels. Routine environmental data are stored on both magnetic media (i.e., in a computer environment) and hard-copy printouts.

TRAINING

To ensure quality and consistency in sample collection and handling, all personnel performing such work received formal training. All health physics technicians (HPT) are required to complete a certification program. In addition, those HPTs assigned to environmental monitoring receive special classroom orientation and on-the-job training by experienced personnel. WMNW Environmental Monitoring and Investigations personnel, in addition to their formal training received while obtaining professional degrees, received training in such courses as "Radiation in the Environment," taught through the Washington State University, courses taught at the Harvard School of Public Health, and various short courses.

SAMPLE FREQUENCY

The frequency of sample collection is as follows.

1. Ambient air sample filters are collected biweekly.

2. Water samples from active ponds and ditches are collected weekly.

3. Radiological surveys of roads are performed quarterly, bimonthly, or annually, as stated in Section 7.0.

4. The thermoluminescent dosimeters (TLD) at facilities, ponds, and ditches are exchanged quarterly.

5. Radiological surveys of waste sites are performed quarterly, semiannually, or annually depending on the operating status, condition, and history of the site.

6. The soil, vegetation, and fecal samples are collected annually. Mud and vegetation samples from active ponds and ditches also are collected annually.

ANALYTICAL PROCEDURES

Three laboratories provided analytical support to the near-facility environmental monitoring; these are the Quanterra Environmental Services and Waste Sampling and Characterization Facility, and the 222-S Analytical Laboratory. The environmental samples are analyzed in accordance with prescribed procedures and quality control guides. The analytical procedures necessary to implement the environmental monitoring program are described briefly in the following paragraphs and are listed according to the respective laboratory.

Quanterra Environmental Services

Much of the near-facility environmental monitoring involves measuring radionuclide concentrations at or near background levels. These environmental measurements require a very low detection limit and typically are performed at Quanterra Environmental Services. The analytical laboratory routinely analyzes soil, vegetation, animal feces, and air samples. Analyses are performed according to procedures and quality control guides described by the Environmental Measurements Laboratory (EML 1972), the U.S. Atomic Energy Commission (AEC 1974), and the National Council on Radiation Protection and Measurements (NCRPM 1976).

1. Air Samples

   a. Gamma Energy Analysis - Gamma-emitting radionuclides are measured by direct counting of the air sample filter with a germanium detector. The gamma spectra are analyzed using a Nuclear Data 7700 software system.

   b. Strontium - Airborne ^{89}Sr and ^{90}Sr are determined by leaching the composited air sample filters with nitric acid and initially precipitating them as a nitrate. The sample is purified by iron and barium scavenging. The final precipitate, strontium carbonate, then is counted for total beta (needed to set the ^{89}Sr value) with a low-background beta proportional counter. Both ^{89}Sr and ^{90}Sr are calculated from the resulting count data using a computer.

c. Plutonium - The various plutonium isotopes are leached from the air sample filter with nitric acid and passed through an ion-exchange resin. Further decontamination from lead, bismuth, and other transuranics by washing with nitric and hydrochloric acids is done. The plutonium then is eluted from the resin and electrodeposited on a stainless-steel disk, where it is counted using a surface barrier alpha spectrometer, and data are collected on a Nuclear Data system.

d. Uranium - The uranium is leached from the air sample filter and extracted as tetrapropyl ammonium uranyltrinitrate followed by back extraction into water. Following treatment with sodium and LiF, the aqueous sample is analyzed with a fluorometer to determine the mass of uranium.

2. Groundwater Samples

a. Total Alpha and Beta Activity - The total activity caused by alpha- and beta-emitting radionuclides is measured by directly counting the dried residue with a gas-flow proportional counter.

b. Strontium-90 - The strontium is removed from the water sample by precipitating it as a nitrate using nitric acid. The sample is purified by repeated scavenging with barium chromate and precipitating with barium carbonate. The strontium carbonate then is counted with a low-background gas-flow proportional counter.

c. Gamma Energy Analysis - Gamma-emitting radionuclides are analyzed by directly counting the water sample with a germanium-lithium Ge(Li) detector equipped with a multi-channel pulse-height analyzer.

d. Tritium - Water samples are analyzed for tritium with a liquid scintillation spectrometer.

e. Total Uranium - The water samples are analyzed for uranium first by treating them with sodium and lithium fluoride and then analyzing them with a fluorometer.

3. Soil Samples

a. Gamma Energy Analysis - Gamma-emitting radionuclides in soil are measured using a Marinelli beaker and counting with a Ge(Li) detector equipped with a multichannel pulse-height analyzer.

b. Strontium-90 - The ^{90}Sr is removed from the soil sample by leaching the dried sample with nitric acid. The strontium in solution is converted to an oxalate followed by precipitation as strontium carbonate. The carbonate is deposited on a planchet and counted in the same manner as the ^{90}Sr water samples.

c. Technetium-99 - The ^{99}Tc is isolated from other elements using hydroxide carbonate coprecipitation, leaving it in solution as the pertechnethe ion (TcO_4^-). Further purification is achieved by an anion-exchange column path, followed by liquid scintillation spectrometry.

4. Vegetation Samples

a. Gamma Energy Analysis - Gamma-emitting radionuclides in vegetation are measured by direct counting of the sample with a Ge(Li) detector equipped with a multichannel pulse height analyzer.

b. Strontium-90 - The ^{90}Sr is removed from the vegetation sample by leaching the dried sample with nitric acid. The strontium in solution is converted to an oxalate followed by precipitation as strontium carbonate. The carbonate is deposited on a planchet and counted in the same manner as the ^{90}Sr water samples.

c. Technetium-99 - The ^{99}Tc is isolated from other elements using hydroxide carbonate coprecipitation, leaving it in solution as the pertechnethe ion (TcO_4^-). Further purification is achieved by an anion-exchange column path, followed by liquid scintillation spectrometry.

Pacific Northwest National Laboratory Radiation Standards and Engineering

Thermoluminescent Dosimeters - External radiation levels are measured using TLDs. TLDs at each sampling location monitor facilities, water sampling sites, active tank farms and various cribs, and trenches. The Hanford Site uses the Harshaw 8807 dosimeter and the Harsahw 8800 reader.

The TLDs are calibrated, packaged, and read by the PNNL Radiation Calibration Laboratory, Radiation Standards and Engineering Department. All TLD work is performed in accordance with the procedures and specific guides from the American National Standards Institute (ANSI 1975) and PNNL.

222-S and Waste Sampling and Characterization Facility (WSCF) Analytical Laboratories

The 222-S and Waste Sampling and Characterization Facility (WSCF) laboratories also provides analytical support to near-facility environmental monitoring. The 222-S Laboratory is normally used for samples containing higher than normal environmental levels of radioactivity. Analytical procedures and quality control guides are described by the Environmental Measurements Laboratory (EML 1972), the American Society for Testing and Materials (ASTM 1976), the American Public Health Association (APHA 1980), and the U.S. Environmental Protection Agency (EPA 1979). A brief description of the routine analyses performed by the 222-S and WSCF Laboratories follows.

1. Pond and Ditch Water

a. Total Alpha and Beta Activity - An aliquot of the pond or ditch water is added to a stainless-steel dish and evaporated to dryness. The total alpha and beta activities are measured by direct counting with a gas flow proportional counter.

b. Gamma Energy Analysis - The liquid sample is sealed inside a geometrically approved container. The gamma-emitting radionuclides are measured by direct counting with a Ge(Li) detector equipped with a multichannel analyzer.

c. Strontium-90 - The ^{90}Sr is removed from the aqueous sample by precipitating it out with barium carbonate. The strontium carbonate is purified by redissolving with nitric acid, precipitating as a nitrate, and precipitating again as a carbonate. The ^{90}Sr activity is determined by beta counting with a gas flow proportional counter.

d. Plutonium - Actinides are removed from the aqueous sample by precipitation with iron. The precipitate is redissolved in hydrochloric acid and the plutonium is separated from the other actinides by ion exchange. The plutonium is electrodeposited on a planchet and counted using alpha spectrometry.

2. Pond and Ditch Mud and Sediment

   a. Gamma Energy Analysis - The gamma-emitting radionuclides are measured by direct counting of the dried sediment sample using a Ge(Li) detector equipped with a multichannel analyzer.

   b. Soil Leach - Strontium, plutonium, americium, and other elements are leached from the soil sample using a mixture of hydrochloric and nitric acids. The leachate is then analyzed for specific radionuclides as is done with the liquid samples.

3. Pond and Ditch Vegetation

   a. Gamma Energy Analysis - The liquid sample is sealed inside a geometrically approved container. The gamma-emitting radionuclides are measured by direct counting with a Ge(Li) detector equipped with a multichannel analyzer.

   b. Vegetation Leach - The vegetation samples are dry ashed in a furnace and then leached with a mixture of hydrochloric and nitric acids. The leachate is analyzed for specific radionuclides as is done with the liquid samples.

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APPENDIX B

GLOSSARY

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DEFINITIONS

Aboveground Tank - A tank situated so that its entire surface area is completely above the plane of the adjacent surrounding surface and the entire surface area of the tank (including the tank bottom) can be visually inspected (WAC 173-303-040).

Accessible Soils - Hanford soils that are not behind security fences must meet the Table 6.2 values found in the Westinghouse Hanford Company *Environmental Compliance Manual*, WHC-CM-7-5. The values reflect a 10-mrem/yr effective dose equivalent (EDE) limit from Hanford Site operations to the most exposed member of the public.

Administrative Control Value (ACV) - Operating contractor's internally imposed release limit for an airborne or liquid effluent. The ACV is usually expressed as a fraction or multiple of the derived concentration guide (DCG)-public but may also be expressed as a total release value (curies per year for Kr-85 and tritium). In applying the ACV, the "Unity Rule" applies; the sum of the fractions of the ACV in an effluent shall not exceed 1.

Airborne Radioactive Effluents - Radioactive particles, mists, vapors, fumes, and/or gases contained or entrained in airborne effluents.

Aquifer - A subsurface formation consisting of sufficient saturated permeable material to yield significant quantities of water.

Areal Contamination - Contamination generally confined to less than the first centimeter of soil. Numerically, the radioactivity content averaged over a suitable area.

As Low As Reasonably Achievable (ALARA) - The implementation of ALARA is described in WHC-CM-4-11, *ALARA Program Manual*. This concept applies to maintaining releases at or below prescribed regulatory limits.

Assure - To remove any doubt, to promise.

Audit - An announced examination of a facility or operation to determine compliance with the specific requirements.

Average Soil Contamination - Contamination generally dispersed through the soil. Numerically, the radioactivity content averaged over a suitable mass of soil.

Backfill Soil - The soil used as a plant growth medium between the depths of 30-120 cm as measured at the restabilization site.

Background Radiation - Refers to regional levels of radioactivity produced by sources other than those of specific interest (e.g., the nuclear activities at the Hanford Site).

Barrier or Engineered Barrier - At a disposal site, a manufactured addition designed to retard or preclude radionuclide or other contaminant transport and/or preserve the integrity of the disposal site.

Becquerel (Bq) - The standard international unit of radioactivity. One Bq is one disintegration per second or:

$$Bq = 2.7 E - 11 Ci$$

Biological Transport - Means of biological transport may include one or more of the following processes:

- Movement of subsurface radioactivity to the surface by physiological vegetative processes
- Dispersion of such vegetation by the wind
- Contaminated urine and feces deposited by animals that have gained access to and ingested radioactive materials
- Contaminated animals themselves that have ingested radioactive materials directly or ingested other contaminated animals or plants
- Physical displacement of radioactive materials by burrowing animals
- Nests built using contaminated materials.

Biota - The plant and animal life of a specific region.

Building - A structure created to shelter any form of human activity, such as a house, barn, church, hotel, or similar structure; it also may refer to a historically related complex, such as a courthouse and jail; or, on the Hanford Site, buildings to include: old reactor buildings, office buildings, e.g., 2750 Building, 222-S Laboratory Building, etc.

Burial Ground - A land area specifically designated to receive contaminated solid or solidified liquid waste packages and equipment. The contaminated articles are usually placed in trenches and covered with overburden.

Byproduct - A material that is not one of the primary products of a production process and is not solely or separately produced by the production process. Examples are process residues such as slags or distillation column bottoms. The term does not include a coproduct that is produced for the general public's use and is ordinarily used in the form in which it is produced by the process.

Calibration - Determining the deviation of an instrument from a standard traceable to the National Bureau of Standards (NIST) or other recognized agency and reporting the deviations and/or eliminating them by adjustment.

Central Landfill - The contractor-operated, U.S. Department of Energy (DOE)-owned disposal site used for disposal of trash and other nonhazardous nonradioactive wastes.

Chemical Processing - Chemical treatment of material to separate desired components selectively. At the Hanford Site, plutonium, uranium, and fission products were chemically separated from irradiated fuels.

Chemical Substance - Any organic or inorganic substance except the following:

1. Any mixture
2. Any pesticide when used as a pesticide
3. Any tobacco product
4. Any source material, special nuclear material, or byproduct material

5. Any firearms, shells, or cartridges

6. Any food, food additive, drug, cosmetic, or device, when used for its intended purpose.

Manufacture for Commercial Purpose - To import, produce, or manufacture with the purpose of obtaining commercial advantage for the manufacturer, including manufacturing any amount of a chemical substance or mixture for the following reasons:

1. Distribution in commerce

2. Use by the manufacturer, including use for product research and development, or as an intermediate. The definition of manufacturer includes extracting a chemical from another chemical substance or mixture of substances.

Chemical Trench - The central landfill trench that was used for the disposal of chemicals, hazardous wastes, and hazardous substances.

Committed Dose Equivalent - The predicted total dose equivalent to a tissue or organ over a 50-year period after a known intake of a radionuclide into the body. It does not include contributions from external dose. Committed dose equivalent is expressed in units of rem (or sievert).

Committed Effective Dose Equivalent - The sum of the committed dose equivalents to various tissues in the body, each multiplied by the appropriate weighing factor. Committed effective dose equivalent is expressed in units of rem (or sievert).

Composite Sample - A number of random samples initially collected from a waste and combined into a single sample; this sample is analyzed for the contaminants of concern.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 **(CERCLA)** - Commonly known as "Superfund," CERCLA was enacted to respond to uncontrolled releases of hazardous substances to the environment, primarily at inactive sites that were not adequately addressed by the *Resource Conservation and Recovery Act of 1976* (RCRA). CERCLA also applies to actively managed facilities and any onshore or offshore facility.

Confined Aquifer - A subsurface water-bearing region having defined and relatively impermeable upper and lower boundaries.

Conserve - Use methods and procedures necessary to protect any endangered or threatened species. Such methods and procedures include, but are not limited to, activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation. In the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, methods and procedures may include regulated taking.

Controlled Area - An area where access is controlled to protect individuals from exposure to radiation and radioactive materials.

Construction - Addition, enlargement, modification, replacement, alteration, or restart (after a period of 5 years of nonoperation) of any process or stationary source that may increase emissions or ambient air concentrations of any contaminant for which federal or state ambient or emission standards have been established.

Contamination Limit - That concentration limit or activity limit for radioactive materials below which posting restrictions and environmental controls to protect personnel or the environment are not necessary.

Crib - An underground structure designed to receive liquid waste that percolates into the soil directly or percolates into the soil after having traveled through a connected tile field.

Decommissioning - Actions taken to reduce the potential health and safety impacts of DOE-controlled contaminated facilities. Actions could include stabilizing, reducing, or removing radioactivity or demolishing the contaminated facilities.

Decontamination - The removal of radioactive or hazardous contamination from facilities, equipment, or soils by washing, heating, chemical or electrochemical treating, mechanical cleaning, or other techniques.

Demolition Waste - Solid waste, made up largely of inert waste resulting from the demolition or razing of buildings, roads, and other manufactured structures. Demolition waste consists of, but is not limited to, concrete, brick, bituminous concrete, wood and masonry, composition roofing and roofing paper, steel, and minor amounts of other metals such as copper. [Plaster (sheet rock or plaster board), asbestos, or any material other than wood that is likely to produce gases or a leachate during the decomposition process is not considered to be demolition waste.]

Derived Concentration Guide for Occupational Exposure (DCG-Occupational) - Those concentrations in air or water that an occupationally exposed individual would have to inhale/ingest in a year to result in 5,000 mrem/50 year dose commitment.

Derived Concentration Guide for Public Exposure (DCG-Public) - The concentration of radioactive materials in air or water specified in Appendix A, "Derived Concentration Guides for Controlling Exposure to Members of the Public," of this manual. The DCG-Public are those concentrations of radionuclides in air or water that would result in a maximum effective committed dose equivalent of up to 100 mrem per year using ICRP-30 dose methodology under conditions of continuous exposure or use (i.e., continuously breathing or being in contact with contaminated air or exclusively drinking contaminated water).

Diffuse Source - A source or sources of radioactive or chemical contaminants released into the environment that do not have a defined point or origin of release (a nonpoint source). Such sources are also known as area sources.

Dispersible - Capable of being widely spread.

Disposal - Discharging, discarding, or abandoning dangerous waste, or the treatment, decontamination, or recycling of such waste once it has been discarded or abandoned. This includes the discharge of any dangerous waste into or on any land, air, or water (WAC 173-303-040). This definition also includes radioactive materials.

Disposal Facility - Any facility or part of a facility where hazardous and/or radioactive waste is intentionally placed or where any land or water waste will remain after closure.

District - A geographically definable area (urban or rural) with a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united either by past events or aesthetically by planned physical development. A district may also be individual elements that are separated geographically but linked by association or history.

Disturbance - Includes, but is not limited to, the following: leveling; firebreak, road, or utility line construction; excavation of pits, foundations and trenches; quarrying and borrowing of rock and soils; seismic testing; and stockpiling of earth.

Ditch - An open surface site for transport of liquid wastes to a pond or trench structure designed for percolation.

Ecology - The Washington State Department of Ecology.

Effective Dose Equivalent (EDE) - The summation of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighing factor. This sum is a risk-equivalent value and can be used to estimate the health-effects risk of the exposed individual. The tissue-specific weighing factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue. The EDE includes the committed EDE from internal deposition of radionuclides and the EDE caused by penetrating radiation from sources outside the body. EDE is expressed in units of rem (or sievert).

Effluent - An airborne or liquid discharge from a facility after all engineered waste treatment and effluent controls have been performed. The term includes onsite discharges to the atmosphere, lagoons, ponds, cribs, injection wells, French drains, or ditches. The term does not include solid waste stored or removed for disposal or waste that is contained in retention basins or tanks before treatment and/or disposal.

Emissions Unit - Regarding air pollutant emissions, any part of a stationary source that emits or would have the potential to emit any pollutant subject to regulation.

Ensure - To make certain, make sure, make safe.

Environmental Monitoring Plan (EMP) - A two-part document prepared for each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials.

Environmental Sites Database (ESD) - A database of environmental Sites which is administered by the ERC.

Exhaust System - A stack, gaseous effluent system, building ventilation system, or any system that vents air or gaseous material to the atmosphere.

Expedited Response Action - An interim response action (IRA) or interim measure (IM) process. This includes any onsite response action (under CERCLA or RCRA authority) to mitigate site contamination conducted before initiation of remedial action or corrective action in accordance with final record of decision (ROD) or permit modifications.

Facility - A processing plant, tank farm, shop, laboratory, powerhouse, or laundry. Including all contiguous land and structures, other appurtenances, and improvements on land used for recycling, reusing, reclaiming, transferring, storing, treating of dangerous waste (including treatment, storage, and disposal sites as well as groundwater wells). (40 CFR 264, "Standards for Owners and Operators of Hazardous Waste Treatment Storage and Disposal Facilities," and WAC 173-303-040.)

Facility-Specific Environmental Monitoring - Routine environmental monitoring of all environmental media (air, biota, etc.) around facility parameters.

Field Blank - Aliquots of analyte-free water or solvents brought to the field in sealed containers and transported to the laboratory with the sample container. Field blanks include trip blanks and

equipment blanks.

Field Duplicate - Field duplicates are collected at specified frequencies and are used to document precision. The field duplicate precision depends on the variance of waste composition, sampling techniques, and analytical technique.

Fish or Wildlife - Any member of the animal kingdom including (without limitation) any mammal, fish, bird, amphibian, reptile, mollusk, crustacean, arthropod, or other invertebrate--including any part, product, egg, offspring, or the dead body or parts of the offspring.

French Drain - A covered or rock-filled encasement with the bottom end open to allow liquids to seep into the ground.

Fugitive Emissions - Material that is generated incidental to an operation, process, or activity and that is released or dispersed into the open air. Fugitive emissions occur via pathways that do not allow routine measurement at the point of release.

Grab Sample - A single sample removed from a stream over a short time interval.

Groundwater - Water that exists below the water table, also referred to as the zone of saturation. However, the capillary fringe directly above can be completely saturated if the sediment is fine enough. To avoid this ambiguous term, the use of phreatic water, which is water that enters freely into wells under both confined and unconfined conditions is suggested. Phreatic water is a term originally applied only to water that occurs in the upper part of the zone of saturation under water table conditions (unconfined groundwater or well water), but has come to be applied to all water in the zone of saturation, thus making it an exact synonym of groundwater. Above the water table is the vadose zone, where water pressures are less than atmospheric pressure. This zone still contains water, but the water is held to the soil particles or other groundwater material by capillary force. Thus, while this water still can move within the vadose zone, it cannot move out of the zone into a well or other places that are exposed to atmospheric pressure. The dividing line between water in the vadose zone and phreatic water is the atmospheric pressure between the two, with the pressure of vadose water being below atmospheric pressure and that of phreatic water (i.e., groundwater) above atmospheric pressure.

High-Efficiency Particulate Air (HEPA) Filter - To qualify as a HEPA filter, a filter must achieve an efficiency of 99.97% under laboratory conditions and 99.95% after installation for the removal of airborne particulates greater than 3 E-05 cm (0.3 microns).

High-Level Nuclear Waste - Spent nuclear fuel or radioactive waste resulting directly from the dissolution and reprocessing of spent nuclear fuel. Secondary waste streams resulting from the dissolution and reprocessing of spent nuclear fuel are not considered high-level waste.

Immobile Radionuclides - All those radionuclides that are sorbed onto Hanford Site soils and usually would not migrate through the vadose zone or the groundwater below the future control zone.

Inaccessible Soils - Areas from which the general public is excluded (by fences, posting, patrols, or distance), but that are still subject to meteorological effects, are subject to a 10-mrem/yr operational EDE limit, as reflected in Table 6-1.

Inactive Crib - A crib that has been designated as permanently out of service.

Inactive Radioactive Waste Site - Any waste site that is no longer needed for current operational programs and that is not currently an active waste disposal site.

Inactive Waste Sites - Inactive waste sites include units such as burial grounds, unplanned release sites, cribs, ditches, ponds, trenches, and basins, abandoned storage areas, drains, single-shell tank piping, transfer pits, and jumper boxes.

Injection Well - A well used for mixing liquid waste with groundwater.

Inert Waste - Noncombustible, nondangerous solid waste that is likely to retain its physical and chemical structure under expected conditions of disposal, including resistance to biological attack and chemical attack from acidic rainwater.

Insure - To cover by insurance against loss.

Less Than Detectable - An analytical term for a concentration in a sample that is lower than the minimum detection capabilities of that analytical equipment or process.

Low-Level Waste - Any gaseous, liquid, or solid radioactive waste not classified as high-level waste, transuranic (TRU) waste, or spent nuclear fuel, as defined by DOE Order 5820.2. Also see Threshold Concentrations.

Maximum Contaminant Level (MCL) - The drinking water standards specified in 40 CFR 141, "National Primary Drinking Water Regulations." See Appendix C, "Maximum Contaminant Levels."

Minimum Detection Limit - See detection limit.

Mixed Waste - Dangerous waste that also contains enough radioactivity to be classified as radioactive waste.

Modification - Any physical or operational change to a stationary source that results in an increase in the rate of emission to the atmosphere of an air pollutant to which a standard applies.

Monitored Sample - A sample collected in a monitoring system and used to alert operations to nonroutine releases and to provide process control.

Monitoring System - Instrumentation that provides measurement of an airborne or liquid waste stream parameters. The system includes a detector and associated readout components. A continuous monitoring system measures the stream parameters on a near-real-time basis or as specified in applicable

EPA regulations, 40 CFR 52, "Approval and Promulgation of Implementation Plans," Appendix E; 40 CFR 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans," Appendix P, or as defined in applicable ANSI Standards. A radiation monitoring system is a system in which radiation or radioactivity is the measured parameter. An integrating monitoring system totals the instantaneously measured parameter over some time period. A sampling system does not measure or read out an instantaneous stream parameter.

Naturally Occurring Radioactive Materials - Also see Threshold Concentrations.

Nonroutine Activities - Any actions on a large-scale (>5 acres), including stabilization, soil removal, fixative or sealant application, other surface treatments, or other activities that could affect future remediation activities in an inactive waste site.

Normally Contaminated Airborne or Liquid Effluent - An airborne or liquid effluent from a facility or area that contains dispersible or unsealed radioactive materials in quantities sufficient to cause releases of radioactive materials in excess of 10% of the administrative control limit (ACL) averaged over 1 year (i.e., the total activity present times an appropriate suspendable or immersible fraction divided by the total annual flow exceeds 10% of the ACL).

Operate - As used in this section with respect to the activities of WHC, the term "operate" (and other forms of the term) will refer to the performance by WHC of its day-to-day activities in connection with the tanks and tank systems. Such activities shall be subject to the overall management, control, and oversight by DOE.

Operational Environmental Monitoring - The collection and analysis of samples of air, water, soil, biota, and other media near nuclear facilities on DOE sites and their environs and the measurement of external radiation to demonstrate compliance with applicable standards and assess radiation exposures to employees and members of the public, and the near-field environment.

Operations - In this report this term loosely refers to WHC activities including chemical processing, waste management, and decommissioning.

Operations - The contractor organization responsible for operating plants and facilities.

Overall Error - In this report, this term means the overall analytical error supplied by the laboratory performing the analysis.

Percolation - Downward movement of water through the interstices of unsaturated rock or soil because of gravity or hydrostatic pressure.

Pesticide - In this manual, as defined in 40 CFR 162, the term pesticide covers all pest-control chemicals such as herbicides, rodenticides, and insecticides.

Plutonium Processing and Handling Facility - Any facility constructed primarily to process plutonium (including ^{238}Pu) and that handles in-process plutonium.

Plutonium Storage Facility - Any facility constructed to store strategic (category I) quantities of plutonium.

Point of Release - The point at which a material is released to the environment such as the top of a stack or the end of a pipe.

Point Source - A single defined point (origin) of an airborne release, such as a vent or stack.

Pond - A surface impoundment used to contain or percolate low-level liquid radioactive waste, mixed waste, or hazardous waste.

Potentially Contaminated Airborne or Liquid Effluent - An airborne or liquid effluent from a facility or area that contains radioactive materials in quantities sufficient to cause releases of radioactive materials in excess of 10% of the ACV averaged over 1 year (the total activity present times a reasonable suspendable or immersible fraction divided by the annual flow equals more than 10% of the ACV).

Potentially Corrosive Liquid Waste Stream - Any liquid waste stream that has been identified as having the potential, during upset conditions, to discharge liquid with a pH value of less than or equal to 2, or greater than or equal to 12.5.

Previously Disturbed Ground - Ground that has had its contours altered by leveling, filling, or

excavation or that has been contaminated by radiation or dangerous chemicals to the extent that an individual cannot enter the area without wearing protective clothing. Disturbance is determined by observation, aerial photographs, and topographic maps.

Quality Assurance - A process designed to maintain the quality of the results of a program within established limits of acceptance.

Quality Assurance - All those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service.

Radiation Survey - Evaluation of an area or object with portable instruments to identify radioactive materials and radiation fields present.

Radioactive Byproduct - Any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or using special nuclear material (*Atomic Energy Act of 1954*, as amended). The nonradioactive hazardous component of the waste material will be subject to regulation under the RCRA.

Radioactive Liquid Effluent - A liquid effluent that has a reasonable potential for containing radioactive materials in quantities such that the annual average concentration is equal to or greater than the MCL. Also see Threshold Concentrations.

Radioactive Solid Waste - See Threshold Concentrations.

Radiological Control Area - An area where access is controlled to protect individuals from exposure to radiation and/or radioactive materials. Radiological control areas include, but are not limited to, areas posted as Radiation Area, Surface Contamination, and Underground Radioactive Materials, to describe the radiological condition of the area within.

Radiological Posting - Information in the form of signs and chains to inform people of conditions that warrant avoidance or special precautions for entry.

Release From Radiological Posting - Removal of signs and chains when access to an area no longer needs to be restricted for radiological protection purposes.

Representative Sample - The average stream parameter being measured occurs in the sample in the same average proportion that it occurs in the environmental discharge.

Retired Waste Site - A waste site that is isolated and no longer available to receive waste in any form.

Reverse Well - Same as injection well.

Routine Activities - Any actions on a small-scale (<5 acres), including radioactive hot-spot removal, vegetation removal, fencing, posting, herbicide spraying, stabilization, or immediate spill response) in an inactive waste site. In general, these routine actions shall not interfere with RCRA/CERCLA response or site investigations.

Routine Emissions - Air emissions of pollutants or releases from accidents are not considered routine. However, releases of air pollutants to the atmosphere that result from normal operations and releases that are not routine, but are more likely than not to occur, are included as routine emissions.

Sampling System - Instrumentation and equipment that remove a part of a liquid or airborne waste

stream for subsequent quantitative determination of stream parameters. The system generally employs such devices as filters, other sample collection media, or effluent traps of some kind. A continuous sampling system removes a part of the stream continuously except during sample change, maintenance, repair, or other necessary outages. A grab sampling system removes an instantaneous part of the stream or removes a part of the stream over a time period.

Sealed - A container having a cover bonded with the container or a cover strong enough to prevent contact with and dispersion of the contents of the container under conditions of use and wear for which it was designed.

Sediment Column - The sediment beneath a crib. It can mean either all the sediment beneath the bottom of the crib extending to the water table or all sediment beneath a crib contaminated by radioactive materials.

Separations Area - The primary area on the Hanford Site where chemical processing and most waste management activities are performed. It includes the 200 Areas and nearby 600 Area sites. WHC is landlord of the Separations Area.

Site - The location of a significant event, a prehistoric or historic occupation or activity, or a building or structure (whether standing, ruined, or vanished) where the location itself maintains historical or archeological value, regardless of the value of any existing structure.

Soil at depth - Soil below 36 in.

Solid Waste - Any discarded material that is not excluded by WAC 173-303-017(2) or that is not excluded by a variance granted under WAC 173-303-017(5). Materials are solid waste if they are: (1) abandoned by being disposed of, burned, or incinerated, or (2) accumulated, stored, or treated (but not recycled) before (or in lieu of) being abandoned by being disposed of, burned, or incinerated. In addition, a solid waste includes any material considered to be inherently waste-like.

Speck Contamination - Single grains of soil, rust particles, feces, or pieces of vegetation.

Speculative Accumulation - A material accumulated before being recycled. If the material is potentially recyclable and at least 75% is recycled during the calendar year (commencing on January 1), it is <u>not</u> a speculative accumulation.

Spent Materials - Used materials that are no longer usable without being regenerated, reclaimed, or reprocessed. Examples are spent solvents, spent activated carbon, spent catalysts, and spent acids. Does not include spent fuel from reactors.

Spot Contamination - A spot or quantity of contamination less than 1 cm^3 in volume, or areal contamination less than 15 cm^2 in area.

Stabilization - The process of covering surface contaminated areas with clean backfill or topsoil.

Standard - A specified set of rules or conditions concerned with the classification of components; delineation of procedures; definition of terms; designation of materials, performance, design, or operations; or measurements of quality in describing materials, products, systems, services, or practices. A standard is more general than a procedure or specification and more specific than a criterion.

Standard Error of the Mean - A measure of the uncertainty in the estimated averages of data because of random variations.

Stationary Source - Any building, structure, facility, or installation that emits or may emit any air pollutant.

Structure - A work constructed by humans that consists of interdependent and interrelated parts in a definite pattern of organization. It is often a large-scale engineering project.

Suitable Surface Area - Area no more than 15 cm^2 over which spot contamination may be averaged in determining areal contamination.

Sump - Any stationary pit or reservoir, including those troughs/trenches connected to it, that serve to collect oil products, hazardous substances, low-level radioactive material, dangerous waste, mixed waste, high-level radioactive materials, or TRU materials.

Surface Contamination - A radiological control status that refers to radioactivity on the surface of the ground that exceeds the soil contamination standard.

Surface Soil - Soil from 0- to 2-in. deep.

Surface Stabilization - A remedial action program on waste disposal sites that includes the addition of at least 46 to 50 cm (18 to 20 in.) of clean soil followed by revegetation. It is designed to cover surface contamination and inhibit biological and wind transport.

Surplus Facilities - Surplus facilities include all facilities that have been accepted into a decommissioning program.

Survey - A method to detect the release, disposal, or presence of radioactive materials or hazardous substances under a specific set of conditions to determine actual or potential hazards. Such an evaluation may include, but is not limited to, tests, physical examinations, and measurements of radiation or concentrations of materials.

Suspect Waste Site - A site, believed to have been previously unknown or undocumented, that, because of characteristics present at the site or historical information about the site, is suspected of containing waste (i.e., non-dangerous, hazardous, dangerous, mixed, and radioactive).

Suspendable Fraction - The fraction of material that may become airborne.

Taking of Any Animal - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect any animal or attempt to engage in any such activity.

Tank - A stationary device designed to contain an accumulation of oil products, hazardous substances, low-level radioactive material, dangerous waste, mixed waste, high-level radioactive materials, or TRU materials, that is constructed primarily of nonearthen materials (e.g., wood, concrete, steel, plastic) that provide structural support.

Tank Farm - An area of large underground tanks designed to store up to 1 Mgal each of high-level liquid waste.

Technologically Enhanced Naturally Occurring Radioactivity - Refined or processed ores or other materials containing naturally occurring radioactive materials, such that radiation exposure or potential radiation exposure is increased.

Thermoluminescent Dosimeter - A chip or series of chips used for measuring external gamma radiation. It consists of a material capable of absorbing energy imparted by ionizing radiation, then

emitting light as a result of thermal stimulation. A measure of that light is proportional to the radioactivity absorbed.

Threshold Concentrations - Those concentrations of radionuclides in various waste or substances that do not require the controls of radioactive waste disposal.

1. Air. No threshold value exists.

2. Liquid. Liquids containing radionuclides in a concentration of less than 0.04 x DCG may be disposed of as nonradioactive liquid waste. This threshold level is equivalent to the EPA Drinking Water Standard (40 CFR 141).

3. Soil/Solid. Soils or other solids containing radionuclides below those listed in Table 6-1 (on hold) may be released for onsite disposal as nonradioactive waste. No offsite release criteria exist.

Threshold Limit Value (TLV) - Threshold limit value time-weighted average (TLV-TWA). The time-weight average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

Topsoil - The soil used as a plant growth medium at the surface to a depth of 30 cm as measured at the restabilization site. Topsoil is added soil to support the stabilization of a retired disposal facility with the objective of controlling erosion, establishing the growth of perennial grasses, and preventing the growth of deep-rooted vegetation.

Transuranic (TRU) Radionuclide - Any radionuclide having an atomic number greater than 92 (DOE Order 5820.2).

Transuranic Waste - Without regard to source or form, radioactive waste that at the end of institutional control periods is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g (3700 Bq/g). The Waste Isolation Pilot Plant, high-level waste, and spent nuclear fuel as defined by DOE Order 5820.2 are specifically excluded from this definition.

Trip Blank - A type of field blank used to accompany sample containers to and from the field and to detect contamination or cross-contamination that occurs during sample handling and transportation.

Unconfined Aquifer - An aquifer that has a water table or surface at atmospheric pressure.

Uncontaminated Soil - A soil or a land area that requires no controls or restrictions in any way for radiation protection purposes and/or meets the contamination limit specifications.

Underground Radioactive Material - A radiological posting status where subsurface radioactivity is present but where surface contamination does not exceed the soil standards.

Underground Storage Tank - Any one or any combination of tanks (including underground connection pipes) used to contain an accumulation of regulated substances. At least 10% of the volume of the tanks (including the volume of underground pipes) is beneath the surface of the ground (WAC 173-360-120). A tank situated in an underground area (such as a basement, cellar, etc.) is not considered to be underground if the tank is situated on or above the surface of the floor (WAC 173-360-110). Surface impoundments, pits, ponds, lagoons, storm water collection systems, or septic tanks are not considered to be underground storage tanks, and are not subject to the underground storage tank requirements (WAC 173-360-110).

Unity Rule - If more than one radionuclide is present, the sum of the fractions represented by each radionuclide concentration divided by its respective limiting concentration (ACV) shall not exceed unity. This rule could also apply to parameters other than radionuclide concentration.

Unplanned Release Site - An area that was contaminated by an unplanned release of radioactive contamination, making it a radiological control area.

Unrestricted Release - Values below which unrestricted release of soils will occur will be defined in an applicable record of decision.

Unsampled Liquid Disposal Site - A liquid waste disposal site that is currently receiving an effluent stream that does not require sampling.

U.S. Environmental Protection Agency (EPA) - The federal agency chartered with carrying out and monitoring the environmental regulations.

Vector - A vertebrate or invertebrate that can transmit toxic, radioactive, or infectious material from a disposal or storage site to uncontrolled areas. Vectors include flies, birds, and mice.

Waste Information Data System (WIDS) - A database that identifies waste management units on the Hanford Site. It is a subset of the ESD.

Waste Management - The activity involved with storing, disposing of, shipping, handling, and monitoring all radioactive waste.

Waste Sites - Any facility used for the planned disposal of hazardous, radioactive, toxic, or nonradioactive/nontoxic waste.

Water Table - The upper boundary of an unconfined aquifer below which saturated groundwater occurs.

Table B-1. Radionuclide Nomenclature

Radionuclide	Symbol	Half-Life	Radionuclide	Symbol	Half-Life
tritium	^{3}H	12.3 yr	cesium-137	^{137}Cs	30.3 yr
beryllium-7	^{7}Be	53.28 d	cerium-144	^{144}Ce	284.6 d
carbon-14	^{14}C	5,715 yr	promethium-147	^{147}Pm	13.4 m
sodium-22	^{22}Na	2.6 yr	europium-152	^{152}Eu	13.5 y
potassium-40	^{40}K	1.26×10^{9} yr	europium-154	^{154}Eu	8.6 y
argon-41	^{41}Ar	1.8 h	europium-155	^{155}Eu	4.7 yr
chromium-51	^{51}Cr	27.7 d	thallium-208	^{208}Tl	3.1 min
manganese-54	^{54}Mn	312 d	bismuth-212	^{212}Bi	60.6 min
cobalt-57	^{57}Co	271.8 d	lead-212	^{212}Pb	10.6 h
cobalt-60	^{60}Co	5.3 yr	polonium-212	^{212}Po	0.3×10^{-6} s
nickel-63	^{63}Ni	100 yr	polonium-216	^{216}Po	0.15 s
zinc-65	^{65}Zn	243.8 d	radon-220	^{220}Rn	55.6 s
krypton-85	^{85}Kr	10.7 yr	radium-226	^{226}Ra	1,600 yr
strontium-89	^{89}Sr	50.5 d	radium-228	^{228}Ra	5.75 yr
strontium-90	^{90}Sr	29.1 yr	thorium-232	^{232}Th	1.4×10^{10} yr
niobium-95	^{95}Nb	35.0 d	uranium total	U or uranium	--
zirconium-95	^{95}Zr	64.0 d	uranium-234	^{234}U	2.4×10^{5} yr
molybdenum-99	^{99}Mo	2.7 d	uranium-235	^{235}U	7×10^{8} yr
technetium-99	^{99}Tc	2.12×10^{5} yr	uranium-236	^{236}U	2.3×10^{7} yr
ruthenium-103	^{103}Ru	39.4 d	uranium-238	^{238}U	4.5×10^{9} yr
ruthenium-106	^{106}Ru	1.0 yr	plutonium-238	^{238}Pu	87.7 yr
tin-113	^{113}Sn	115 d	neptunium-239	^{239}Np	2.4 d
antimony-125	^{125}Sb	2.7 yr	plutonium-239	^{239}Pu	2.4×10^{4} yr
iodine-129	^{129}I	1.7×10^{7} yr	plutonium-240	^{240}Pu	6537 yr
iodine-131	^{131}I	8.0 d	plutonium-241	^{241}Pu	14.4 yr
barium-133	^{133}Ba	10.53 yr	americium-241	^{241}Am	433 yr
cesium-134	^{134}Cs	2.1 yr			

APPENDIX C

AMBIENT AIR MONITORING FIGURES AND TABLES

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Figure C-1. The 100 KE/KW Reactors Area Air Sampler Locations.

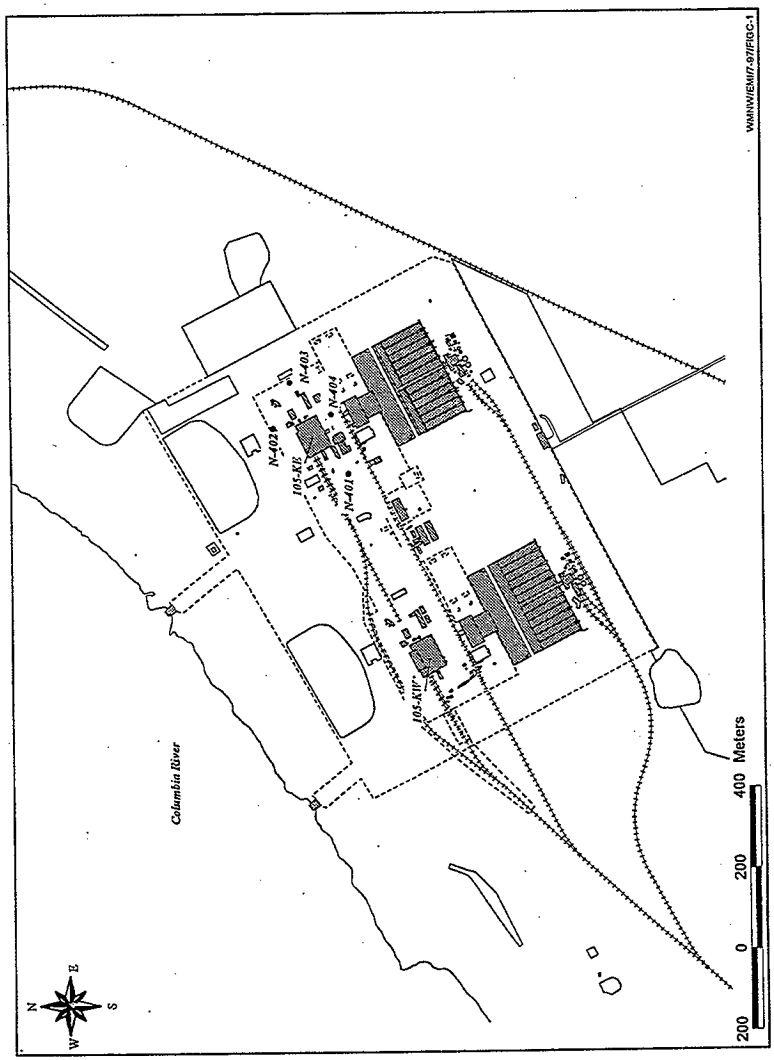

Figure C-2. The 100N Reactor Area Air Sampler Locations.

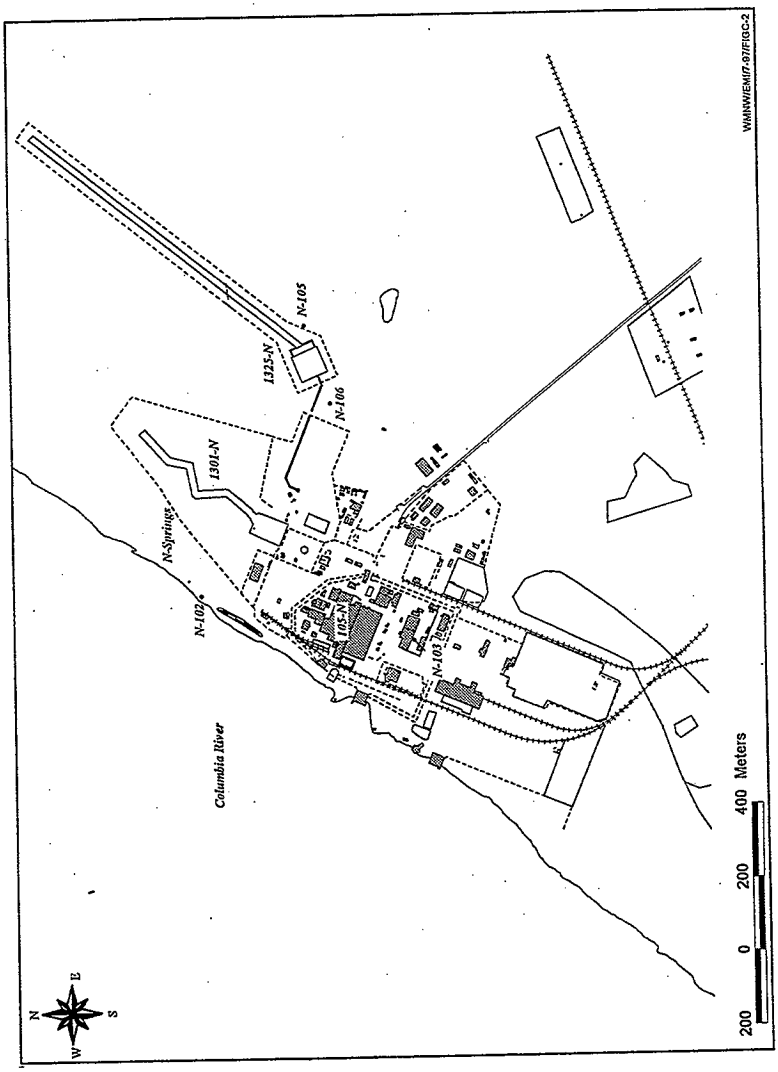

Figure C-3. The 200 East Area Air Sampler Locations.

