IT CORPORATION
A Member of The IT Group

Project No. 829509
January 2002

Remedial Investigation Report

Kiski Valley Water Pollution Control Authority
Ash Lagoon
Leechburg, Pennsylvania

Prepared for:
BWXT Services Inc.

Prepared by:
IT Corporation
Monroeville, Pennsylvania

RESPONSIVE TO THE NEEDS OF ENVIRONMENTAL MANAGEMENT

Remedial Investigation Report

Kiski Valley Water Pollution Control Authority
Ash Lagoon
Leechburg, Pennsylvania

Prepared for:

BWXT Services, Inc.
Lynchburg, Virginia

Prepared by:

IT Corporation
Monroeville, Pennsylvania

January 2001

Table of Contents

List of Tables iii
List of Figures iv
List of Appendices v
List of Acronyms vi
Executive Summary ES-1
1.0 Introduction 1-1
1.1 Purpose and Scope of Remedial Investigation 1-1
1.2 Program Objectives 1-2
1.3 Report Organization 1-2
2.0 Characterization of Environmental Setting 2-1
2.1 Geography 2-1
2.2 Demography 2-1
2.3 Current/Future Land Use 2-1
2.4 Meteorology and Climatology 2-2
2.5 Local and Regional Topography 2-3
2.6 Local and Regional Geology and Seismology 2-3
2.7 Groundwater Hydrology 2-4
2.8 Surface Water Hydrology 2-5
2.9 Natural Resources 2-6
2.10 Ecology 2-6
3.0 Site History and Current Conditions 3-1
3.1 Site Description 3-1
3.1.1 Location and Description of KVWPCA Site 3-1
3.1.2 Location and Description of Ash Lagoon 3-1
3.2 Summary of Existing Data 3-2
3.2.1 Lagoon Soil/Ash 3-3
3.2.1.1 USNRC Sampling 3-3
3.2.1.2 B. Koh Associates, Inc., Sampling 3-5
3.2.2 Miscellaneous Soil/Sediment Sampling 3-6
3.2.3 Surface Water 3-7

Table of Contents (continued)

3.2.4 Groundwater 3-7

3.2.5 Groundwater Elevations Response to River Stage 3-8

4.0 Dose Assessment 4-1

4.1 Identification of Receptors 4-2

4.2 Pathway Analysis 4-2

4.2.1 Source analysis 4-4

4.2.2 Environmental Transport Analysis 4-