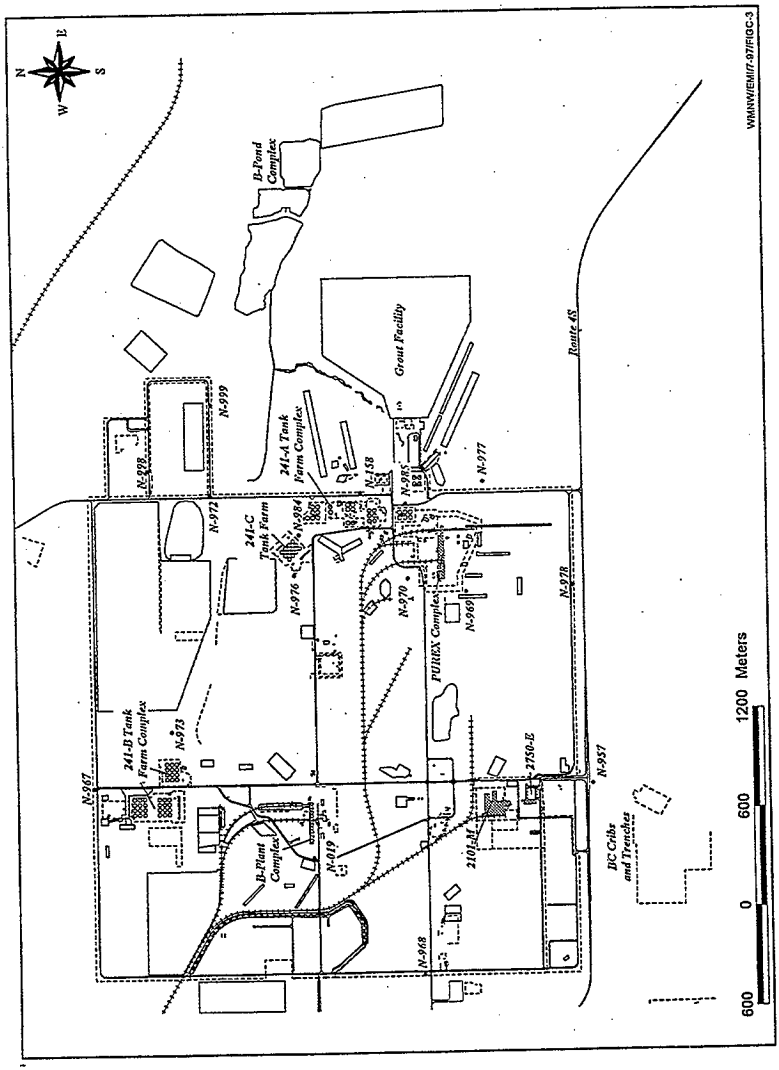

Figure C-4. The 200 West Area Air Sampler Locations.

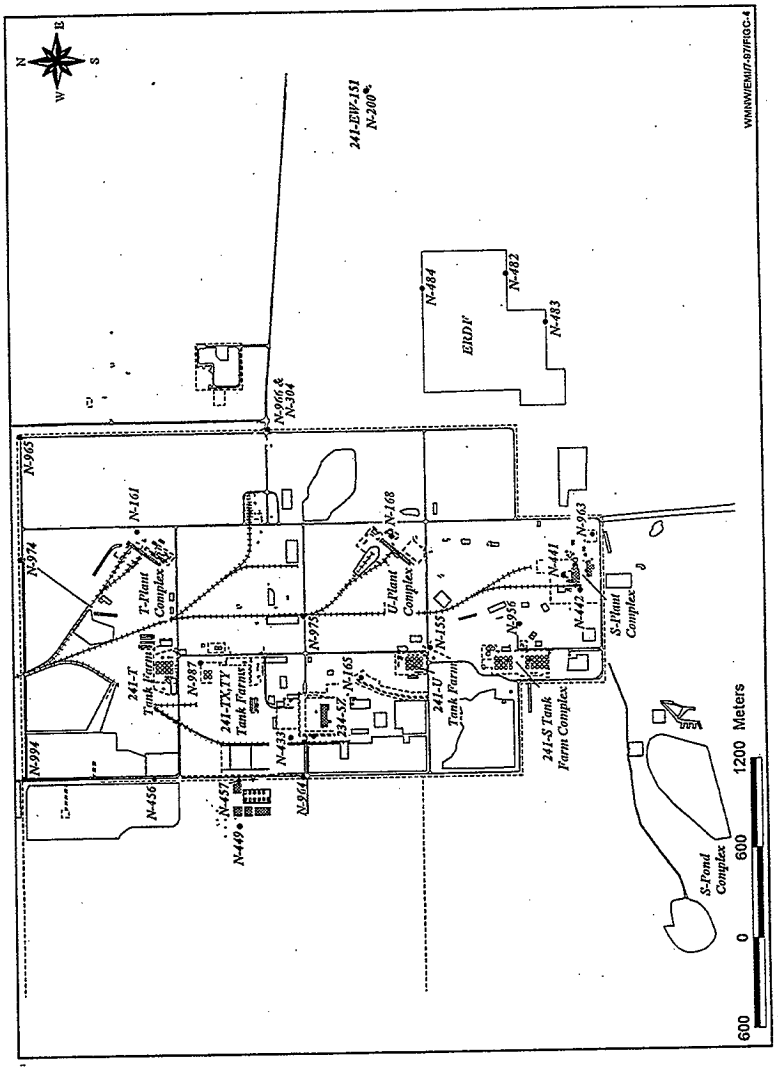

Figure C-5. The 300 Area TEDF Air Sampler Location.

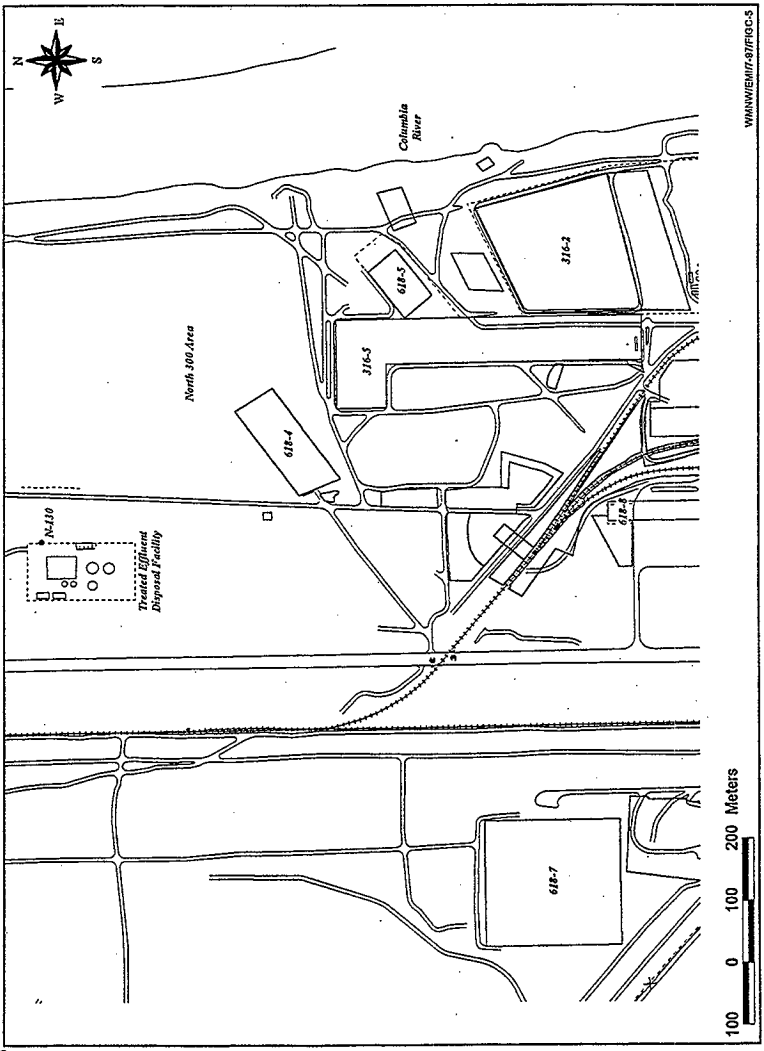

Table C-6. The 600 Area Air Sampler Location.

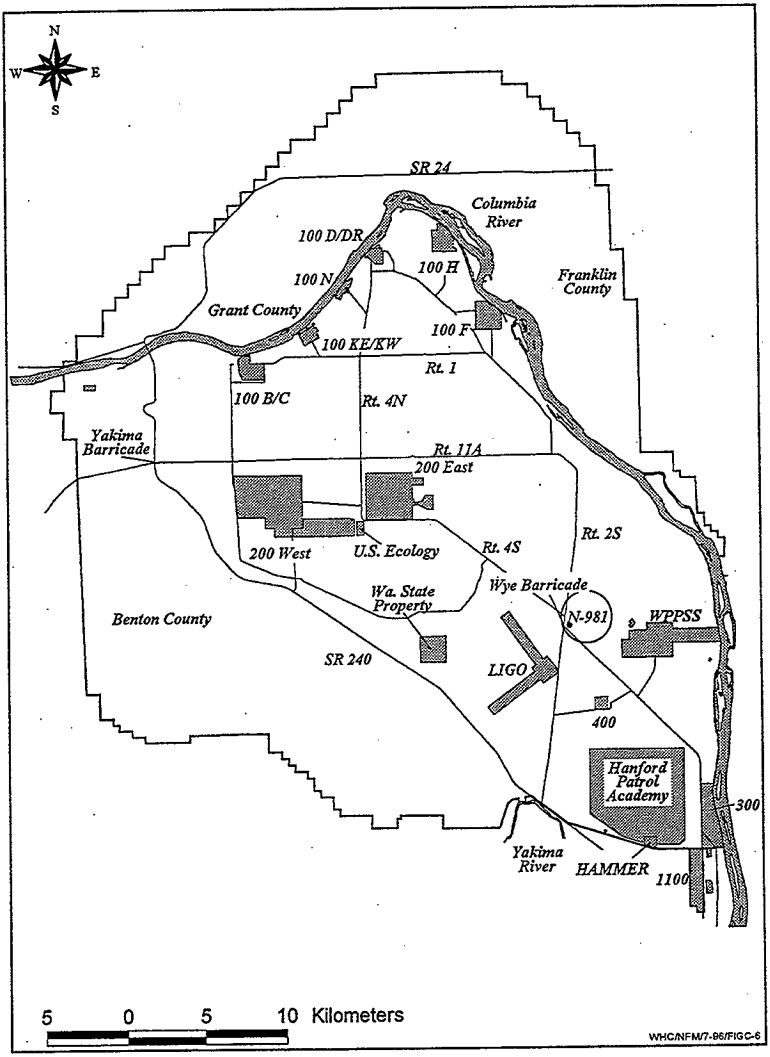

Figure C-7. The B/C Air Sampler Locations.

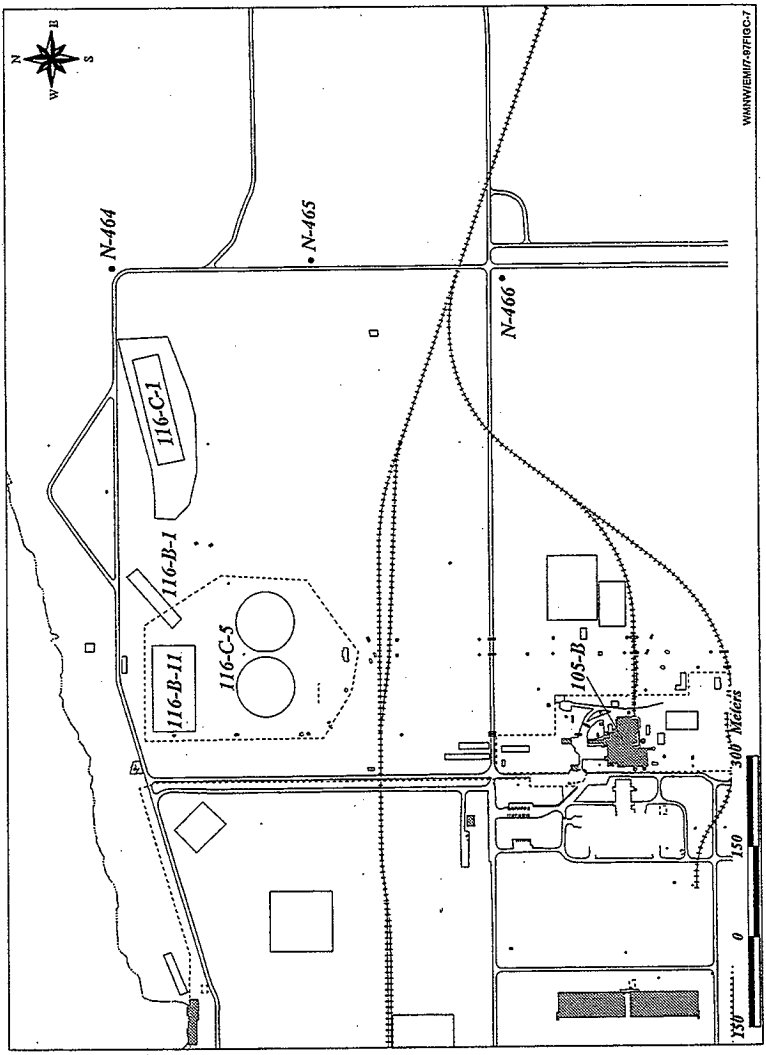

Figure C-8. The 100 D/DR Air Sampler Locations.

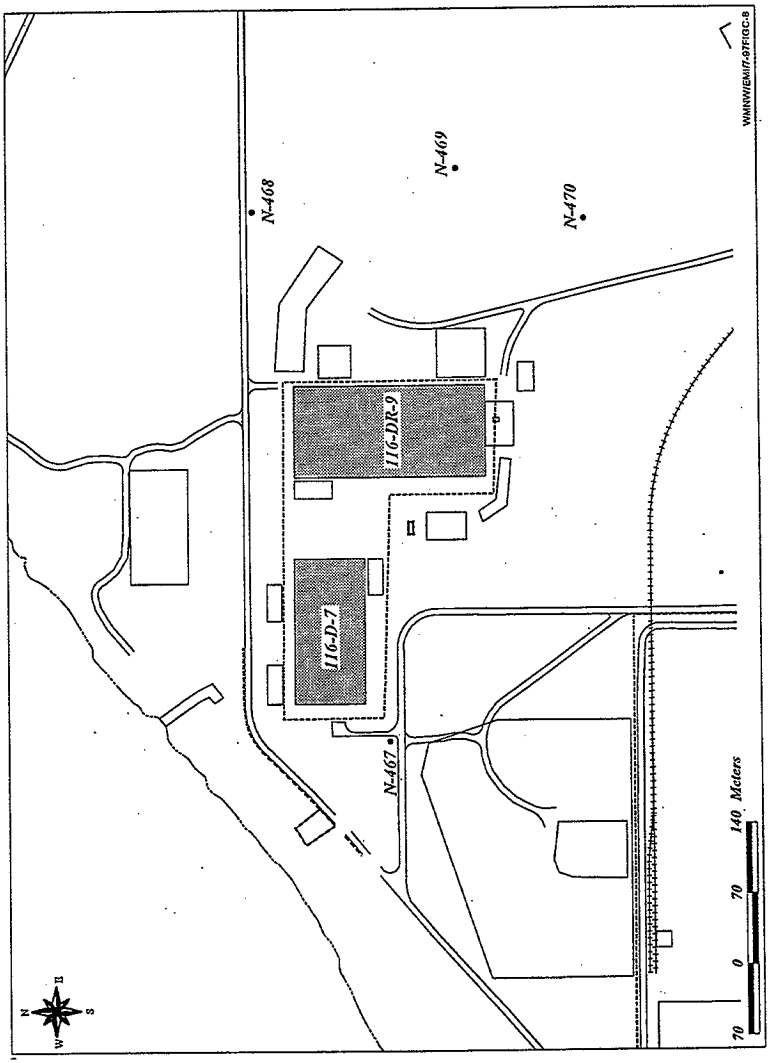

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N102	Co-60	-2.90E-04	166	1.40E-04	42	-7.50E-05	573.3
N102	Zn-65			-5.00E-05	210		
N102	Sr-90	3.10E-04	34	9.60E-05	180	2.00E-04	105.4
N102	Ru-103			-1.20E-05	310		
N102	Ru-106			-1.30E-04	310		
N102	Sn-113			-2.00E-05	250		
N102	Sb-125			6.10E-06	1000		
N102	Cs-134			1.30E-05	380		
N102	Cs-137	2.20E-04	147	6.50E-05	79	1.40E-04	108.8
N102	Ce-144			-1.80E-04	230		
N102	Eu-152			6.80E-05	150		
N102	Eu-154	8.40E-05	1237	-4.10E-05	320	2.20E-05	581.4
N102	Eu-155	-2.00E-04	346	-9.10E-05	120	-1.50E-04	74.9
N102	U-234	8.70E-06	109	1.60E-05	50	1.20E-05	59.1
N102	U-235	1.60E-06	301	6.60E-06	70	4.10E-06	122
N102	U-238	8.90E-06	107	1.40E-05	50	1.10E-05	44.5
N102	Pu-238	-1.30E-07	140	8.90E-07	200	3.80E-07	268.4
N102	Pu239/40	4.70E-06	85	1.60E-05	50	1.00E-05	109.2
N103	Co-60	3.20E-04	82	6.60E-05	68	1.90E-04	131.6
N103	Zn-65			-7.90E-05	120		
N103	Sr-90	2.80E-04	34	-8.10E-05	190	1.00E-04	362.8
N103	Ru-103			1.10E-05	300		
N103	Ru-106			-4.60E-05	770		
N103	Sn-113			-1.10E-06	1000		
N103	Sb-125			-4.30E-05	220		
N103	Cs-134			2.80E-05	150		
N103	Cs-137	2.00E-05	1443	2.40E-05	170	2.20E-05	18.2
N103	Ce-144			-4.50E-05	890		
N103	Eu-152			-2.20E-05	550		
N103	Eu-154	1.40E-04	202	-6.00E-05	180	4.00E-05	500
N103	Eu-155	3.60E-04	173	7.40E-05	150	2.20E-04	131.8
N103	U-234	6.90E-06	93	1.80E-05	50	1.20E-05	89.2
N103	U-235	-3.10E-07	116	1.30E-05	60	6.30E-06	209.8
N103	U-238	2.10E-06	181	8.90E-06	70	5.50E-06	123.6
N103	Pu-238	4.80E-07	217	9.60E-07	350	7.20E-07	66.7
N103	Pu239/40	5.70E-06	100	2.90E-06	120	4.30E-06	65.1
N105	Co-60	4.20E-04	147	3.00E-04	37	3.60E-04	33.3
N105	Zn-65			1.70E-04	92		
N105	Sr-90	3.00E-04	34	-2.10E-04	100	4.50E-05	1133
N105	Ru-103			1.80E-05	340		
N105	Ru-106			4.50E-05	1000		
N105	Sn-113			3.70E-05	200		
N105	Sb-125			4.70E-06	1000		
N105	Cs-134			-1.90E-05	370		

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N105	Cs-137	1.30E-04	318	-1.90E-05	360	5.60E-05	268.5
N105	Ce-144			5.10E-04	130		
N105	Eu-152			3.10E-05	540		
N105	Eu-154			-5.00E-05	410		
N105	Eu-155	-3.50E-05	2043	-6.90E-05	260	-5.20E-05	65.4
N105	U-234	4.00E-06	150	7.20E-05	30	3.80E-05	178.9
N105	U-235	2.80E-06	150	9.20E-06	100	6.00E-06	106.7
N105	U-238	5.30E-06	113	7.70E-05	30	4.10E-05	174.2
N105	Pu-238	-5.00E-08	201	8.50E-06	90	4.20E-06	202.4
N105	Pu239/40	2.40E-06	107	1.40E-06	200	1.90E-06	52.6
N106	Co-60	3.60E-04	246	1.70E-04	41	2.70E-04	71.7
N106	Zn-65			-3.70E-05	280		
N106	Sr-90	4.50E-05	155	2.00E-04	70	1.20E-04	126.5
N106	Ru-103			3.80E-05	110		
N106	Ru-106			-2.90E-04	140		
N106	Sn-113			8.10E-06	540		
N106	Sb-125			1.90E-06	1000		
N106	Cs-134			4.60E-05	100		
N106	Cs-137			5.20E-05	110		
N106	Ce-144			-2.70E-04	150		
N106	Eu-152			-9.50E-06	1000		
N106	Eu-154	1.90E-03	90	-2.00E-05	710	9.40E-04	204.3
N106	Eu-155	2.20E-03	67	-1.00E-04	110	1.00E-03	219
N106	U-234	1.80E-05	109	2.10E-05	40	1.90E-05	15.4
N106	U-235	8.00E-06	148	1.10E-05	60	9.50E-06	31.6
N106	U-238	1.90E-05	101	1.40E-05	50	1.70E-05	30.3
N106	Pu-238	-4.60E-07	115	2.10E-06	250	8.20E-07	312.2
N106	Pu239/40	3.50E-06	155	4.80E-05	40	2.60E-05	172.8
N401	Co-60	2.00E-05	0	-2.20E-05	240	-9.00E-07	4688
N401	Zn-65	2.70E-05	0	-1.00E-05	1000	8.50E-06	435.3
N401	Sr-90	1.00E-04	100	4.50E-04	30	2.80E-04	126.7
N401	Ru-103	-3.00E-05	0	5.60E-06	720	-1.20E-05	293.3
N401	Ru-106	-1.30E-04	0	-1.40E-05	1000	-7.10E-05	160.6
N401	Sn-113	1.90E-05	0	-4.30E-05	120	-1.20E-05	522.7
N401	Sb-125	5.30E-05	0	-9.60E-05	120	-2.20E-05	693
N401	Cs-134	-2.10E-05	0	3.40E-05	130	6.50E-06	846.2
N401	Cs-137	1.20E-03	15.3	3.80E-03	16	2.50E-03	101.6
N401	Ce-144			2.30E-04	200		
N401	Eu-152	5.30E-08	0	-1.40E-05	840	-7.00E-06	201.5
N401	Eu-154	6.10E-05	0	7.40E-05	190	6.80E-05	18.9
N401	Eu-155	1.10E-04	0	-6.10E-05	180	2.30E-05	730.4
N401	U-234	1.50E-05	40	1.60E-05	50	1.50E-05	9.2
N401	U-235	6.20E-06	60	7.50E-07	450	3.50E-06	156.7
N401	U-238	1.00E-05	50	1.00E-05	50	1.00E-05	1
N401	Pu-238	1.10E-06	0	3.00E-06	160	2.10E-06	91.3

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N401	Pu239/40	2.20E-05	40	3.00E-06	140	1.30E-05	152.9
N401	Am-241	1.50E-05	60	7.50E-06	80	1.10E-05	67.8
N402	Co-60	1.20E-05	0	1.60E-05	290	1.40E-05	26.1
N402	Zn-65	2.90E-06	0	-1.10E-04	100	-5.40E-05	210.9
N402	Sr-90	-2.10E-04	0	1.60E-04	90	-2.30E-05	1622
N402	Ru-103	4.50E-06	0	-3.00E-05	130	-1.30E-05	271.5
N402	Ru-106	-2.30E-04	0	8.90E-05	420	-7.30E-05	443.8
N402	Sn-113	-1.10E-05	0	-1.80E-06	1000	-6.30E-06	142.9
N402	Sb-125	-3.70E-05	0	2.30E-05	410	-7.10E-06	847.9
N402	Cs-134	-1.30E-06	0	-1.30E-05	350	-7.10E-06	163.9
N402	Cs-137	6.00E-05	67.3	2.10E-04	38	1.30E-04	111.3
N402	Ce-144			-1.30E-04	300		
N402	Eu-152	4.90E-06	0	-2.20E-05	450	-8.50E-06	316.1
N402	Eu-154	-9.70E-05	0	-6.90E-05	190	-8.30E-05	34.1
N402	Eu-155	1.80E-05	0	2.00E-05	510	1.90E-05	11.6
N402	U-234	3.20E-05	30	2.70E-05	30	3.00E-05	17.3
N402	U-235	9.60E-06	60	9.40E-06	50	9.50E-06	2.3
N402	U-238	1.50E-05	40	2.80E-05	30	2.20E-05	58.1
N402	Pu-238	5.60E-07	0	-1.80E-06	220	-6.20E-07	379.7
N402	Pu239/40	6.40E-06	60	1.10E-05	50	8.70E-06	52.7
N402	Am-241	1.70E-05	50	8.10E-06	70	1.30E-05	72.4
N403	Co-60	4.10E-05	0	-3.10E-05	150	5.10E-06	1427
N403	Zn-65	-5.30E-05	0	-1.90E-04	100	-1.20E-04	113.3
N403	Sr-90	-7.30E-05	0	2.90E-04	50	1.10E-04	333.6
N403	Ru-103	-9.70E-07	0	3.20E-05	120	1.60E-05	212.5
N403	Ru-106	-2.10E-04	0	2.20E-04	170	6.00E-06	7133
N403	Sn-113	9.90E-06	0	-1.90E-06	1000	4.00E-06	295.1
N403	Sb-125	2.00E-05	0	-8.60E-05	120	-3.30E-05	322.8
N403	Cs-134	-6.80E-06	0	6.10E-06	690	-3.60E-07	3588
N403	Cs-137	9.20E-05	52	1.20E-04	52	1.10E-04	26.8
N403	Ce-144			1.70E-04	200		
N403	Eu-152	5.70E-05	0	-5.50E-06	1000	2.60E-05	242.7
N403	Eu-154	9.30E-05	0	-8.00E-05	150	6.30E-06	2719
N403	Eu-155	-2.90E-05	0	4.10E-05	230	6.00E-06	1155
N403	U-234	8.40E-06	50	1.30E-05	50	1.10E-05	43.2
N403	U-235	4.40E-06	70	5.10E-06	90	4.70E-06	15.6
N403	U-238	2.30E-06	90	1.30E-05	50	7.60E-06	140.1
N403	Pu-238	6.10E-07	0	1.40E-06	250	1.00E-06	77.9
N403	Pu239/40	1.40E-05	50	5.10E-06	90	9.50E-06	93.2
N403	Am-241	2.00E-05	40	2.70E-05	50	2.40E-05	29.3
N404	Co-60	1.70E-05	0	1.40E-05	230	1.60E-05	20.5
N404	Zn-65	-7.70E-05	0	-1.00E-04	100	-8.80E-05	26.2
N404	Sr-90	4.50E-05	0	4.00E-05	280	4.30E-05	12.2
N404	Ru-103	7.20E-06	0	-3.30E-06	1000	2.00E-06	535.9
N404	Ru-106	-2.40E-05	0	2.90E-04	110	1.30E-04	235.6

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N404	Sn-113	-3.30E-05	0	3.60E-05	110	1.70E-06	4035
N404	Sb-125	-3.80E-05	0	-6.90E-05	130	-5.40E-05	56.7
N404	Cs-134	3.70E-05	0	5.30E-06	650	2.10E-05	150.4
N404	Cs-137	1.30E-04	49.3	8.70E-04	17	5.00E-04	149.4
N404	Ce-144			9.00E-05	400		
N404	Eu-152	-8.80E-06	0	1.10E-05	790	1.10E-06	1837
N404	Eu-154	8.30E-05	0	6.00E-05	170	7.20E-05	32.4
N404	Eu-155	3.00E-05	0	5.60E-05	180	4.30E-05	60.2
N404	U-234	1.50E-05	40	2.30E-05	40	1.90E-05	43.4
N404	U-235	6.10E-06	70	7.30E-06	70	6.70E-06	18.6
N404	U-238	6.50E-06	60	2.00E-05	40	1.30E-05	102.5
N404	Pu-238	4.10E-06	80	4.00E-11	1000	2.10E-06	200
N404	Pu239/40	4.30E-06	80	8.60E-06	60	6.50E-06	66.3
N404	Am-241	1.10E-05	60	8.60E-06	60	9.80E-06	24.5
N019	Co-60	6.30E-05	79	-4.30E-05	120	1.00E-05	1060
N019	Zn-65	-2.10E-05	420	-1.20E-04	100	-7.00E-05	140.4
N019	Sr-90	-3.60E-05	140	-4.50E-04	100	-2.40E-04	170.4
N019	Ru-103	-1.60E-05	250	1.00E-05	360	-3.00E-06	866.7
N019	Ru-106	3.80E-05	990	1.50E-04	240	9.40E-05	119.1
N019	Sn-113	1.10E-05	430	-1.60E-05	280	-2.50E-06	1080
N019	Sb-125	-7.30E-05	140	-2.10E-05	490	-4.70E-05	110.6
N019	Cs-134	2.10E-05	210	-3.10E-06	1000	8.90E-06	269.3
N019	Cs-137	1.70E-04	42	1.90E-04	50	1.80E-04	11.1
N019	Ce-144	3.10E-04	130	1.90E-04	210	2.50E-04	48
N019	Eu-152	-5.00E-05	150	8.00E-05	130	1.50E-05	866.7
N019	Eu-154	3.00E-05	390	-1.20E-04	120	-4.50E-05	333.3
N019	Eu-155	-4.90E-05	250	5.40E-05	210	2.50E-06	4119
N019	U-234	2.00E-05	55	1.60E-05	50	1.80E-05	22.2
N019	U-235	1.20E-05	70	7.30E-06	70	9.60E-06	48.7
N019	U-238	5.70E-06	100	1.10E-05	60	8.30E-06	63.5
N019	Pu-238	-7.30E-07	430	2.90E-05	40	1.40E-05	210.3
N019	Pu239/40	1.50E-05	70	8.10E-06	70	1.20E-05	59.7
N155	Co-60	-7.90E-06	500	-3.60E-05	100	-2.20E-05	128
N155	Zn-65	-2.00E-05	400	2.10E-05	400	5.00E-07	8199
N155	Sr-90	1.50E-04	80	-4.00E-05	320	5.50E-05	345.5
N155	Ru-103	1.20E-05	260	1.10E-05	280	1.20E-05	8.7
N155	Ru-106	-4.30E-04	100	-9.80E-05	320	-2.60E-04	125.8
N155	Sn-113	-5.30E-06	740	2.90E-05	130	1.20E-05	289.5
N155	Sb-125	4.80E-05	190	-9.80E-05	110	-2.50E-05	584
N155	Cs-134	-1.00E-05	390	2.80E-06	1000	-3.60E-06	355.6
N155	Cs-137	2.10E-04	30	1.10E-04	50	1.60E-04	62.5
N155	Ce-144	1.70E-06	1000	9.80E-06	1000	5.80E-06	140.9
N155	Eu-152	2.20E-05	310	3.70E-05	250	3.00E-05	50.8
N155	Eu-154	5.10E-05	200	-4.70E-05	200	2.00E-06	4899
N155	Eu-155	-4.50E-05	210	1.10E-04	91	3.30E-05	476.9

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N155	U-234	1.70E-05	50	2.80E-05	40	2.30E-05	48.9
N155	U-235	4.70E-06	110	8.00E-06	70	6.40E-06	52
N155	U-238	6.90E-06	80	1.20E-05	50	9.50E-06	54
N155	Pu-238	-1.50E-06	250	8.60E-07	350	-3.20E-07	737.5
N155	Pu239/40	1.60E-05	60	1.60E-05	50	1.60E-05	0
N158	Co-60	4.10E-05	110	3.00E-05	180	3.60E-05	31
N158	Zn-65	-1.20E-04	100	5.50E-05	210	-3.30E-05	538.5
N158	Sr-90	5.40E-05	220	2.30E-04	80	1.40E-04	123.9
N158	Ru-103	1.20E-05	310	3.00E-05	130	2.10E-05	85.7
N158	Ru-106	-2.30E-04	170	2.70E-04	150	2.00E-05	2499
N158	Sn-113	1.70E-05	270	1.70E-05	310	1.70E-05	0
N158	Sb-125	9.40E-05	120	1.50E-04	77	1.20E-04	45.9
N158	Cs-134	5.90E-05	76	-1.40E-05	340	2.30E-05	324.4
N158	Cs-137	2.50E-04	41	3.80E-04	28	3.20E-04	41.3
N158	Ce-144	-8.10E-05	510	2.30E-04	200	7.40E-05	417.4
N158	Eu-152	-2.10E-05	380	-2.40E-05	600	-2.30E-05	13.3
N158	Eu-154	-7.00E-07	1000	3.90E-05	390	1.90E-05	207.3
N158	Eu-155	5.10E-05	240	8.50E-06	1000	3.00E-05	142.9
N158	U-234	1.60E-05	60	2.50E-05	40	2.00E-05	43.9
N158	U-235	2.30E-05	50	1.40E-05	50	1.90E-05	48.6
N158	U-238	2.00E-05	50	1.20E-05	50	1.60E-05	50
N158	Pu-238	-1.80E-06	240	9.00E-07	350	-4.50E-07	600
N158	Pu239/40	-3.20E-06	210	1.30E-05	60	4.90E-06	330.6
N161	Co-60	4.80E-05	110	-4.20E-05	110	3.00E-06	2999
N161	Zn-65	-6.10E-05	170	-8.40E-05	130	-7.20E-05	31.7
N161	Sr-90	8.90E-05	100	1.00E-03	30	5.40E-04	167.3
N161	Ru-103	2.50E-05	180	-1.50E-05	260	5.00E-06	800
N161	Ru-106	-4.70E-04	100	-3.00E-04	140	-3.90E-04	44.2
N161	Sn-113	1.50E-05	320	-4.30E-05	110	-1.40E-05	414.3
N161	Sb-125	-1.10E-05	930	-3.70E-05	280	-2.40E-05	108.3
N161	Cs-134	3.20E-05	140	-2.20E-05	220	5.00E-06	1080
N161	Cs-137	5.80E-04	24	1.30E-04	62	3.50E-04	126.8
N161	Ce-144	-2.80E-05	1000	1.30E-04	340	5.10E-05	309.8
N161	Eu-152	4.50E-05	170	-9.60E-05	120	-2.60E-05	552.9
N161	Eu-154	2.70E-05	470	-2.10E-05	650	3.00E-06	1600
N161	Eu-155	1.80E-05	620	1.80E-05	610	1.80E-05	0
N161	U-234	1.70E-05	50	1.20E-05	50	1.40E-05	34.5
N161	U-235	1.30E-06	260	8.40E-06	70	4.90E-06	146.4
N161	U-238	1.70E-05	50	9.80E-06	60	1.30E-05	53.7
N161	Pu-238	-2.90E-07	1000	2.70E-06	100	1.20E-06	248.1
N161	Pu239/40	2.20E-05	50	2.40E-05	40	2.30E-05	8.7
N165	Co-60	2.50E-05	0	6.00E-06	750	1.50E-05	122.6
N165	Zn-65	-3.20E-05	0	-1.50E-04	100	-9.10E-05	128.9
N165	Sr-90	1.00E-04	210	1.50E-04	80	1.30E-04	38.1
N165	Ru-103	1.10E-05	0	-3.70E-05	100	-1.30E-05	378.1

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N165	Ru-106	-1.50E-04	0	3.90E-04	97	1.20E-04	444.6
N165	Sn-113	2.80E-05	0	-3.80E-05	110	-5.10E-06	1290
N165	Sb-125	-3.50E-05	0	-4.60E-05	200	-4.00E-05	28.3
N165	Cs-134	-3.00E-05	0	5.40E-06	790	-1.20E-05	289.6
N165	Cs-137	4.10E-04	20.6	5.70E-05	76	2.30E-04	150.9
N165	Ce-144			1.70E-05	1000		
N165	Eu-152	-2.10E-05	0	-6.30E-05	150	-4.20E-05	101.1
N165	Eu-154	2.10E-05	0	-1.60E-05	780	2.70E-06	1363
N165	Eu-155	1.00E-04	0	7.00E-05	150	8.70E-05	40
N165	U-234	1.70E-05	50	1.20E-05	50	1.40E-05	34.5
N165	U-235	7.50E-06	70	6.70E-06	70	7.10E-06	11
N165	U-238	1.00E-05	60	1.20E-05	50	1.10E-05	16.2
N165	Pu-238	1.90E-06	120	1.90E-06	140	1.90E-06	0
N165	Pu239/40	7.50E-05	25	5.70E-05	30	6.60E-05	27
N165	Am-241	2.70E-05	40	2.40E-05	40	2.60E-05	12.5
N168	Co-60	4.00E-05	170	-2.60E-05	210	7.00E-06	942.9
N168	Zn-65	2.50E-05	540	-4.00E-05	260	-7.50E-06	866.7
N168	Sr-90	7.60E-05	150	-1.90E-04	100	-5.70E-05	466.7
N168	Ru-103	-2.00E-05	330	3.00E-05	150	5.00E-06	999
N168	Ru-106	-1.30E-04	430	-1.80E-04	250	-1.50E-04	32.3
N168	Sn-113	3.10E-06	1000	-6.80E-06	720	-1.80E-06	535.1
N168	Sb-125	-1.90E-05	770	-1.20E-04	110	-7.00E-05	145.3
N168	Cs-134	-1.20E-05	530	-3.70E-05	140	-2.50E-05	102
N168	Cs-137	6.50E-04	24	2.00E-04	52	4.30E-04	105.9
N168	Ce-144	1.90E-04	300	-6.00E-04	100	-2.10E-04	385.4
N168	Eu-152	-3.80E-05	300	-1.10E-04	100	-7.40E-05	97.3
N168	Eu-154	6.70E-05	280	-8.00E-05	190	-6.50E-06	2261
N168	Eu-155	-1.20E-05	1000	2.50E-06	1000	-4.80E-06	305.3
N168	U-234	5.00E-05	40	2.00E-05	50	3.50E-05	85.7
N168	U-235	1.50E-05	80	6.70E-06	90	1.10E-05	76.5
N168	U-238	2.10E-05	60	1.30E-05	60	1.70E-05	47.1
N168	Pu-238	-2.10E-06	290	-1.10E-06	200	-1.60E-06	62.5
N168	Pu239/40	5.60E-06	210	2.70E-05	50	1.60E-05	131.3
N200	Co-60	1.80E-05	350	3.20E-05	130	2.50E-05	56
N200	Zn-65	7.10E-06	1000	-4.60E-05	180	-1.90E-05	273
N200	Sr-90	1.70E-05	320	-1.20E-04	100	-5.20E-05	266
N200	Ru-103	-1.60E-05	320	4.10E-07	1000	-7.80E-06	210.5
N200	Ru-106	-8.80E-05	580	3.80E-05	850	-2.50E-05	504
N200	Sn-113	-9.00E-06	630	2.60E-05	150	8.50E-06	411.8
N200	Sb-125	-3.60E-05	350	1.20E-06	1000	-1.70E-05	213.8
N200	Cs-134	1.80E-05	330	1.70E-05	220	1.70E-05	5.7
N200	Cs-137	4.30E-05	140	4.50E-06	880	2.40E-05	162.1
N200	Ce-144	-4.70E-05	1000	1.40E-04	260	4.70E-05	402.2
N200	Eu-152	-2.50E-05	400	-5.40E-05	160	-4.00E-05	73.4
N200	Eu-154	-3.40E-05	510	9.10E-05	120	2.90E-05	438.6

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N200	Eu-155	-3.80E-05	360	1.70E-06	1000	-1.80E-05	218.7
N200	U-234	2.20E-05	60	2.00E-05	40	2.10E-05	9.5
N200	U-235	9.50E-06	90	3.20E-06	100	6.30E-06	99.2
N200	U-238	2.00E-05	60	1.60E-05	50	1.80E-05	22.2
N200	Pu-238	-4.10E-07	600	1.00E-06	200	3.00E-07	478
N200	Pu239/40	1.50E-05	75	1.60E-05	60	1.50E-05	6.5
N304	Co-60	4.50E-05	81	1.20E-05	330	2.80E-05	115.8
N304	Zn-65	1.70E-05	450	-3.70E-05	240	-1.00E-05	540
N304	Sr-90	-2.20E-05	750	1.60E-04	100	6.90E-05	263.8
N304	Ru-103	-2.30E-05	150	1.50E-06	1000	-1.10E-05	227.9
N304	Ru-106	-1.30E-06	1000	-3.40E-06	1000	-2.30E-06	89.4
N304	Sn-113	3.00E-06	1000	1.40E-05	310	8.50E-06	129.4
N304	Sb-125	-4.20E-05	220	5.90E-05	190	8.50E-06	1188
N304	Cs-134	-9.30E-06	430	-3.00E-05	140	-2.00E-05	105.3
N304	Cs-137	-7.70E-06	530	9.90E-05	53	4.60E-05	233.7
N304	Ce-144	-1.50E-04	230	3.10E-05	1000	-6.00E-05	304.2
N304	Eu-152	1.30E-05	500	5.10E-07	1000	6.80E-06	184.9
N304	Eu-154	1.50E-05	700	-8.40E-05	140	-3.50E-05	287
N304	Eu-155	5.00E-05	190	1.00E-05	900	3.00E-05	133.3
N304	U-234	8.70E-06	130	1.60E-05	50	1.20E-05	59.1
N304	U-235	8.70E-06	120	6.00E-06	80	7.40E-06	36.7
N304	U-238	1.40E-05	80	7.90E-06	60	1.10E-05	55.7
N304	Pu-238	3.30E-07	940	1.60E-06	140	9.60E-07	131.6
N304	Pu239/40	1.70E-05	60	1.70E-05	50	1.70E-05	0
N433	Co-60	9.00E-05	65.5	2.70E-06	1000	4.60E-05	188.3
N433	Zn-65	5.70E-05	0	-7.10E-05	140	-6.90E-06	1857
N433	Sr-90	-6.20E-05	0	4.00E-04	40	1.70E-04	273.5
N433	Ru-103	-8.50E-06	0	-1.10E-05	340	-9.80E-06	25.1
N433	Ru-106	-2.70E-04	0	-9.10E-05	380	-1.80E-04	97.8
N433	Sn-113	-1.60E-05	0	-1.10E-05	400	-1.30E-05	35.2
N433	Sb-125	-2.20E-05	0	1.90E-06	1000	-1.00E-05	237.1
N433	Cs-134	-1.80E-05	0	1.80E-05	230	1.50E-07	9999
N433	Cs-137	1.20E-04	51.6	1.80E-04	39	1.50E-04	41.6
N433	Ce-144			-2.30E-04	170		
N433	Eu-152	3.00E-05	0	-4.30E-05	230	-6.40E-06	1154
N433	Eu-154	4.10E-05	0	-7.40E-05	190	-1.70E-05	691.6
N433	Eu-155	-9.60E-05	0	-1.10E-05	930	-5.30E-05	158.8
N433	U-234	2.20E-05	60	1.20E-05	50	1.70E-05	59.2
N433	U-235	8.30E-06	0	1.30E-06	240	4.80E-06	145.7
N433	U-238	1.20E-05	80	8.80E-06	60	1.00E-05	28.3
N433	Pu-238	2.30E-06	0	2.50E-06	160	2.40E-06	9.2
N433	Pu239/40	1.40E-05	60	2.00E-05	40	1.70E-05	31.9
N433	Am-241	1.60E-05	60	1.30E-05	50	1.40E-05	20.1
N441	Co-60	5.70E-05	74	2.40E-05	160	4.00E-05	81.5
N441	Zn-65	-1.00E-04	100	5.10E-05	170	-2.50E-05	616.3

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N441	Sr-90	7.20E-05	250	2.90E-04	50	1.80E-04	120.4
N441	Ru-103	1.90E-05	180	-2.10E-05	150	-1.00E-06	3999
N441	Ru-106	-5.50E-05	660	-1.20E-04	260	-8.80E-05	74.3
N441	Sn-113	1.20E-05	330	-9.90E-06	350	1.10E-06	2085
N441	Sb-125	1.20E-05	790	-5.20E-05	160	-2.00E-05	320
N441	Cs-134	-1.40E-05	320	3.10E-07	1000	-6.80E-06	209.1
N441	Cs-137	1.70E-04	40	8.10E-05	54	1.30E-04	70.9
N441	Ce-144	9.70E-05	390	6.40E-05	480	8.10E-05	41
N441	Eu-152	1.20E-05	630	7.70E-05	73	4.40E-05	146.1
N441	Eu-154	4.70E-05	230	2.40E-05	450	3.60E-05	64.8
N441	Eu-155	-4.50E-05	250	2.40E-05	340	-1.00E-05	657.1
N441	U-234	2.80E-05	50	2.00E-05	40	2.40E-05	33.3
N441	U-235	2.60E-06	170	8.20E-06	60	5.40E-06	103.7
N441	U-238	1.40E-05	70	1.50E-05	50	1.50E-05	6.9
N441	Pu-238	1.40E-06	230	1.30E-06	200	1.40E-06	7.4
N441	Pu239/40	1.00E-05	80	3.10E-05	40	2.00E-05	102.4
N442	Co-60	-1.30E-05	300	-1.10E-05	340	-1.20E-05	16.7
N442	Zn-65	-1.40E-05	540	8.50E-06	870	-2.80E-06	818.2
N442	Sr-90	2.70E-05	700	1.30E-04	90	7.90E-05	131.2
N442	Ru-103	2.00E-05	200	1.20E-05	270	1.60E-05	50
N442	Ru-106	-1.60E-04	220	-2.30E-04	140	-2.00E-04	35.9
N442	Sn-113	2.30E-05	180	2.30E-05	160	2.30E-05	0
N442	Sb-125	9.70E-05	93	-5.00E-06	1000	4.60E-05	221.7
N442	Cs-134	1.20E-05	330	3.50E-06	920	7.70E-06	109.7
N442	Cs-137	6.20E-05	110	7.20E-05	83	6.70E-05	14.9
N442	Ce-144	-4.40E-05	800	3.90E-04	85	1.70E-04	250.9
N442	Eu-152	-2.60E-05	260	-7.40E-06	1000	-1.70E-05	111.4
N442	Eu-154	2.30E-05	510	-2.80E-05	340	-2.50E-06	2040
N442	Eu-155	3.40E-06	1000	7.60E-06	1000	5.50E-06	76.4
N442	U-234	6.70E-06	95	1.80E-05	50	1.20E-05	91.5
N442	U-235	1.70E-06	200	-1.50E-06	200	1.00E-07	3200
N442	U-238	6.30E-06	95	1.10E-05	60	8.70E-06	54.3
N442	Pu-238	3.90E-06	150	2.10E-06	120	3.00E-06	60
N442	Pu239/40	-1.40E-06	300	5.70E-06	80	2.20E-06	330.2
N449	Co-60	1.70E-05	290	5.90E-07	1000	8.80E-06	186.6
N449	Zn-65	-1.20E-04	100	-5.20E-05	220	-8.60E-05	79.1
N449	Sr-90	-7.00E-06	1000	3.30E-04	50	1.60E-04	208.7
N449	Ru-103	-2.70E-07	1000	7.10E-06	580	3.40E-06	215.8
N449	Ru-106	2.50E-04	170	-1.60E-04	250	4.50E-05	911.1
N449	Sn-113	-1.70E-05	290	3.60E-05	140	9.50E-06	557.9
N449	Sb-125	-1.10E-04	100	-1.60E-05	610	-6.30E-05	149.2
N449	Cs-134	2.40E-05	200	-1.00E-05	400	7.00E-06	485.7
N449	Cs-137	6.70E-05	92	1.60E-06	1000	3.40E-05	190.7
N449	Ce-144	2.50E-04	170	-2.80E-04	160	-1.50E-05	3533
N449	Eu-152	-2.50E-05	300	-1.00E-05	1000	-1.80E-05	85.7

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N449	Eu-154	7.70E-05	200	1.70E-04	86	1.20E-04	75.3
N449	Eu-155	1.60E-04	100	-1.20E-04	100	2.00E-05	1400
N449	U-234	7.70E-06	85	1.80E-05	40	1.30E-05	80.2
N449	U-235	2.20E-06	170	9.90E-06	60	6.00E-06	127.3
N449	U-238	1.10E-05	65	9.20E-06	60	1.00E-05	17.8
N449	Pu-238	-2.60E-06	140	6.90E-07	200	-9.60E-07	344.5
N449	Pu239/40	2.00E-05	50	5.50E-06	80	1.30E-05	113.7
N456	Co-60	-9.40E-06	490	1.10E-05	370	8.00E-07	2550
N456	Zn-65	-4.30E-05	230	-6.10E-05	130	-5.20E-05	34.6
N456	Sr-90	6.70E-05	230	4.10E-04	50	2.40E-04	143.8
N456	Ru-103	-1.50E-05	260	6.90E-06	500	-4.10E-06	540.7
N456	Ru-106	-3.10E-04	120	9.10E-05	340	-1.10E-04	366.2
N456	Sn-113	-6.40E-06	680	-1.10E-05	340	-8.70E-06	52.9
N456	Sb-125	-6.40E-05	160	5.90E-05	150	-2.50E-06	4920
N456	Cs-134	-3.70E-06	1000	-1.50E-05	260	-9.40E-06	120.9
N456	Cs-137	1.30E-04	66	6.90E-04	18	4.10E-04	136.6
N456	Ce-144	1.40E-05	1000	-1.60E-04	200	-7.30E-05	238.4
N456	Eu-152	-6.30E-05	120	2.10E-05	400	-2.10E-05	400
N456	Eu-154	1.00E-04	140	1.30E-04	81	1.20E-04	26.1
N456	Eu-155	1.10E-04	98	3.70E-05	230	7.30E-05	99.3
N456	U-234	1.40E-05	70	1.80E-05	40	1.60E-05	25
N456	U-235	1.10E-05	70	1.90E-06	120	6.50E-06	141.1
N456	U-238	1.30E-05	60	1.40E-05	50	1.40E-05	7.4
N456	Pu-238	1.60E-06	150	2.80E-06	100	2.20E-06	54.5
N456	Pu239/40	3.00E-05	40	3.50E-06	90	1.70E-05	158.2
N457	Co-60	-1.70E-05	230	-5.80E-06	620	-1.10E-05	98.2
N457	Zn-65	-5.10E-05	150	-1.10E-04	100	-8.10E-05	73.3
N457	Sr-90	4.70E-05	300	1.40E-05	970	3.00E-05	108.2
N457	Ru-103	7.60E-06	410	1.80E-05	190	1.30E-05	81.3
N457	Ru-106	-2.40E-04	140	-3.00E-05	1000	-1.40E-04	155.6
N457	Sn-113	-1.00E-05	360	2.50E-05	160	7.50E-06	466.7
N457	Sb-125	2.90E-05	280	4.30E-05	200	3.60E-05	38.9
N457	Cs-134	8.90E-06	400	1.10E-05	310	1.00E-05	21.1
N457	Cs-137	6.40E-05	86	6.60E-05	58	6.50E-05	3.1
N457	Ce-144	-5.00E-05	650	3.40E-04	110	1.40E-04	269
N457	Eu-152	2.60E-06	1000	1.80E-05	490	1.00E-05	149.5
N457	Eu-154	-4.90E-05	220	3.90E-05	270	-5.00E-06	1760
N457	Eu-155	-2.60E-05	360	-3.80E-06	1000	-1.50E-05	149
N457	U-234	3.00E-05	40	2.10E-05	40	2.60E-05	35.3
N457	U-235	1.30E-05	60	7.50E-06	70	1.00E-05	53.7
N457	U-238	2.60E-05	40	1.20E-05	50	1.90E-05	73.7
N457	Pu-238	6.10E-07	670	2.20E-06	120	1.40E-06	113.2
N457	Pu239/40	4.90E-06	130	6.10E-06	80	5.50E-06	21.8
N956	Co-60	-4.60E-05	130	-1.10E-05	430	-2.90E-05	122.8
N956	Zn-65	-7.70E-05	170	-2.50E-05	430	-5.10E-05	102

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N956	Sr-90	3.00E-04	90	1.40E-04	90	2.20E-04	72.7
N956	Ru-103	4.30E-05	150	2.30E-05	190	3.30E-05	60.6
N956	Ru-106	6.90E-05	800	4.10E-04	97	2.40E-04	142.4
N956	Sn-113	-2.50E-05	240	-1.50E-05	310	-2.00E-05	50
N956	Sb-125	1.60E-05	850	1.40E-05	710	1.50E-05	13.3
N956	Cs-134	-1.50E-05	420	-1.60E-05	300	-1.50E-05	6.5
N956	Cs-137	2.10E-04	43	1.60E-04	51	1.80E-04	27
N956	Ce-144	-3.60E-04	150	2.70E-05	1000	-1.70E-04	232.4
N956	Eu-152	-9.30E-06	1000	-2.50E-05	450	-1.70E-05	91.5
N956	Eu-154	8.40E-05	210	-1.40E-06	1000	4.10E-05	206.8
N956	Eu-155	-6.10E-06	1000	4.10E-05	280	1.70E-05	269.9
N956	U-234	3.70E-05	40	8.60E-06	60	2.30E-05	124.6
N956	U-235	7.20E-06	90	7.90E-06	70	7.60E-06	9.3
N956	U-238	4.30E-05	40	1.10E-05	50	2.70E-05	118.5
N956	Pu-238	-7.20E-07	660	7.10E-07	200	-5.00E-09	9999
N956	Pu239/40	4.20E-06	190	3.60E-06	90	3.90E-06	15.4
N957	Co-60	4.70E-06	920	-5.20E-06	890	-2.50E-07	3960
N957	Zn-65	-8.50E-06	1000	7.70E-06	1000	-4.00E-07	4050
N957	Sr-90	-5.70E-05	330	-1.60E-04	100	-1.10E-04	94.9
N957	Ru-103	1.40E-05	310	-2.00E-05	170	-3.00E-06	1133
N957	Ru-106	-6.60E-05	550	-2.40E-05	1000	-4.50E-05	93.3
N957	Sn-113	1.70E-05	260	-7.10E-06	580	4.90E-06	486.9
N957	Sb-125	3.40E-05	290	6.20E-05	150	4.80E-05	58.3
N957	Cs-134	-2.40E-05	190	-2.50E-06	1000	-1.30E-05	162.3
N957	Cs-137	1.40E-05	300	2.00E-05	220	1.70E-05	35.3
N957	Ce-144	-3.90E-05	1000	6.10E-05	620	1.10E-05	909.1
N957	Eu-152	6.40E-06	1000	-2.40E-05	410	-8.80E-06	345.5
N957	Eu-154	3.00E-05	390	4.60E-05	280	3.80E-05	42.1
N957	Eu-155	-1.00E-05	1000	-3.00E-05	330	-2.00E-05	100
N957	U-234	1.20E-05	70	8.30E-06	60	1.00E-05	36.5
N957	U-235	4.20E-06	150	5.10E-06	80	4.60E-06	19.4
N957	U-238	8.60E-06	70	1.10E-05	50	9.80E-06	24.5
N957	Pu-238	1.40E-06	280	-6.80E-07	450	3.60E-07	577.8
N957	Pu239/40	1.30E-06	420	4.70E-06	80	3.00E-06	113.3
N963	Co-60	-1.50E-05	380	4.30E-05	97	1.40E-05	414.3
N963	Zn-65	-1.40E-04	100	2.90E-05	320	-5.60E-05	304.5
N963	Sr-90	2.10E-04	80	-1.20E-04	100	4.50E-05	733.3
N963	Ru-103	-1.40E-05	320	-1.20E-05	270	-1.30E-05	15.4
N963	Ru-106	1.10E-04	440	-2.30E-04	150	-6.00E-05	566.7
N963	Sn-113	-1.60E-06	1000	2.50E-05	160	1.20E-05	227.4
N963	Sb-125	-6.80E-05	180	6.70E-06	1000	-3.10E-05	243.7
N963	Cs-134	-3.30E-05	180	-3.00E-05	130	-3.10E-05	9.5
N963	Cs-137	9.10E-05	82	7.00E-05	82	8.10E-05	26.1
N963	Ce-144	-2.60E-04	170	-1.60E-04	200	-2.10E-04	47.6
N963	Eu-152	5.20E-05	170	-5.90E-05	150	-3.50E-06	3171

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N963	Eu-154	-1.10E-04	150	5.80E-05	200	-2.60E-05	646.2
N963	Eu-155	-3.10E-05	420	-2.90E-05	300	-3.00E-05	6.7
N963	U-234	1.90E-05	60	1.60E-05	40	1.70E-05	17.1
N963	U-235	3.70E-06	160	4.40E-06	70	4.00E-06	17.3
N963	U-238	1.30E-05	70	1.10E-05	40	1.20E-05	16.7
N963	Pu-238	1.40E-05	60	2.90E-05	40	2.20E-05	69.8
N963	Pu239/40	5.10E-06	160	7.40E-06	70	6.20E-06	36.8
N964	Co-60	1.20E-05	0	4.50E-05	86	2.80E-05	118.6
N964	Zn-65	-1.40E-06	0	-6.10E-05	140	-3.10E-05	191
N964	Sr-90	-4.10E-05	0	3.40E-04	40	1.50E-04	255.5
N964	Ru-103	8.50E-06	0	-9.60E-06	310	-5.30E-07	3457
N964	Ru-106	-3.70E-05	0	3.40E-05	930	-1.50E-06	4889
N964	Sn-113	-1.10E-05	0	1.20E-06	1000	-4.80E-06	249.5
N964	Sb-125	-4.70E-05	0	8.40E-06	1000	-1.90E-05	287
N964	Cs-134	-4.60E-06	0	1.10E-05	340	3.20E-06	486.4
N964	Cs-137	-1.40E-07	0	8.40E-05	59	4.20E-05	200.7
N964	Ce-144			-9.40E-05	360		
N964	Eu-152	4.50E-06	0	3.80E-05	240	2.10E-05	157.5
N964	Eu-154	2.80E-05	0	9.10E-06	1000	1.90E-05	101.6
N964	Eu-155	-8.20E-06	0	1.80E-05	550	4.90E-06	535.4
N964	U-234	2.10E-05	40	1.60E-05	50	1.90E-05	28.9
N964	U-235	5.50E-06	70	4.80E-06	90	5.20E-06	14
N964	U-238	1.40E-05	50	1.90E-05	40	1.60E-05	31.7
N964	Pu-238	8.30E-07	0	-1.20E-06	200	-1.90E-07	1090
N964	Pu239/40	1.50E-05	60	3.50E-05	30	2.50E-05	78.9
N964	Am-241	1.30E-05	60	1.00E-05	60	1.20E-05	26.8
N965	Co-60	5.20E-06	760	6.70E-05	60	3.60E-05	171.2
N965	Zn-65	-4.30E-05	190	-3.90E-05	200	-4.10E-05	9.8
N965	Sr-90	2.80E-04	80	-1.90E-05	550	1.30E-04	229.1
N965	Ru-103	-1.00E-05	280	-1.10E-06	1000	-5.50E-06	160.4
N965	Ru-106	-1.80E-04	170	-4.50E-05	690	-1.10E-04	120
N965	Sn-113	-1.10E-06	1000	-7.80E-06	510	-4.40E-06	150.6
N965	Sb-125	-4.50E-05	190	-4.30E-05	180	-4.40E-05	4.5
N965	Cs-134	4.10E-06	950	-1.80E-05	200	-6.90E-06	318
N965	Cs-137	2.60E-04	31	6.20E-05	74	1.60E-04	123
N965	Ce-144	-1.40E-04	220	-9.10E-05	370	-1.20E-04	42.4
N965	Eu-152	-2.20E-05	280	1.50E-05	580	-3.50E-06	1057
N965	Eu-154	3.50E-05	310	9.10E-05	110	6.30E-05	88.9
N965	Eu-155	3.60E-05	250	-1.10E-04	100	-3.70E-05	394.6
N965	U-234	1.10E-05	70	1.70E-05	50	1.40E-05	42.9
N965	U-235	8.00E-06	90	7.00E-06	80	7.50E-06	13.3
N965	U-238	1.30E-05	60	9.60E-06	60	1.10E-05	30.1
N965	Pu-238	-3.90E-06	100	7.00E-07	200	-1.60E-06	287.5
N965	Pu239/40	1.50E-05	70	5.90E-06	70	1.00E-05	87.1
N966	Co-60	3.40E-05	150	1.20E-05	430	2.30E-05	95.7

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N966	Zn-65	9.50E-05	110	-1.60E-05	740	3.90E-05	281
N966	Sr-90	1.20E-04	210	-1.40E-05	1000	5.30E-05	252.8
N966	Ru-103	-2.20E-05	180	6.00E-06	750	-8.00E-06	350
N966	Ru-106	5.10E-04	82	1.20E-04	330	3.20E-04	123.8
N966	Sn-113	5.10E-05	94	2.40E-05	190	3.80E-05	72
N966	Sb-125	4.40E-05	260	6.20E-05	170	5.30E-05	34
N966	Cs-134	-1.50E-05	330	2.90E-06	1000	-6.10E-06	295.9
N966	Cs-137	1.40E-04	54	2.90E-04	34	2.20E-04	69.8
N966	Ce-144	2.00E-05	1000	8.30E-05	480	5.10E-05	122.3
N966	Eu-152	4.00E-06	1000	-5.10E-05	200	-2.30E-05	234
N966	Eu-154	1.40E-04	88	1.30E-04	110	1.40E-04	7.4
N966	Eu-155	-9.60E-05	140	1.10E-05	970	-4.30E-05	251.8
N966	U-234	3.00E-05	50	2.40E-05	40	2.70E-05	22.2
N966	U-235	1.40E-05	70	1.30E-05	60	1.40E-05	7.4
N966	U-238	2.80E-05	50	1.60E-05	50	2.20E-05	54.5
N966	Pu-238	-1.10E-06	360	3.00E-06	100	9.50E-07	431.6
N966	Pu239/40	1.10E-05	90	1.70E-05	50	1.40E-05	42.9
N967	Co-60	-4.70E-05	130	3.20E-05	130	-7.50E-06	1053
N967	Zn-65	-5.80E-05	230	-7.90E-05	120	-6.80E-05	30.7
N967	Sr-90	4.20E-04	60	3.40E-05	430	2.30E-04	170
N967	Ru-103	2.10E-05	260	-2.40E-07	1000	1.00E-05	204.6
N967	Ru-106	-3.20E-05	1000	-2.40E-04	150	-1.40E-04	152.9
N967	Sn-113	1.50E-05	410	-1.30E-05	310	1.00E-06	2799
N967	Sb-125	1.10E-05	1000	-4.00E-05	230	-1.40E-05	351.7
N967	Cs-134	3.60E-05	190	-2.60E-05	160	5.00E-06	1240
N967	Cs-137	2.20E-04	52	1.90E-04	30	2.00E-04	14.6
N967	Ce-144	4.20E-04	130	-8.50E-05	380	1.70E-04	301.5
N967	Eu-152	2.80E-05	350	5.60E-05	160	4.20E-05	66.7
N967	Eu-154	1.30E-04	95	-7.90E-05	150	2.60E-05	819.6
N967	Eu-155	-2.00E-05	750	-1.30E-05	670	-1.70E-05	42.4
N967	U-234	1.30E-05	70	1.50E-05	50	1.40E-05	14.3
N967	U-235	5.00E-06	120	1.20E-05	50	8.50E-06	82.4
N967	U-238	6.50E-06	110	1.60E-05	50	1.10E-05	84.4
N967	Pu-238	-7.40E-07	650	-2.50E-06	180	-1.60E-06	108.6
N967	Pu239/40	-1.00E-05	100	5.70E-06	80	-2.20E-06	730.2
N968	Co-60	2.30E-05	180	1.30E-05	330	1.80E-05	55.6
N968	Zn-65	-4.60E-05	200	-2.50E-05	390	-3.60E-05	59.2
N968	Sr-90	7.60E-05	52	3.40E-05	400	5.50E-05	76.4
N968	Ru-103	6.20E-07	1000	-2.30E-05	190	-1.10E-05	211.1
N968	Ru-106	2.40E-04	150	1.00E-04	370	1.70E-04	82.4
N968	Sn-113	4.40E-06	910	5.80E-06	910	5.10E-06	27.5
N968	Sb-125	-2.00E-05	450	-5.20E-05	180	-3.60E-05	88.9
N968	Cs-134	4.00E-06	1000	-2.80E-06	1000	6.00E-07	1133
N968	Cs-137	-1.20E-05	320	8.40E-05	81	3.60E-05	266.7
N968	Ce-144	1.70E-04	220	1.20E-04	320	1.40E-04	34.5

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N968	Eu-152	-9.90E-06	730	2.10E-06	1000	-3.90E-06	307.7
N968	Eu-154	-2.90E-06	1000	-7.40E-06	1000	-5.20E-06	87.4
N968	Eu-155	-6.40E-05	170	6.10E-05	170	-1.50E-06	8333
N968	U-234	2.80E-05	40	3.20E-05	40	3.00E-05	13.3
N968	U-235	7.60E-06	80	1.40E-05	50	1.10E-05	59.3
N968	U-238	1.20E-05	60	2.00E-05	40	1.60E-05	50
N968	Pu-238	-3.10E-06	130	1.20E-06	140	-9.50E-07	452.6
N968	Pu239/40	5.80E-08	1000	1.80E-06	120	9.30E-07	187.5
N969	Co-60	-3.00E-05	170	-1.90E-05	240	-2.50E-05	44.9
N969	Zn-65	-1.10E-04	100	-6.70E-05	140	-8.90E-05	48.6
N969	Sr-90	2.50E-04	70	7.60E-06	1000	1.30E-04	188.2
N969	Ru-103	-2.70E-05	150	-4.10E-05	100	-3.40E-05	41.2
N969	Ru-106	5.60E-05	810	4.70E-05	780	5.10E-05	17.5
N969	Sn-113	1.50E-05	350	-8.80E-06	510	3.10E-06	767.7
N969	Sb-125	9.50E-05	120	-1.70E-05	550	3.90E-05	287.2
N969	Cs-134	1.70E-05	330	-8.70E-07	1000	8.10E-06	221.6
N969	Cs-137	6.60E-05	83	4.10E-06	1000	3.50E-05	176.6
N969	Ce-144	-1.80E-04	240	-2.20E-04	160	-2.00E-04	20
N969	Eu-152	1.70E-05	500	4.40E-05	210	3.00E-05	88.5
N969	Eu-154	1.60E-05	930	2.80E-05	450	2.20E-05	54.5
N969	Eu-155	-1.10E-04	110	4.10E-05	230	-3.50E-05	437.7
N969	U-234	1.40E-05	60	2.30E-05	40	1.90E-05	48.6
N969	U-235	4.30E-06	130	1.20E-05	60	8.20E-06	94.5
N969	U-238	1.30E-05	60	1.40E-05	50	1.40E-05	7.4
N969	Pu-238	-9.90E-07	460	1.10E-06	200	5.50E-08	3800
N969	Pu239/40	4.40E-06	180	9.90E-06	70	7.10E-06	76.9
N970	Co-60	5.40E-05	91	5.40E-05	80	5.40E-05	0
N970	Zn-65	-9.70E-05	100	-1.50E-04	100	-1.20E-04	42.9
N970	Sr-90	3.20E-04	40	3.20E-07	1000	1.60E-04	199.6
N970	Ru-103	4.80E-06	630	1.60E-05	300	1.00E-05	107.7
N970	Ru-106	-2.00E-04	170	-1.00E-04	380	-1.50E-04	66.7
N970	Sn-113	7.50E-06	500	-8.80E-06	570	-6.50E-07	2507
N970	Sb-125	5.90E-05	140	7.20E-05	150	6.50E-05	19.8
N970	Cs-134	6.30E-06	550	1.70E-05	260	1.20E-05	91.8
N970	Cs-137	4.80E-05	79	8.30E-04	18	4.40E-04	178.1
N970	Ce-144	-3.50E-04	100	-1.30E-04	350	-2.40E-04	91.7
N970	Eu-152	-1.40E-05	460	1.10E-04	100	4.80E-05	258.3
N970	Eu-154	-1.80E-05	580	8.10E-05	160	3.10E-05	314.3
N970	Eu-155	1.50E-04	96	-5.50E-05	210	4.80E-05	431.6
N970	U-234	7.40E-06	100	3.20E-05	40	2.00E-05	124.9
N970	U-235	7.40E-06	100	2.00E-05	50	1.40E-05	92
N970	U-238	1.30E-05	70	2.80E-05	40	2.00E-05	73.2
N970	Pu-238	1.70E-06	200	1.90E-06	140	1.80E-06	11.1
N970	Pu239/40	3.40E-06	180	9.70E-06	70	6.50E-06	96.2
N972	Co-60	2.60E-05	170	1.30E-05	400	1.90E-05	66.7

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N972	Zn-65	-3.40E-05	270	-1.30E-04	100	-8.20E-05	117.1
N972	Sr-90	2.40E-04	100	5.50E-04	40	4.00E-04	78.5
N972	Ru-103	-4.80E-06	780	6.10E-06	750	6.50E-07	1676
N972	Ru-106	9.70E-05	380	-2.00E-05	1000	3.90E-05	303.9
N972	Sn-113	-4.60E-06	940	-3.70E-05	130	-2.10E-05	155.8
N972	Sb-125	1.30E-05	780	4.10E-05	260	2.70E-05	103.7
N972	Cs-134	4.70E-06	910	7.10E-06	680	5.90E-06	40.7
N972	Cs-137	4.50E-05	97	9.60E-05	56	7.00E-05	72.3
N972	Ce-144	1.50E-04	270	1.40E-04	300	1.40E-04	6.9
N972	Eu-152	-1.60E-05	490	1.80E-05	630	1.00E-06	3400
N972	Eu-154	9.50E-05	130	1.20E-05	1000	5.30E-05	155.1
N972	Eu-155	5.60E-05	220	-3.30E-05	330	1.20E-05	773.9
N972	U-234	1.30E-05	70	1.10E-05	60	1.20E-05	16.7
N972	U-235	3.80E-06	140	9.70E-06	60	6.70E-06	87.4
N972	U-238	1.10E-05	70	8.30E-06	60	9.60E-06	28
N972	Pu-238	-5.20E-08	1000	8.30E-07	450	3.90E-07	226.7
N972	Pu239/40	9.60E-07	360	5.10E-06	120	3.00E-06	136.6
N973	Co-60	3.30E-05	140	-1.30E-06	1000	1.60E-05	216.4
N973	Zn-65	-2.10E-07	1000	-9.40E-05	150	-4.70E-05	199.1
N973	Sr-90	9.00E-05	240	2.10E-04	90	1.50E-04	80
N973	Ru-103	1.00E-05	400	-1.10E-05	460	-5.00E-07	4199
N973	Ru-106	1.20E-04	330	-7.80E-05	540	2.10E-05	942.9
N973	Sn-113	4.10E-08	1000	-3.80E-05	150	-1.90E-05	200.4
N973	Sb-125	7.90E-05	130	5.80E-05	190	6.80E-05	30.7
N973	Cs-134	-7.50E-08	1000	2.30E-05	230	1.10E-05	201.3
N973	Cs-137	1.60E-04	48	2.10E-04	41	1.80E-04	27
N973	Ce-144	-2.50E-04	160	-3.50E-04	130	-3.00E-04	33.3
N973	Eu-152	-1.20E-05	630	1.50E-05	820	1.50E-06	1800
N973	Eu-154	3.00E-05	450	-7.90E-05	200	-2.40E-05	444.9
N973	Eu-155	3.80E-05	290	-4.80E-05	260	-5.00E-06	1719
N973	U-234	1.50E-05	60	1.30E-05	50	1.40E-05	14.3
N973	U-235	1.50E-06	280	9.20E-06	70	5.30E-06	143.9
N973	U-238	1.10E-05	70	1.40E-05	60	1.30E-05	24
N973	Pu-238	-2.60E-06	100	2.50E-06	120	-5.00E-08	9999
N973	Pu239/40	-2.70E-06	230	9.90E-06	70	3.60E-06	350
N974	Co-60	2.50E-05	160	-1.90E-06	1000	1.20E-05	232.9
N974	Zn-65	-9.90E-05	100	-1.60E-04	100	-1.30E-04	47.1
N974	Sr-90	2.80E-04	70	1.90E-04	90	2.30E-04	38.3
N974	Ru-103	3.60E-06	930	-5.90E-05	100	-2.80E-05	226
N974	Ru-106	3.60E-05	1000	-1.10E-04	370	-3.70E-05	394.6
N974	Sn-113	1.80E-05	230	-1.80E-06	1000	8.10E-06	244.4
N974	Sb-125	-3.30E-05	270	-1.10E-04	100	-7.10E-05	107.7
N974	Cs-134	-2.90E-05	130	3.20E-05	150	1.50E-06	4066
N974	Cs-137	4.00E-05	97	7.70E-05	91	5.80E-05	63.2
N974	Ce-144	-9.20E-05	410	5.40E-05	760	-1.90E-05	768.4

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N974	Eu-152	-2.10E-05	340	3.10E-06	1000	-8.90E-06	269.3
N974	Eu-154	-7.20E-05	150	-6.30E-05	220	-6.70E-05	13.3
N974	Eu-155	-1.10E-04	100	5.60E-05	200	-2.70E-05	614.8
N974	U-234	1.80E-05	50	2.60E-05	40	2.20E-05	36.4
N974	U-235	1.80E-06	210	8.10E-06	70	4.90E-06	127.3
N974	U-238	7.40E-06	90	6.80E-06	80	7.10E-06	8.5
N974	Pu-238	-3.20E-06	110	7.10E-07	350	-1.20E-06	314.1
N974	Pu239/40	9.40E-06	100	1.00E-05	70	9.70E-06	6.2
N975	Co-60	-2.00E-06	0	-3.10E-05	130	-1.70E-05	175.8
N975	Zn-65	4.20E-06	0	1.10E-04	78	5.70E-05	185.4
N975	Sr-90	-6.60E-05	0	3.80E-04	40	1.60E-04	284.4
N975	Ru-103	-1.50E-05	0	-1.50E-05	260	-1.50E-05	3.3
N975	Ru-106	-5.10E-04	0	-2.40E-04	140	-3.70E-04	71.3
N975	Sn-113	-3.10E-06	0	-2.00E-05	210	-1.20E-05	147.1
N975	Sb-125	-5.70E-05	0	-1.60E-06	1000	-3.00E-05	189.2
N975	Cs-134	1.50E-05	0	-4.40E-06	850	5.40E-06	361.5
N975	Cs-137	8.60E-05	73.2	7.10E-05	63	7.90E-05	19.1
N975	Ce-144			-3.50E-05	920		
N975	Eu-152	-2.50E-05	0	2.50E-05	330	-5.00E-08	9999
N975	Eu-154	1.70E-05	0	4.80E-05	240	3.30E-05	93.1
N975	Eu-155	2.30E-05	0	-3.50E-05	240	-5.90E-06	996.6
N975	U-234	1.60E-05	50	1.40E-05	50	1.50E-05	14.6
N975	U-235	4.20E-06	90	4.50E-06	100	4.30E-06	7.1
N975	U-238	1.70E-05	50	1.20E-05	50	1.40E-05	33.9
N975	Pu-238			7.60E-07	200		
N975	Pu239/40	2.90E-05	40	1.40E-05	50	2.10E-05	68.9
N975	Am-241	1.70E-05	60	8.90E-06	70	1.30E-05	62
N976	Co-60	-8.10E-06	0				
N976	Zn-65	-1.60E-05	0				
N976	Sr-90	5.00E-05	73				
N976	Ru-103	-2.20E-05	0				
N976	Ru-106	4.20E-04	0				
N976	Sn-113	-2.70E-06	0				
N976	Sb-125	-3.70E-05	0				
N976	Cs-134	-8.80E-06	0				
N976	Cs-137	4.90E-05	0				
N976	Eu-152	-5.70E-05	0				
N976	Eu-154	8.00E-05	0				
N976	Eu-155	-2.90E-05	0				
N976	U-234	3.30E-05	40				
N976	U-235	6.30E-06	0				
N976	U-238	2.70E-05	40				
N976	Pu-238	-1.00E-06	0				
N976	Pu239/40	8.60E-06	0				
N977	Co-60	2.00E-05	230	-2.30E-05	250	-1.50E-06	2866

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N977	Zn-65	-1.00E-04	100	1.80E-05	780	-4.10E-05	267.8
N977	Sr-90	5.70E-04	40	-1.50E-05	1000	2.80E-04	210.8
N977	Ru-103	-9.20E-06	460	-3.40E-05	130	-2.20E-05	114.8
N977	Ru-106	-8.60E-05	500	2.80E-04	150	9.70E-05	377.3
N977	Sn-113	-5.20E-05	110	-9.20E-06	580	-3.10E-05	139.9
N977	Sb-125	9.10E-05	120	-2.50E-05	520	3.30E-05	351.5
N977	Cs-134	5.40E-06	900	-4.40E-06	1000	5.00E-07	1959
N977	Cs-137	1.30E-06	1000	6.90E-05	79	3.50E-05	192.6
N977	Ce-144	6.00E-05	720	-7.30E-04	100	-3.30E-04	235.8
N977	Eu-152	-5.40E-06	1000	-4.00E-05	310	-2.30E-05	152.4
N977	Eu-154	4.40E-05	300	1.80E-05	1000	3.10E-05	83.9
N977	Eu-155	1.20E-04	100	-1.30E-05	1000	5.40E-05	248.6
N977	U-234	5.70E-06	150	2.00E-05	50	1.30E-05	111.3
N977	U-235	1.30E-05	80	6.70E-06	80	9.90E-06	64
N977	U-238	1.70E-05	60	1.50E-05	50	1.60E-05	12.5
N977	Pu-238	-7.40E-07	650	7.60E-07	200	1.00E-08	9999
N977	Pu239/40	-1.30E-05	100	5.30E-05	30	2.00E-05	330
N978	Co-60	1.50E-06	1000	8.20E-06	660	4.90E-06	138.1
N978	Zn-65	6.80E-05	200	-8.40E-05	140	-8.00E-06	1899
N978	Sr-90	2.10E-05	210	1.00E-04	140	6.10E-05	130.6
N978	Ru-103	8.20E-06	600	2.70E-05	200	1.80E-05	106.8
N978	Ru-106	2.50E-05	1000	6.80E-05	630	4.60E-05	92.5
N978	Sn-113	2.30E-05	270	-1.80E-06	1000	1.10E-05	234
N978	Sb-125	6.50E-05	220	-1.20E-04	100	-2.80E-05	672.7
N978	Cs-134	-2.90E-06	1000	8.80E-06	620	2.90E-06	396.6
N978	Cs-137	1.60E-03	17	2.60E-05	200	8.10E-04	193.6
N978	Ce-144	1.80E-04	300	2.60E-04	200	2.20E-04	36.4
N978	Eu-152	3.70E-05	290	2.20E-05	590	3.00E-05	50.8
N978	Eu-154	-6.10E-05	260	-1.10E-04	140	-8.50E-05	57.3
N978	Eu-155	-2.60E-05	620	7.80E-06	1000	-9.10E-06	371.4
N978	U-234	1.80E-05	80	2.40E-05	50	2.10E-05	28.6
N978	U-235	5.50E-06	160	1.20E-05	70	8.80E-06	74.3
N978	U-238	9.80E-06	100	7.90E-06	70	8.90E-06	21.5
N978	Pu-238	-1.30E-05	100	-8.70E-07	200	-6.90E-06	174.9
N978	Pu239/40	-1.00E-05	110	5.30E-06	110	-2.30E-06	651.1
N984	Co-60	1.00E-05	970	2.70E-06	1000	6.40E-06	115
N984	Zn-65	-9.80E-05	170	-2.50E-05	350	-6.20E-05	118.7
N984	Sr-90	6.40E-04	50	4.00E-04	40	5.20E-04	46.2
N984	Ru-103	-2.40E-05	280	-7.40E-06	470	-1.60E-05	105.7
N984	Ru-106	-4.00E-05	1000	-5.40E-07	1000	-2.00E-05	194.7
N984	Sn-113	4.10E-05	190	2.50E-05	170	3.30E-05	48.5
N984	Sb-125	-1.20E-04	140	-2.20E-05	440	-7.10E-05	138
N984	Cs-134	-8.10E-06	940	2.90E-05	150	1.00E-05	355
N984	Cs-137	3.70E-04	38	5.00E-04	21	4.30E-04	29.9
N984	Ce-144	3.10E-04	230	3.80E-05	940	1.70E-04	156.3

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N984	Eu-152	1.30E-04	100	2.90E-05	350	8.00E-05	127
N984	Eu-154	-1.20E-05	1000	7.10E-05	180	3.00E-05	281.4
N984	Eu-155	-1.10E-04	190	1.60E-05	600	-4.70E-05	268.1
N984	U-234	4.50E-05	50	5.70E-05	30	5.10E-05	23.5
N984	U-235	3.50E-05	60	2.70E-05	50	3.10E-05	25.8
N984	U-238	3.90E-05	50	2.20E-05	50	3.10E-05	55.7
N984	Pu-238	-2.70E-06	100	8.50E-07	200	-9.30E-07	383.8
N984	Pu239/40	-1.50E-05	100	3.60E-06	100	-5.70E-06	326.3
N985	Co-60	-1.40E-05	370	3.50E-05	120	1.00E-05	466.7
N985	Zn-65	-1.20E-04	100	-1.20E-05	730	-6.60E-05	163.6
N985	Sr-90	-7.80E-05	130	7.50E-05	170	-1.50E-06	9999
N985	Ru-103	-2.10E-05	240	1.60E-05	210	-2.50E-06	1480
N985	Ru-106	-2.70E-04	170	-2.70E-04	140	-2.70E-04	0
N985	Sn-113	-1.50E-05	320	2.50E-05	170	5.00E-06	800
N985	Sb-125	-3.10E-05	330	-5.10E-05	190	-4.10E-05	48.8
N985	Cs-134	-1.60E-05	310	-2.60E-06	1000	-9.30E-06	144.1
N985	Cs-137	1.20E-04	54	3.10E-04	29	2.20E-04	88.4
N985	Ce-144	-2.70E-05	1000	-3.70E-04	100	-2.00E-04	172.8
N985	Eu-152	-1.00E-05	760	2.90E-05	340	9.50E-06	410.5
N985	Eu-154	6.20E-05	230	4.10E-05	270	5.10E-05	40.8
N985	Eu-155	7.40E-05	150	7.40E-05	150	7.40E-05	0
N985	U-234	2.90E-05	50	2.40E-05	40	2.60E-05	18.9
N985	U-235	6.50E-06	90	9.00E-06	70	7.70E-06	32.3
N985	U-238	3.30E-05	40	1.40E-05	50	2.40E-05	80.9
N985	Pu-238	-2.80E-06	110	7.50E-07	200	-1.00E-06	346.3
N985	Pu239/40	6.50E-07	1000	8.20E-06	60	4.40E-06	170.6
N987	Co-60	1.30E-05	410	8.90E-06	600	1.10E-05	37.4
N987	Zn-65	4.40E-05	240	-1.80E-04	100	-6.80E-05	329.4
N987	Sr-90	8.80E-05	180	2.90E-05	450	5.90E-05	100.9
N987	Ru-103	-2.10E-05	240	3.80E-05	130	8.50E-06	694.1
N987	Ru-106	-4.30E-04	110	6.50E-05	640	-1.80E-04	271.2
N987	Sn-113	1.70E-05	320	8.20E-06	640	1.30E-05	69.8
N987	Sb-125	-2.50E-05	450	6.10E-05	170	1.80E-05	477.8
N987	Cs-134	2.60E-05	200	-3.10E-05	160	-2.50E-06	2280
N987	Cs-137	8.30E-05	90	1.60E-04	43	1.20E-04	63.4
N987	Ce-144	5.50E-04	120	1.40E-05	1000	2.80E-04	190.1
N987	Eu-152	-2.20E-05	400	-1.40E-05	810	-1.80E-05	44.4
N987	Eu-154	3.80E-05	380	1.50E-06	1000	2.00E-05	184.8
N987	Eu-155	-4.20E-05	310	-2.40E-05	490	-3.30E-05	54.5
N987	U-234	1.60E-05	70	2.00E-05	40	1.80E-05	22.2
N987	U-235	1.10E-05	80	2.50E-06	150	6.80E-06	125.9
N987	U-238	2.40E-05	50	1.40E-05	50	1.90E-05	52.6
N987	Pu-238	-3.60E-07	1000	-1.20E-06	200	-7.80E-07	107.7
N987	Pu239/40	8.00E-06	110	2.60E-05	50	1.70E-05	105.9
N994	Co-60	-2.50E-05	200	-1.80E-05	230	-2.20E-05	32.6

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N994	Zn-65	4.80E-05	230	-2.20E-04	100	-8.60E-05	311.6
N994	Sr-90	1.20E-04	60	5.00E-05	250	8.50E-05	82.4
N994	Ru-103	4.30E-06	890	-1.40E-05	240	-4.90E-06	377.3
N994	Ru-106	-1.50E-04	260	1.40E-04	240	-5.00E-06	5799
N994	Sn-113	-3.10E-05	150	6.50E-06	560	-1.20E-05	306.1
N994	Sb-125	3.70E-06	1000	1.90E-05	540	1.10E-05	134.8
N994	Cs-134	4.90E-05	100	4.50E-05	170	4.70E-05	8.5
N994	Cs-137	6.20E-05	81	2.00E-06	1000	3.20E-05	187.5
N994	Ce-144	2.00E-04	210	5.30E-06	1000	1.00E-04	189.7
N994	Eu-152	-5.90E-05	130	-1.80E-05	480	-3.90E-05	106.5
N994	Eu-154	3.40E-06	1000	1.00E-04	120	5.20E-05	186.8
N994	Eu-155	4.10E-05	290	1.90E-06	1000	2.10E-05	182.3
N994	U-234	1.80E-05	50	1.30E-05	50	1.50E-05	32.3
N994	U-235	3.60E-06	120	2.10E-06	150	2.90E-06	52.6
N994	U-238	1.00E-05	70	9.50E-06	50	9.70E-06	5.1
N994	Pu-238	1.10E-07	1000	9.50E-07	350	5.30E-07	158.5
N994	Pu239/40	1.10E-05	90	1.30E-05	60	1.20E-05	16.7
N998	Co-60	1.50E-05	410	2.50E-05	240	2.00E-05	50
N998	Zn-65	6.50E-05	190	5.90E-05	220	6.20E-05	9.7
N998	Sr-90	-1.40E-04	170	-2.20E-04	100	-1.80E-04	44.4
N998	Ru-103	-2.20E-06	1000	-9.10E-06	460	-5.70E-06	122.1
N998	Ru-106	7.70E-05	620	-4.20E-05	1000	1.70E-05	680
N998	Sn-113	-4.30E-05	140	6.30E-06	880	-1.80E-05	268.7
N998	Sb-125	3.00E-05	420	-1.30E-05	960	8.50E-06	505.9
N998	Cs-134	2.70E-05	200	1.40E-06	1000	1.40E-05	180.3
N998	Cs-137	5.40E-05	110	2.60E-05	220	4.00E-05	70
N998	Ce-144	-1.10E-04	470	-1.90E-04	240	-1.50E-04	53.3
N998	Eu-152	4.80E-05	200	8.00E-05	150	6.40E-05	50
N998	Eu-154	1.10E-04	140	-1.40E-04	120	-1.50E-05	1666
N998	Eu-155	-8.50E-06	1000	7.40E-05	160	3.30E-05	251.9
N998	U-234	2.90E-05	60	1.60E-05	50	2.30E-05	57.8
N998	U-235	3.60E-06	190	4.80E-06	90	4.20E-06	28.6
N998	U-238	2.40E-05	60	1.10E-05	60	1.80E-05	74.3
N998	Pu-238	3.70E-07	1000	-1.50E-06	530	-5.70E-07	331
N998	Pu239/40	2.30E-05	60	4.50E-06	120	1.40E-05	134.5
N999	Co-60			3.60E-05	140		
N999	Zn-65	-8.50E-05	130	-7.00E-06	1000	-4.60E-05	169.6
N999	Sr-90	8.90E-06	1000	2.20E-04	50	1.10E-04	184.4
N999	Ru-103	-7.00E-06	580	-5.70E-06	680	-6.40E-06	20.5
N999	Ru-106	-8.90E-05	510	2.70E-04	140	9.10E-05	396.7
N999	Sn-113	1.80E-05	300	6.80E-08	1000	9.00E-06	198.5
N999	Sb-125	-5.70E-05	200	8.90E-06	1000	-2.40E-05	274
N999	Cs-134	-7.70E-06	680	-1.20E-05	370	-9.90E-06	43.7
N999	Cs-137	4.00E-05	130	1.10E-04	69	7.50E-05	93.3
N999	Ce-144	1.60E-05	1000	-3.10E-05	1000	-7.50E-06	626.7

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N999	Eu-152	8.10E-07	1000	3.20E-05	340	1.60E-05	190.1
N999	Eu-154	-3.40E-05	400	1.00E-04	130	3.30E-05	406.1
N999	Eu-155	-8.20E-05	160	9.30E-05	140	5.50E-06	3181
N999	U-234	2.90E-05	60	1.60E-05	50	2.30E-05	57.8
N999	U-235	1.60E-05	70	4.40E-06	110	1.00E-05	113.7
N999	U-238	1.70E-05	70	1.40E-05	50	1.50E-05	19.4
N999	Pu-238	4.40E-06	180	2.70E-06	120	3.50E-06	47.9
N999	Pu239/40	5.20E-06	160	2.70E-06	150	4.00E-06	63.3
N130	Co-60	-3.00E-05	170	-1.70E-05	250	-2.40E-05	55.3
N130	Zn-65	-9.30E-05	120	-1.20E-04	100	-1.10E-04	25.4
N130	Sr-90	4.30E-04	71	-4.10E-05	300	1.90E-04	242.2
N130	Ru-103	-1.50E-05	270	-2.10E-05	150	-1.80E-05	33.3
N130	Ru-106	-5.70E-05	750	-2.90E-04	120	-1.70E-04	134.3
N130	Sn-113	1.50E-05	320	-3.10E-05	120	-8.00E-06	575
N130	Sb-125	1.10E-04	100	2.40E-05	420	6.70E-05	128.4
N130	Cs-134	2.30E-05	230	-1.90E-05	220	2.00E-06	2099
N130	Cs-137	1.70E-04	52	2.10E-05	190	9.50E-05	156
N130	Ce-144	2.30E-04	190	-1.40E-05	1000	1.10E-04	225.9
N130	Eu-152	-2.90E-05	280	-6.50E-05	140	-4.70E-05	76.6
N130	Eu-154	-6.80E-05	220	-4.80E-05	240	-5.80E-05	34.5
N130	Eu-155	1.50E-04	99	-4.70E-05	220	5.20E-05	382.5
N130	U-234	1.90E-05	50	2.00E-05	40	1.90E-05	5.1
N130	U-235	1.00E-05	70	4.10E-06	90	7.10E-06	83.7
N130	U-238	9.60E-06	70	1.70E-05	50	1.30E-05	55.6
N130	Pu-238	-2.40E-06	160	1.90E-06	140	-2.50E-07	1719
N130	Pu239/40	-7.40E-06	100	9.60E-07	200	-3.20E-06	259.6
N981	Co-60	1.80E-05	210	1.40E-05	340	1.60E-05	25
N981	Zn-65	-1.30E-04	100	-7.50E-05	140	-1.00E-04	53.7
N981	Sr-90	-8.30E-05	120	1.80E-04	100	4.80E-05	542.3
N981	Ru-103	9.60E-06	340	-1.30E-05	300	-1.70E-06	1329
N981	Ru-106	-8.70E-06	1000	8.40E-05	480	3.80E-05	246.2
N981	Sn-113	-2.80E-06	1000	2.00E-05	220	8.60E-06	265.1
N981	Sb-125	-1.00E-04	110	-2.60E-05	380	-6.30E-05	117.5
N981	Cs-134	9.70E-06	380	-2.20E-05	200	-6.20E-06	515.4
N981	Cs-137	9.60E-06	400	2.10E-05	220	1.50E-05	74.5
N981	Ce-144	3.40E-05	1000	3.50E-04	110	1.90E-04	164.6
N981	Eu-152	2.10E-05	300	-3.10E-05	340	-5.00E-06	1040
N981	Eu-154	7.90E-06	1000	7.80E-05	180	4.30E-05	163.2
N981	Eu-155	-4.50E-06	1000	1.00E-04	110	4.80E-05	218.8
N981	U-234	1.70E-05	50	1.00E-05	60	1.30E-05	51.9
N981	U-235	1.30E-05	60	1.20E-05	70	1.30E-05	8
N981	U-238	9.70E-06	70	1.20E-05	60	1.10E-05	21.2
N981	Pu-238	-2.10E-06	70	8.10E-07	200	-6.50E-07	451.2
N981	Pu239/40	4.20E-07	90	5.10E-06	90	2.80E-06	169.6
N464	Co-60	-1.80E-05	350				

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N464	Zn-65	-1.30E-04	100				
N464	Sr-90	-3.50E-05	450				
N464	Ru-103	1.90E-05	280				
N464	Ru-106	-3.20E-04	160				
N464	Sn-113	2.30E-05	240				
N464	Sb-125	-3.00E-05	400				
N464	Cs-134	-6.40E-05	100				
N464	Cs-137	2.00E-04	44				
N464	Ce-144	2.30E-04	230				
N464	Eu-152	8.80E-05	160				
N464	Eu-154	3.60E-05	500				
N464	Eu-155	-4.20E-05	330				
N464	U-234	4.30E-05	30				
N464	U-235	1.20E-05	60				
N464	U-238	2.00E-05	50				
N464	Pu-238	-6.10E-06	160				
N464	Pu239/40	9.60E-06	70				
N465	Co-60	3.00E-05	180				
N465	Zn-65	9.30E-05	120				
N465	Sr-90	5.30E-04	30				
N465	Ru-103	-2.40E-05	200				
N465	Ru-106	3.10E-05	1000				
N465	Sn-113	-1.30E-05	440				
N465	Sb-125	8.30E-06	1000				
N465	Cs-134	2.20E-05	220				
N465	Cs-137	3.10E-05	160				
N465	Ce-144	-1.10E-05	1000				
N465	Eu-152	6.90E-06	1000				
N465	Eu-154	-1.10E-04	110				
N465	Eu-155	3.80E-05	340				
N465	U-234	2.90E-05	40				
N465	U-235	8.30E-06	80				
N465	U-238	1.30E-05	60				
N465	Pu-238	1.90E-06	140				
N465	Pu239/40	2.00E-05	50				
N466	Co-60	-3.90E-05	190				
N466	Zn-65	7.20E-05	220				
N466	Sr-90	4.50E-04	60				
N466	Ru-103	-2.80E-06	1000				
N466	Ru-106	1.10E-04	490				
N466	Sn-113	2.90E-05	230				
N466	Sb-125	2.10E-05	670				
N466	Cs-134	1.50E-05	450				
N466	Cs-137	6.50E-05	93				
N466	Ce-144	6.00E-04	99				

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N466	Eu-152	-1.60E-06	1000				
N466	Eu-154	1.30E-04	150				
N466	Eu-155	1.60E-07	1000				
N466	U-234	3.30E-05	40				
N466	U-235	1.30E-05	70				
N466	U-238	2.60E-05	50				
N466	Pu-238	1.20E-06	200				
N466	Pu239/40	8.70E-06	80				
N467	Co-60	2.30E-04	120				
N467	Zn-65	-6.80E-04	100				
N467	Sr-90	-1.30E-03	100				
N467	Ru-103	-3.60E-05	560				
N467	Ru-106	3.00E-05	1000				
N467	Sn-113	-1.10E-04	220				
N467	Sb-125	2.40E-04	220				
N467	Cs-134	-1.20E-04	210				
N467	Cs-137	-5.30E-05	480				
N467	Ce-144	-8.30E-04	240				
N467	Eu-152	7.20E-05	750				
N467	Eu-154	1.70E-04	430				
N467	Eu-155	-3.30E-05	1000				
N467	U-234	5.50E-05	60				
N467	U-235	4.70E-05	60				
N467	U-238	3.20E-05	80				
N467	Pu-238	6.70E-11	1000				
N467	Pu239/40	-7.90E-06	140				
N468	Co-60	-1.60E-04	100				
N468	Zn-65	4.00E-04	94				
N468	Sr-90	-1.70E-03	100				
N468	Ru-103	1.10E-04	120				
N468	Ru-106	-7.40E-04	200				
N468	Sn-113	5.10E-05	320				
N468	Sb-125	6.20E-05	560				
N468	Cs-134	1.10E-05	1000				
N468	Cs-137	-1.40E-04	110				
N468	Ce-144	-1.30E-04	920				
N468	Eu-152	9.90E-05	350				
N468	Eu-154	3.30E-05	1000				
N468	Eu-155	4.00E-05	880				
N468	U-234	3.40E-05	70				
N468	U-235	2.50E-05	80				
N468	U-238	5.60E-06	140				
N468	Pu-238	5.90E-06	140				
N468	Pu239/40	3.10E-06	200				
N469	Co-60	-6.40E-07	1000				

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N469	Zn-65	-6.20E-04	100				
N469	Sr-90	-4.50E-04	160				
N469	Ru-103	1.00E-04	190				
N469	Ru-106	3.10E-04	520				
N469	Sn-113	-3.30E-06	1000				
N469	Sb-125	-1.70E-04	290				
N469	Cs-134	1.70E-04	110				
N469	Cs-137	-9.90E-05	180				
N469	Ce-144	-1.80E-04	970				
N469	Eu-152	1.30E-04	320				
N469	Eu-154	-3.10E-04	190				
N469	Eu-155	2.50E-05	1000				
N469	U-234	2.80E-05	70				
N469	U-235	3.10E-05	70				
N469	U-238	2.30E-05	70				
N469	Pu-238	3.40E-06	200				
N469	Pu239/40	9.90E-06	120				
N470	Co-60	3.60E-05	390				
N470	Zn-65	-7.40E-04	100				
N470	Sr-90	-3.30E-04	170				
N470	Ru-103	-1.00E-04	140				
N470	Ru-106	1.10E-03	140				
N470	Sn-113	5.70E-05	290				
N470	Sb-125	8.80E-05	390				
N470	Cs-134	-4.60E-05	340				
N470	Cs-137	-4.70E-05	320				
N470	Ce-144	-1.20E-03	120				
N470	Eu-152	-7.70E-05	470				
N470	Eu-154	-7.10E-05	600				
N470	Eu-155	-1.60E-06	1000				
N470	U-234	2.50E-05	70				
N470	U-235	2.40E-05	70				
N470	U-238	9.50E-06	150				
N470	Pu-238	2.80E-06	360				
N470	Pu239/40	-2.80E-06	360				
N482	K-40	2.50E-02	22				
N482	Co-60	-2.30E-04	99.4				
N482	Sr-90	1.60E-04	59.1				
N482	Ru-106	-3.50E-04	591.2				
N482	Sb-125	-1.90E-05	2663				
N482	Cs-134	4.30E-05	422.1				
N482	Cs-137	4.40E-05	373.3				
N482	Eu-154	2.10E-04	208				
N482	Eu-155	1.50E-04	236.7				
N482	U-234	2.10E-05	125.9				

Table C-1. 1996 Air Sample Results, All Areas (pCi/m^3).

Site	Isotope	Result	% Error	Result	% Error	Average	% 2SEM
N482	U-235	-1.20E-06	144.4				
N482	U-238	-6.00E-07	202				
N482	Pu239/40	1.00E-06	240.9				
N482	Am-241	1.80E-06	178.5				
N483	K-40	1.60E-02	29.2				
N483	Co-60	-1.40E-04	189.4				
N483	Sr-90	-2.20E-07	9999				
N483	Ru-106	-2.50E-03	88.6				
N483	Sb-125	3.50E-04	149.7				
N483	Cs-134	4.60E-05	418.2				
N483	Cs-137	7.50E-05	290.2				
N483	Eu-154	-3.60E-05	1907				
N483	Eu-155	1.90E-04	200				
N483	U-234	8.40E-06	201.6				
N483	U-235	-1.30E-06	144.8				
N483	Pu-238	-2.80E-07	116.6				
N483	Pu239/40	-1.90E-07	142.6				
N483	Am-241	6.50E-07	339.4				
N484	K-40	1.20E-02	37.3				
N484	Co-60	1.40E-04	139				
N484	Sr-90	3.00E-05	100.9				
N484	Ru-106	-2.30E-03	97.7				
N484	Sb-125	2.70E-04	155.5				
N484	Cs-134	6.90E-05	258.7				
N484	Cs-137	1.20E-04	169.4				
N484	Eu-154	1.20E-04	681.8				
N484	Eu-155	-3.40E-04	131.3				
N484	U-234	-1.20E-06	144.4				
N484	U-235	-6.20E-07	202.6				
N484	Pu-238	-5.00E-07	117.3				
N484	Pu239/40	-4.90E-07	117.3				
N484	Am-241	-9.00E-07	117.8				

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APPENDIX D

GROUNDWATER MONITORING FIGURES AND RESULTS

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Figure D-1. Location of Groundwater Wells at 100-N Area.

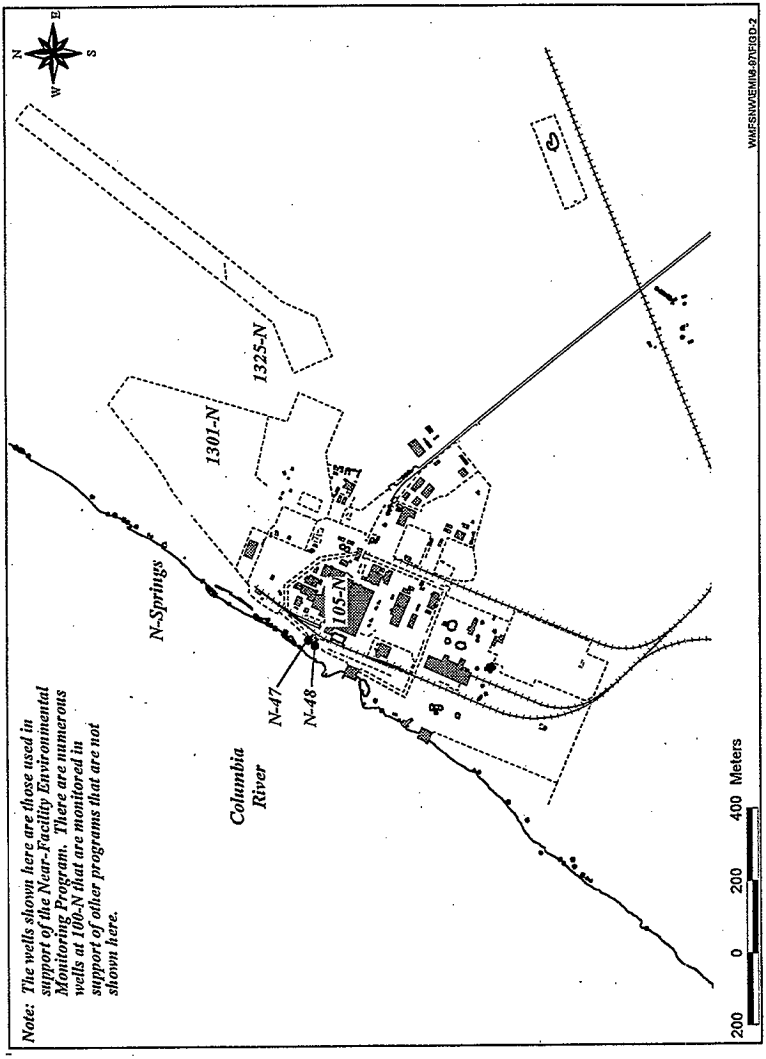

Table D-1. Radiological Results for Groundwater Samples (μCi/ml)

EDP Code	Co-60	Cs-137	Eu-152	Eu-154	Eu-155
Y847	1.50E-09	-4.00E-09	-3.90E-09	6.00E-09	7.80E-09
	1.10E-09	1.10E-09	-3.90E-09	6.20E-09	-1.70E-08
	3.10E-09	3.20E-09	-6.30E-09	2.10E-08	-1.70E-08
	7.90E-10	1.60E-09	-8.90E-09	3.70E-09	3.60E-09
	-4.20E-09	-1.10E-09	1.00E-09	-1.40E-08	-1.00E-09
	-1.50E-09	9.80E-10	-3.10E-09	-4.50E-09	-3.80E-09
# Samples	6	6	5	6	5
Average	<1.4E-10	<3.0E-10	?4.2E-09	3.20E-09	?2.0E-09
Maximum				2.10E-08	
Minimum				2.10E-08	
2SEM	<1.9E-09	<1.9E-09	<3.0E-09	8.70E-09	<7.4E-09

EDP Code	Co-60	Cs-137	Eu-152	Eu-154	Eu-155
Y848	3.40E-09		1.20E-09	8.20E-09	-4.20E-09
	9.60E-09	-3.90E-09	-4.50E-09	-9.00E-09	-4.70E-09
# Samples	2	1	2	2	2
Average	6.50E-09	?3.9E-09	?1.6E-09	?4.0E-10	?4.5E-09
Maximum	9.60E-09				
Minimum	9.60E-09				
2SEM	4.40E-09		<4.0E-09	<1.2E-08	<3.4E-10

APPENDIX E

SOIL AND VEGETATION MONITORING FIGURES AND TABLES

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Figure E-1. Soil Sampling Locations in the 100 N Area.

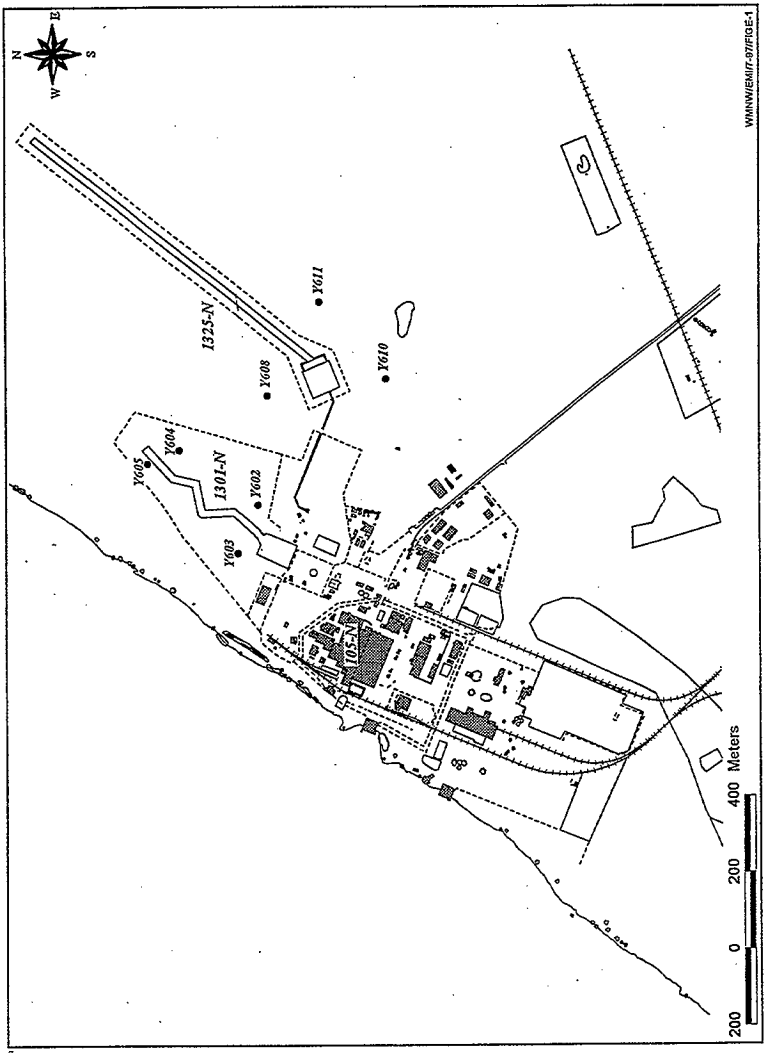

Figure E-2. Soil Sampling Locations in the 200 East Area.

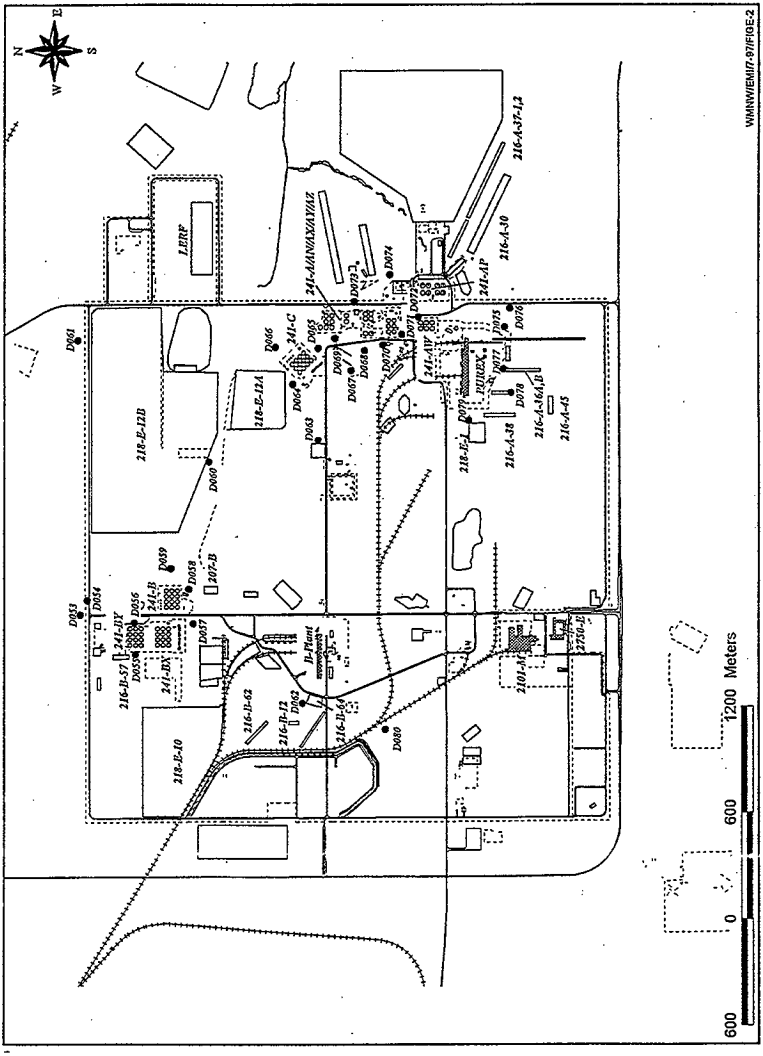

Figure E-3. Soil Sampling Locations in the 200 West Area.

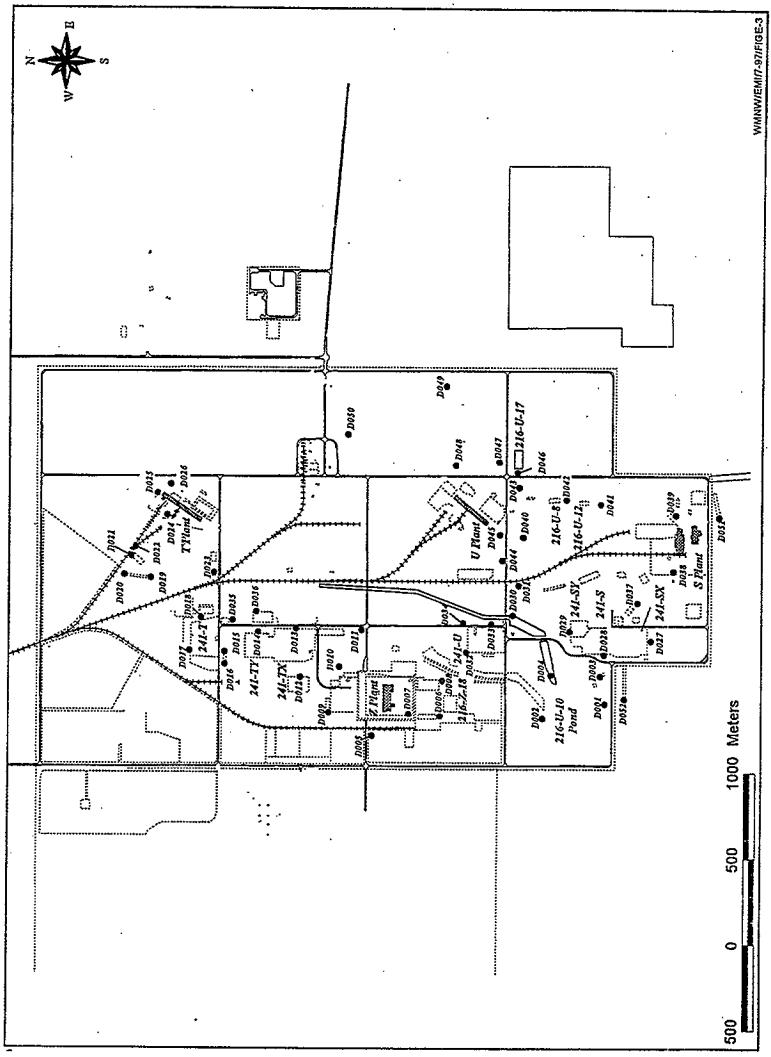

Figure E-4. Soil Sampling Locations in the 600 Area.

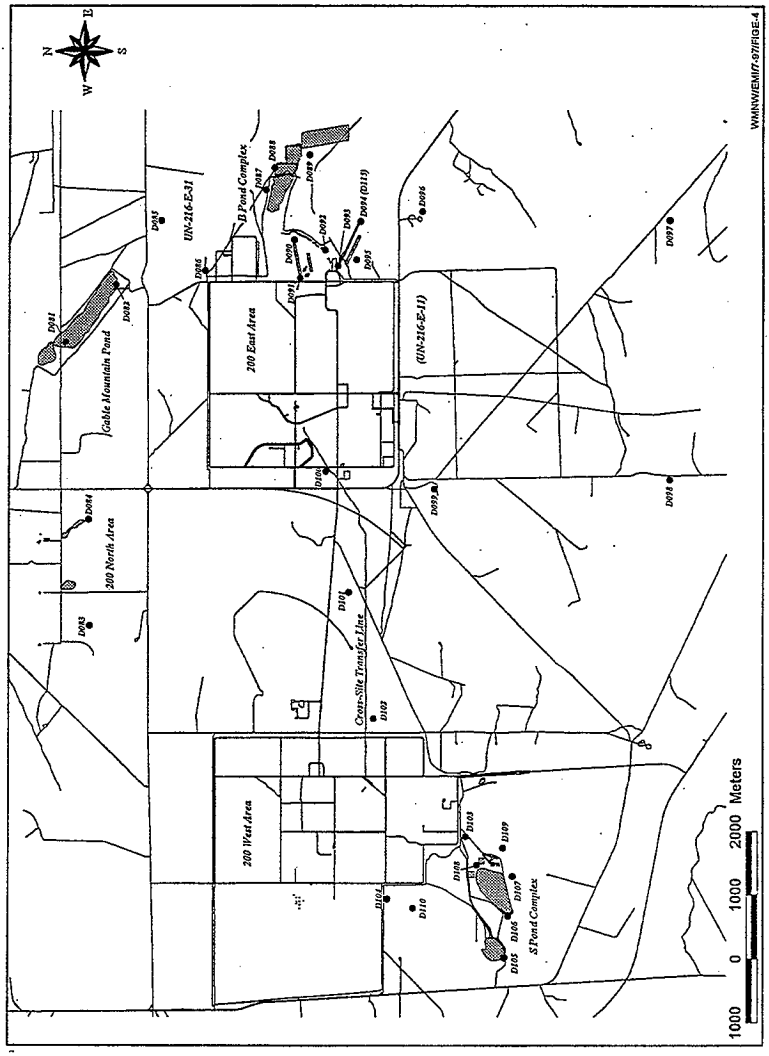

Figure E-5. Soil Sampling Locations in the 300 Area.

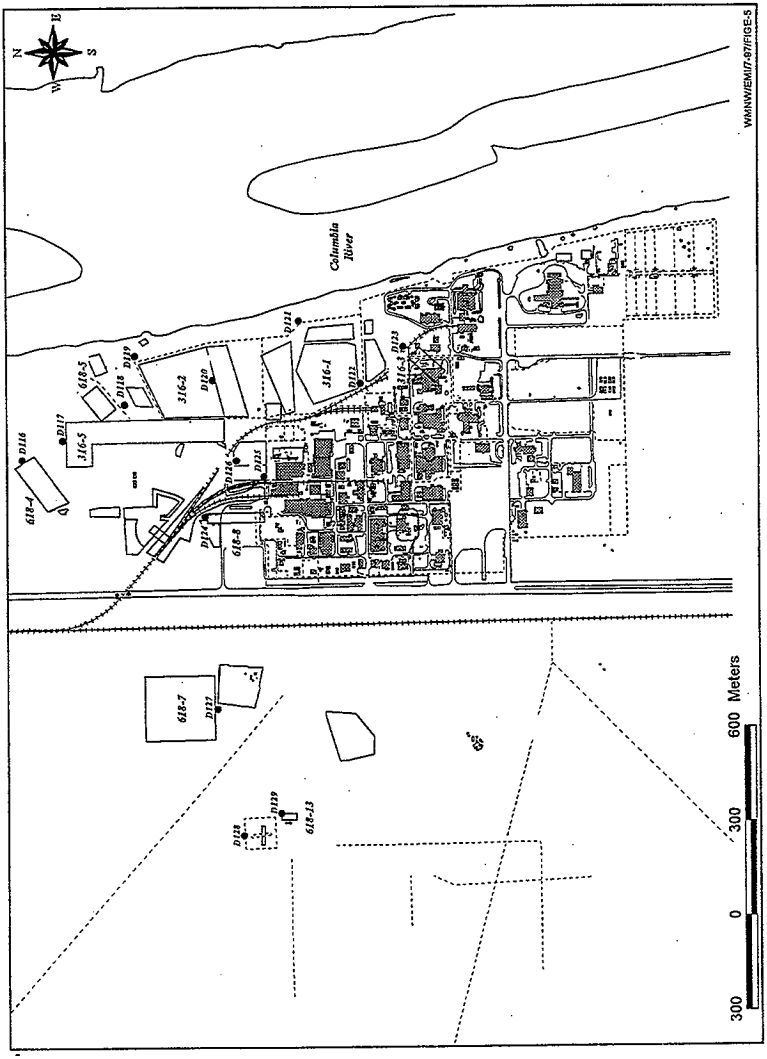

Figure E-6. Soil Sampling Locations in the 400 Area.

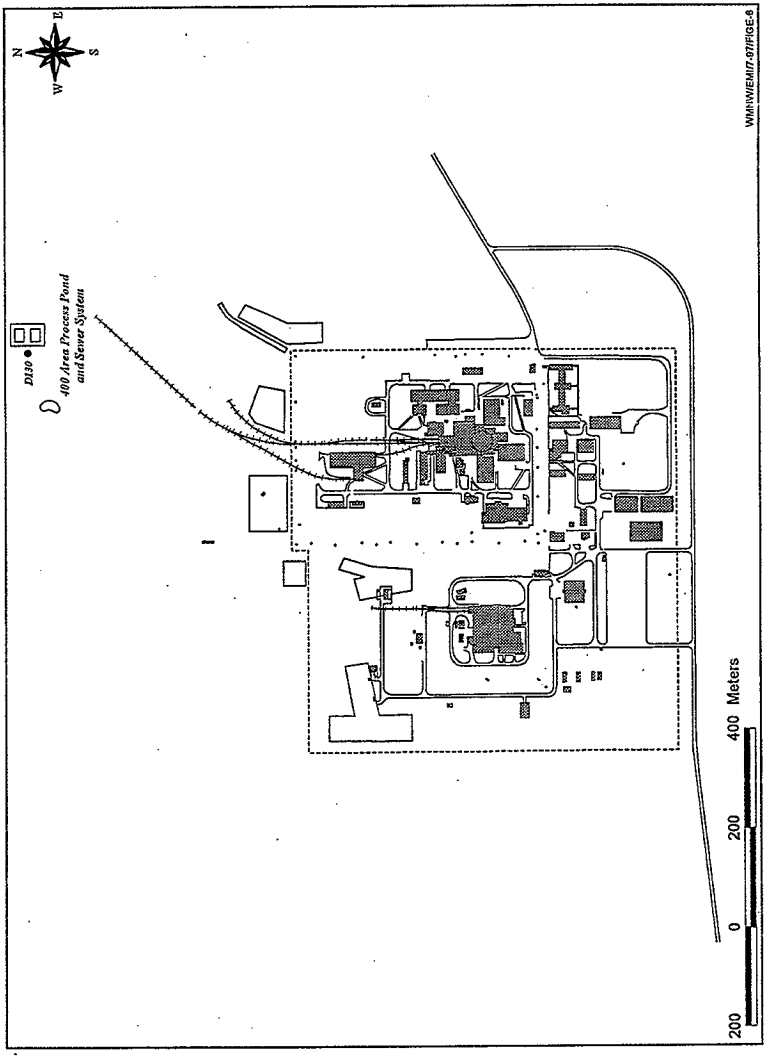

Figure E-7. Vegetation Sampling Locations in the 100 N Area.

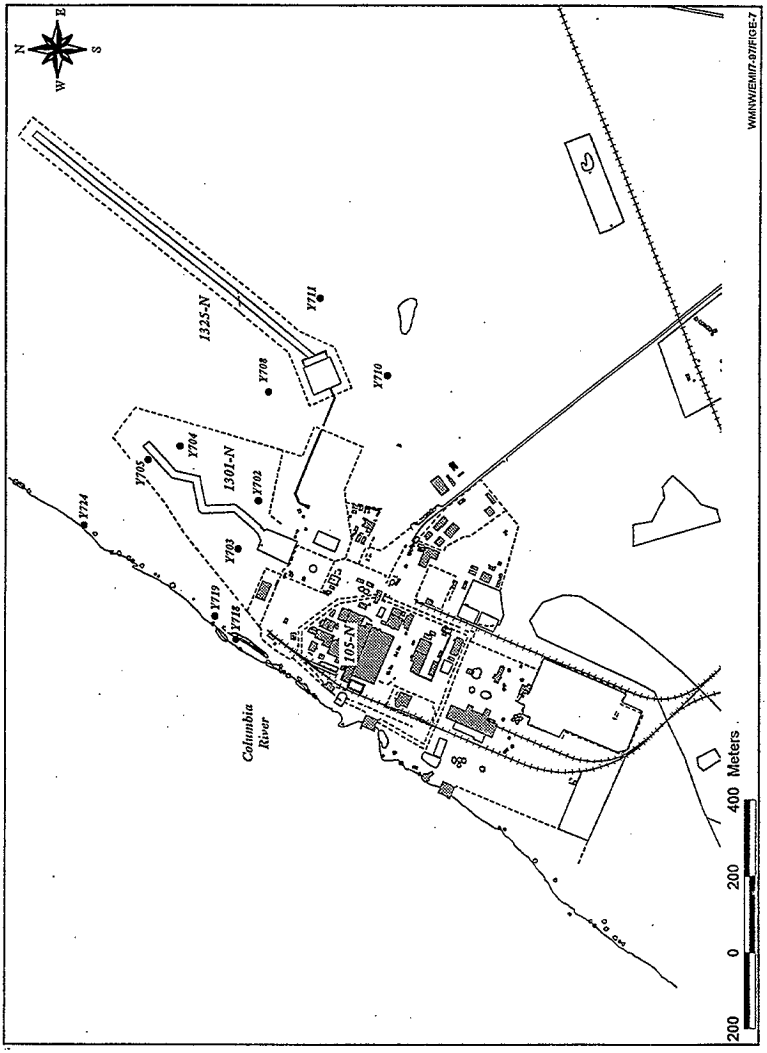

Figure E-8. Vegetation Sampling Locations in the 200 East Area.

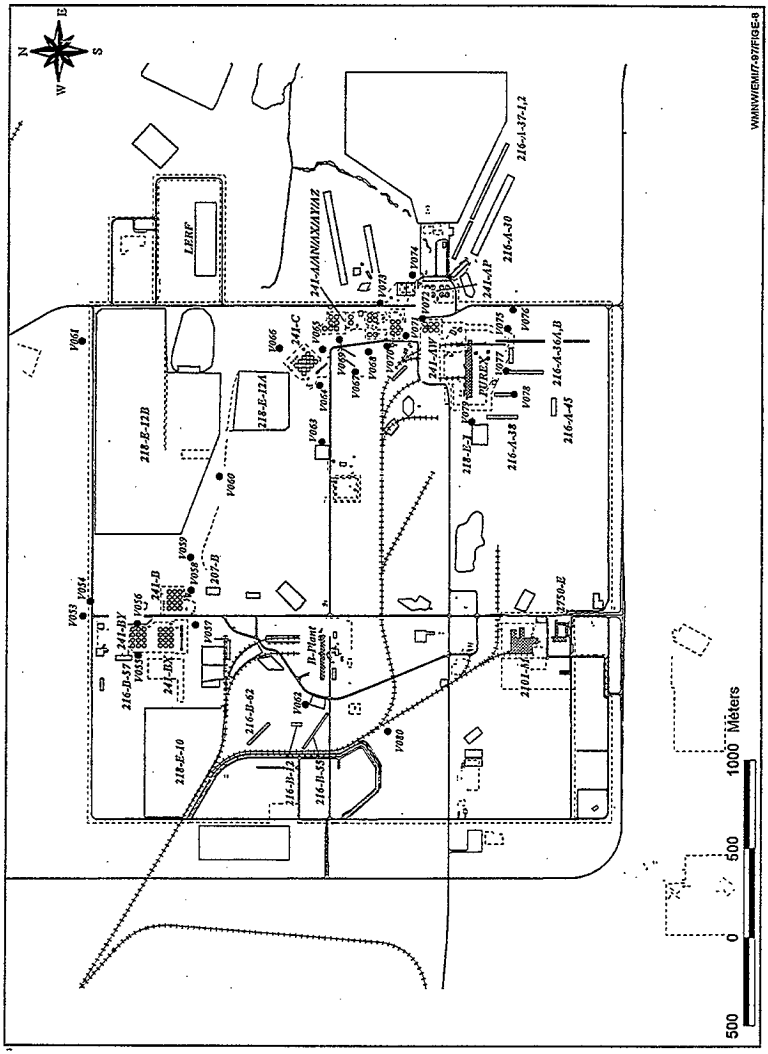

Figure E-9. Vegetation Sampling Locations in the 200 West Area.

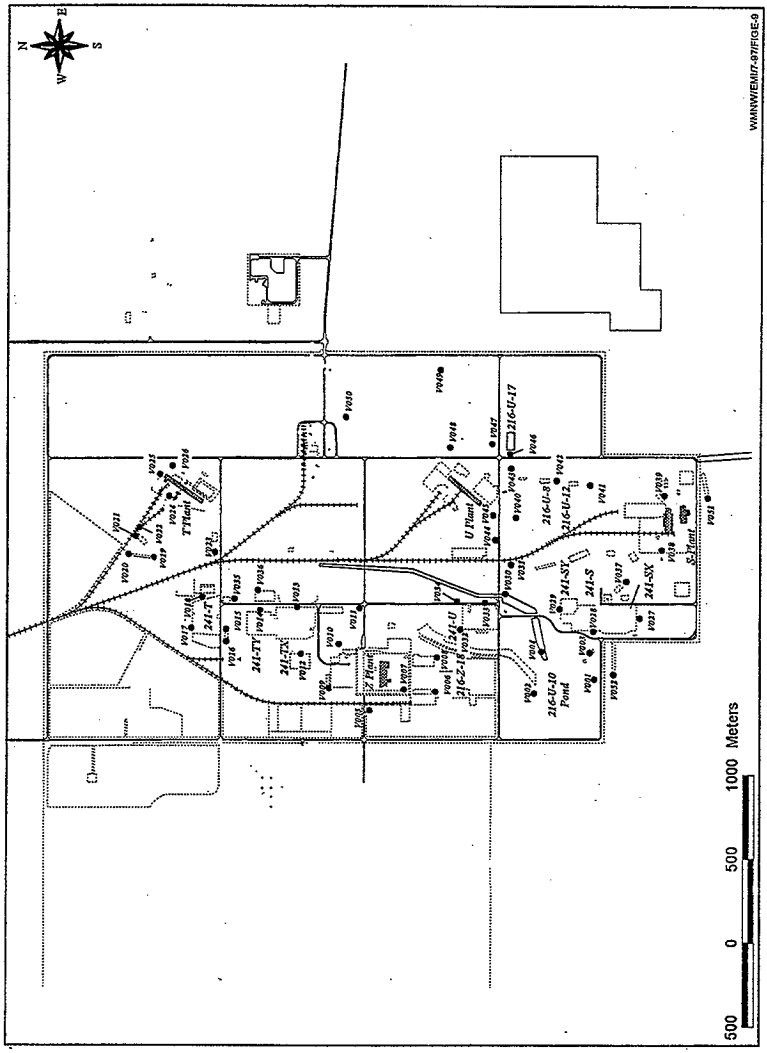

Figure E-10. Vegetation Sampling Locations in the 600 Areas.

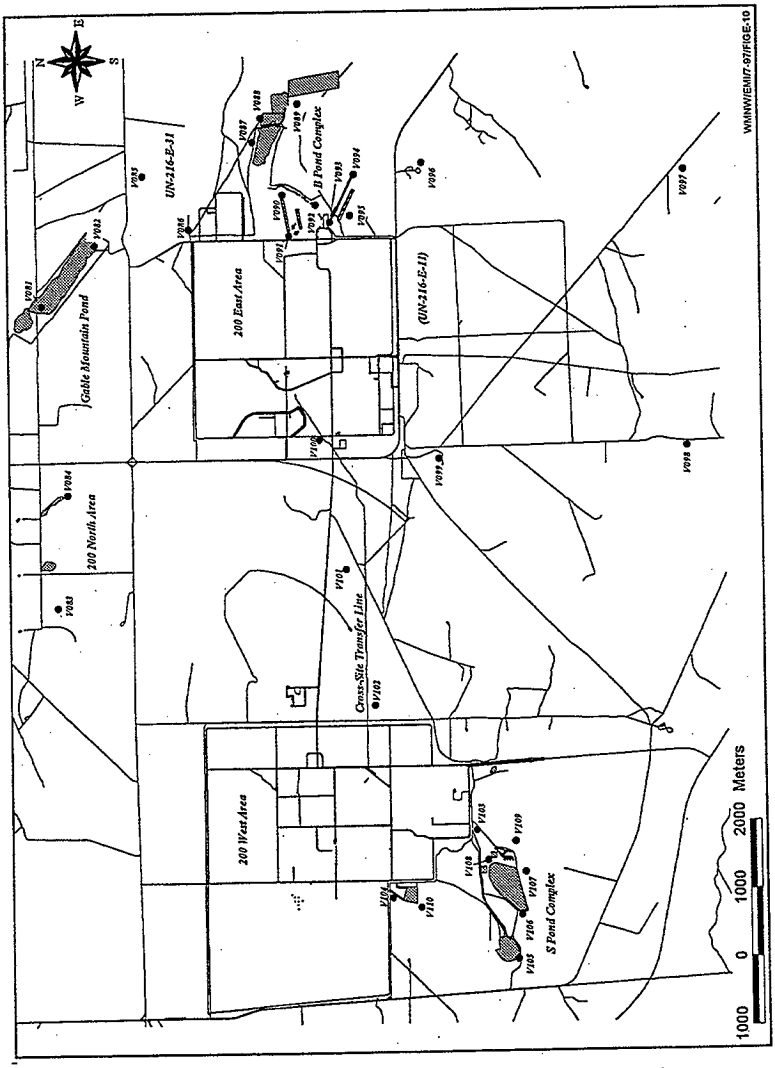

Figure E-11. Vegetation Sampling Locations in the 100 Area.

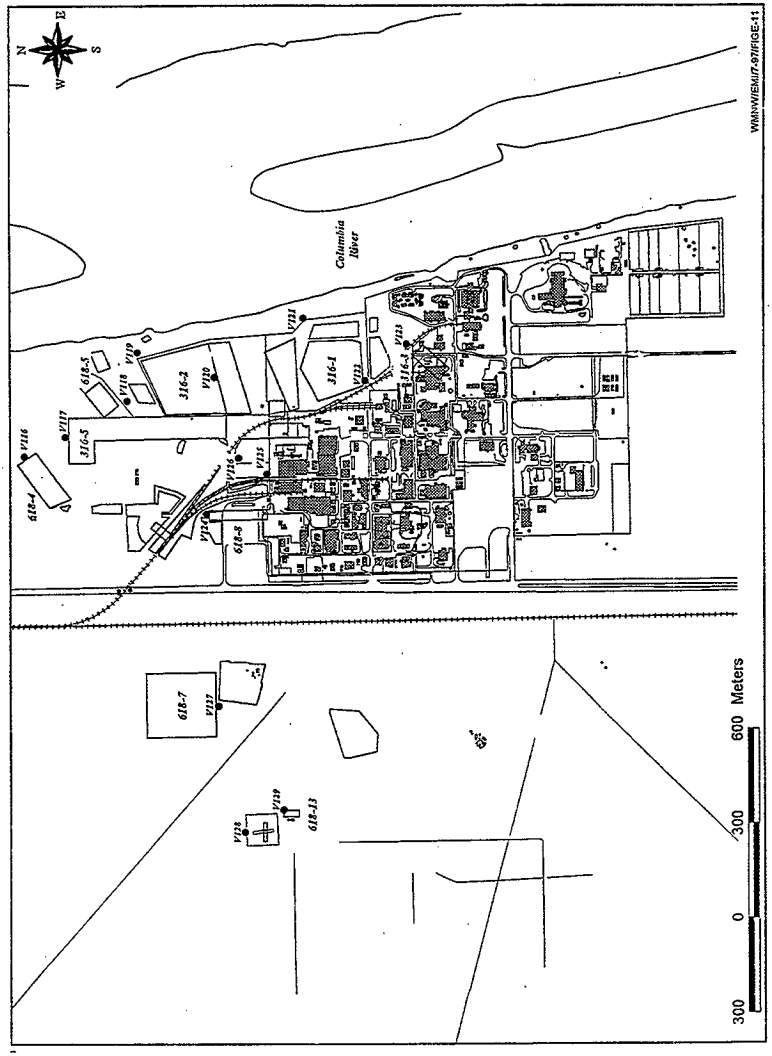

Figure E-12. Vegetation Sampling Locations in the 400 Area.

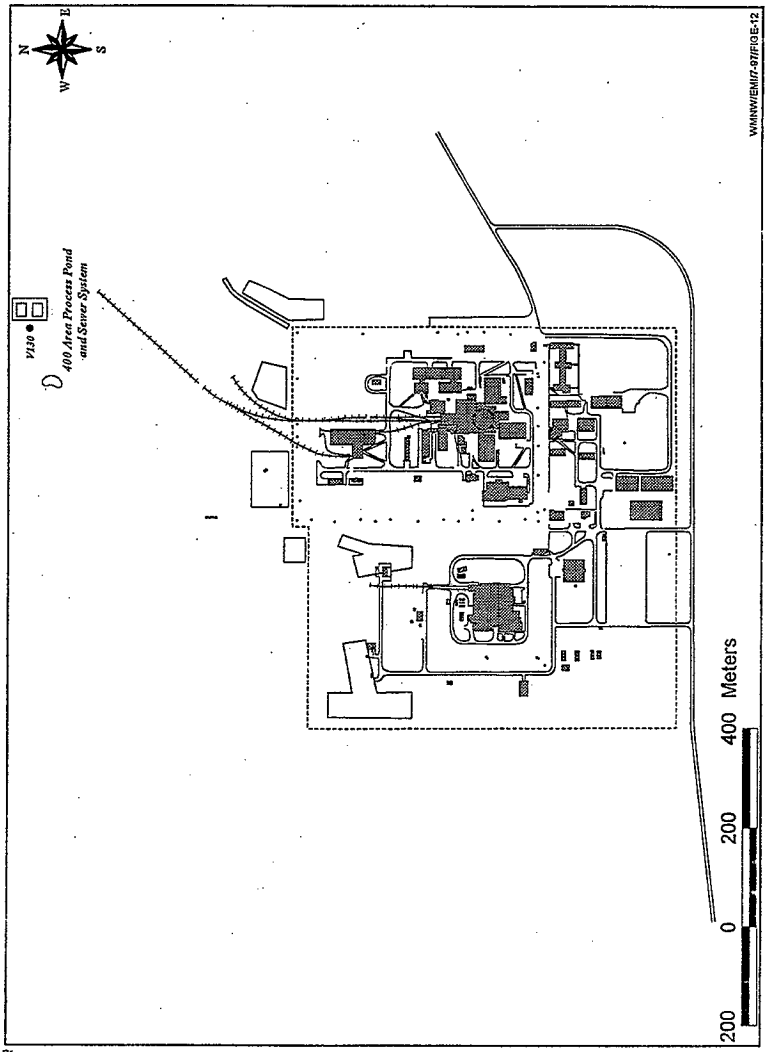

Figure E-13. Soil Sampling Locations for the 100 D/DR Remediation Project.

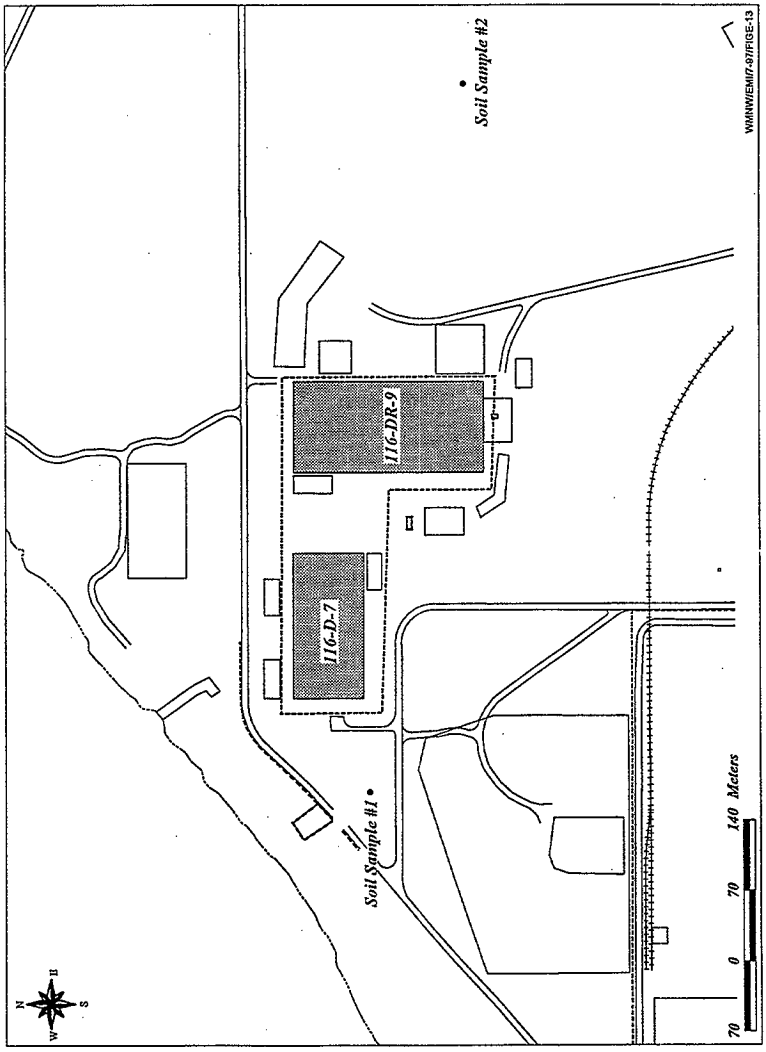

Table E-1. Soil Sample Results (pCi/g).

	K-40		Co-60		Sr-90		Cs-137			
	Result	% Error	Result	% Error	Result	% Error	Result	%Error		
Y602	1.00E+01	11	1.70E+00	11	9.50E-02	64	2.10E-01	14		
Y603	1.10E+01	11	2.40E+00	10	3.70E-01	33	9.10E-01	11		
Y604	1.60E+01	11	1.20E+00	11	2.40E-01	35	1.30E+00	10		
Y605	1.20E+01	11	4.70E+00	10	2.30E-01	367	1.50E+00	11		
Y608	1.40E+01	11	4.30E-01	13	2.80E-01	35	1.20E+00	11		
Y610	1.60E+01	11	3.50E-01	14	9.10E-02	61	1.10E-01	24		
Y611	1.50E+01	12	5.40E-02	28	9.60E-02	67	1.70E-01	15		
	Eu-154		Eu-155		Ra-226		U-234		U-235	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
Y602	9.60E-03	303	3.80E-02	74	4.00E-01	14	7.50E-01	25	1.90E-02	116
Y603	3.40E-02	96	3.50E-02	85	5.00E-01	14	4.60E-01	28	9.80E-03	163
Y604	-2.60E-02	170	4.90E-02	82	6.20E-01	13	6.10E-01	29	5.90E-02	75
Y605	6.80E-02	63	4.30E-02	94	4.80E-01	17	4.50E-01	25	1.10E-02	132
Y608	-4.80E-03	745	5.70E-02	57	6.60E-01	12	5.20E-01	25	9.00E-03	156
Y610	2.50E-02	178	6.00E-02	65	8.10E-01	12	6.50E-01	25	2.70E-02	96
Y611	-2.60E-02	146	8.10E-02	41	6.40E-01	12	5.30E-01	25	2.90E-02	85
	U-238		Pu-238		Pu239/40					
	Result	% Error	Result	% Error	Result	% Error				
Y602	8.90E-01	25	-1.30E-03	200	1.40E-02	242				
Y603	4.60E-01	28	-1.20E-03	203	7.60E-02	94				
Y604	5.00E-01	30	-1.30E-03	200	4.60E-02	124				
Y605	4.00E-01	25	2.20E-02	149	5.70E-02	93				
Y608	4.90E-01	25	7.40E-02	106	5.30E-02	126				
Y610	6.70E-01	26	-1.30E-03	205	1.50E-02	219				
Y611	5.50E-01	25	-3.50E-03	117	4.00E-02	129				
	K-40		Co-60		Zn-65		Sr-90		Zr-95	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error		
D002	9.80E+00	10.8	-4.60E-03	198.7			5.40E-02	21.3		
D004	1.40E+01	10.6	8.40E-03	132.5			1.70E-01	19.9		
D006	1.50E+01	10.6	-5.20E-04	999.9			4.00E-02	25.2		
D008	1.50E+01	10.7	-7.30E-03	163			1.20E-02	41.9		
D010	1.40E+01	10.5	1.70E-02	59.9			5.20E-02	23.7		
D012	1.50E+01	10.6	-3.40E-03	391.3			6.60E-01	18.4		
D014	1.40E+01	10.5	7.90E-03	110			3.00E-01	19		
D016	1.30E+01	10.6	-1.20E-03	869.9			8.40E-02	20.7		
D018	1.40E+01	10.6	1.10E-02	81.8			1.70E-01	19.3		
D020	1.50E+01	10.6	1.30E-02	79.5			2.00E-01	18.9		
D022	1.50E+01	10.7	4.50E-04	999.9			4.40E-01	17.7		
D024	1.60E+01	10.6	2.00E-02	62.1			3.00E+00	17.4		
D026	1.40E+01	10.6	7.90E-02	29.6			1.00E+00	18.7		
D028	1.50E+01	10.6	9.10E-03	129			1.40E-01	24.8		
D030	1.50E+01	10.5	1.30E-03	798.5			5.20E-01	18.3		
D032	1.50E+01	10.5	1.20E-02	92.6			8.70E-01	22.5		
D034	1.40E+01	10.6	8.60E-03	109.1			1.30E+00	18.1		

Table E-1. Soil Sample Results (pCi/g).

D036	1.50E+01	10.6	-3.00E-03	345.8			1.30E-01	21.4		
D038	1.30E+01	10.5	-5.20E-03	193.5			1.80E-01	20		
D040	1.40E+01	10.6	2.70E-03	347			5.60E-02	23.9		
D042	1.30E+01	10.5	-7.40E-03	129.3			1.40E-01	21.4		
D044	1.60E+01	10.7	6.90E-03	214			2.20E-01	19.9		
D046	1.50E+01	10.5	1.10E-03	990.8			1.30E-01	20.3		
D048	1.30E+01	10.7	3.30E-03	346.6			8.80E-01	18.6		
D050	1.40E+01	10.6	1.30E-02	95.4			2.40E-02	26.8		
D052	1.40E+01	10.6	1.60E-03	698.1			5.60E-02	21.9		
D054	1.50E+01	10.6	1.10E-02	97.3			6.00E-01	18.4		
D056	1.40E+01	10.7	-6.40E-03	168.5			5.70E-02	24.6		
D058	1.50E+01	10.6	2.00E-04	999.9			2.00E+00	18.3		
D060	1.60E+01	10.6	-1.20E-02	101.7			2.30E-01	19.8		
D062	1.50E+01	10.6	-1.50E-02	90.7			2.60E-01	18.8		
D064	1.50E+01	10.5	-1.80E-03	651.4			9.80E-01	18.3		
D066	9.70E+00	10.8	-3.30E-03	237.4			7.10E-01	18.4		
D068	1.60E+01	10.6	8.70E-03	154.7			1.60E-01	19.7		
D072	1.30E+01	10.4	-3.70E-03	224.3			4.10E-01	18.9		
D074	1.50E+01	10.7	6.40E-03	168			9.10E-02	19.6		
D076	1.50E+01	10.5	7.10E-04	999.9			2.60E-01	18.1		
D078	1.70E+01	10.4	1.50E-04	999.9						
D080	1.50E+01	10.6	-6.50E-03	167.2			1.80E-01	20		
D082	1.40E+01	10.7	2.40E-03	530.9			2.30E-02	34.6		
D084	1.60E+01	10.6	-2.90E-03	378.9			1.70E-01	22.4		
D086	1.50E+01	10.6	3.40E-03	320.7			2.60E-01	22.6		
D088	1.60E+01	10.5	-6.20E-03	201.6			1.10E-01	20.8		
D090	1.40E+01	10.5	1.20E-02	80.3			5.80E-02	21.8		
D092	1.40E+01	10.5	-4.60E-03	236.4			1.10E-01	25		
D094	1.40E+01	10.6	2.00E-03	538.1			4.10E-02	23.7		
D096	1.50E+01	10.6	4.20E-03	257.1			1.90E-01	19.6		
D098	1.50E+01	10.5	3.10E-04	999.9			2.20E-02	28.1		
D100	1.50E+01	10.5	-1.30E-02	82.4			1.10E-01	19.7		
D102	1.30E+01	10.5	-2.40E-03	375.9			1.20E-01	19.5		
D104	1.30E+01	10.5	2.80E-03	312.8			1.20E-02	36.6		
D106	1.20E+01	10.5	1.50E-02	56.5			1.20E-01	22.9		
D108	1.40E+01	10.6	9.90E-04	999.9			2.20E-01	23.9		
D110	1.40E+01	10.6	-2.20E-03	454.5			1.80E-02	30.3		
	Ru-106		Sb-125		Cs-134		Cs-137		Ce-144	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
D002					1.00E-02	68.5	4.90E-01	11.3		
D004					-1.10E-02	92.5	4.00E+00	10.1		

Table E-1. Soil Sample Results (pCi/g).

D006					-1.30E-02	72.7	1.10E-01	17.3		
D008					3.00E-04	999.9	5.20E-02	40.7		
D010					-4.70E-03	172.2	3.70E-01	12		
D012					-2.30E-02	58.4	5.90E+00	10.1		
D014					-5.00E-03	218.3	6.10E+00	10.1		
D016					-1.20E-02	74	1.30E+00	10.4		
D018					-2.60E-03	317.6	1.90E+00	10.3		
D020					1.20E-03	723.1	9.20E-01	10.7		
D022					-2.60E-02	53.8	4.10E+00	10.1		
D024					-5.70E-04	999.9	7.70E+00	10.1		
D026					-1.80E-02	56	2.60E+00	10.2		
D028					-2.30E-03	386.6	4.70E-01	11.8		
D030					-2.20E-02	59.9	1.00E+01	10		
D032					-4.70E-03	235.8	7.10E+00	10.1		
D034					-4.60E-03	225.9	6.90E+00	10.1		
D036					-6.40E-03	141.5	1.00E+00	10.5		
D038					4.30E-03	154.7	2.60E-01	12.7		
D040					8.40E-03	85.6	3.00E-01	12.3		
D042					-6.70E-04	999.9	2.20E-01	12.8		
D044					-2.40E-02	62.5	6.50E+00	10.1		
D046					-1.80E-02	51	9.30E-01	10.6		
D048					-6.60E-05	999.9	6.90E+00	10.1		
D050					-6.10E-03	140	2.10E-01	13.9		
D052					-7.90E-02	17.2	3.00E-01	13		
D054					-2.60E-02	47.3	3.20E+00	10.2		
D056					2.10E-03	431.3	1.30E+00	10.5		
D058					-2.40E-02	58.5	8.90E+00	10.1		
D060					-2.90E-03	334.8	1.80E+00	10.3		
D062					-3.00E-02	38.1	6.90E-01	10.9		
D064					-1.50E-02	65.7	9.50E-01	10.7		
D066					-2.50E-03	362.2	6.20E+00	10.1		
D068					-2.40E-02	46.5	1.90E-01	16.5		
D072					-8.30E-03	84.1	3.00E-01	12.1		
D074					9.80E-03	91.5	5.60E-01	11.5		
D076					-9.10E-04	898.6	4.20E-01	11.9		
D078					-1.80E-02	51.4	2.20E-01	14		
D080					-6.70E-03	125.5	9.90E-01	10.6		
D082					-3.00E-02	38.5	7.70E-02	31.6		
D084					2.10E-03	405.7	1.30E+00	10.5		
D086					-2.10E-02	48.5	1.10E+00	10.5		
D088					-1.30E-02	83.7	5.10E-01	11.4		
D090					-2.10E-02	38.9	1.80E-01	13.8		
D092					-9.10E-03	96.5	7.40E-01	10.7		
D094					8.90E-04	858.6	1.20E-01	23.4		
D096					-5.50E-03	170.5	1.00E+00	10.8		
D098					-1.90E-02	50.9	4.10E-02	33.8		
D100					-1.10E-02	75.9	9.10E-01	10.6		
D102					-1.30E-02	64.4	4.90E-01	11.1		

Table E-1. Soil Sample Results (pCi/g).

D104					-1.70E-02	48.2	6.80E-02	22.9		
D106					-4.60E-03	161.6	1.30E-01	15.4		
D108					-8.40E-02	16.9	6.60E-01	11.2		
D110					-7.80E-03	106.1	2.20E-02	48.9		
	Eu-154		Eu-155		U-234		U-235		U-238	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
D002	-2.40E-02	119.4	1.90E-02	142.8	1.40E-01	12.9	3.20E-03	55.8	1.70E-01	12.4
D004	-3.00E-02	118.5	5.70E-02	61.4	1.30E-01	12.7	4.50E-03	43.3	1.30E-01	12.6
D006	1.90E-03	999.9	4.60E-02	73.3	1.50E-01	12.7	4.20E-03	47.1	1.40E-01	12.7
D008	-3.00E-02	132.8	5.30E-02	62.6	5.40E-02	16.1	2.20E-03	64.7	6.10E-02	15.3
D010	3.90E-02	81.1	2.60E-02	110.7	1.20E-01	16.1	6.50E-03	50.9	1.30E-01	15.9
D012	-1.90E-02	218.3	3.50E-02	128	1.00E-01	13.1	3.20E-03	50.6	1.10E-01	12.8
D014	3.50E-02	87.9	2.30E-02	171.5	1.40E-01	13	5.00E-03	43.9	1.40E-01	12.8
D016	-6.60E-03	537	1.90E-02	166.1	6.50E-02	22.9	2.90E-03	91.5	7.40E-02	21.6
D018	-4.40E-02	77.4	6.60E-02	52	5.60E-02	15.5	1.10E-03	89.5	6.10E-02	15
D020	-2.00E-02	181.3	4.10E-02	77.3	6.70E-02	14.3	2.60E-03	53.4	7.10E-02	13.9
D022	3.80E-02	122.7	4.90E-02	96.5	6.10E-02	16.3	3.00E-03	60.3	6.40E-02	15.9
D024	1.90E-02	197.9	9.00E-02	50.4	9.40E-02	13.9	5.10E-03	42.3	9.50E-02	13.9
D026	-4.90E-02	77.5	3.00E-03	999.9	7.20E-02	15.8	3.70E-03	53.6	7.30E-02	15.6
D028	8.60E-03	426.7	8.40E-02	40.5	1.90E-01	12.9	6.80E-03	41.6	1.90E-01	12.8
D030	-5.60E-02	65.3	-1.80E-03	999.9	2.20E-01	12.2	9.30E-03	32.9	2.30E-01	12.2
D032	1.30E-02	270.9	5.50E-02	66.6	1.20E-01	13	3.40E-03	50	1.30E-01	12.8
D034	-1.60E-02	203.1	2.50E-02	148	1.00E-01	14.7	3.40E-03	59.5	1.10E-01	14.5
D036	-2.40E-02	158.2	2.50E-02	129.8	1.20E-01	15	6.80E-03	43.4	1.40E-01	14.3
D038	-3.10E-02	102	5.70E-02	46.7	1.00E-01	13.9	4.40E-03	47	1.10E-01	13.6
D040	-2.30E-02	143.9	3.70E-02	78.7	1.20E-01	13	4.70E-03	43.3	1.20E-01	13.1
D042	3.00E-02	96.3	1.20E-02	216.9	1.20E-01	13.2	4.80E-03	43.4	1.20E-01	13.1
D044	3.10E-03	999.9	6.60E-02	77.4	1.40E-01	11.6	7.60E-03	29.7	1.40E-01	11.4
D046	-3.30E-02	108.8	4.40E-02	70.6	1.40E-01	13	5.90E-03	39.9	1.40E-01	12.9
D048	-1.70E-02	214.4	6.60E-02	63.4	3.80E-02	17.6	2.10E-03	71	4.00E-02	16.8
D050	-1.40E-02	256.1	4.10E-02	80.7	8.70E-02	13.5	4.80E-03	39.5	9.00E-02	13.4
D052	4.70E-03	798.3	5.00E-02	65.3	6.80E-02	15.6	5.00E-03	47.2	6.90E-02	15.4
D054	2.90E-02	126.6	3.90E-02	95.7	1.50E-01	12.6	6.20E-03	38.6	1.50E-01	12.5
D056	-1.10E-03	999.9	6.30E-02	50.5	1.60E-01	12.2	6.30E-03	36.6	1.70E-01	12.1
D058	7.40E-03	519.5	5.20E-02	89.5	1.60E-01	12.3	7.00E-03	35.1	1.60E-01	12.1
D060	-3.30E-02	114.4	4.70E-02	68.6	5.80E-02	15.7	1.50E-03	81.8	5.80E-02	15.5
D062	2.20E-02	181.5	6.00E-02	61.5	1.00E-01	13.9	4.50E-03	45.8	1.10E-01	13.6
D064	-8.90E-03	419	2.40E-02	144.9	1.10E-01	13.4	4.40E-03	45.2	1.30E-01	12.8
D066	6.90E-03	373.9	4.60E-02	74.2	7.60E-02	16.2	3.40E-03	59.7	8.80E-02	15.5
D068	3.10E-02	134.5	1.70E-02	214.5	8.40E-02	13.9	2.70E-03	56.7	9.50E-02	13.5
D072	-1.20E-02	234.4	4.50E-02	55.8	9.80E-02	13.6	3.60E-03	50	1.00E-01	13.3
D074	-1.50E-02	256.5	5.50E-02	63.4	7.60E-02	14.6	4.00E-03	47.2	7.90E-02	14.4
D076	9.50E-03	332.6	2.70E-02	114.8	8.20E-02	14.8	4.40E-03	47.1	8.30E-02	14.6
D078	-4.10E-04	999.9	1.90E-02	176.1	6.90E-02	13.7	3.70E-03	42.2	6.70E-02	13.6
D080	-1.90E-02	180.1	5.40E-02	56.5	1.50E-01	12.5	8.60E-03	32	1.50E-01	12.4
D082	-7.10E-03	591	3.80E-02	97.1	9.60E-02	14.8	2.10E-03	73.8	1.00E-01	14.5
D084	-3.30E-02	108.8	8.30E-02	38.5	9.00E-02	13.7	5.50E-03	39.5	1.10E-01	13.2

Table E-1. Soil Sample Results (pCi/g).

D086	-8.80E-03	437.7	3.60E-02	93.1	9.70E-02	14	4.50E-03	46.2	1.10E-01	13.5
D088	-3.80E-02	116.4	5.10E-02	75.6	1.40E-01	12.9	4.50E-03	45.8	1.40E-01	12.8
D090	-3.30E-02	97.6	5.20E-02	54.7	1.10E-01	13.9	7.10E-03	37.5	1.40E-01	13.1
D092	2.80E-02	119.1	5.30E-02	58.5	7.10E-02	14.8	2.00E-03	70.4	7.50E-02	14.4
D094	-8.50E-03	400.9	3.10E-02	97.7	6.40E-02	14.9	2.50E-03	59.1	7.20E-02	14.2
D096	1.90E-02	173.4	4.70E-02	70	7.50E-02	14.3	3.00E-03	53.4	7.10E-02	14.4
D098	8.70E-03	397.2	1.10E-02	290.1	3.90E-02	16.4	8.50E-04	105.5	4.10E-02	16
D100	2.10E-02	144.9	7.40E-02	41.9	2.70E-01	11.3	1.20E-02	26.5	2.50E-01	11.4
D102	-5.30E-02	64.1	4.00E-02	71.5	8.20E-02	13.9	2.80E-03	54.8	8.00E-02	14
D104	4.60E-03	638.2	2.50E-02	105.6	6.40E-02	15.1	3.20E-03	52.7	7.10E-02	14.6
D106	-2.80E-02	109.2	2.00E-02	125	5.50E-02	15.3	2.30E-03	58.8	6.30E-02	14.6
D108	-6.20E-03	587.5	4.10E-02	85.7	6.60E-02	15	3.30E-03	51.2	8.20E-02	14.2
D110	3.20E-02	105.6	7.70E-02	40.8	5.50E-02	15.7	2.60E-03	59.3	6.80E-02	14.7
	Pu-238		Pu239/40							
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
D002	2.00E-03	36.2	1.20E-02	18.7						
D004	2.50E-03	34.4	6.00E-02	14.7						
D006	1.60E-03	57.5	4.50E-02	19.1						
D008	1.10E-02	25	1.00E+00	10						
D010	1.70E-03	40.2	8.60E-02	14.1						
D012	1.90E-03	48.8	8.10E-02	11.1						
D014	4.30E-04	83.8	6.00E-03	25.2						
D016	3.80E-04	77.7	2.00E-02	16.3						
D018	2.20E-04	84.9	1.10E-02	15.9						
D020	9.20E-04	59.8	3.30E-02	16.9						
D022	1.30E-02	17.3	1.30E-01	12.9						
D024	4.30E-02	15.5	2.10E+00	13.5						
D026	1.20E-02	15.9	1.20E+00	11.5						
D028	6.30E-04	65.4	2.30E-02	17						
D030	2.10E-03	34.2	8.50E-02	13.6						
D032	2.70E-02	13.9	1.50E+00	11.6						
D034	1.50E-02	16.3	7.50E-01	12.1						
D036	2.50E-04	117.6	4.40E-03	29.7						
D038	6.80E-04	69	1.20E-02	21.8						
D040	1.00E-03	50.8	2.70E-02	16.3						
D042	8.20E-04	49.1	2.80E-02	14.7						
D044	1.40E-02	24	7.40E-01	16.3						
D046	1.90E-03	41.8	4.30E-02	16.4						
D048	4.60E-03	35.6	2.30E-01	17.1						
D050	6.50E-04	84.5	2.70E-02	14.3						
D052	9.10E-04	64.9	2.70E-02	18.4						
D054	3.50E-04	77.3	3.20E-03	26.8						
D056	5.60E-04	68.9	1.60E-03	42.7						
D058	7.20E-04	62.1	2.90E-02	13.7						
D060	1.30E-04	249.6	1.30E-02	17.2						
D062	1.70E-04	123.1	9.60E-03	17.7						

Table E-1. Soil Sample Results (pCi/g).

D064	4.30E-04	83.8	9.60E-03	21.6						
D066	1.40E-04	104.9	1.00E-02	15.9						
D068	4.50E-05	167.4	3.60E-03	20.4						
D072	2.20E-04	142.2	2.50E-03	40.6						
D074	1.60E-04	111.7	8.90E-03	17.1						
D076	1.00E-03	60.1	2.80E-02	18.1						
D078	2.30E-04	114.6	6.10E-03	23.6						
D080	3.90E-04	67.7	2.70E-02	13.7						
D082	-3.20E-05	331.3	5.90E-04	58.7						
D084	5.90E-04	57.6	3.10E-02	14.4						
D086	3.20E-04	78.5	7.60E-03	20						
D088	3.70E-04	83.9	7.90E-03	21.4						
D090	-1.80E-05	698.9	2.50E-03	31.2						
D092	3.20E-04	92.7	1.00E-02	21.2						
D094	3.00E-04	71.3	3.20E-03	21.5						
D096	1.00E-03	62.6	2.10E-02	20						
D098	2.00E-05	501	1.40E-03	40.1						
D100	1.20E-03	51.6	2.30E-02	14						
D102	1.00E-03	67.8	3.00E-02	18.9						
D104	5.30E-04	39.9	2.00E-03	22.4						
D106	1.80E-04	154.8	1.20E-02	17.7						
D108	2.20E-03	28.2	7.20E-02	12.4						
D110	3.60E-04	112.3	5.60E-03	27.8						
	K-40		Co-60		Sr-90		Cs-134		Cs-137	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
D116	1.50E+01	11.3	3.30E-03	612.3	6.80E-02	23.6	-5.30E-03	293	1.90E-01	19.4
D117	1.40E+01	11.2	7.00E-03	219.7	3.10E-02	28.7	-2.60E-02	61.1	9.00E-02	31.4
D118	1.40E+01	11.4	-1.40E-02	107.6	3.90E-02	25.7	-2.20E-02	73.1	9.50E-02	34
D119	1.50E+01	11.5	-1.40E-03	999.9	6.30E-02	22.9	-1.40E-02	122.8	2.40E-01	18
D120	1.00E+01	10.9	-1.20E-02	97.5	9.10E-03	54.7	-5.80E-03	170.8	3.40E-03	310.9
D121	1.50E+01	11.4	1.10E-02	196.2	4.40E-02	25.5	5.70E-03	264.8	2.30E-01	20.6
D122	1.40E+01	10.3	-6.80E-03	130.5	6.10E-03	65.6	3.30E-03	203.9	1.20E-02	69
D123	1.40E+01	10.7	1.20E-02	94.1	4.70E-03	68.4	8.60E-03	117.2	2.70E-02	48.7
D124	1.40E+01	11.3	-2.30E-02	86.3	7.60E-02	21.7	-1.80E-02	85.8	2.70E-01	16.6
D125	1.50E+01	11.3	-6.10E-04	999.9	4.80E-02	24	-1.30E-02	129.8	5.90E-01	13.1
D126	1.50E+01	10.3	5.00E-03	155.9	9.30E-03	50	-2.20E-03	291.1	1.90E-02	64.4
D127	1.40E+01	11.2	2.10E-02	77.4	6.30E-02	22.1	-3.30E-02	48.5	1.80E-01	18.9
D128	1.40E+01	11.2	-6.60E-03	258.4	3.90E-02	29	-1.70E-02	89.8	8.80E-02	34.4
D129	1.40E+01	10.7	5.00E-03	259.6	2.50E-02	31.8	-2.00E-02	59	1.00E-01	29.1
D130	1.40E+01	11.3	2.20E-02	73.4	1.90E-03	150	-9.90E-03	166.3	5.90E-02	47.7
D131	1.40E+01	11.5	-3.30E-03	512	7.80E-02	22	3.10E-03	458.6	3.40E-01	15.1
D132	1.40E+01	11.3	1.20E-02	139.8	1.80E-02	37.4	4.00E-03	355.9	4.50E-02	102.2
	Eu-154		Eu-155		Ra-226		U-234		U-235	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error

Table E-1. Soil Sample Results (pCi/g).

D116	2.70E-02	192.6	4.50E-02	102.2			1.60E-01	12.4	8.00E-03	33.8
D117	-6.00E-03	840	1.40E-02	348.9			1.70E+00	10.9	9.70E-02	14.7
D118	2.20E-02	244.4	-7.70E-04	999.9			9.00E-01	10.7	4.30E-02	17.1
D119	3.10E-02	173.9	-6.00E-03	999.9			9.10E+00	10.6	4.00E-01	11.6
D120	4.70E-03	704.6	-1.50E-02	214.7			9.90E-01	11.6	5.80E-02	17.8
D121	1.10E-02	578.9	-1.40E-02	406.9			1.80E+00	10.8	7.70E-02	15.5
D122	8.40E-03	317.4	4.50E-02	55.9			1.70E-01	12.8	9.40E-03	33.3
D123	-1.70E-02	231.9	4.60E-02	76.9			5.40E-01	11.2	2.30E-02	22.4
D124	-1.20E-01	53.8	4.10E-02	120.4			3.30E-01	11.5	1.50E-02	26.1
D125	9.40E-02	49.3	6.80E-02	84.3			3.00E+00	10.4	3.00E-01	11.4
D126	-1.20E-02	241.4	2.80E-02	70.1			1.50E-01	13	6.80E-03	39.1
D127	-8.60E-03	603.7	9.40E-02	52.9			2.20E-01	12.7	7.30E-03	40.3
D128	3.00E-02	177.8	5.50E-03	869.1			8.40E-02	14.1	4.10E-03	47.3
D129	5.20E-04	999.9	4.20E-02	85.1			2.10E-01	12.2	9.20E-03	33
D130	7.60E-02	72.3	5.30E-02	83.6			1.40E-01	12.4	8.60E-03	31.1
D131	4.30E-03	999.9	1.50E-02	309			2.50E-01	12.3	1.40E-02	28.8
D132	-7.90E-02	74.9	4.90E-02	95.1			2.80E+00	10.3	2.50E-01	11.7

	U-238		Pu-238		Pu239/40					
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
D116	1.70E-01	12.2	3.50E-04	99.7	5.40E-03	26.6				
D117	1.20E+00	11	4.70E-03	29	4.40E-03	29.7				
D118	7.60E-01	10.8	2.80E-04	109.5	3.00E-03	31.5				
D119	9.10E+00	10.6	4.40E-03	28.5	2.90E-01	13.9				
D120	8.70E-01	11.6	1.70E-03	28.3	1.90E-03	26.9				
D121	1.80E+00	10.9	1.50E-03	47	4.90E-02	16				
D122	1.80E-01	12.6	2.40E-04	63.2	2.20E-03	22.2				
D123	5.80E-01	11.2	9.00E-04	52.9	3.20E-02	15.1				
D124	3.30E-01	11.4	3.40E-04	73	8.50E-03	18.3				
D125	2.30E+00	10.4	7.60E-04	59.6	5.00E-03	25.9				
D126	1.60E-01	12.9	1.30E-04	218.5	6.20E-04	78.9				
D127	2.30E-01	12.5	4.10E-04	109	5.20E-03	30.2				
D128	9.80E-02	13.5	5.80E-04	71.3	2.50E-03	33.9				
D129	2.40E-01	12	5.00E-04	52	1.50E-03	30.8				
D130	1.40E-01	12.4	5.30E-04	59.4	1.60E-03	34.8				
D131	2.60E-01	12.2	8.20E-04	53.3	8.20E-03	20.2				
D132	2.10E+00	10.4	1.80E-03	57.7	3.50E-03	41.6				

Table E-2. Vegetation Sample Results (pCi/g).

	K-40		Co-60		Sr-90		Cs-134		Cs-137	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
Y702	1.60E+01	16	1.70E-01	41	2.60E-02	150			2.00E-01	44
Y703	1.50E+01	15	4.60E-02	107	1.00E-01	55			1.40E-01	44
Y704	2.50E+01	13	5.90E-02	76	4.90E-01	41			3.50E-01	31
Y705	2.10E+01	19	2.40E+01	11	2.30E+03	24	8.40E+00	18	1.10E+04	10
Y708	1.60E+01	16	1.10E-02	480	8.60E-02	74			1.50E-01	37
Y710	1.40E+01	15	5.80E-02	77	5.60E-02	89			3.80E-02	111
Y711	4.40E+01	11	-1.50E-02	397	2.00E-01	75			5.60E-02	80
Y718	3.10E+01	12	2.00E-02	276	6.60E+00	20			6.10E-02	81
Y719	3.00E+01	13	-2.70E-03	999	4.20E-01	55			4.70E-02	94
Y724	6.20E+01	11	1.30E-02	579	1.70E-01	90			4.50E-02	126
	Eu-154		Eu-155		U-234		U-235		U-238	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
Y702	1.80E-01	82	-8.30E-02	120	5.20E-02	87	4.70E-03	387	1.70E-02	151
Y703	-9.00E-02	156	-2.70E-02	342	2.60E-03	568	-2.30E-03	100	-2.30E-03	100
Y704	-1.10E-01	136	1.10E-02	780	-2.80E-03	85	-4.70E-04	200	1.50E-02	141
Y705	-1.40E-01	382	-3.00E-01	990	1.70E-01	266			-9.10E-02	91
Y708	-8.70E-02	161	2.40E-02	418	8.60E-03	198	-1.90E-03	100	4.50E-03	265
Y710	-5.10E-02	277	-4.00E-02	229	5.30E-03	337	3.90E-03	459	8.20E-03	220
Y711	1.50E-01	106	2.10E-02	483	-1.90E-03	93	-1.20E-03	121	1.30E-02	127
Y718	1.50E-01	78	-2.10E-02	461	8.40E-03	214	-1.50E-03	115	9.40E-03	192
Y719	-2.80E-01	68	9.50E-02	115	1.60E-02	166	-1.20E-03	138	5.70E-02	79
Y724	-2.00E-01	131	1.70E-02	898	3.00E-03	471	-2.70E-03	93	-2.20E-03	102
	Pu-238		Pu239/40							
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
Y702	-1.30E-03	114								
Y703	-1.10E-03	144	6.40E-03	220						
Y704	-1.10E-03	144	6.40E-03	220						
Y705	-6.80E-02	100	-5.10E-02	117						
Y708	-6.60E-04	198	-2.60E-03	103						
Y710	-6.90E-04	204	-2.10E-03	117						
Y711			5.30E-03	209						
Y718	-1.40E-03	115								
Y719	7.40E-03	217	-2.60E-03	102						
Y724	-8.60E-04	140	-4.30E-04	200						
	K-40		Co-60		Zn-65		Sr-90		Zr-95	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
V002	1.20E+01	32.4	1.40E-01	97.2			4.00E-01	23.8		
V004	1.80E+01	22.6	3.80E-02	317.5			1.70E-01	26.1		

Table E-2. Vegetation Sample Results (pCi/g).

V006	1.20E+01	25.5	2.60E-02	380.9			7.80E-02	24.7		
V008	2.10E+00	171.2	9.10E-02	134.5			1.60E-02	57.4		
V010	1.10E+01	45.9	-1.40E-01	130.5			8.10E-02	26.3		
V012	1.60E+01	23.7	9.50E-02	123.8			3.70E-02	33		
V016	1.40E+01	32.3	4.90E-03	999.9			7.00E-02	26.5		
V018	1.70E+01	21.7	7.00E-02	150.6			3.40E-01	20.4		
V020	1.10E+01	44.1	-9.00E-02	198.9			3.80E-01	20.2		
V022	9.80E+00	37.4	3.30E-01	38.3			3.20E-01	24		
V024	1.80E+01	24.5	-5.40E-02	243			1.20E-01	24.1		
V026	1.60E+01	21.4	1.20E-01	82.8			3.20E-01	22.4		
V030	1.50E+01	25.4	2.80E-03	999.9			1.80E-01	25.1		
V032	2.30E+01	18.6	9.40E-02	111.6			3.70E+00	21.6		
V034	1.60E+01	17.6	5.10E-02	143.6			5.60E-01	17.9		
V036	1.00E+01	26.3	5.60E-02	150.9			1.40E-01	21.3		
V040	1.80E+01	16	6.70E-03	999.9			3.40E-02	56.5		
V042	2.00E+01	16.9	1.10E-01	80.6			3.40E-02	38.5		
V044	2.40E+01	16.1	-6.20E-02	142			1.60E-01	21.1		
V046	2.00E+01	18.2	5.50E-02	163.8			8.30E-02	23		
V048	2.90E+01	15.1	7.50E-02	135.2			2.10E+00	22.6		
V050	1.30E+01	35.9	-7.70E-02	231.2			5.60E-02	55.6		
V052	1.10E+01	29.6	-1.00E-01	107.6			6.10E-02	26.5		
V054	1.60E+01	24.2	-1.70E-02	691.9			2.20E-01	26.1		
V056	2.40E+01	22.5	-1.70E-01	103.6			7.90E-02	27.9		
V058	1.80E+01	25.8	6.60E-02	141.6			1.10E+00	21.8		
V060	1.50E+01	37.7	2.30E-02	708.2			3.10E-01	19.2		
V062	1.50E+01	30.1	-5.20E-02	299.4			2.00E-01	21.5		
V064	1.80E+01	19.1	2.30E-02	463.8			2.20E-01	20.5		
V066	1.00E+01	36.5	1.60E-01	72.8			1.10E+00	18.5		
V068	9.70E+00	36.2	6.20E-02	224.2			1.60E-01	27		
V076	1.90E+01	23.3	-5.60E-02	229.8			1.90E-01	23.9		
V078	1.40E+01	29.1	1.40E-01	105.9			1.10E-01	23.7		
V080	6.40E+01	11.5	-2.40E-02	310.6			1.30E+00	22.5		
V082	7.80E+00	66	-6.10E-02	276.1			6.10E-02	23.5		
V084	4.60E+00	68.7	6.60E-02	170			1.00E-01	24.6		
V086	3.10E+01	15.2	2.70E-02	333.6			1.00E+00	19.7		
V088	1.50E+01	18.8	-4.50E-02	170.5			5.30E-02	25.2		
V090	1.80E+01	16.8	-7.20E-03	988.8			1.10E-01	22.9		
V092	1.10E+01	28.3	2.90E-02	320.6			2.30E-02	44.4		
V094	2.00E+01	19.6	7.90E-02	127.2			7.90E-02	21.6		
V096	1.50E+01	19.1	7.20E-02	102.9			8.20E-02	25		

Table E-2. Vegetation Sample Results (pCi/g).

V098	1.50E+01	24.2	-2.30E-02	550.2			3.30E-02	51.7		
V100	1.50E+01	23.2	5.00E-02	192.7			9.80E-02	54.4		
V102	2.20E+01	19.2	4.10E-02	200.5			2.10E-01	25		
V104	1.30E+01	20.7	-2.10E-03	999.9			1.30E+00	19.8		
V106	1.70E+01	26.3	2.20E-02	488.6			4.10E-01	19.3		
V108	9.00E+00	31.2	1.10E-02	999.9			8.60E-02	24.6		
V110	1.20E+01	27.5	-8.50E-04	999.9			8.30E-02	27.8		
	Ru-106		Sb-125		Cs-134		Cs-137		Ce-144	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
V002					6.30E-02	177.3	1.50E-01	82.8		
V004					-4.30E-02	258.1	1.30E-01	90.6		
V006					-6.30E-02	143.2	-4.40E-03	999.9		
V008					-6.30E-02	164.3	-5.80E-02	193.2		
V010					5.80E-02	243.9	9.50E-02	152.1		
V012					-7.00E-02	130	-7.40E-03	999.9		
V016					-8.70E-02	125.3	2.50E-02	508.1		
V018					-3.70E-02	257.6	8.00E-02	126.3		
V020					1.90E-02	718.7	-5.40E-02	259.2		
V022					2.90E-02	415.2	9.90E-02	127.4		
V024					-8.90E-03	999.9	-1.10E-01	106.4		
V026					-4.50E-02	176.2	1.90E-01	48.9		
V030					-3.30E-02	250.5	2.00E-01	78.3		
V032					-2.40E-02	316.3	2.50E-01	72.1		
V034					-7.00E-02	95.6	4.90E-01	28.5		
V036					-4.80E-02	178.2	2.60E-01	60.4		
V040					-2.50E-02	247.4	-3.40E-03	999.9		
V042					-1.10E-01	71.3	1.60E-02	501.9		
V044					-1.00E-02	706.8	1.40E-01	56.3		
V046					-1.60E-02	460.4	7.10E-02	115.6		
V048					-6.50E-02	118.7	7.10E-02	115.6		
V050					-5.30E-02	265	1.90E-01	81.7		
V052					2.30E-02	371.7	-7.30E-02	134.3		
V054					-3.80E-02	237.7	4.10E-02	242.1		
V056					-6.90E-02	198.3	1.30E-01	106		
V058					4.30E-02	258.7	1.30E-03	999.9		
V060							1.30E-02	999.9		
V062					-3.60E-02	298.3	1.90E-01	55.9		
V064							6.00E-02	137		
V066					-3.90E-02	252.1	2.50E-01	46.3		
V068					-3.20E-02	371.5	9.70E-02	127.3		
V076					-1.00E-01	109.6	1.60E-02	668.8		
V078					-1.20E-02	891.7	3.10E-02	347.3		
V080					-3.30E-02	170.1	-1.20E-02	575.2		
V082					8.70E-02	144.2	7.40E-03	999.9		
V084					-2.80E-02	367.9	2.50E-02	344.7		
V086					4.60E-02	161.8	1.20E-01	63.1		

Table E-2. Vegetation Sample Results (pCi/g).

V088					-2.10E-02	296.7	4.40E-02	152.1		
V090					-6.70E-02	97.5	1.60E-02	381.1		
V092					1.50E-02	576.6	6.40E-02	138.4		
V094					4.60E-02	166.2	-4.90E-02	170.1		
V096					2.80E-02	260.5	3.40E-03	999.9		
V098					4.90E-02	203.1	8.80E-02	111.3		
V100					5.20E-02	157.8	1.30E-02	657		
V102					6.30E-02	127.7	-6.80E-02	136.7		
V104					-9.40E-03	764.1	1.10E-01	71.7		
V106					-2.80E-02	373.2	2.70E-02	423.8		
V108					1.20E-02	794.3	-3.10E-02	323.3		
V110					-8.50E-04	999.9	3.60E-02	220.4		
	Eu-154		Eu-155		U-234		U-235		U-238	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
V002	6.70E-01	61.4	8.60E-02	292.5	3.60E-03	67.2	3.10E-04	269.1	2.10E-03	93.8
V004	2.30E-01	141.5	9.60E-02	189.3	4.50E-03	54.9	-1.30E-04	406.7	2.30E-03	82.8
V006	3.10E-01	79.7	-8.40E-02	207.3	8.10E-03	63.3	-8.00E-05	999.9	1.20E-02	48.4
V008	-7.00E-01	56.3	-1.30E-01	132	2.10E-03	88.9	-2.90E-04	89.2	2.40E-03	80.7
V010	-1.20E-01	335	1.60E-01	151.2	5.80E-03	46.3	1.90E-04	367.4	6.90E-03	41.8
V012	7.80E-02	366	7.30E-02	257.8	4.00E-03	56.9	-2.80E-04	87.1	6.00E-03	45.2
V016	-5.30E-02	767.5			4.70E-03	49.5	1.20E-03	91.8	4.30E-03	51.3
V018	5.50E-02	481.9	2.40E-02	683.1	6.50E-03	45.8	-2.70E-04	302.3	4.60E-03	51.9
V020	1.70E-01	270.7	5.80E-02	518	1.30E-02	31.7	1.00E-04	713.3	8.70E-03	38.8
V022	1.10E-01	332.1	-4.60E-02	444.4	2.40E-03	75.7	2.40E-04	256.6	1.30E-03	116.5
V024	2.50E-01	151.4	-2.50E-02	807.2	5.00E-03	45.5	2.00E-05	999.9	3.10E-03	59
V026	3.40E-02	868.8	2.60E-02	527.1	3.50E-03	58.8	1.60E-04	401.9	3.70E-03	55.8
V030	-4.60E-02	649.1	-2.40E-02	620.4	6.00E-03	42.3	6.80E-04	127.3	6.30E-03	41.7
V032	2.20E-02	999.9	4.60E-02	327.5	7.00E-03	41.1	-5.40E-05	912.5	7.30E-03	39.8
V034	-7.00E-02	330	7.70E-03	999.9	9.00E-03	34.6	-1.80E-04	362.1	1.10E-02	31.8
V036	2.00E-02	999.9	1.40E-01	104.9	6.50E-03	41.7	2.90E-05	999.9	2.70E-03	68.3
V040	-1.50E-01	142	4.00E-02	292.9	4.90E-03	47.2	2.20E-04	267.7	7.10E-03	38.6
V042	2.10E-01	120.2	9.60E-02	160.2	7.30E-03	38.6	1.50E-04	418.8	6.90E-03	39.1
V044	2.60E-01	94.3	1.70E-01	97	6.00E-03	40.7	-6.90E-05	630.2	5.10E-03	44.2
V046	-1.30E-01	200	4.90E-02	366.8	1.00E-02	33.4	4.90E-04	182	8.30E-03	36.8
V048	-1.00E-02	999.9	-8.00E-03	999.9	1.40E-02	27.6	8.30E-04	111.4	1.70E-02	25.1
V050	-3.00E-01	165.5	7.30E-02	364.9	6.90E-03	46	-3.40E-05	999.9	4.60E-03	53.6
V052	-4.40E-01	70.5	-3.30E-02	491	3.40E-03	58.7	-5.00E-05	936.5	4.30E-03	51.1
V054	2.70E-03	999.9	4.10E-02	402.4	6.60E-04	223.6	3.90E-04	202	2.20E-03	83.6
V056	-2.50E-01	189.6	-7.40E-02	386.2	2.30E-03	89	1.70E-04	565.9	2.70E-03	69.9
V058	1.20E-02	999.9	1.90E-01	109.8	9.10E-04	161.9	3.00E-04	270.7	6.50E-04	219.8
V060	-4.00E-01	149.5	2.80E-01	121.8	1.50E-03	112.5	-1.30E-04	398.4	1.20E-03	129.5
V062	1.30E-01	329.8	1.50E-02	999.9	3.80E-03	57.3	1.70E-04	394.6	4.50E-03	51.5
V064	-7.00E-03	999.9	5.60E-02	252.3	4.10E-03	54.2	3.30E-05	999.9	4.20E-03	52.6
V066	-1.50E-01	218.2	-2.00E-	949.2	3.50E-03	58.9	2.50E-04	254.3	5.40E-03	45.9

Table E-2. Vegetation Sample Results (pCi/g).

			02							
V068	2.10E-01	163.8	6.60E-02	273.1	1.80E-03	99.5	8.20E-04	132	2.40E-03	76.5
V076	-2.60E-01	142.2	9.60E-02	227.2	2.10E-03	82.7	3.90E-05	999.9	3.20E-03	64.1
V078	1.80E-01	187.4	-1.00E-01	228.4	3.60E-03	56.4	-5.70E-05	788.1	5.20E-03	44.6
V080	1.70E-01	159.5	-1.70E-02	614.9	2.00E-02	24	1.70E-03	75.3	1.30E-02	28.7
V082	1.10E-01	390.6	3.20E-01	75.8	1.60E-03	110.9	-3.00E-04	93.3	3.20E-03	72.2
V084	2.30E-01	117.5	1.10E-01	170.8	2.10E-03	97.6	1.00E-03	122.8	3.90E-03	58.8
V086	-8.60E-02	292.9	3.80E-02	421.9	2.80E-03	77.6	3.60E-04	217.5	3.50E-03	66
V088	-2.20E-01	101.4	1.20E-01	108.5	2.10E-03	77	1.10E-04	508.1	1.40E-03	100.7
V090	-3.90E-02	529.7	-7.50E-02	190.9	9.40E-04	138.6	-1.80E-04	315.2	3.10E-04	337.7
V092	1.20E-01	213.3	-6.30E-03	999.9	1.50E-03	109.3	4.80E-04	191.8	1.00E-03	141.3
V094	3.00E-02	926.4	1.20E-01	151.2	7.20E-04	186.2	-1.80E-04	393.3	1.40E-03	116.2
V096	-1.90E-01	115	-5.00E-02	251.5	3.80E-03	55.6	1.20E-04	485.6	3.40E-03	58.1
V098	4.60E-02	757.6	1.70E-02	999.9	7.90E-03	39.1	5.00E-04	180.3	9.00E-03	35.7
V100	3.00E-02	930.9	9.40E-02	181.6	5.10E-03	48.1	-5.50E-05	882.8	3.80E-03	55.5
V102	-1.30E-01	225.6	7.20E-03	999.9	5.50E-03	43.3	-1.80E-04	337.8	6.90E-03	38.2
V104	3.40E-01	60.9	4.80E-02	285.7	4.10E-03	51.8	6.50E-04	130.1	1.80E-03	92
V106	1.70E-02	999.9	-1.30E-01	140.5	3.40E-03	60.7	1.30E-03	87.8	1.60E-03	100.6
V108	1.70E-01	167.7	9.80E-02	186.9	5.60E-03	42.5	4.00E-04	171	5.60E-03	43.4
V110	-2.50E-01	117.2	-3.00E-02	545.8	1.00E-02	32.6	1.30E-04	453.4	1.30E-02	27.9
	Pu-238		Pu239/40							
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
V002	5.30E-05	284.4	1.90E-03	42						
V004	1.80E-04	172	5.30E-03	25.9						
V006	3.50E-04	91.8	2.80E-03	30.6						
V008	4.80E-04	91.4	4.00E-02	13.2						
V010	3.00E-04	110.2	1.30E-02	19.2						
V012	-5.30E-05	152.7	1.60E-03	43						
V016	7.20E-05	233.7	7.60E-04	56.4						
V018	1.40E-04	285.8	1.40E-03	63						
V020	2.00E-05	656.9	3.10E-03	30.4						
V022	1.90E-04	248.4	1.10E-03	80.2						
V024	-4.60E-05	294.5	2.90E-03	29.3						
V026	2.20E-04	100.4	1.20E-02	16.7						
V030	-4.30E-05	151.7	2.80E-03	30.1						
V032	1.60E-03	50.7	6.20E-02	13.5						
V034	1.50E-03	46.8	7.50E-02	12.7						
V036	-6.60E-05	155.1	1.30E-03	67.4						
V040	1.50E-04	330.7	3.90E-03	51.1						
V042	-3.20E-04	109.6	2.40E-03	43.1						
V044	5.40E-04	137.2	1.30E-02	26.8						
V046	-9.30E-05	158.5	1.10E-03	88.9						
V048	-1.90E-04	122.6	1.50E-03	74.3						
V050	2.50E-04	160.7	3.80E-03	35.4						

Table E-2. Vegetation Sample Results (pCi/g).

V052	9.30E-05	252.4	4.80E-04	124.7						
V054	4.00E-04	78.3	7.60E-04	52.8						
V056	3.80E-04	122.7	8.80E-04	78.3						
V058	-1.10E-04	104.4	7.00E-04	73.4						
V060	-5.70E-05	648.6	-2.60E-04	86						
V062	-7.50E-05	93.8	3.50E-04	74.2						
V064	9.60E-06	999.9	1.00E-04	227.7						
V066	9.00E-05	265.8	6.20E-04	76.7						
V068	9.90E-05	297.5	1.70E-04	243						
V076	4.80E-05	256.8	4.50E-04	66.3						
V078	2.10E-04	125.9	4.00E-04	87.5						
V080	2.10E-04	190.5	9.10E-04	92						
V082	1.70E-04	148.2	-4.40E-05	140.6						
V084	-1.30E-04	151.5	5.10E-04	170.5						
V086	1.10E-04	397.3	4.20E-03	48						
V088	-5.60E-05	150.5	4.40E-04	95.7						
V090	-1.00E-04	153	2.80E-04	167.1						
V092	-2.60E-04	103.5	2.20E-04	234.2						
V094	3.60E-05	589.5	3.20E-04	124.4						
V096	-1.40E-04	326.2	2.80E-05	999.9						
V098	-1.50E-04	104.8	4.00E-04	107.5						
V100	1.30E-05	999.9	-8.80E-05	327.7						
V102	-9.60E-05	150.4	1.10E-03	74.8						
V104	-1.90E-05	999.9	2.70E-04	196.7						
V106	9.80E-06	999.9	-1.80E-04	107.7						
V108	5.90E-05	291	1.50E-03	40.3						
V110	-1.50E-04	122.5	5.60E-04	108.2						
	K-40		Co-60		Sr-90		Cs-134		Cs-137	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
V116	1.20E+01	17.7	-1.10E-01	56.8	3.80E-02	27.8	-1.40E-02	332.4	7.40E-03	604.6
V117	1.60E+01	15.2	2.80E-02	171.9	3.20E-02	43.4	-3.70E-02	139.7	-2.50E-03	999.9
V118	1.90E+01	15.1	-5.20E-03	999.9	5.00E-02	31.7	-6.00E-02	93.1	-9.60E-03	675.7
V119	1.70E+01	15.8	3.40E-02	182.1	5.90E-02	29.9	-1.00E-02	436.2	-1.60E-02	300
V120	1.90E+01	15.6	3.10E-02	180.2	1.10E-01	26.5	4.50E-03	999.9	-5.40E-03	999.9
V121	1.90E+01	16.6	6.10E-02	121.1	5.80E-02	33.1	8.10E-02	77.4	3.50E-02	199.7
V122	2.30E+01	14.7	-2.30E-02	327.5	5.30E-02	30.4	-5.90E-02	103.6	8.70E-02	61.5
V123	1.30E+01	16.3	8.40E-02	67.6	2.50E-01	21	2.40E-03	999.9	4.50E-02	116.5
V124	1.50E+01	19.5	1.60E-02	452.2	2.80E-02	40.9	-1.20E-02	619	3.60E-02	203
V125	2.00E+01	16.1	-8.90E-03	753.4	3.70E-02	35.2	-2.60E-02	236	-3.90E-02	169.2
V126	2.20E+01	13	1.30E-02	423.7	9.80E-02	39.8	4.90E-02	98.6	1.10E-02	498.2
V127	1.40E+01	15.6	6.90E-03	690.4	7.50E-02	27.6	9.00E-03	346.2	2.50E-02	159.3
V128	1.30E+01	14.5	-8.30E-03	507.2	4.80E-02	29.3	2.30E-02	150.4	3.80E-02	92.2
V129	1.70E+01	15.3	-2.90E-02	204.5	4.30E-02	30.5	-3.30E-02	159.9	1.30E-02	452.8

Table E-2. Vegetation Sample Results (pCi/g).

V130	1.40E+01	15.8	-4.80E-02	118.8	1.90E-02	57.5	-3.20E-02	158.9	-4.30E-02	131.6
V131	1.30E+01	16.9	5.60E-02	78.6	3.60E-02	31.3	-5.00E-03	841.3	5.40E-02	98.3
V132	1.70E+01	16	2.40E-02	239.7	3.10E-02	34.5	-3.00E-02	172.8	3.90E-02	121.6
	Eu-154		Eu-155		U-234		U-235		U-238	
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
V116	6.40E-02	257.1	1.10E-01	110	8.70E-03	37.3	7.50E-05	640.4	8.10E-03	37.9
V117	-6.80E-02	239.4	7.80E-02	166.2	8.20E-03	44.2	5.60E-05	999.9	5.50E-03	53.4
V118	7.80E-02	228.1	1.60E-02	826.9	4.10E-02	23	1.30E-03	140.5	4.00E-02	23.3
V119	-7.60E-02	226.4	4.40E-02	271.7	1.60E-01	17.4	6.60E-03	58.2	1.40E-01	17.7
V120	1.40E-01	130.3	8.80E-02	134.4	6.30E-02	19.2	2.80E-03	76	6.00E-02	19.4
V121	2.20E-01	89.6	-5.10E-02	317.6	2.80E-02	28.2	1.50E-03	113.5	3.90E-02	24.8
V122	-1.70E-01	121.8	-4.10E-02	352.2	3.30E-01	12.6	1.60E-02	29.7	3.20E-01	12.6
V123	-5.20E-02	321.2	5.20E-02	204.6	3.40E-02	23.9	3.70E-03	64.8	3.10E-02	24.6
V124	1.60E-01	149.7	-2.90E-02	585.4	7.40E-03	48.9	4.00E-04	305.8	4.90E-03	60
V125	4.40E-02	433.5	-3.00E-02	465.1	6.70E-02	17.7	3.70E-03	63.6	5.60E-02	18.7
V126	-2.30E-02	692.3	5.10E-02	248	2.30E-02	31.5	1.40E-03	130.7	2.10E-02	31.4
V127	-1.60E-01	100	6.70E-02	133.6	5.10E-03	57.4	1.00E-04	574.8	7.00E-03	49.1
V128	5.20E-02	243.8	-4.00E-02	221.8	6.00E-03	51.6	3.00E-04	297.7	5.80E-03	51.6
V129	1.70E-01	101.8	-5.70E-02	225.9	2.70E-02	26.2	3.60E-04	280.9	3.10E-02	24.8
V130	-2.70E-02	591.1	-2.30E-02	545.1	4.30E-03	59.1	-1.70E-04	458.2	3.80E-03	60.3
V131	1.00E-01	144	4.60E-04	999.9	4.10E-03	61.9	1.10E-03	116.4	3.10E-03	71.9
V132	-6.00E-02	327.2	-9.00E-02	126.1	1.30E-02	31.9	-1.70E-04	442.9	9.00E-03	37.5
	Pu-238		Pu239/40							
	Result	% Error	Result	% Error	Result	% Error	Result	% Error	Result	%Error
V116	1.50E-03	57.9	2.80E-04	145.7						
V117	1.80E-03	30.6	6.50E-05	207.4						
V118	7.10E-04	46.5	1.80E-04	91						
V119	1.70E-03	52.2	5.30E-04	100.9						
V120	3.90E-03	27.9	2.60E-04	108.7						
V121	2.10E-03	49.1	-1.20E-04	114.8						
V122	1.80E-03	50.4	1.90E-04	186.2						
V123	9.50E-04	47.8	3.50E-04	75.9						
V124	2.20E-03	34.5	1.50E-04	132.2						
V125	2.50E-03	41.1	2.50E-04	128.1						
V126	2.70E-03	50.6	-2.30E-05	999.9						
V127	9.20E-04	64.5	1.50E-03	49.4						
V128	1.90E-03	32.8	4.10E-04	69.7						
V129	3.90E-03	29.6	2.50E-04	107.9						
V130	3.70E-03	33.2	3.30E-04	121.1						
V131	1.30E-02	18.6	1.00E-03	53.7						
V132	1.10E-02	18	8.20E-04	54.3						

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APPENDIX F

EXTERNAL RADIATION MONITORING FIGURES AND TABLES

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Figure F-1. Thermoluminescent Dosimeter Locations in the 100 KE/KW Area.

Figure F-2. Thermoluminescent Dosimeter Locations in the 100 N Area.

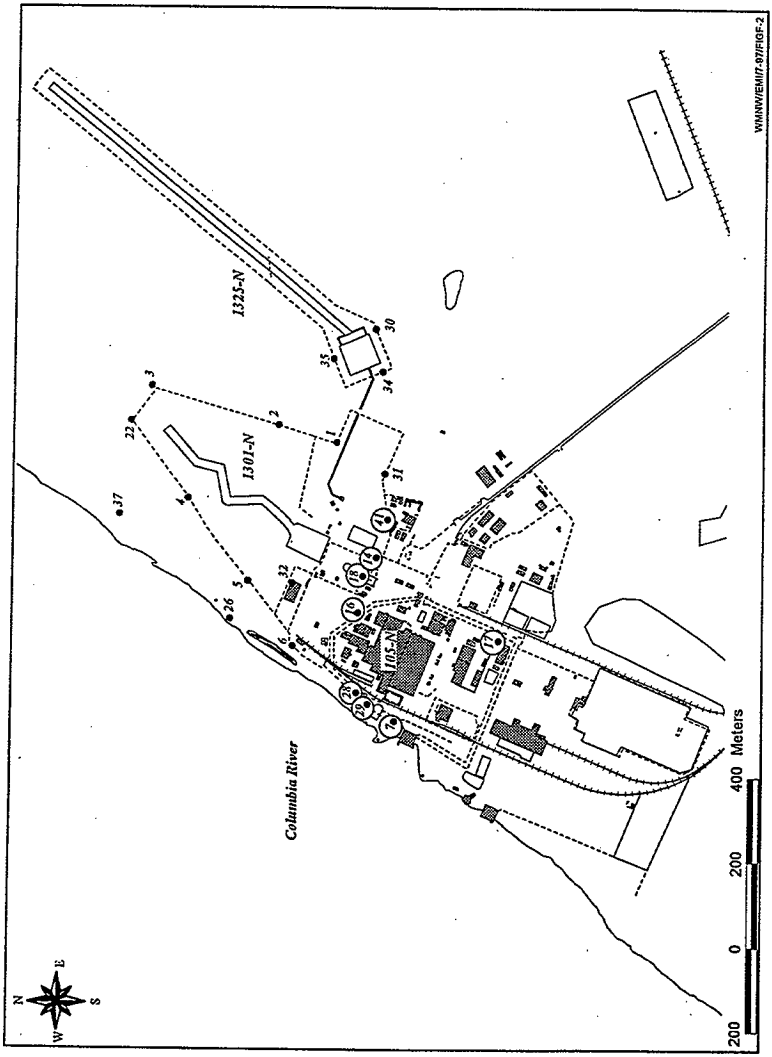

Figure F-3. Thermoluminescent Dosimeter Locations in the 200 East Area.

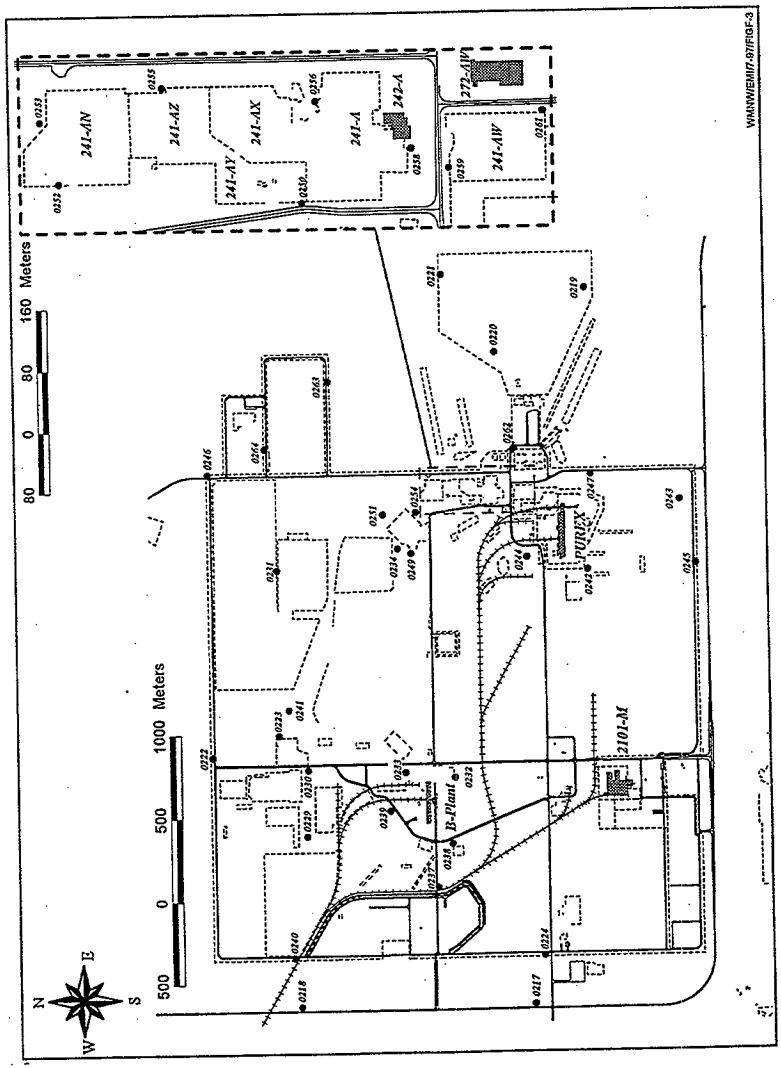

Figure F-4. Thermoluminescent Dosimeter Locations in the 200 West Area.

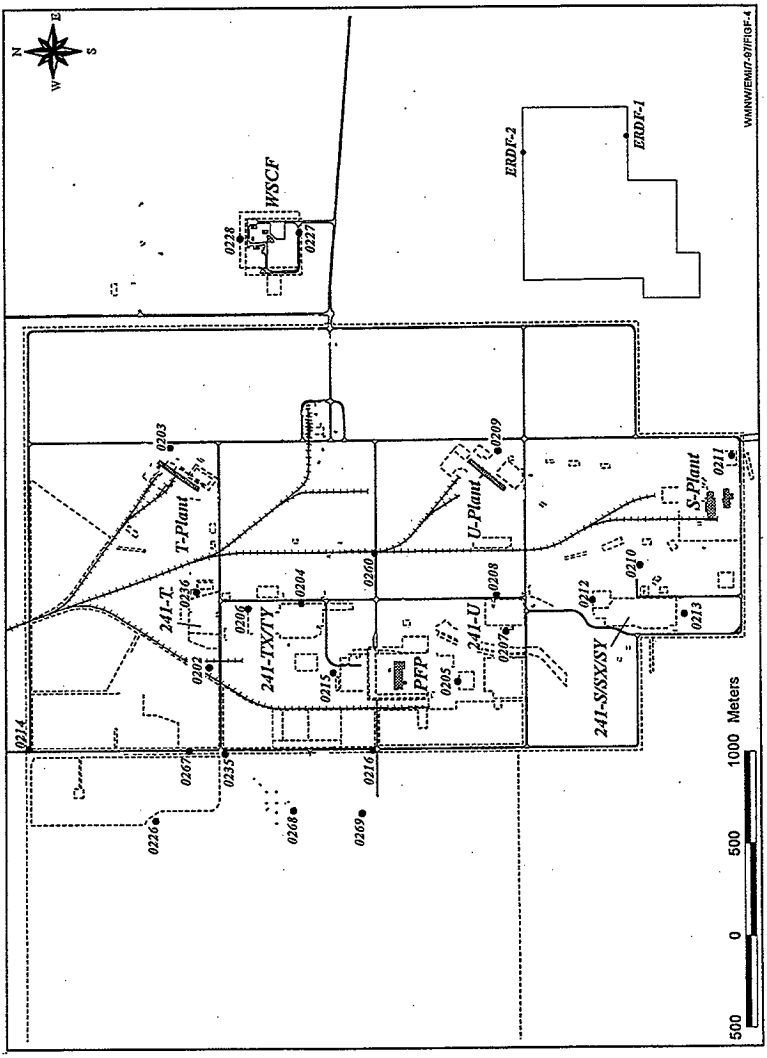

Figure F-5. Thermoluminescent Dosimeter Locations in the 300 Area.

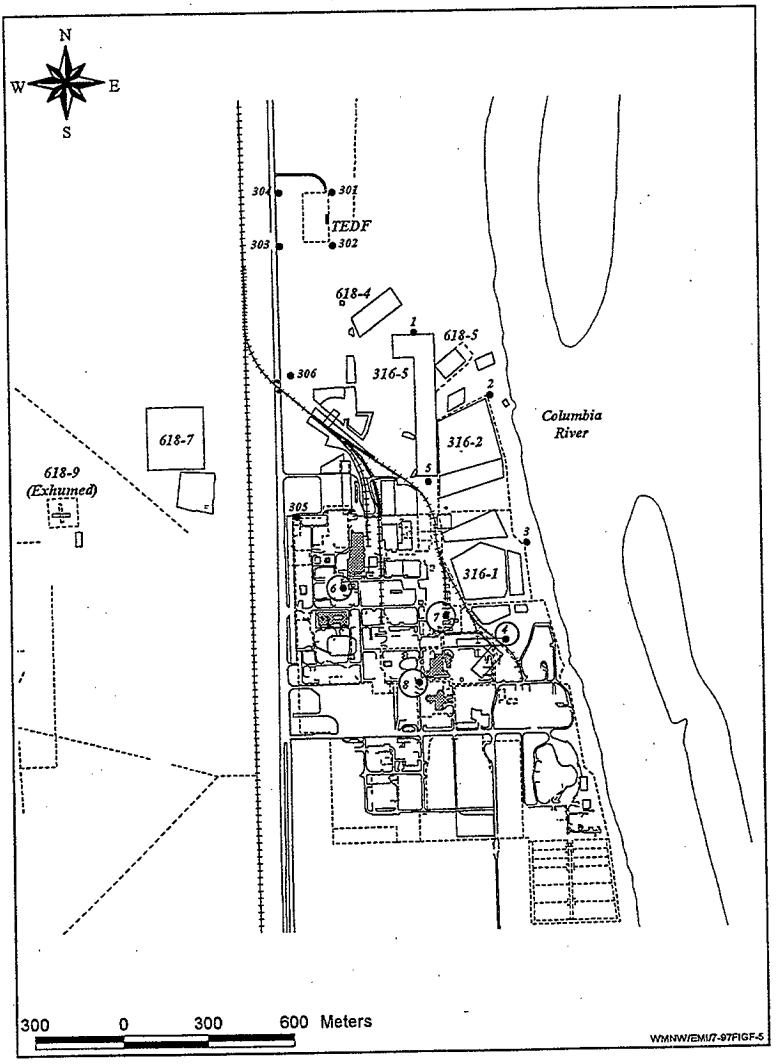

Figure F-6. Thermoluminescent Dosimeter Locations in the 400 Area.

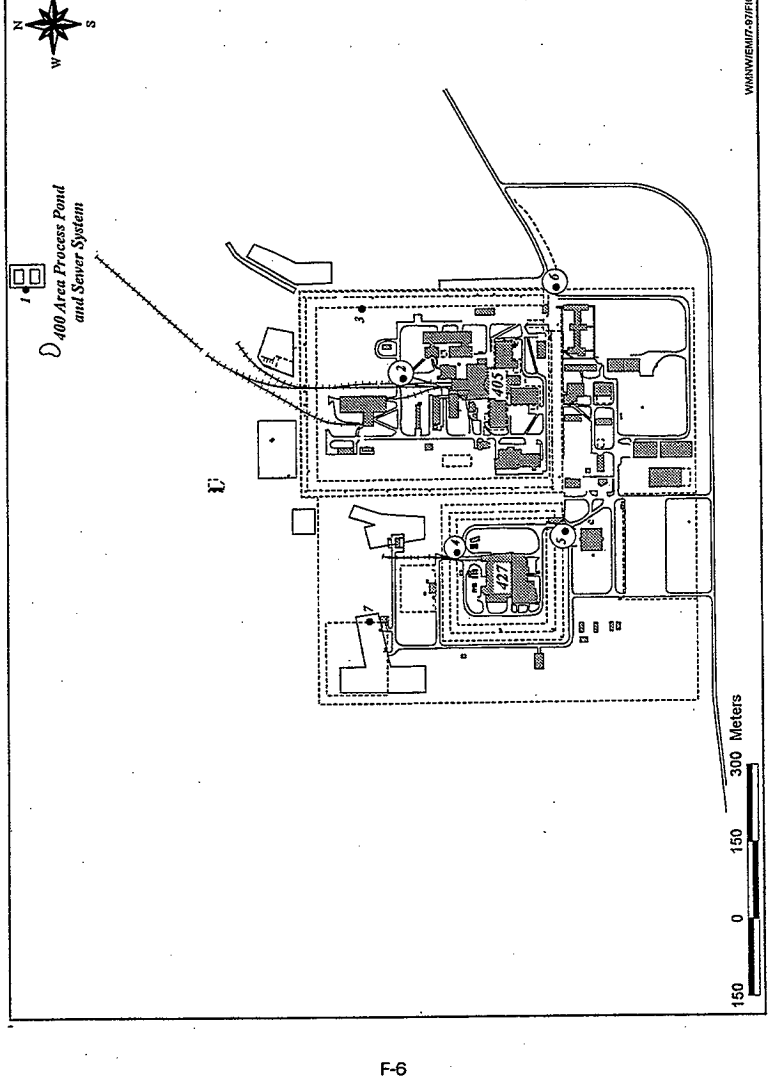

Figure F-7. Thermoluminescent Dosimeter Locations for the 100D/DR Remediation Project.

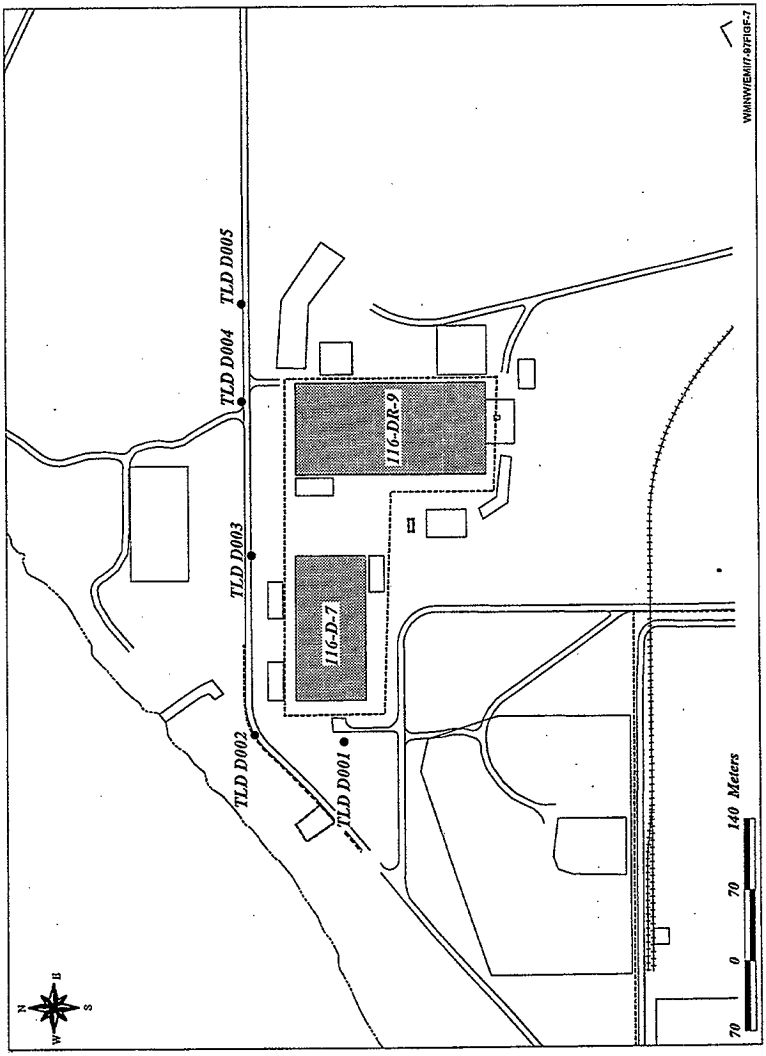

Table F-1. 100-K Thermoluminescent Dosimeter Exposure Results, Calendar Year 1996.

Site I.D.	1st and 2nd Quarters		3rd Quarter		4th Quarter		Annual Results (mrem/yr)		
	mrem/hr	mrem/yr	mrem/hr	mrem/yr	mrem/hr	mrem/yr	Maximum	Minimum	Average
K-1	7.9E-03	6.9E+01	7.4E-03	6.5E+01	9.6E-03	8.4E+01	8.4E+01	6.5E+01	7.3E+01
K-2	9.0E-03	7.9E+01	8.0E-03	7.0E+01	1.1E-02	9.2E+01	9.2E+01	6.8E+01	8.0E+01
K-3	1.2E-02	1.0E+02	7.7E-03	6.8E+01	1.0E-02	9.1E+01	1.0E+02	6.8E+01	8.8E+01
K-4	1.6E-02	1.4E+02	8.2E-03	7.2E+01	1.0E-02	8.9E+01	1.4E+02	7.2E+01	1.0E+02
K-5	1.2E-02	1.0E+02	1.1E-02	9.8E+01	1.2E-02	1.0E+02	1.0E+02	8.0E+01	1.0E+02
K-6	9.2E-03	8.1E+01	9.1E-03	8.0E+01	1.1E-02	9.9E+01	9.9E+01	8.0E+01	8.6E+01
K-7	1.2E-02	1.0E+02	1.0E-02	9.1E+01	1.6E-02	1.4E+02	1.4E+02	9.1E+01	1.1E+02
K-8	3.2E-02	2.8E+02	3.3E-02	2.9E+02	4.7E-02	4.1E+02	4.1E+02	2.8E+02	3.3E+02
K-9	2.1E-01	1.9E+03	2.2E-01	1.9E+03	3.3E-01	2.9E+03	2.9E+03	9.9E+02	2.2E+03
K-10	4.4E-01	3.9E+03	1.1E-01	9.9E+02	1.2E-01	1.0E+03	3.9E+03	9.0E+01	2.0E+03
K-11	1.2E-02	1.0E+02	1.0E-02	9.0E+01	1.4E-02	1.2E+02	1.2E+02	0.0E+00	1.0E+02

Table F-2. 100-N Thermoluminescent Dosimeter Exposure Results, Calendar Year 1996.

100-N	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Annual Results (mrem/yr)		
Site I.D.	mR/hour	mR/yr	mR/hr	mR/yr	mR/hr	mR/yr	mR/hr	mR/yr	Max	Min	Avg
1	9.6E-02	8.5E+02	NR[a]	NR	8.6E-02	7.5E+02	1.0E-01	9.0E+02	9.0E+02	7.5E+02	8.3E+02
2	9.6E-02	8.4E+02	NR	NR	8.5E-02	7.5E+02	1.0E-01	8.9E+02	8.9E+02	7.5E+02	8.3E+02
3	4.3E-02	3.8E+02	4.3E-02	3.8E+02	3.7E-02	3.3E+02	4.6E-02	4.1E+02	4.1E+02	3.3E+02	3.7E+02
4	1.7E-01	1.5E+03	1.7E-01	1.5E+03	1.9E-01	1.7E+03	2.4E-01	2.1E+03	2.1E+03	1.5E+03	1.7E+03
5	6.0E-02	5.3E+02	6.0E-02	5.3E+02	6.8E-02	6.0E+02	6.6E-02	5.8E+02	6.0E+02	5.3E+02	5.6E+02
6	2.4E-02	2.1E+02	2.5E-02	2.2E+02	2.9E-02	2.5E+02	2.7E-02	2.3E+02	2.5E+02	2.1E+02	2.3E+02
7	4.6E-02	4.0E+02	4.4E-02	3.8E+02	4.3E-02	3.7E+02	4.9E-02	4.3E+02	4.3E+02	3.7E+02	4.0E+02
8	1.1E-02	9.3E+01	1.0E-02	8.8E+01	Removed	Removed	Removed	Removed	9.3E+01	8.8E+01	9.0E+01
10	9.9E-03	8.7E+01	9.9E-03	8.7E+01	Removed	Removed	Removed	Removed	8.7E+01	8.7E+01	8.7E+01
12	1.1E-02	9.4E+01	1.2E-02	1.1E+02	Removed	Removed	Removed	Removed	1.1E+02	9.4E+01	1.0E+02
13	1.9E-02	1.6E+02	1.7E-02	1.5E+02	Removed	Removed	Removed	Removed	1.6E+02	1.5E+02	1.6E+02
14	4.5E-02	4.0E+02	4.4E-02	3.8E+02	3.2E-02	2.8E+02	4.1E-02	3.6E+02	4.0E+02	2.8E+02	3.6E+02
15	7.5E-02	6.6E+02	7.7E-02	6.7E+02	Removed	Removed	Removed	Removed	6.7E+02	6.6E+02	6.7E+02
16	3.4E-02	3.0E+02	3.4E-02	2.9E+02	2.9E-02	2.6E+02	3.5E-02	3.1E+02	3.1E+02	2.6E+02	2.9E+02
17	5.2E-02	4.6E+02	1.5E-02	1.3E+02	1.4E-02	1.3E+02	1.7E-02	1.5E+02	4.6E+02	1.3E+02	2.2E+02
18	1.2E-01	1.1E+03	8.9E-02	7.8E+02	5.0E-02	4.4E+02	5.5E-02	4.8E+02	1.1E+03	4.4E+02	7.0E+02
22	4.8E-02	4.2E+02	5.0E-02	4.4E+02	4.3E-02	3.8E+02	5.5E-02	4.8E+02	4.8E+02	3.8E+02	4.3E+02
26	2.4E-02	2.1E+02	2.4E-02	2.1E+02	2.2E-02	1.9E+02	2.6E-02	2.3E+02	2.3E+02	1.9E+02	2.1E+02
28	2.8E-02	2.4E+02	2.0E-02	1.8E+02	1.8E-02	1.6E+02	2.2E-02	1.9E+02	2.4E+02	1.6E+02	1.9E+02
29	7.9E-02	7.0E+02	7.8E-02	6.9E+02	6.3E-02	5.5E+02	8.6E-02	7.5E+02	7.5E+02	5.5E+02	6.7E+02
30	6.2E-01	5.5E+03	6.2E-01	5.4E+03	5.1E-01	4.5E+03	6.9E-01	6.1E+03	6.1E+03	4.5E+03	5.4E+03
31	4.3E-02	3.8E+02	4.6E-02	4.1E+02	5.4E-02	4.8E+02	4.8E-02	4.2E+02	4.8E+02	3.8E+02	4.2E+02
32	3.4E-02	2.9E+02	3.4E-02	3.0E+02	3.0E-02	2.7E+02	3.7E-02	3.3E+02	3.3E+02	2.7E+02	3.0E+02
33	1.9E-02	1.7E+02	2.0E-02	1.8E+02	Removed	Removed	Removed	Removed	1.8E+02	1.7E+02	1.7E+02
34	1.1E+00	9.3E+03	1.1E+00	9.5E+03	9.1E-01	8.0E+03	1.1E+00	9.8E+03	9.8E+03	8.0E+03	9.2E+03
35	1.0E+00	8.9E+03	1.1E+00	9.3E+03	8.5E-01	7.5E+03	1.1E+00	9.4E+03	9.4E+03	7.5E+03	8.8E+03
36	3.7E-02	3.2E+02	3.9E-02	3.4E+02	Removed	Removed	Removed	Removed	3.4E+02	3.2E+02	3.3E+02
37	3.8E-02	3.3E+02	3.8E-02	3.3E+02	3.4E-02	3.0E+02	4.0E-02	3.5E+02	3.5E+02	3.0E+02	3.3E+02
38	1.6E-02	1.4E+02	1.7E-02	1.5E+02	Removed	Removed	Removed	Removed	1.5E+02	1.4E+02	1.5E+02
41	3.5E-02	3.1E+02	3.6E-02	3.2E+02	3.1E-02	2.7E+02	3.6E-02	3.2E+02	3.2E+02	2.7E+02	3.1E+02

[a] NR = Not Reported

Table F-3. 200/600 Areas Thermoluminescent Dosimeter Exposure Results, Calendar Year 1996.

Site	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Annual Results (mrem/yr)		
I.D.	mrem/hr	mrem/yr	mrem/hr	mrem/yr	mrem/hr	mrem/yr	mrem/hr	mrem/yr	Min	Max	Avg
202	1.0E-02	8.9E+01	1.0E-02	9.1E+01	1.0E-02	9.0E+01	1.1E-02	9.2E+01	8.9E+01	9.2E+01	9.1E+01
203	1.1E-02	9.9E+01	1.1E-02	9.9E+01	1.1E-02	9.6E+01	1.2E-02	1.1E+02	9.6E+01	1.1E+02	1.0E+02
204	1.7E-02	1.4E+02	1.7E-02	1.4E+02	1.6E-02	1.4E+02	1.5E-02	1.3E+02	1.3E+02	1.4E+02	1.4E+02
205	1.0E-02	8.8E+01	9.4E-03	8.2E+01	9.7E-03	8.5E+01	9.7E-03	8.5E+01	8.2E+01	8.8E+01	8.5E+01
206	1.3E-02	1.2E+02	1.3E-02	1.1E+02	1.2E-02	1.1E+02	1.3E-02	1.1E+02	1.1E+02	1.2E+02	1.1E+02
207	1.1E-02	9.6E+01	1.1E-02	9.6E+01	1.1E-02	9.9E+01	1.2E-02	1.0E+02	9.6E+01	1.0E+02	9.9E+01
208	1.8E-02	1.6E+02	1.9E-02	1.7E+02	1.9E-02	1.7E+02	1.9E-02	1.7E+02	1.6E+02	1.7E+02	1.6E+02
209	1.0E-02	8.9E+01	1.0E-02	8.8E+01	1.0E-02	8.7E+01	1.0E-02	9.1E+01	8.7E+01	9.1E+01	8.9E+01
210	1.1E-02	1.0E+02	1.1E-02	1.0E+02	1.1E-02	1.0E+02	1.1E-02	1.0E+02	1.0E+02	1.0E+02	1.0E+02
211	1.1E-02	9.8E+01	1.1E-02	9.7E+01	1.1E-02	9.9E+01	1.4E-02	1.3E+02	9.7E+01	1.3E+02	1.0E+02
212	1.3E-02	1.1E+02	1.3E-02	1.1E+02	1.3E-02	1.1E+02	1.7E-02	1.4E+02	1.1E+02	1.4E+02	1.2E+02
213	2.3E-02	2.0E+02	2.3E-02	2.0E+02	2.1E-02	1.9E+02	2.3E-02	2.0E+02	1.9E+02	2.0E+02	2.0E+02
214	9.8E-03	8.5E+01	9.4E-03	8.2E+01	8.9E-03	7.8E+01	9.5E-03	8.3E+01	7.8E+01	8.5E+01	8.2E+01
215	1.1E-02	9.7E+01	1.1E-02	9.4E+01	1.0E-02	9.0E+01	1.0E-02	9.1E+01	9.0E+01	9.7E+01	9.3E+01
216	1.1E-02	1.0E+02	1.1E-02	9.9E+01	1.2E-02	1.0E+02	1.2E-02	1.0E+02	9.9E+01	1.0E+02	1.0E+02
217	1.0E-02	8.8E+01	9.8E-03	8.6E+01	9.5E-03	8.3E+01	1.0E-02	8.8E+01	8.3E+01	8.8E+01	8.6E+01
218	1.2E-02	1.0E+02	7.7E-03	6.7E+01	9.0E-03	7.8E+01	9.3E-03	8.1E+01	6.7E+01	1.0E+02	8.2E+01
219	1.1E-02	9.5E+01	1.1E-02	9.5E+01	1.0E-02	9.1E+01	1.2E-02	1.0E+02	9.1E+01	1.0E+02	9.5E+01
220	1.1E-02	9.9E+01	1.1E-02	9.3E+01	1.1E-02	9.5E+01	1.1E-02	9.7E+01	9.3E+01	9.9E+01	9.6E+01
221	1.1E-02	9.5E+01	1.0E-02	8.8E+01	1.0E-02	9.1E+01	1.1E-02	9.8E+01	8.8E+01	9.8E+01	9.3E+01
222	1.4E-02	1.2E+02	1.3E-02	1.1E+02	1.4E-02	1.2E+02	1.4E-02	1.2E+02	1.1E+02	1.2E+02	1.2E+02
223	1.6E-02	1.4E+02	1.6E-02	1.4E+02	1.6E-02	1.4E+02	1.7E-02	1.5E+02	1.4E+02	1.5E+02	1.4E+02
224	1.1E-02	9.3E+01	9.7E-03	8.5E+01	9.8E-03	8.5E+01	1.1E-02	9.9E+01	8.5E+01	9.9E+01	9.0E+01
226	1.0E-02	9.2E+01	1.0E-02	8.7E+01	1.0E-02	9.0E+01	9.8E-03	8.6E+01	8.6E+01	9.2E+01	8.9E+01
227	1.0E-02	8.8E+01	9.5E-03	8.3E+01	9.9E-03	8.7E+01	9.8E-03	8.6E+01	8.3E+01	8.8E+01	8.6E+01
228	9.6E-03	8.4E+01	9.9E-03	8.7E+01	9.7E-03	8.5E+01	1.0E-02	8.7E+01	8.4E+01	8.7E+01	8.6E+01
229	1.1E-02	9.6E+01	1.1E-02	9.3E+01	1.0E-02	8.9E+01	1.1E-02	9.5E+01	8.9E+01	9.6E+01	9.3E+01
230	1.4E-02	1.2E+02	1.4E-02	1.2E+02	1.4E-02	1.2E+02	1.4E-02	1.3E+02	1.2E+02	1.3E+02	1.2E+02
231	1.1E-02	9.5E+01	1.0E-02	8.9E+01	1.1E-02	9.5E+01	1.1E-02	9.8E+01	8.9E+01	9.8E+01	9.4E+01
232	1.6E-02	1.4E+02	1.6E-02	1.4E+02	1.8E-02	1.5E+02	1.7E-02	1.5E+02	1.4E+02	1.5E+02	1.5E+02
233	1.0E-02	9.1E+01	1.0E-02	8.9E+01	1.0E-02	8.9E+01	1.1E-02	9.3E+01	8.9E+01	9.3E+01	9.1E+01
234	1.2E-02	1.1E+02	1.2E-02	1.1E+02	1.4E-02	1.2E+02	1.3E-02	1.1E+02	1.1E+02	1.2E+02	1.1E+02
235	1.0E-02	8.9E+01	1.0E-02	9.0E+01	9.9E-03	8.7E+01	1.0E-02	8.9E+01	8.7E+01	9.0E+01	8.9E+01
236	1.2E-02	1.1E+02	1.1E-02	1.0E+02	1.1E-02	1.0E+02	1.2E-02	1.0E+02	1.0E+02	1.1E+02	1.0E+02
237	9.7E-03	8.5E+01	9.1E-03	8.0E+01	9.3E-03	8.2E+01	9.6E-03	8.4E+01	8.0E+01	8.5E+01	8.3E+01
238	9.9E-03	8.7E+01	1.0E-02	8.9E+01	1.3E-02	1.1E+02	1.0E-02	9.1E+01	8.7E+01	1.1E+02	9.5E+01
239	1.1E-02	9.3E+01	1.1E-02	9.2E+01	1.0E-02	9.1E+01	1.1E-02	9.3E+01	9.1E+01	9.3E+01	9.3E+01
240	9.8E-03	8.5E+01	9.0E-03	7.9E+01	9.3E-03	8.1E+01	9.4E-03	8.2E+01	7.9E+01	8.5E+01	8.2E+01
241	1.1E-02	9.9E+01	1.0E-02	9.1E+01	1.0E-02	8.8E+01	1.0E-02	9.2E+01	8.8E+01	9.9E+01	9.3E+01
242	1.1E-02	9.7E+01	1.1E-02	9.7E+01	9.6E-03	8.4E+01	1.1E-02	9.7E+01	8.4E+01	9.7E+01	9.4E+01
243	1.0E-02	9.1E+01	9.6E-03	8.4E+01	9.3E-03	8.1E+01	9.5E-03	8.4E+01	8.1E+01	9.1E+01	8.5E+01

Table F-3. 200/600 Areas Thermoluminescent Dosimeter Exposure Results, Calendar Year 1996.

Site I.D.	1st Quarter		2nd Quarter		3rd Quarter		4th Quarter		Annual Results (mrem/yr)		
	mrem/hr	mrem/yr	mrem/hr	mrem/yr	mrem/hr	mrem/yr	mrem/hr	mrem/yr	Min	Max	Avg
244	1.7E-02	1.5E+02	2.2E-02	1.9E+02	1.0E-02	8.8E+01	9.5E-03	8.3E+01	8.3E+01	1.9E+02	1.3E+02
245	1.0E-02	8.8E+01	9.3E-03	8.1E+01	9.3E-03	8.1E+01	9.7E-03	8.5E+01	8.1E+01	8.8E+01	8.4E+01
246	1.0E-02	9.0E+01	9.4E-03	8.2E+01	9.3E-03	8.2E+01	9.6E-03	8.4E+01	8.2E+01	9.0E+01	8.5E+01
247	1.0E-02	8.8E+01	9.8E-03	8.6E+01	9.5E-03	8.3E+01	9.5E-03	8.4E+01	8.3E+01	8.8E+01	8.5E+01
249	1.4E-02	1.2E+02	1.3E-02	1.1E+02	1.6E-02	1.4E+02	1.2E-02	1.1E+02	1.1E+02	1.4E+02	1.2E+02
250	1.6E-02	1.4E+02	2.1E-02	1.8E+02	2.6E-02	2.3E+02	2.7E-02	2.4E+02	1.4E+02	2.4E+02	2.0E+02
251	1.6E-02	1.4E+02	1.6E-02	1.4E+02	1.9E-02	1.7E+02	1.6E-02	1.4E+02	1.4E+02	1.7E+02	1.5E+02
252	1.6E-02	1.4E+02	1.3E-02	1.1E+02	1.4E-02	1.2E+02	1.4E-02	1.2E+02	1.1E+02	1.4E+02	1.2E+02
253	1.2E-02	1.1E+02	1.1E-02	1.0E+02	1.8E-02	1.6E+02	1.4E-02	1.2E+02	1.0E+02	1.6E+02	1.2E+02
254	2.2E-02	2.0E+02	2.0E-02	1.7E+02	2.8E-02	2.5E+02	2.0E-02	1.8E+02	1.7E+02	2.5E+02	2.0E+02
255	1.7E-02	1.5E+02	1.8E-02	1.6E+02	1.9E-02	1.7E+02	*	*	1.5E+02	1.7E+02	1.6E+02
256	4.9E-02	4.3E+02	4.2E-02	3.7E+02	3.7E-02	3.2E+02	3.8E-02	3.3E+02	3.2E+02	4.3E+02	3.6E+02
258	6.1E-02	5.4E+02	6.4E-02	5.6E+02	5.8E-02	5.1E+02	4.2E-02	3.7E+02	3.7E+02	5.6E+02	4.9E+02
259	1.6E-02	1.4E+02	3.9E-02	3.4E+02	1.4E-02	1.2E+02	1.4E-02	1.2E+02	1.2E+02	3.4E+02	1.8E+02
260	9.6E-03	8.4E+01	9.2E-03	8.0E+01	8.8E-03	7.7E+01	9.5E-03	8.3E+01	7.7E+01	8.4E+01	8.1E+01
261	1.2E-02	1.1E+02	1.2E-02	1.0E+02	1.2E-02	1.1E+02	1.2E-02	1.0E+02	1.0E+02	1.1E+02	1.0E+02
262	9.9E-03	8.7E+01	9.8E-03	8.5E+01	9.3E-03	8.1E+01	9.4E-03	8.2E+01	8.1E+01	8.7E+01	8.4E+01
263	9.6E-03	8.4E+01	8.8E-03	7.7E+01	8.7E-03	7.6E+01	9.7E-03	8.5E+01	7.6E+01	8.5E+01	8.1E+01
264	1.1E-02	9.2E+01	1.1E-02	9.3E+01	9.8E-03	8.6E+01	1.0E-02	9.1E+01	8.6E+01	9.3E+01	9.0E+01
267	1.1E-02	9.6E+01	9.9E-03	8.7E+01	9.5E-03	8.4E+01	1.0E-02	9.0E+01	8.4E+01	9.6E+01	8.9E+01
268	1.5E-02	1.3E+02	1.4E-02	1.3E+02	1.3E-02	1.2E+02	1.1E-02	9.8E+01	9.8E+01	1.3E+02	1.2E+02
269	1.1E-02	9.9E+01	1.1E-02	9.9E+01	1.1E-02	9.3E+01	1.1E-02	9.6E+01	9.3E+01	9.9E+01	9.7E+01

= Lost TLD

Figure F-4. 300/300 TEDF/400 Areas Thermoluminescent Dosimeter Exposure Results, Calendar Year 1996.

300 Area Site I.D.	1st Qtr		2nd Qtr		3rd Qtr		4th Qtr		Annual Results (mrem/yr)		
	mrem/hr	mrem/yr	mrem/hr	mrem/yr	mrem/hr	mrem/yr	mrem/hr	mrem/yr	Min	Max	Avg
1	9.6E-03	8.4E+01	9.6E-03	8.4E+01	9.1E-03	8.0E+01	1.1E-02	9.3E+01	8.0E+01	9.3E+01	8.5E+01
2	1.0E-02	9.1E+01	9.9E-03	8.7E+01	9.8E-03	8.6E+01	1.1E-02	1.0E+02	8.6E+01	1.0E+02	9.1E+01
3	9.7E-03	8.5E+01	9.9E-03	8.7E+01	9.0E-03	7.8E+01	1.1E-02	9.4E+01	7.8E+01	9.4E+01	8.6E+01
4	3.2E-02	2.8E+02	3.0E-02	2.6E+02	2.2E-02	2.0E+02	2.4E-02	2.1E+02	2.0E+02	2.8E+02	2.4E+02
5	9.8E-03	8.6E+01	9.9E-03	8.7E+01	9.1E-03	8.0E+01	1.1E-02	9.6E+01	8.0E+01	9.6E+01	8.7E+01
6	1.2E-02	1.1E+02	1.2E-02	1.1E+02	1.1E-02	9.4E+01	1.2E-02	1.1E+02	9.4E+01	1.1E+02	1.0E+02
7	2.9E-02	2.6E+02	2.7E-02	2.3E+02	2.0E-02	1.8E+02	1.9E-02	1.7E+02	1.7E+02	2.6E+02	2.1E+02
8	1.1E-02	1.0E+02	1.1E-02	9.9E+01	1.1E-02	9.5E+01	1.2E-02	1.1E+02	9.5E+01	1.1E+02	1.0E+02

Figure F-4. 300/300 TEDF/400 Areas Thermoluminescent Dosimeter Exposure Results, Calendar Year 1996.

300 TEDF	1st Qtr		2nd Qtr		3rd Qtr		2nd Qtr		Annual Results (mrem/yr)		
Site I.D.	mrem/hr	mrem/yr	mrem/hr	mrem/yr	mrem/hr	mrem/yr	mrem/hr	mrem/yr	Min	Max	Avg
301	1.0E-02	8.8E+01	9.5E-03	8.3E+01	8.9E-03	7.8E+01	1.0E-02	9.2E+01	7.8E+01	9.2E+01	8.5E+01
302	9.8E-03	8.6E+01	9.5E-03	8.4E+01	8.8E-03	7.7E+01	1.0E-02	8.8E+01	7.7E+01	8.8E+01	8.3E+01
303	1.0E-02	8.8E+01	1.0E-02	8.7E+01	9.2E-03	8.1E+01	1.1E-02	9.4E+01	8.1E+01	9.4E+01	8.7E+01
304	1.1E-02	9.3E+01	9.8E-03	8.6E+01	8.8E-03	7.7E+01	1.0E-02	8.9E+01	7.7E+01	9.3E+01	8.6E+01
305	1.0E-02	8.9E+01	9.2E-03	8.0E+01	8.8E-03	7.7E+01	9.9E-03	8.7E+01	7.7E+01	8.9E+01	8.3E+01
306	9.9E-03	8.7E+01	9.8E-03	8.6E+01	9.1E-03	8.0E+01	1.0E-02	9.1E+01	8.0E+01	9.1E+01	8.6E+01
400 Area Site I.D.											
	mrem/hr	mrem/yr	mrem/hr	mrem/yr	mrem/hr	mrem/yr	mrem/hr	mrem/yr	Min	Max	Avg
1	9.6E-03	8.4E+01	9.5E-03	8.4E+01	8.8E-03	7.7E+01	9.9E-03	8.7E+01	7.7E+01	8.7E+01	8.3E+01
2	9.7E-03	8.5E+01	8.9E-03	7.8E+01	8.0E-03	7.0E+01	9.7E-03	8.5E+01	7.0E+01	8.5E+01	7.9E+01
3	1.0E-02	8.9E+01	1.2E-02	1.1E+02	9.0E-03	7.9E+01	1.1E-02	9.3E+01	7.9E+01	1.1E+02	9.2E+01
4	9.6E-03	8.4E+01	9.1E-03	8.0E+01	8.3E-03	7.3E+01	1.0E-02	8.9E+01	7.3E+01	8.9E+01	8.1E+01
5	9.7E-03	8.5E+01	9.0E-03	7.9E+01	8.3E-03	7.2E+01	9.9E-03	8.7E+01	7.2E+01	8.7E+01	8.1E+01
6	9.8E-03	8.5E+01	9.2E-03	8.0E+01	8.5E-03	7.5E+01	1.0E-02	9.1E+01	7.5E+01	9.1E+01	8.3E+01
7	9.8E-03	8.6E+01	9.2E-03	8.1E+01	8.4E-03	7.3E+01	9.9E-03	8.7E+01	7.3E+01	8.7E+01	8.2E+01

APPENDIX G

SURFACE WATER DISPOSAL UNIT (POND AND DITCH) MONITORING FIGURES AND TABLES

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Table G-1. Radiological Results for N Springs Samples (pCi/l)

Site	H-3	Co-60	Sr-90	Cs-137
1	2.50 E+02	1.80 E+00	5.80 E+01	1.90 E+00
2	8.50 E+02	5.90 E-01	2.60 E+02	-2.80 E+00
3	1.60 E+04	3.60 E+00	5.80 E+03	-2.00 E+00
4	4.20 E+03	4.70 E+00	9.50 E+02	1.80 E-01
5	1.50 E+02	1.50 E+00	3.70 E+01	3.40 E+00
6	2.20 E+02	5.80 E+00	1.60 E+01	-3.40 E+00
7	1.90 E+02	6.00 E-01	6.50 E+00	5.50 E-01
8	2.40 E+02	-3.50 E+00	2.20 E+01	-2.70 E+00
11	2.20 E+02	5.00 E+00	1.70 E+02	-6.10 E-02

Table G-2. Radiological Results for Liquid Samples from Surface Water Disposal Units, 200 Areas, 1996 (pCi/L).

Sample Location	Number of Samples		^{238}Pu	$^{239,240}Pu$	$^{total}U$	^{137}Cs	$^{Sr}90$	^{3}H[a]
200 East Powerhouse Ditch	12	Mean	ND	4.3E-05	3.8E-04	ND	1.5E-03	1.7E+02
		Max	ND	4.3E-05	7.7E-04	ND	1.5E-03	3.8E+02
		Min	ND	4.3E-05	8.2E-05	ND	1.5E-03	5.0E+01
216-B-3C Pond	12	Mean	2.0E-04	1.7E-05	2.0E-04	ND	1.2E-03	2.0E+02
		Max	2.0E-04	1.7E-05	5.2E-04	ND	1.2E-03	4.7E+02
		Min	2.0E-04	1.7E-05	2.3E-05	ND	1.2E-03	7.1E+01

ND = Not Detected
[a] ^{3}H Analyses are performed quarterly

Table G-3. Nonradiological Results for Liquid Samples from Surface Water Disposal Units, 200 Areas, 1996.

Sample Locations	pH				Nitrate (NO_3, mg/L)			
	Number of Samples	Mean	Max	Min	Number of Samples	Mean	Max	Min
216-B-3C Pond	52	8.9	9.3	7.8	4	0.16	0.32	0.08
200 East Area Powerhouse Pond	52	8.2	8.7	6.6	4	0.17	0.32	0.08

Table G-4. Radiological Results for Aquatic Vegetation from Surface Water Disposal Units, 200 Area, 1996 (pCi/g dry weight).

Sample Locations	^{137}Cs	^{90}Sr	$^{239,240}Pu$	$^{total}U$ (g/g)
216-B-3C Pond	4.7E-01	3.5E-01	2.4E-01	2.4E-09
200 East Area Powerhouse Pond	ND	7.3E-01	4.9E-01	3.4E-09

ND = Not Detected

Table G-5. Radiological Results for Sediment (Surface) from Surface Water Disposal Units, 200 Area, 1996 (pCi/g dry weight).

Sample Locations	^{137}Cs	^{90}Sr	$^{239,240}Pu$	$^{total}U$ (g/g)
216-B-3C Pond	7.9E+00	3.8E-01	7.8E-01	1.9E-10
200 East Area Powerhouse Pond	7.6E-02	4.3E+00	2.6E-01	3.0E-09

Figure G-1. N Springs Sample Locations.

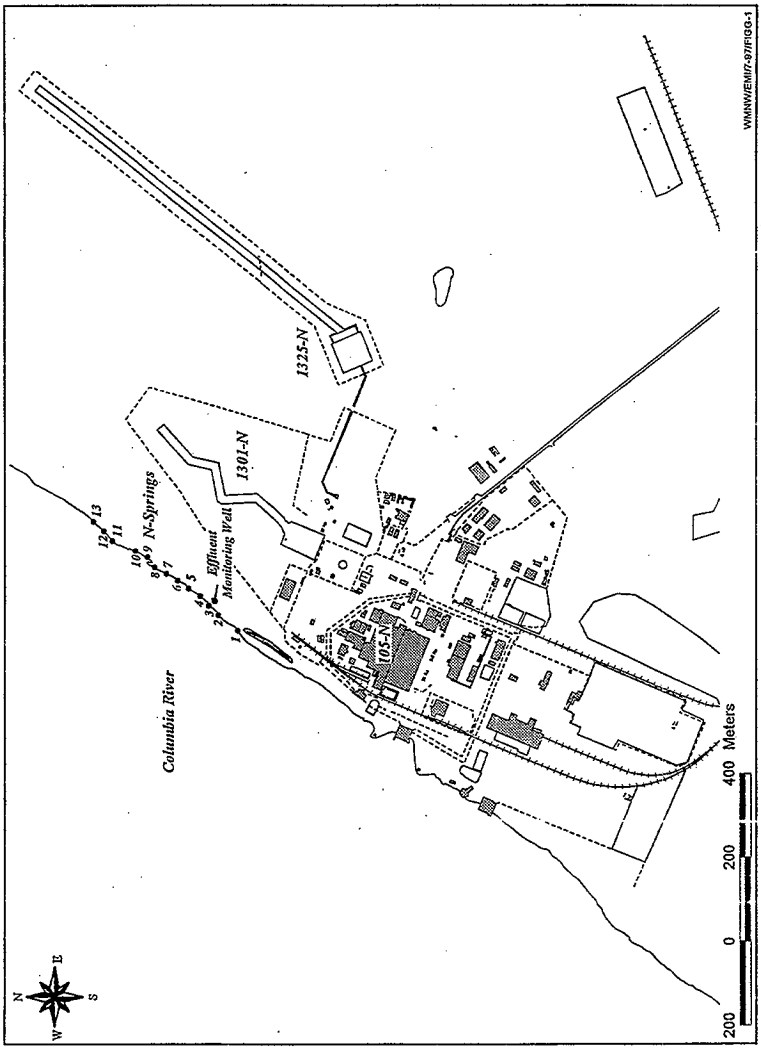
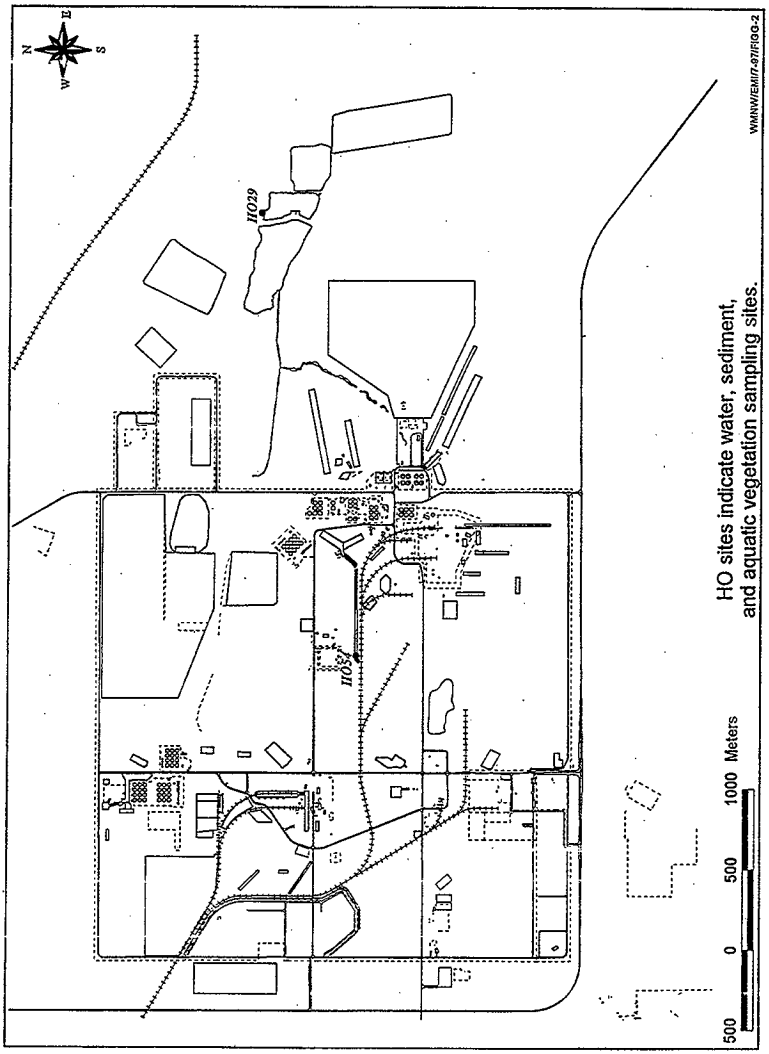


Figure G-2. 200 East Area Liquid Waste Disposal Facilities.



APPENDIX H

RADIOLOGICAL SURVEYS FIGURES AND TABLES

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Figure H-1. Radiological Survey Location in the 100 B/C Area.

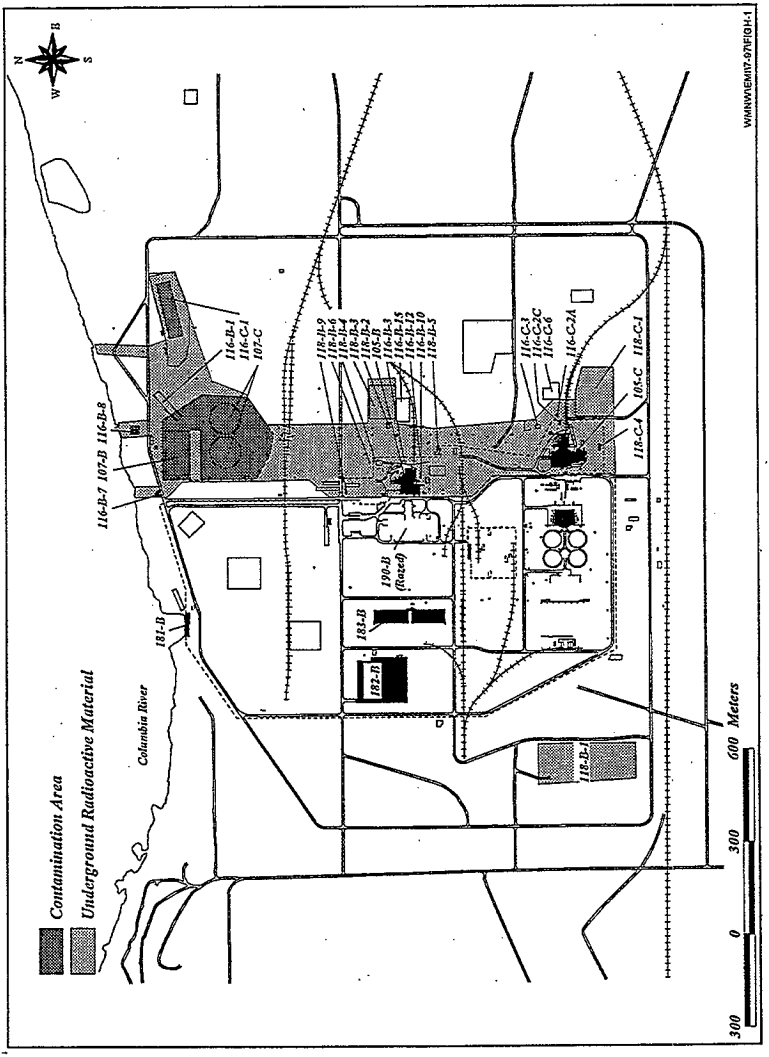

Figure H-2. Radiological Survey Location in the 100 D/DR Area.

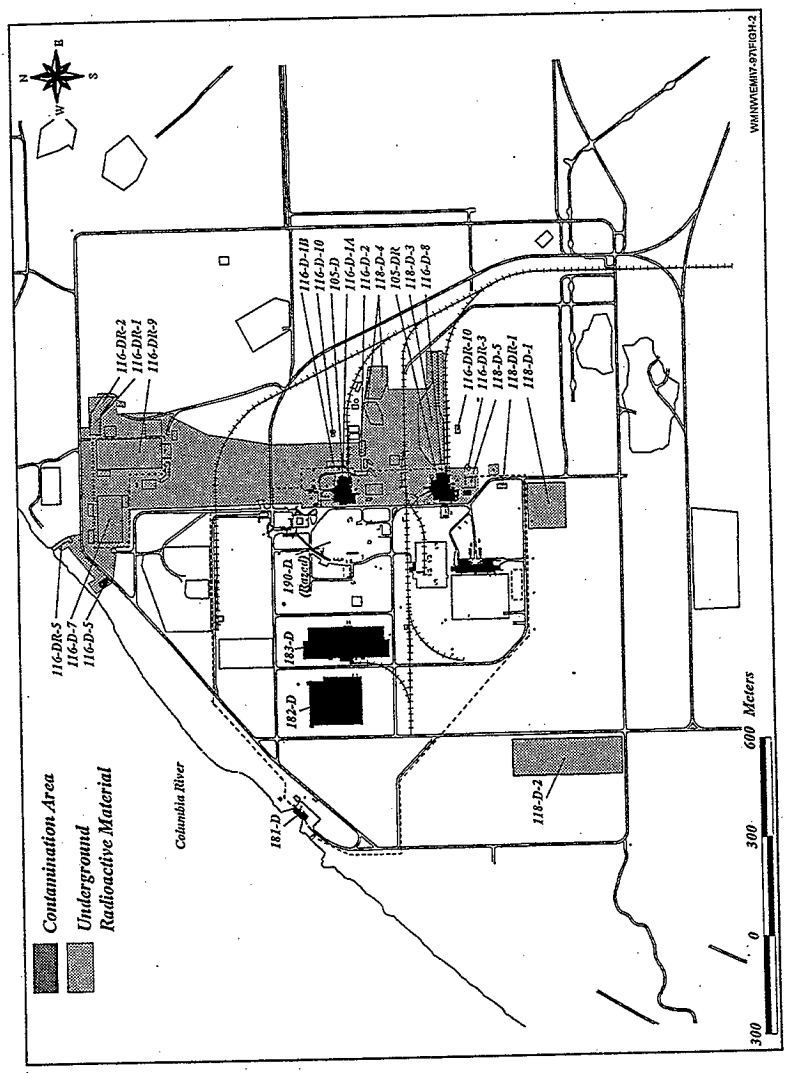

Figure H-3. Radiological Survey Locations in the 100 F Area.

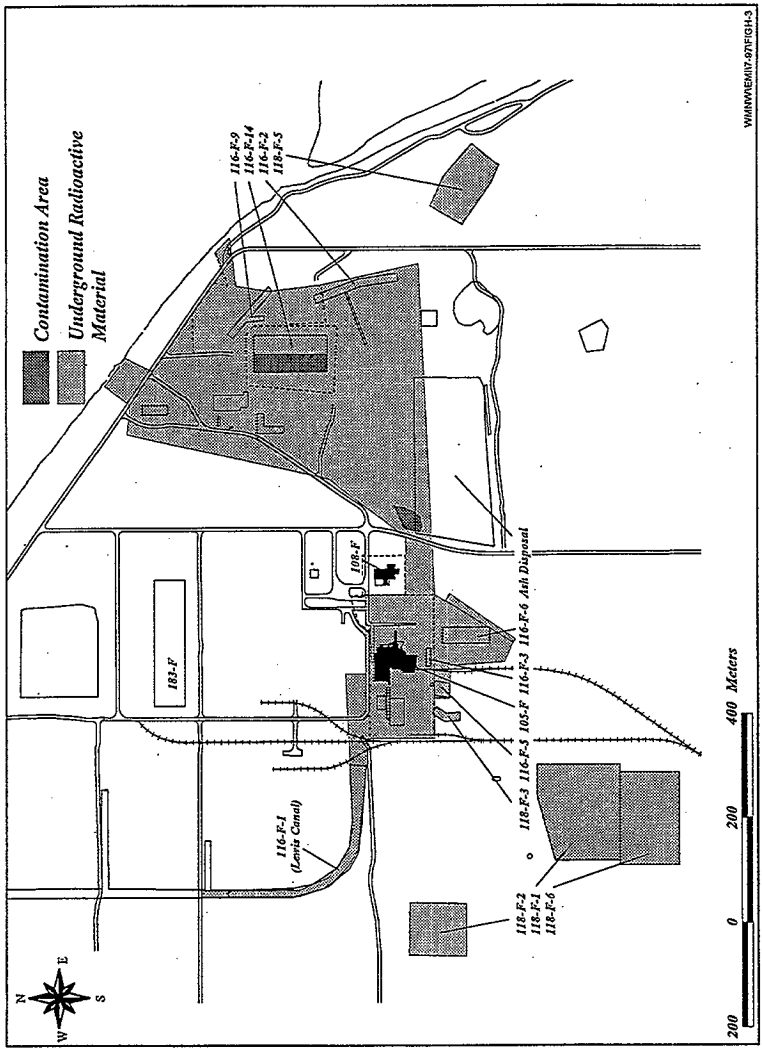

Figure H-4. Radiological Survey Locations in the 100 H Area.

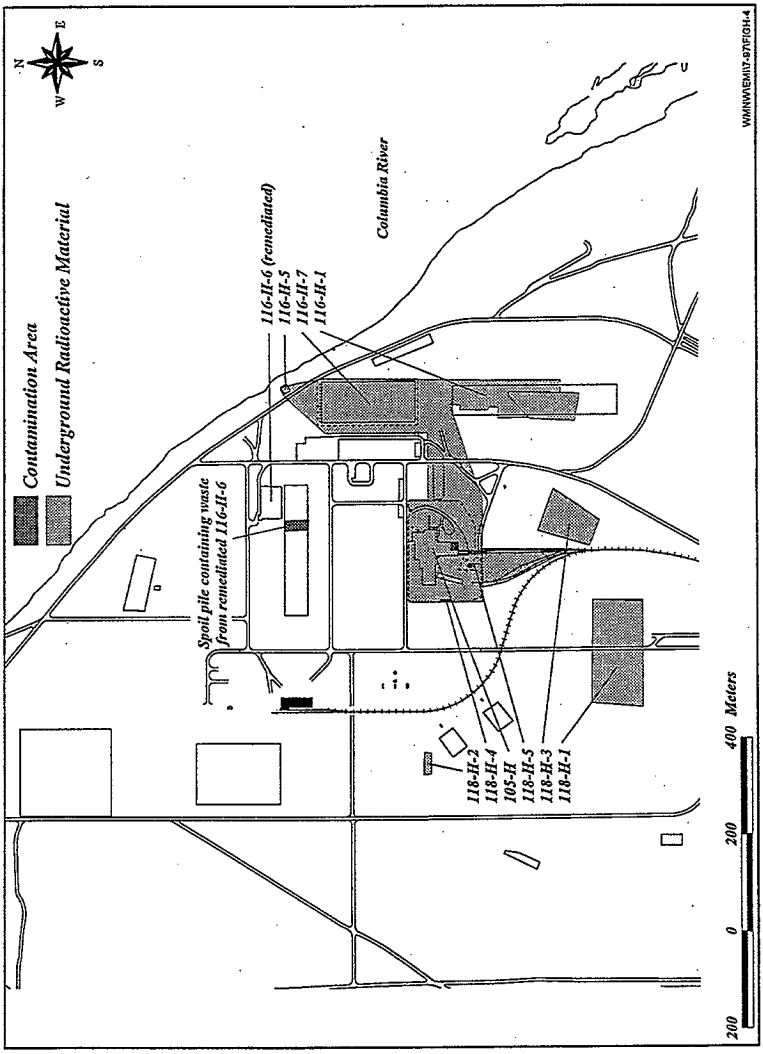

Figure H-5. Radiological Survey Locations in the 100 KE/KW Area.

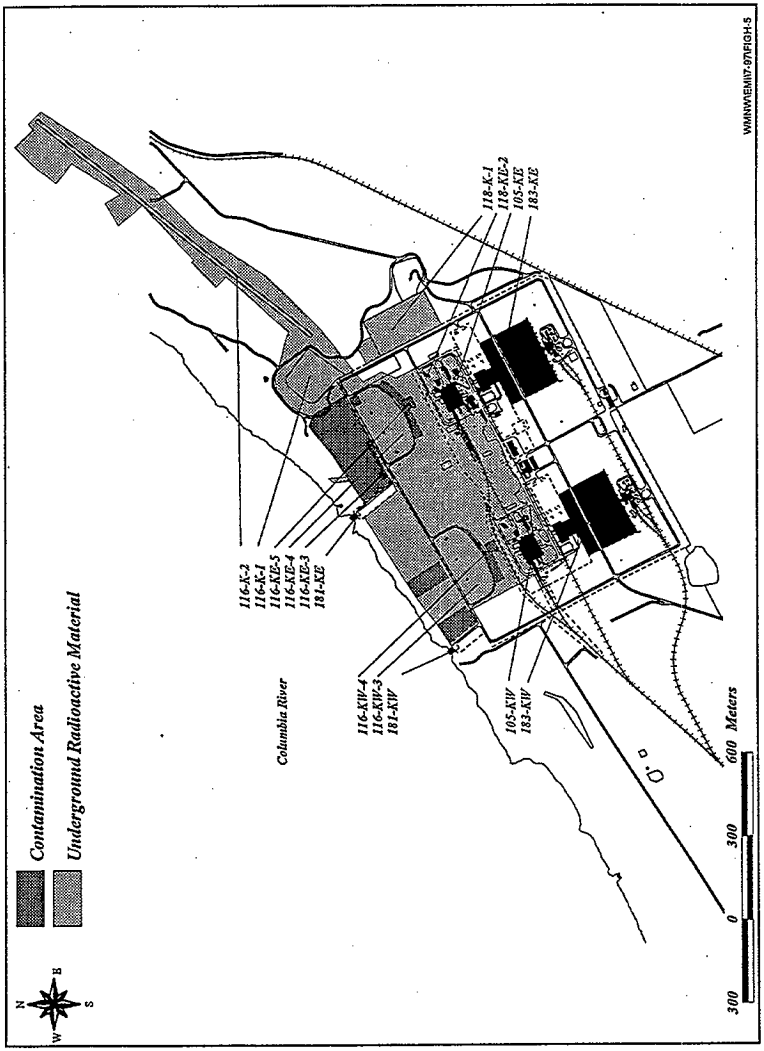

Figure H-6. Radiological Survey Locations in the 100 N Area.

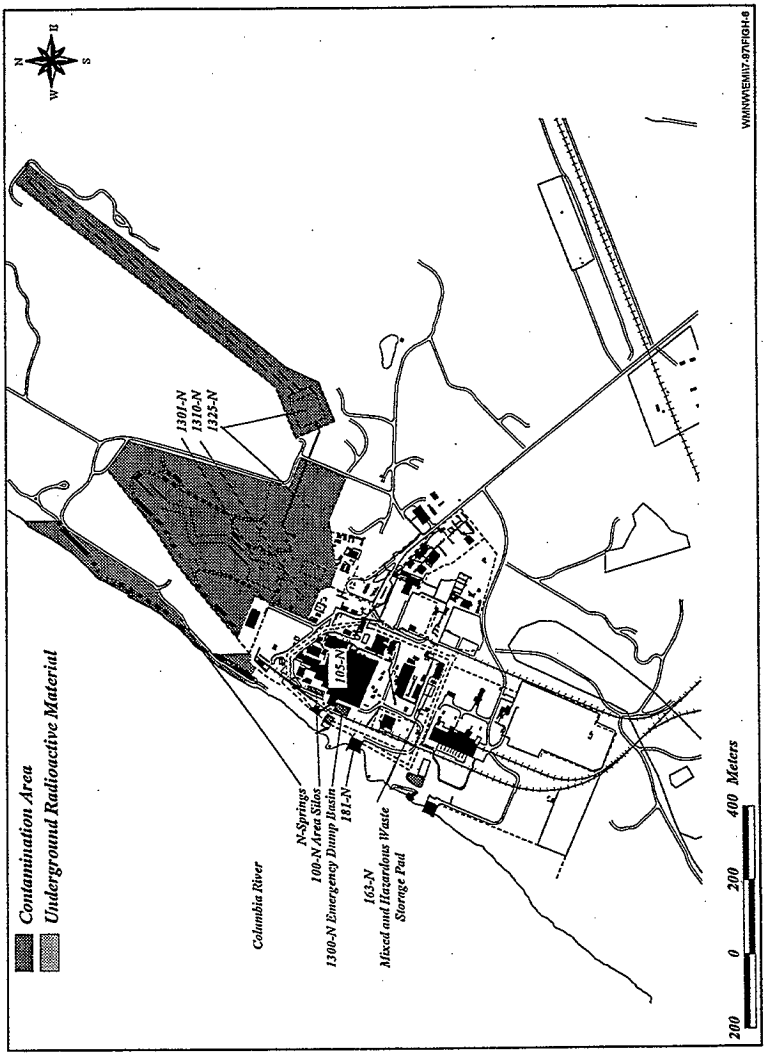

Figure H-7. Radiological Survey Locations in the 200 East Area.

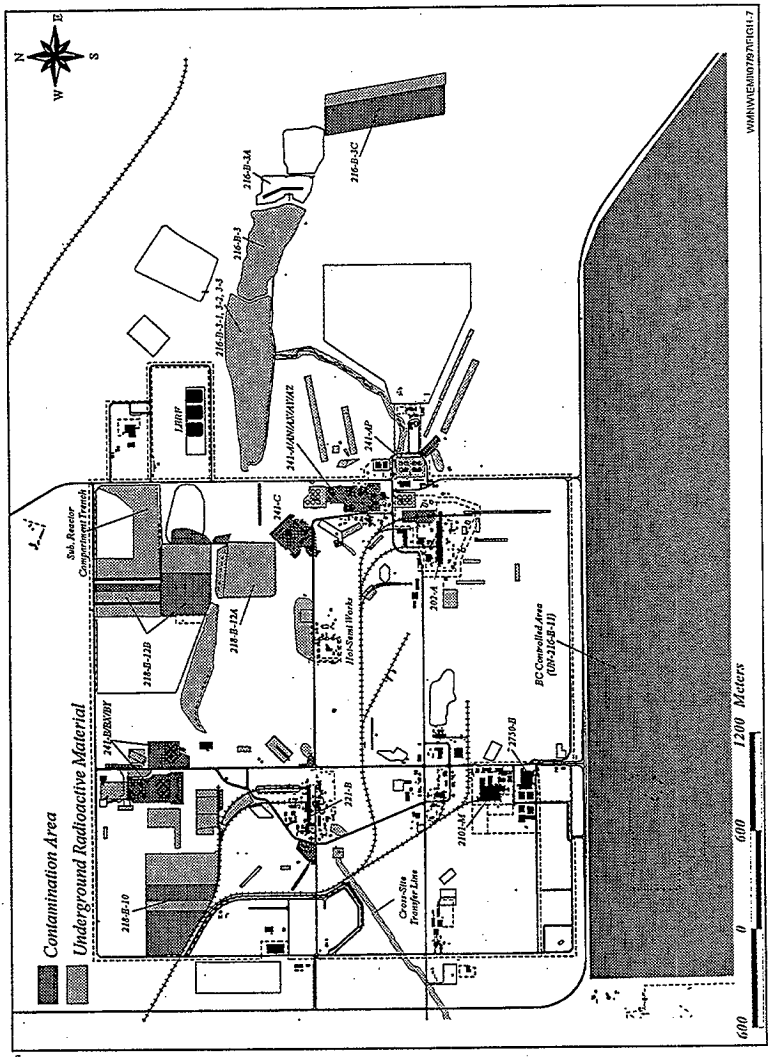

Figure H-8. Radiological Survey Locations in the 200 West Area.

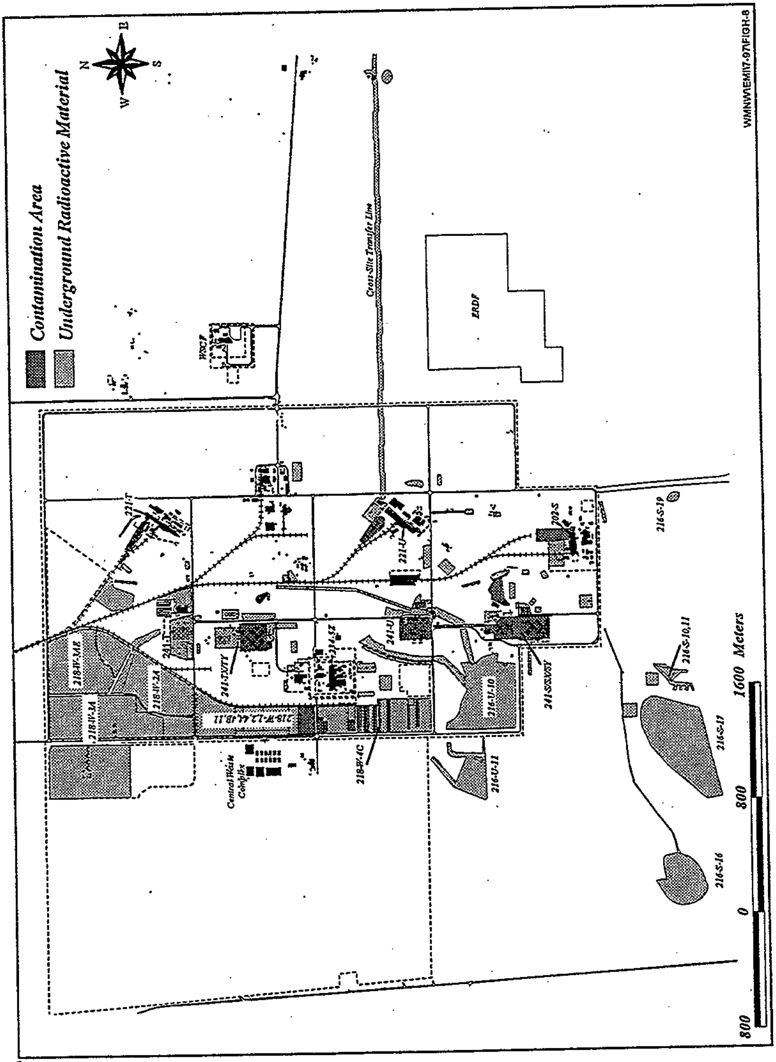

Figure H-9. Radiological Survey Locations in the 600 Area.

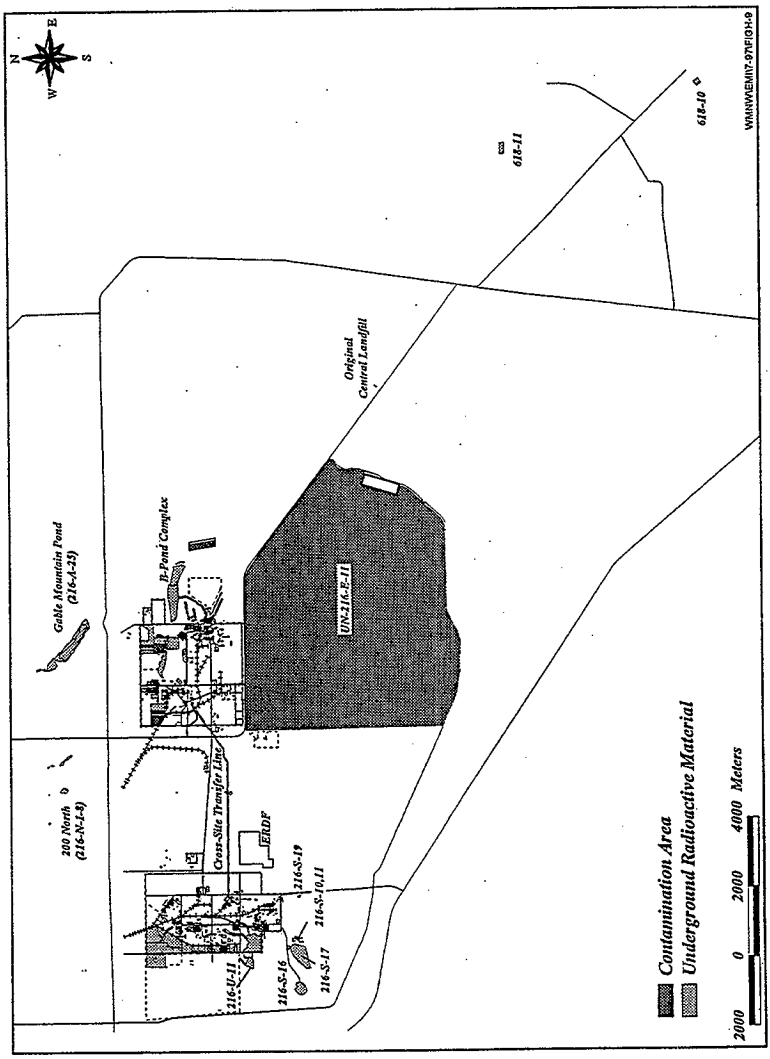

Figure H-10. Radiological Survey Locations in the 300 Area.

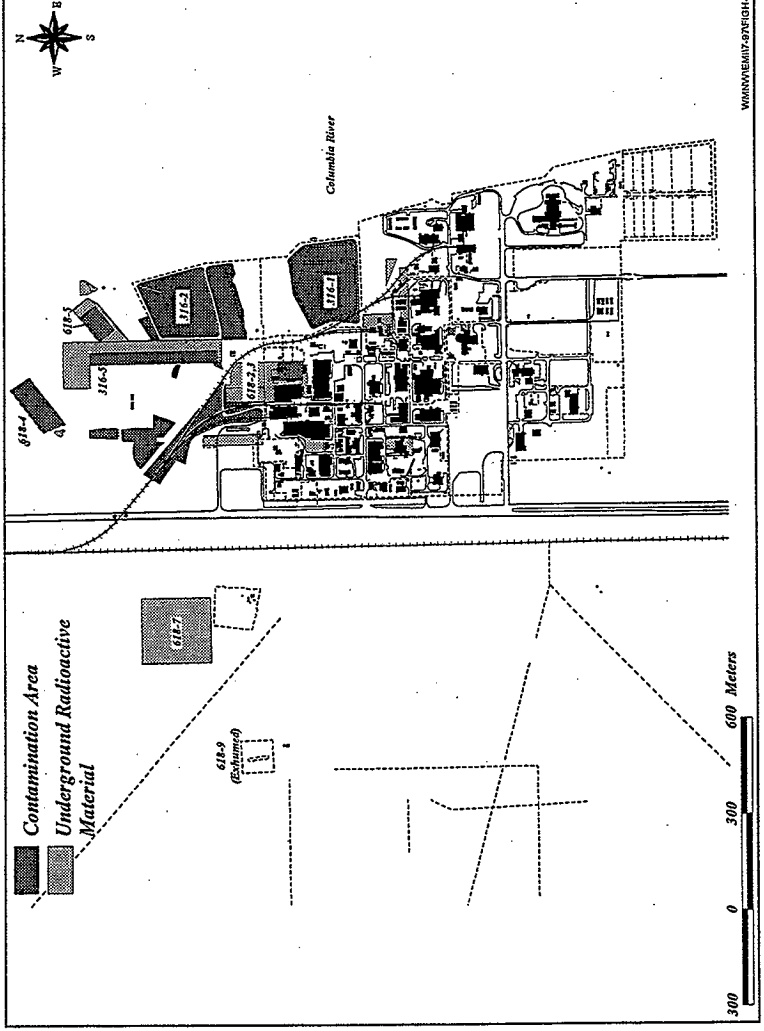

Table H-1. 100-N Area Shoreline Radiation Surveys (μ/hr).

Location	1991	1992	1993	1994	1995*	1996*
1	11	12	11	10	10	
	15	13	13	11	9	
	14	14	14	13	9	
	17	18	17	14	10	
	18	18	18	15	10	
	17	20	20	14	11	
	20	28	27	23	12	
	33	37	35	33	14	
	46	46	45	44	16	
10	59	55	50	50	17	
	72	65	55	55	16	
	85	70	60	60	15	
	100	75	70	70	14	
	110	100	80	75	13	
	120	105	100	85	12	
	140	110	90	85	13	
	130	120	75	75	10	
	100	100	60	60	9	
	80	70	40	40	8	
20	70	50	40	40	11	
	50	45	35	35	12	10
	50	50	30	35	11	
	50	40	30	35	11	
	40	40	35	35	12	15
	50	50	35	35	11	
	50	50	30	35	11	20
	50	50	30	40	12	
	50	60	30	40	11	
	50	60	35	45	12	
30	50	70	45	45	13	
	50	80	55	50	11	20
	50	80	50	60	11	
	70	80	60	60	12	
	80	100	65	65	11	20
	90	100	60	65	13	
	90	100	70	70	16	25
	90	110	70	70	16	
	100	110	70	75	14	
	110	120	80	75	18	30
40	110	120	80	80	22	

Table H-1. 100-N Area Shoreline Radiation Surveys (μ/hr).						
	110	120	90	80	21	25
	120	130	80	85	19	
	130	140	80	90	20	
	130	145	80	95	20	20
	140	150	90	100	19	
	140	150	90	110	18	15
	150	160	95	110	18	
	180	170	110	115	20	
	170	160	110	120	22	15
50	180	160	95	120	19	
	180	160	100	120	18	10
	170	160	100	115	19	
	170	170	110	115	18	10
	190	160	115	110	18	
	180	160	100	110	16	
	170	150	95	110	17	10
	170	140	90	105	18	
	170	130	90	100	18	
	150	120	90	85	16	8
60	160	120	80	80	15	
	140	110	75	80	12	10
	140	100	70	75	12	
	130	90	70	65	11	
	120	80	55	60	10	10
	120	80	45	55	10	
	110	70	45	50	11	10
	90	60	40	45	11	
	90	60	45	45	10	
	80	60	35	40	11	10
70	70	50	40	40	10	
	70	40	35	35	10	10
	60	40	30	35	11	
	50	40	30	30	10	
	50	30	30	25	10	10
	50	30	25	24	10	
	50	27	30	23	11	10
	40	26	30	19	8	
	40	22	25	19	10	10
	30	21	20	19	7	
80	30	20	20	17	9	
	30	19	25	15	9	10

Table H-1. 100-N Area Shoreline Radiation Surveys (μ/hr).						
	30	17	20	17	8	
	30	17	18	14	7	
	30	16	18	13	8	
	30	14	18	12	7	
	20	13	18	12	8	
	20	14	15	11	7	
	15	14	15	11	4	
	15	12	18	11	5	
90	15	12	15	11	4	
	14	11	10	12	5	
	13	10	10	11	5	
	12	9	12	10	5	

*This survey used an alternate field instrument

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APPENDIX I

INVESTIGATIVE SPECIAL SAMPLE TABLES

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Table I.1. Radionuclide Concentrations in Investigative Samples in 1996.

Sample Type	Location	Radionuclides	Concentration (pCi/g)[a]
Paint Chips	241-TX Tank Farm East Perimeter Fence/200 West Area	^{60}Co	<7.8E+01
		$^{89/90}Sr$	2.4E+03
		^{134}Cs	<5.4E+02
		^{137}Cs	7.8E+05
		^{152}Eu	<3.9E+02
		^{154}Eu	<4.3E+02
		^{155}Eu	<1.9E+03
		^{238}Pu	<5.3E+01
		$^{239/240}Pu$	<5.3E+01
		$^{Total}U$	3.3E-01
Soil	216-A-25 (Gable Mountian Pond) Pipeline at Route 11A Crossing/600 Area	^{60}Co	<4.5E-02
		$^{89/90}Sr$	9.8E+00
		^{134}Cs	<1.6E-01
		^{137}Cs	3.6E+02
		^{152}Eu	<2.0E-01
		^{154}Eu	<1.7E-01
		^{155}Eu	<7.4E-01
		^{238}Pu	<2.7E+00
		$^{239/240}Pu$	<2.7E+00
		$^{Total}U$	3.9E-02
	216-A-25 (Gable Mountian Pond)/600 Area	^{60}Co	<2.3E+00
		$^{89/90}Sr$	5.3E+01
		^{134}Cs	<6.2E+00
		^{137}Cs	7.2E+03
		^{152}Eu	<1.3E+01
		^{154}Eu	<8.6E+00
		^{155}Eu	<1.6E+01
		^{238}Pu	<7.9E+00
		$^{239/240}Pu$	<7.9E+00
		$^{Total}U$	1.5E-01
	2401-W (northeast corner)/200 West Area	^{60}Co	<4.7E-02
		$^{89/90}Sr$	<3.1E-01
		^{134}Cs	<3.9E-02
		^{137}Cs	2.3E-01
		^{152}Eu	<2.3E-01
		^{154}Eu	<1.5E-01
		^{155}Eu	<1.7E-01
		^{238}Pu	<2.3E+02
		$^{239/240}Pu$	<2.3E+02
		$^{Total}U$	2.9E-02
	2401-W (southeast corner)/200 West Area	^{60}Co	<3.7E-02
		$^{89/90}Sr$	6.6E-01
		^{134}Cs	<3.7E-02
		^{137}Cs	<8.5E-02
		^{152}Eu	<1.9E-01
		^{154}Eu	<1.3E-01
		^{155}Eu	<1.5E-01
		^{238}Pu	<9.0E+01

Table I.1. Radionuclide Concentrations in Investigative Samples in 1996.

Sample Type	Location	Radionuclides	Concentration (pCi/g)[a]
		$^{239/240}Pu$	<9.0E+01
		$^{Total}U$	2.6E-02
Vegetation (Cryptogams)	2401-W (northeast corner)/200 West Area	^{60}Co	<6.7E-02
		$^{89/90}Sr$	7.4E-01
		^{134}Cs	<5.7E-02
		^{137}Cs	2.9E-01
		^{152}Eu	<3.0E-01
		^{154}Eu	<1.9E-01
		^{155}Eu	<2.3E-01
		^{238}Pu	<1.0E+02
		$^{239/240}Pu$	1.2E+02
		$^{Total}U$	1.8E-02
	2401-W (50 meters east)/200 West Area	^{60}Co	<5.9E-02
		$^{89/90}Sr$	<6.9E-01
		^{134}Cs	<5.7E-02
		^{137}Cs	5.5E-01
		^{152}Eu	<2.7E-01
		^{154}Eu	<1.8E-01
		^{155}Eu	<2.2E-01
		^{238}Pu	<1.8E+02
		$^{239/240}Pu$	<1.8E+02
		$^{Total}U$	1.2E-02
Vegetation (Mixed)	216-A-30 Crib (above pipeline 15 meters west of crib)/600 Area	^{60}Co	<4.1E+00
		$^{89/90}Sr$	7.0E+03
		^{134}Cs	<3.5E+00
		^{137}Cs	<4.6E+00
		^{152}Eu	<2.0E+01
		^{154}Eu	<1.3E+01
		^{155}Eu	<1.7E+01
		$^{Total}U$	6.5E-02
Vegetation (Tumbleweeds)	241-A Tank Farm/200 East Area	^{60}Co	<8.4E+00
		$^{89/90}Sr$	8.6E+00
		^{134}Cs	<8.0E+00
		^{137}Cs	<9.7E+00
		^{152}Eu	<4.3E+01
		^{154}Eu	<2.9E+01
		^{155}Eu	<2.3E+01
		^{238}Pu	<5.5E+00
		$^{239/240}Pu$	<5.5E+00
		$^{Total}U$	7.7E-02
	241-C Tank Farm/200 East Area	^{60}Co	<6.4E+00
		$^{89/90}Sr$	8.1E+03
		^{134}Cs	<5.6E+00
		^{137}Cs	<8.2E+00
		^{152}Eu	<2.9E+01
		^{154}Eu	<1.8E+01
		^{155}Eu	<2.4E+01
		^{238}Pu	<1.2E+00
		$^{239/240}Pu$	<1.2E+00

Table I.1. Radionuclide Concentrations in Investigative Samples in 1996.

Sample Type	Location	Radionuclides	Concentration (pCi/g)[a]
		$^{Total}U$	6.2E-03
	221-T Plant (above pipeline 40 meters west)/200 West Area	^{60}Co	<1.5E-01
		$^{89/90}Sr$	1.4E+02
		^{134}Cs	<1.4E-01
		^{137}Cs	6.7E-01
		^{152}Eu	<8.1E-01
		^{154}Eu	<4.3E-01
		^{155}Eu	<7.6E-01
		^{238}Pu	<5.5E-01
		$^{239/240}Pu$	<5.5E-01
		$^{Total}U$	3.3E-02
	241-U Tank Farm (across Camden Ave)/200 West Area	^{60}Co	<2.6E+00
		$^{89/90}Sr$	1.3E+06
		^{134}Cs	<5.8E+00
		^{137}Cs	<6.5E+00
		^{152}Eu	<1.0E+01
		^{154}Eu	<8.0E+00
		^{155}Eu	<8.0E+01
		^{238}Pu	<1.0E+00
		$^{239/240}Pu$	<1.0E+00
		$^{Total}U$	8.9E-02
Fresh Water Clams	207-B Retention Basin/200 East Area	^{60}Co	<9.0E+00
		$^{89/90}Sr$	1.0E+01
		^{134}Cs	<9.5E+00
		^{137}Cs	<1.3E+01
		^{152}Eu	<5.4E+01
		^{154}Eu	<3.6E+01
		^{155}Eu	<3.6E+01
		^{238}Pu	<2.6E-01
		$^{239/240}Pu$	<2.6E-01
		$^{Total}U$	1.8E-02
Caterpillar	241-ER-152 Diversion Box/200 East Area	^{60}Co	<3.4E+02
		$^{89/90}Sr$	3.3E+03
		^{134}Cs	<2.4E+02
		^{137}Cs	<4.5E+02
		^{152}Eu	<1.5E+03
		^{154}Eu	<7.6E+02
		^{155}Eu	<8.3E+02
		^{238}Pu	<1.5E+02
		$^{239/240}Pu$	<1.5E+02
		$^{Total}U$	2.8E-02
Ant Mound	241-ER-152 Diversion Box/200 East Area	^{60}Co	<2.1E-01
		$^{89/90}Sr$	4.2E+01
		^{134}Cs	<4.2E-01
		^{137}Cs	2.8E+01
		^{152}Eu	<7.6E-01
		^{154}Eu	<6.1E-01
		^{155}Eu	<6.1E+00
		^{238}Pu	<5.9E-02
		$^{239/240}Pu$	1.2E-01

Table I.1. Radionuclide Concentrations in Investigative Samples in 1996.

Sample Type	Location	Radionuclides	Concentration (pCi/g)[a]
		$^{Total}U$	9.0E-03
Honey Bee Comb	244-CR Vault/241-C Tank Farm/200 East Area	^{60}Co	<4.9E-01
		$^{89/90}Sr$	1.8E+03
		^{134}Cs	<4.5E-01
		^{137}Cs	1.6E+01
		^{152}Eu	<2.6E+00
		^{154}Eu	<1.6E+00
		^{155}Eu	<4.5E+00
		^{238}Pu	<8.4E-01
		$^{239/240}Pu$	<8.4E-01
		$^{Total}U$	1.0E-02
Darkling Beetles	272-S Building/200 West Area	^{60}Co	<1.1E+02
		$^{89/90}Sr$	1.6E+02
		^{134}Cs	<1.1E+02
		^{137}Cs	<1.8E+02
		^{152}Eu	<7.5E+02
		^{154}Eu	<4.3E+02
		^{155}Eu	<3.7E+02
		^{238}Pu	<4.4E+01
		$^{239/240}Pu$	<4.4E+01
		$^{Total}U$	4.7E-02
Western Toad	105-N Basin/100 N Area	^{60}Co	4.6E+01
		$^{89/90}Sr$	3.1E+02
		^{134}Cs	8.7E-01
		^{137}Cs	8.5E+02
		^{152}Eu	<1.1E+00
		^{154}Eu	<1.0E+00
		^{155}Eu	<2.6E+00
		^{238}Pu	6.2E+04
		$^{239/240}Pu$	1.2E+05
		$^{Total}U$	5.7E-02
Gopher Snake	277-A/200 East Area	^{60}Co	<7.3E-01
		$^{89/90}Sr$	2.3E+02
		^{134}Cs	<5.5E-01
		^{137}Cs	6.1E+01
		^{152}Eu	<2.6E+00
		^{154}Eu	<1.8E+00
		^{155}Eu	<2.6E+00
		^{238}Pu	<5.6E-01
		$^{239/240}Pu$	<5.6E-01
		$^{Total}U$	1.3E-04
Pigeon Feces	221-U Building/200 West Area	^{60}Co	<9.5E-01
		$^{89/90}Sr$	3.0E+00
		^{134}Cs	<9.7E-01
		^{137}Cs	5.4E+00
		^{152}Eu	<4.7E+00
		^{154}Eu	<2.8E+00
		^{155}Eu	<6.7E+00
		^{238}Pu	<7.0E-01
		$^{239/240}Pu$	<7.0E-01

Table I.1. Radionuclide Concentrations in Investigative Samples in 1996.

Sample Type	Location	Radionuclides	Concentration (pCi/g)[a]
		$^{Total}U$	3.8E-02
Owl Pellets	221-U Building/200 West Area	^{60}Co	<1.6E-01
		$^{89/90}Sr$	8.4E+00
		^{134}Cs	<1.6E-01
		^{137}Cs	2.2E+00
		^{152}Eu	<8.9E-01
		^{154}Eu	<4.9E-01
		^{155}Eu	<7.6E-01
		^{238}Pu	<7.0E-01
		$^{239/240}Pu$	<7.0E-01
		$^{Total}U$	4.3E+01
Starlings	105-KW Basin/100 K Area (5 carcasses)	^{60}Co	1.6E-01
		$^{89/90}Sr$	9.6E+01
		^{134}Cs	<1.2E-01
		^{137}Cs	8.4E+01
		^{152}Eu	<2.8E-01
		^{154}Eu	<2.2E-01
		^{155}Eu	<4.8E-01
		^{238}Pu	6.5E-01
		$^{239/240}Pu$	1.9E-01
		$^{Total}U$	2.1E-04
	105-KE Basin/100 K Area (1 carcass)	^{60}Co	<7.0E-01
		$^{89/90}Sr$	2.7E+01
		^{134}Cs	<4.6E-01
		^{137}Cs	2.9E+00
		^{152}Eu	<2.6E+00
		^{154}Eu	<1.8E+00
		^{155}Eu	<1.9E+00
		^{238}Pu	<7.5E+02
		$^{239/240}Pu$	1.0E+03
		$^{Total}U$	4.5E-04
Northern Pocket Gopher	216-T-4-1 Stabilized Ditch (5 meters west)/200 West Area	^{60}Co	<6.1E-01
		$^{89/90}Sr$	3.0E+03
		^{134}Cs	<4.5E-01
		^{137}Cs	<1.5E+00
		^{152}Eu	<2.0E+00
		^{154}Eu	<1.5E+00
		^{155}Eu	<1.9E+00
		^{238}Pu	<8.9E-01
		$^{239/240}Pu$	<8.9E-01
		$^{Total}U$	2.2E-03
	218-W-4A Burial Ground/200 West Area	^{60}Co	<2.3E-01
		$^{89/90}Sr$	6.0E+03
		^{134}Cs	<1.9E-01
		^{137}Cs	<3.7E-01
		^{152}Eu	<1.0E+00
		^{154}Eu	<6.5E-01
		^{155}Eu	<6.9E-01
		^{238}Pu	9.4E-01
		$^{239/240}Pu$	6.3E-01

Table I.1. Radionuclide Concentrations in Investigative Samples in 1996.

Sample Type	Location	Radionuclides	Concentration (pCi/g)[a]
		$^{Total}U$	1.1E-04
Mouse Feces	241-ER-152 Diversion Box/200 East Area	^{60}Co	<1.1E+03
		$^{89/90}Sr$	6.4E+05
		^{134}Cs	<1.2E+03
		^{137}Cs	1.5E+04
		^{152}Eu	<5.1E+03
		^{154}Eu	<2.8E+03
		^{155}Eu	<7.6E+03
		^{238}Pu	<6.6E+02
		$^{239/240}Pu$	<6.6E+02
		$^{Total}U$	1.6E-01
	241-A Tank Farm/200 East Area	^{60}Co	<6.9E+01
		$^{89/90}Sr$	1.1E+04
		^{134}Cs	<5.8E+01
		^{137}Cs	<7.1E+01
		^{152}Eu	<2.9E+02
		^{154}Eu	<2.2E+02
		^{155}Eu	<1.5E+02
		^{238}Pu	<3.7E+01
		$^{239/240}Pu$	<3.7E+01
		$^{Total}U$	3.1E-02
	241-S-151 Vent Station/200 West Area	^{60}Co	6.2E+04
		$^{89/90}Sr$	7.8E+06
		^{134}Cs	<7.4E+02
		^{137}Cs	4.9E+05
		^{152}Eu	<1.2E+03
		^{154}Eu	4.7E+04
		^{155}Eu	2.1E+04
		^{238}Pu	1.8E+04
		$^{239/240}Pu$	8.2E+04
		$^{Total}U$	1.3E+02
Mouse Urine (wipes from traps)	1301 Building/3000 Area	^{60}Co	<3.0E+01 [b]
		$^{89/90}Sr$	2.9E+03 [b]
		^{134}Cs	<2.4E+01 [b]
		^{137}Cs	<6.8E+01 [b]
		^{152}Eu	<1.4E+02 [b]
		^{154}Eu	<7.6E+01 [b]
		^{155}Eu	<9.2E+01 [b]
		^{238}Pu	<1.6E+01 [b]
		$^{239/240}Pu$	<1.6E+01 [b]
		$^{Total}U$	0.0E+00 [b]
Mouse Nest	241-EW-151 Vent Station/600 Area	^{60}Co	4.4E-01
		$^{89/90}Sr$	7.4E+04
		^{134}Cs	<2.7E-01
		^{137}Cs	1.7E+02
		^{152}Eu	<1.0E+00
		^{154}Eu	<6.1E-01
		^{155}Eu	<2.2E+00
		^{238}Pu	<5.0E-01
		$^{239/240}Pu$	<5.0E-01

Table I.1. Radionuclide Concentrations in Investigative Samples in 1996.

Sample Type	Location	Radionuclides	Concentration (pCi/g)[a]
		$^{Total}U$	1.1E-02
	241-ER-152 Diversion Box/200 East Area	^{60}Co	<1.3E+00
		$^{89/90}Sr$	3.5E+05
		^{134}Cs	<3.4E+00
		^{137}Cs	8.1E+02
		^{152}Eu	<5.6E+00
		^{154}Eu	<4.8E+00
		^{155}Eu	<4.4E+01
		^{238}Pu	1.7E+00
		$^{239/240}Pu$	5.6E+00
		$^{Total}U$	1.1E-02
Deer Mouse	202-A (PUREX)/200 East Area	^{60}Co	<6.6E+00
		$^{89/90}Sr$	7.0E+02
		^{134}Cs	<1.2E+01
		^{137}Cs	3.9E+03
		^{152}Eu	<2.6E+01
		^{154}Eu	<2.2E+01
		^{155}Eu	<4.5E+01
		^{238}Pu	4.2E+03
		$^{239/240}Pu$	1.3E+04
		$^{Total}U$	1.1E-01
	241-A Tank Farm/200 East Area	^{60}Co	<8.8E+00
		$^{89/90}Sr$	2.1E+03
		^{134}Cs	<8.7E+00
		^{137}Cs	8.6E+01
		^{152}Eu	<5.1E+01
		^{154}Eu	<3.1E+01
		^{155}Eu	<3.4E+01
		^{238}Pu	<3.7E+00
		$^{239/240}Pu$	<3.7E+00
		$^{Total}U$	2.6E-02
	241-AN Tank Farm/200 East Area	^{60}Co	<1.0E+00
		$^{89/90}Sr$	1.1E+01
		^{134}Cs	<8.2E-01
		^{137}Cs	3.8E+00
		^{152}Eu	<5.6E+00
		^{154}Eu	<2.8E+00
		^{155}Eu	<3.3E+00
		^{238}Pu	<2.0E+00
		$^{239/240}Pu$	<2.0E+00
		$^{Total}U$	3.7E-01
	241-AN Tank Farm/200 East Area	^{60}Co	<5.5E-01
		$^{89/90}Sr$	5.5E+04
		^{134}Cs	<2.0E+00
		^{137}Cs	4.8E+03
		^{152}Eu	<2.3E+00
		^{154}Eu	<2.1E+00
		^{155}Eu	<1.4E+01
		^{238}Pu	<9.5E-01
		$^{239/240}Pu$	1.6E+00

Table I.1. Radionuclide Concentrations in Investigative Samples in 1996.

Sample Type	Location	Radionuclides	Concentration (pCi/g)[a]
		$^{Total}U$	2.7E-01
	241-AZ Tank Farm/200 East Area	^{60}Co	<2.6E+00
		$^{89/90}Sr$	3.0E+02
		^{134}Cs	<2.1E+00
		^{137}Cs	1.4E+01
		^{152}Eu	<1.8E+01
		^{154}Eu	<7.5E+00
		^{155}Eu	<8.7E+00
		^{238}Pu	<3.7E+00
		$^{239/240}Pu$	<3.7E+00
		$^{Total}U$	1.4E-03
	244-A Lift Station/200 East Area (6 mice)	^{60}Co	<1.6E-01
		$^{89/90}Sr$	4.4E+00
		^{134}Cs	<1.4E-01
		^{137}Cs	<2.5E-01
		^{152}Eu	<6.7E-01
		^{154}Eu	<4.8E-01
		^{155}Eu	<8.9E-01
		^{238}Pu	<1.3E+03
		$^{239/240}Pu$	<1.3E+03
		$^{Total}U$	1.4E-03
	272-AW/200 East Area	^{60}Co	<2.1E+00
		$^{89/90}Sr$	2.5E+02
		^{134}Cs	<2.7E+00
		^{137}Cs	3.0E+02
		^{152}Eu	<1.1E+01
		^{154}Eu	<7.5E+00
		^{155}Eu	<9.4E+00
		^{238}Pu	<6.0E+00
		$^{239/240}Pu$	<6.0E+00
		$^{Total}U$	5.7E-04
	241-BX Tank Farm/200 East Area	^{60}Co	<9.2E-01
		$^{89/90}Sr$	2.0E+02
		^{134}Cs	<8.2E+00
		^{137}Cs	3.9E+04
		^{152}Eu	<5.3E+00
		^{154}Eu	<4.9E+00
		^{155}Eu	<3.1E+01
		^{238}Pu	<4.4E-01
		$^{239/240}Pu$	<4.4E-01
		$^{Total}U$	1.9E-03
	241-BY Tank Farm/200 East Area	^{60}Co	<3.1E+00
		$^{89/90}Sr$	1.3E+04
		^{134}Cs	<1.7E+01
		^{137}Cs	<4.1E+04
		^{152}Eu	<1.9E+01
		^{154}Eu	<1.1E+01
		^{155}Eu	<4.6E+01
		^{238}Pu	<2.7E+00
		$^{239/240}Pu$	<2.7E+00

Table I.1. Radionuclide Concentrations in Investigative Samples in 1996.

Sample Type	Location	Radionuclides	Concentration (pCi/g)[a]
		$^{Total}U$	1.1E-01
	2247-B/200 East Area	^{60}Co	<1.6E+00
		$^{89/90}Sr$	1.7E+04
		^{134}Cs	<1.2E+00
		^{137}Cs	<2.1E+00
		^{152}Eu	<6.0E+00
		^{154}Eu	<3.4E+00
		^{155}Eu	<4.2E+00
		^{238}Pu	<2.2E+00
		$^{239/240}Pu$	<2.2E+00
		$^{Total}U$	7.1E-04
	242-B/200 East Area	^{60}Co	<4.7E+00
		$^{89/90}Sr$	5.3E+02
		^{134}Cs	<5.1E+00
		^{137}Cs	6.4E+02
		^{152}Eu	<2.1E+01
		^{154}Eu	<1.3E+01
		^{155}Eu	<1.8E+01
		^{238}Pu	<4.9E+00
		$^{239/240}Pu$	<4.9E+00
		$^{Total}U$	1.0E-03
	241-E-151 Vent Station/200 East Area	^{60}Co	<1.2E+00
		$^{89/90}Sr$	2.4E+03
		^{134}Cs	<9.2E-01
		^{137}Cs	2.7E+01
		^{152}Eu	<5.9E+00
		^{154}Eu	<2.6E+00
		^{155}Eu	<4.3E+00
		^{238}Pu	<9.9E-01
		$^{239/240}Pu$	<9.9E-01
		$^{Total}U$	4.7E-04
	241-E-151 Vent Station/200 East Area	^{60}Co	<8.9E-01
		$^{89/90}Sr$	1.1E+04
		^{134}Cs	<9.5E-01
		^{137}Cs	6.4E+00
		^{152}Eu	<5.2E+00
		^{154}Eu	<2.9E+00
		^{155}Eu	<3.7E+00
		^{238}Pu	<2.0E+00
		$^{239/240}Pu$	<2.0E+00
		$^{Total}U$	2.4E-04
	241-ER-152 Diversion Box/200 East Area (2 mice)	^{60}Co	<9.1E+00
		$^{89/90}Sr$	1.0E+06
		^{134}Cs	<3.5E+01
		^{137}Cs	5.1E+04
		^{152}Eu	<3.6E+01
		^{154}Eu	<2.9E+01
		^{155}Eu	<3.6E+02
		^{238}Pu	<2.0E+00
		$^{239/240}Pu$	<2.0E+00

Table I.1. Radionuclide Concentrations in Investigative Samples in 1996.

Sample Type	Location	Radionuclides	Concentration (pCi/g)[a]
		$^{Total}U$	9.2E-04
	241-ER-152 Diversion Box/200 East Area (2 mice)	^{60}Co	<7.9E-01
		$^{89/90}Sr$	8.7E+04
		^{134}Cs	<1.9E+00
		^{137}Cs	<3.9E+00
		^{152}Eu	<3.6E+00
		^{154}Eu	<3.3E+00
		^{155}Eu	<2.5E+01
		^{238}Pu	<7.8E-01
		$^{239/240}Pu$	<7.8E-01
		$^{Total}U$	1.0E-03
	241-ER-152 Diversion Box/200 East Area	^{60}Co	<6.0E+00
		^{134}Cs	<5.0E+00
		^{137}Cs	<1.3E+01
		^{152}Eu	<1.9E+01
		^{154}Eu	<1.8E+01
		^{155}Eu	<1.7E+01
	241-ER-152 Diversion Box/200 East Area	^{60}Co	<4.0E+00
		$^{89/90}Sr$	1.4E+03
		^{134}Cs	<3.0E+00
		^{137}Cs	<7.4E+00
		^{152}Eu	<1.4E+01
		^{154}Eu	<9.9E+00
		^{155}Eu	<1.1E+01
		^{238}Pu	<3.7E+00
		$^{239/240}Pu$	<3.7E+00
		$^{Total}U$	6.9E-03
	241-ER-152 Diversion Box/200 East Area (3 mice)	^{60}Co	<1.3E+00
		$^{89/90}Sr$	2.6E+01
		^{134}Cs	<1.5E+00
		^{137}Cs	5.0E+02
		^{152}Eu	<7.3E+00
		^{154}Eu	<4.1E+00
		^{155}Eu	<5.6E+00
		^{238}Pu	<1.3E+03
		$^{239/240}Pu$	<1.3E+03
		$^{Total}U$	6.6E-03
	222-S/200 West Area	^{60}Co	<1.7E+00
		$^{89/90}Sr$	9.3E+03
		^{134}Cs	<2.0E+00
		^{137}Cs	3.9E+02
		^{152}Eu	<7.5E+00
		^{154}Eu	<3.5E+00
		^{155}Eu	<1.1E+01
		^{238}Pu	<2.8E+00
		$^{239/240}Pu$	3.0E+00
		$^{Total}U$	1.9E-03
		^{60}Co	<4.7E-01

Table I.1. Radionuclide Concentrations in Investigative Samples in 1996.

Sample Type	Location	Radionuclides	Concentration (pCi/g)[a]
	2727-SX/200 West Area	$^{89/90}Sr$	6.0E+02
		^{134}Cs	<5.2E-01
		^{137}Cs	2.8E+01
		^{152}Eu	<2.7E+00
		^{154}Eu	<1.6E+00
		^{155}Eu	<2.5E+00
		^{238}Pu	<9.2E-01
		$^{239/240}Pu$	<9.2E-01
		$^{Total}U$	1.7E-04
	1301 Building/3000 Area (mouse wash)	^{60}Co	<2.0E+01
		$^{89/90}Sr$	1.2E+03
		^{134}Cs	<1.6E+01
		^{137}Cs	<3.1E+01
		^{152}Eu	<9.0E+01
		^{154}Eu	<5.7E+01
		^{155}Eu	<5.6E+01
		^{238}Pu	<9.4E+00
		$^{239/240}Pu$	<9.4E+00
		$^{Total}U$	<0.0E+00
	1301 Building/3000 Area (mouse fur and skin)	^{60}Co	<6.3E-01
		$^{89/90}Sr$	2.2E+00
		^{134}Cs	<6.0E-01
		^{137}Cs	<1.1E+00
		^{152}Eu	<2.5E+00
		^{154}Eu	<1.8E+00
		^{155}Eu	<1.8E+00
		^{238}Pu	<1.1E-01
		$^{239/240}Pu$	<1.1E-01
		$^{Total}U$	2.0E-04
	1301 Building/3000 Area (mouse muscle)	^{60}Co	<5.6E-01
		$^{89/90}Sr$	1.5E+00
		^{134}Cs	<5.6E-01
		^{137}Cs	<9.9E-07
		^{152}Eu	<3.2E+00
		^{154}Eu	<1.9E+00
		^{155}Eu	<1.5E+00
		^{238}Pu	<1.1E-01
		$^{239/240}Pu$	<1.1E-01
		$^{Total}U$	1.4E-04
	1301 Building/3000 Area (mouse intestine)	^{60}Co	<6.0E-01
		$^{89/90}Sr$	1.7E+00
		^{134}Cs	<5.3E-01
		^{137}Cs	<1.5E+00
		^{152}Eu	<1.7E+00
		^{154}Eu	<1.1E+00
		^{155}Eu	<1.4E+00
		^{238}Pu	<1.1E-01
		$^{239/240}Pu$	<1.1E-01
		$^{Total}U$	1.2E-04
	1301 Building/3000 Area	^{60}Co	<4.6E-01

Table I.1. Radionuclide Concentrations in Investigative Samples in 1996.

Sample Type	Location	Radionuclides	Concentration (pCi/g)[a]
	(mouse bone)	$^{89/90}Sr$	1.1E+00
		^{134}Cs	<3.1E-01
		^{137}Cs	1.7E+00
		^{152}Eu	<2.8E+00
		^{154}Eu	<1.8E+00
		^{155}Eu	<1.4E+00
		^{238}Pu	<8.9E-02
		$^{239/240}Pu$	<8.9E-02
		$^{Total}U$	5.4E-05

[a] picocuries per gram (pCi/g)
[b] values are expressed in pCi/sample because of small sample size

Table I-2. Radiologically Contaminated Samples Disposed of from the Operations Areas in 1996

Sample Type	Location	External Radioactivity (counts per minute)
Yellow Crystalline Speck	216-S-23 Crib (1 meter south)/200 West Area	9,000
Soil Specks	241-B (outside north and east fences)/200 East Area	90,000
Soil Specks	241-B/200 East Area	2,000
Soil Speck	216-C-7/200 East Area	50,000
Soil	241-ER-151 (250 meters sw)/200 East Area	5,000
Soil Speck	216-A-30/200 East Area	15,000
Soil Specks (2)	241-EW-151 (600 meters east)/600 Area	20,000
Soil and Gravel	221-T/R-19/200 West Area	5,500
Soil Specks (5)	216-B-64 (outside north fence)/200 East Area	90,000
Soil Speck	241-A (outside east fence)/200 East Area	>100,000
Soil Specks	241-U (outside north fence)/200 West Area	650
Paint Chips (3)	241-SX (outside se corner)/200 West Area	4,000
Soil Specks (3)	241-SX (outside se corner)/200 West Area	25,000
Soil Specks	241-S (outside nw & sw corners)/200 West Area	5,000
Soil Specks	241-BX/BY (outside sw corner)/200 East Area	4,000
Soil Speck	241-C (outside se fence)/200 East Area	12,500
Soil Specks (3)	244-A (outside north fence)/200 East Area	7,500
Soil Specks (15)	244-A (outside east & south fences)/200 East Area	80,000
Soil Speck	216-S-23/200 West Area	9,000
Soil Specks (3)	241-ER-152/200 East Area	7,000

Table I-2. Radiologically Contaminated Samples Disposed of from the Operations Areas in 1996

Sample Type	Location	External Radioactivity (counts per minute)
Soil Specks	241-EW-151/600 Area	10,000
Soil Speck	241-S/200 West Area	65,000
Soil Speck	272-AW/200 East Area	6,000
Soil Specks (2)	241-EW-151/600 Area	50,000
Soil Specks (22)	241-BX/BY (outside west fence)/200 East Area	35,000
Soil Speck	241-U (east Camden Ave)/200 West Area	6,000
Soil Speck	241-C /200 East Area	25,000
Soil Specks	216-BC Control Area/600 Area	3,000
Soil Speck	244-A/200 East Area	7,000
Soil Speck	241-AN/200 East Area	15,000
Soil	1303-N/100 N Area	50,000
Soil	221-T Complex/200 West Area	7,000
Tumbleweed Fragments	218-E-12A/200 East Area	50,000
Tumbleweed	241-BX/200 East Area	1,000
Vegetation	216-A-6/200 East Area	10,000
Tumbleweeds	241-ER-151 (300 meters sw)/200 East Area	6,000
Tumbleweed	218-E-12B/Trench 94/200 East Area	40,000
Tumbleweeds/Roots	218-W-3A (outside ne fence)/200 West Area	4,000
Tumbleweed Fragments	221-T/R-3 to R-5/200 West Area	20,000
Tumbleweed Fragments	218-W-3A/200 West Area	80,000
Tumbleweed Fragments	218-W-3A/200 West Area	18,000
Tumbleweed Fragments	218-W-3A/200 West Area	15,000
Tumbleweeds	216-T-6 Transfer Line/200 West Area	6,000
Tumbleweed	241-C/200 East Area	>100,000
Tumbleweeds	218-W-3A/Trench 8/200 West	7,000

Table I-2. Radiologically Contaminated Samples Disposed of from the Operations Areas in 1996

Sample Type	Location	External Radioactivity (counts per minute)
	Area	
Tumbleweed	244-A (outside north fence)/200 East Area	6,000
Mouse Feces and Urine	241-ER-152/200 East Area	>100,000
Mouse Feces	241-ER-151/200 East Area	>100,000
Mouse Trap and Soil	202-S (exterior west side)/200 West Area	30,000
Deer Mouse	271-CR/200 East Area	600
Deer Mouse	105-KE/100 K Area	1,500
Deer Mouse Tail	221-BF/200 West Area	>100,000
Mouse Feces	241-AN/200 East Area	6,000
Mouse Feces	241-C (outside perimeter)/200 East Area	15,000

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APPENDIX J

CONCENTRATION GUIDES

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Table J-1. Airborne Derived Concentration Guides.

Radionuclide	DCG[a] (pCi/m3)
^{90}Sr	9
^{137}Cs	400
^{106}Ru	30
^{238}Pu	0.02

[a]Derived Concentration Guides.

Table J-2. Derived Concentration Guides for Water (pCi/L).

Radionuclide	DCG[a]
^{3}H	2.0 E+05
^{60}Co	5.0 E+03
^{90}Sr	1.0 E+03
^{99}Tc	1.0 E+05
^{106}Ru	6.0 E+03
^{129}I	5.0 E+02
^{137}Cs	3.0 E+03
^{234}U	5.0 E+02
^{235}U, ^{238}U	6.0 E+02
^{238}Pu	4.0 E+01
^{239}Pu, ^{240}Pu	3.0 E+01

[a]Derived Concentration Guides.

Table J-3. Inaccessible Soil Concentration Limits, pCi/g.

Radionuclide	100-BDKN	100-F, H	200-W	200-E	300 Area	400 Area
^{3}H	1.4 E+08	7.4 E+07	3.7 E+08	2.0 E+08	9.5 E+06	1.4 E+07
^{14}C	6.2 E+05	6.2 E+05	6.2 E+05	6.2 E+05	6.2 E+05	6.2 E+05
^{55}Fe	9.7 E+06	9.7 E+06	3.6 E+10	1.9 E+10	1.0 E+07	1.4 E+09
^{58}Co	9.8 E+06	9.8 E+06	8.1 E+09	4.3 E+09	1.2 E+07	3.1 E+08
^{60}Co	9.9 E+05	9.9 E+05	5.7 E+08	3.0 E+08	1.0 E+06	9.9 E+06
^{63}Ni	1.5 E+08	1.5 E+08	6.9 E+09	6.9 E+09	1.5 E+08	2.2 E+08
^{90}Sr*	8.3 E+05	8.3 E+05	2.2 E+08	1.2 E+08	8.3 E+05	8.4 E+06
^{99}Tc	1.3 E+07	1.3 E+07	1.3 E+07	1.3 E+07	1.3 E+07	1.3 E+07
^{106}Ru*	2.0 E+07	2.0 E+07	5.7 E+08	3.0 E+08	1.5 E+07	2.2 E+07
^{125}Sb*	9.1 E+06	9.1 E+06	5.7 E+09	3.0 E+09	9.2 E+06	1.1 E+08
^{129}I	2.8 E+05	2.8 E+05	2.8 E+05	2.8 E+05	2.2 E+05	2.8 E+05
^{134}Cs	1.7 E+04	1.7 E+04	2.5 E+08	1.4 E+08	2.4 E+04	9.7 E+06
^{137}Ce*	1.7 E+04	1.7 E+04	3.5 E+08	1.8 E+08	1.7 E+04	1.3 E+07
^{144}Cs*	1.4 E+06	1.4 E+06	7.4 E+08	4.0 E+08	1.9 E+06	2.8 E+07
^{147}Pm	3.4 E+07	3.4 E+07	7.4 E+09	4.0 E+09	3.5 E+07	2.8 E+08
^{152}Eu	4.5 E+06	4.5 E+06	1.2 E+09	6.2 E+08	4.6 E+06	4.5 E+07
^{154}Eu	3.3 E+06	3.3 E+06	8.8 E+08	4.7 E+08	3.3 E+06	3.4 E+07
^{155}Eu	2.3 E+07	2.3 E+07	6.9 E+09	3.7 E+09	2.4 E+07	2.6 E+08
^{226}Ra*	1.3 E+05	1.3 E+05	2.1 E+05	2.1 E+05	1.3 E+05	1.4 E+05
^{227}Ac*	2.4 E+03	2.4 E+03	5.4 E+04	2.9 E+04	1.4 E+03	2.1 E+03
^{232}Th*	2.0 E+04	2.0 E+04	2.0 E+04	2.0 E+04	4.7 E+03	7.1 E+03
^{232}U*	5.5 E+04	5.5 E+04	1.4 E+05	1.4 E+05	9.9 E+03	1.5 E+04
^{233}U	4.5 E+05	4.5 E+05	4.5 E+05	4.5 E+05	6.7 E+04	1.0 E+05
^{234}U	4.6 E+05	4.6 E+05	4.6 E+05	4.6 E+05	6.9 E+04	1.0 E+05
^{235}U*	4.9 E+05	4.9 E+05	4.9 E+05	4.9 E+05	7.3 E+04	1.1 E+05
^{236}U	4.9 E+05	4.9 E+05	4.9 E+05	4.9 E+05	7.1 E+04	1.1 E+05
^{238}U*	4.7 E+05	4.7 E+05	4.7 E+05	4.7 E+05	7.7 E+04	1.2 E+05
^{237}Np*	8.9 E+02	8.9 E+02	8.9 E+02	8.9 E+02	8.9 E+02	8.9 E+02
^{238}Pu	1.3 E+04	1.3 E+04	8.8 E+05	4.7 E+05	1.3 E+04	3.4 E+04
^{239}Pu	1.2 E+04	1.2 E+04	1.2 E+04	1.2 E+04	1.2 E+04	1.2 E+04
^{240}Pu	1.2 E+04	1.2 E+04	1.4 E+04	1.4 E+04	1.2 E+04	1.2 E+04
^{241}Pu	6.1 E+05	6.1 E+05	4.2 E+07	2.2 E+07	6.1 E+05	1.2 E+06
^{241}Am	2.5 E+04	2.5 E+04	7.4 E+05	4.0 E+05	1.9 E+04	2.8 E+04

Note: Asterisks mark nuclides with progeny that are assumed to be present in equilibrium amounts. However, ^{234}U was not included in the ^{238}U limits. For supporting references see WHC-SD-EN-TI-070.

Table J-4. Accessible Soil Concentration Limits, pCi/g.

Radionuclide	100-BDKN	100-F, H	200-W	200-E	300 Area	400 Area
^{3}H	1.4 E+08	7.4 E+07	3.7 E+08	2.0 E+08	9.5 E+06	1.4 E+07
^{14}C	6.2 E+05	6.2 E+05	6.2 E+05	6.2 E+05	6.2 E+05	6.2 E+05
^{55}Fe	5.3 E+05	5.3 E+05	5.3 E+05	5.3 E+05	5.3 E+05	5.3 E+05
^{58}Co	1.8 E+01	1.8 E+01	1.8 E+01	1.8 E+01	1.8 E+01	1.8 E+01
^{60}Co	7.1 E+00	7.1 E+00	7.1 E+00	7.1 E+00	7.1 E+00	7.1 E+00
^{63}Ni	2.5 E+07	2.5 E+07	2.5 E+07	2.5 E+07	2.5 E+07	2.5 E+07
^{90}Sr*	2.8 E+03	2.8 E+03	2.8 E+03	2.8 E+03	2.8 E+03	2.8 E+03
^{99}Tc	1.0 E+06	1.0 E+06	1.0 E+06	1.0 E+06	1.0 E+06	1.0 E+06
^{106}Ru*	7.7 E+01	7.7 E+01	7.7 E+01	7.7 E+01	7.7 E+01	7.7 E+01
^{125}Sb*	3.7 E+01	3.7 E+01	3.7 E+01	3.7 E+01	3.7 E+01	3.7 E+01
^{129}I	1.0 E+04	1.0 E+04	1.0 E+04	1.0 E+04	1.0 E+04	1.0 E+04
^{134}Cs	1.0 E+01	1.0 E+01	1.0 E+01	1.0 E+01	1.0 E+01	1.0 E+01
^{137}Cs*	3.0 E+01	3.0 E+01	3.0 E+01	3.0 E+01	3.0 E+01	3.0 E+01
^{144}Ce*	3.3 E+02	3.3 E+02	3.3 E+02	3.3 E+02	3.3 E+02	3.3 E+02
^{147}Pm	1.1 E+06	1.1 E+06	1.1 E+06	1.1 E+06	1.1 E+06	1.1 E+06
^{152}Eu	1.5 E+01	1.5 E+01	1.5 E+01	1.5 E+01	1.5 E+01	1.5 E+01
^{154}Eu	1.4 E+01	1.4 E+01	1.4 E+01	1.4 E+01	1.4 E+01	1.4 E+01
^{155}Eu	6.3 E+02	6.3 E+02	6.3 E+02	6.3 E+02	6.3 E+02	6.3 E+02
^{226}Ra*	1.0 E+01	1.0 E+01	1.0 E+01	1.0 E+01	1.0 E+01	1.0 E+01
^{227}Ac*	1.0 E+01	1.0 E+01	1.0 E+01	1.0 E+01	1.0 E+01	1.0 E+01
^{232}Th*	5.9 E+00	5.9 E+00	5.9 E+00	5.9 E+00	5.9 E+00	5.9 E+00
^{232}U*	1.0 E+01	1.0 E+01	1.0 E+01	1.0 E+01	1.0 E+01	1.0 E+01
^{233}U	6.3 E+02	6.3 E+02	6.3 E+02	6.3 E+02	6.3 E+02	6.3 E+02
^{234}U	6.3 E+02	6.3 E+02	6.3 E+02	6.3 E+02	6.3 E+02	6.3 E+02
^{235}U*	1.7 E+02	1.7 E+02	1.7 E+02	1.7 E+02	1.7 E+02	1.7 E+02
^{236}U	6.7 E+02	6.7 E+02	6.7 E+02	6.7 E+02	6.7 E+02	6.7 E+02
^{238}U*	3.7 E+02	3.7 E+02	3.7 E+02	3.7 E+02	3.7 E+02	3.7 E+02
^{237}Np*	4.8 E+01	4.8 E+01	4.8 E+01	4.8 E+01	4.8 E+01	4.8 E+01
^{238}Pu	2.1 E+02	2.1 E+02	2.1 E+02	2.1 E+02	2.1 E+02	2.1 E+02
^{239}Pu	1.9 E+02	1.9 E+02	1.9 E+02	1.9 E+02	1.9 E+02	1.9 E+02
^{240}Pu	1.9 E+02	1.9 E+02	1.9 E+02	1.9 E+02	1.9 E+02	1.9 E+02
^{241}Pu	1.0 E+04	1.0 E+04	1.0 E+04	1.0 E+04	1.0 E+04	1.0 E+04
^{241}Am	1.8 E+02	1.8 E+02	1.8 E+02	1.8 E+02	1.8 E+02	1.8 E+02

Note: Asterisks mark nuclides with progeny that are assumed to be present in equilibrium amounts. However, ^{234}U was not included in the ^{238}U limits. For supporting references see WHC-SD-EN-TI-070.

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APPENDIX K

DATA SUMMARY METHODS

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Measuring any physical quantity has some degree of inherent uncertainty. This uncertainty results from the combination of all possible inaccuracies in the measurements process, including such factors as the reading of the result, the calibration of the measuring device, and numerical rounding errors. In this report, individual radioactive measurements are accompanied by a plus or minus (±) value, which is the uncertainty term known as a two-sigma counting error.

The two-sigma counting error gives information on what the measurement might be if the same sample were counted again under identical conditions. The two-sigma counting error implies that approximately 95% of the time, a recount of the same sample would give a value within plus or minus the two-sigma counting error at the value reported.

Values in the tables that are less than the minimum detectable activity indicate that the reported result might have come from a sample with no radioactivity. Such values are considered below the detection limits of the measuring instrument. Also note that each radioactive measurement must have the random background radioactivity of the measuring instrument subtracted; therefore, negative results are possible, especially when the sample has very little radioactivity.

Reported averages also are accompanied by two standard errors of the mean. If the data fluctuate randomly, the standard error is a measure of the uncertainty in the estimated average of the data because of this randomness. If trends of periodic fluctuation are present, the standard error is primarily a measure of the variability in the trends and fluctuations about the average of the data, rather than a measure of the uncertainty of the estimated average because of random fluctuations in the data.

The mean, $\overline{X}$, is computed as:

$$\overline{X} = \frac{1}{n} \sum_{i=1}^{n} X_i$$

where $\overline{X}_i$ is the ith measurement and n is the number of measurements.

The standard error of $\overline{X}$ was computed as:

$$SEM = \sqrt{\left(S^{2\,N}_{M}\right)}$$

where $S5_M^n$, the variance of the n measurements, was computed as:

$$S^2_M = \frac{1}{n-1} \sum_{i=1}^{n} (X_i - \overline{X})^2$$

This estimator, $S5_M^n$, includes the variance among the samples and the counting variance. The estimated $S5_M^n$ occasionally may be less than the average counting variance.

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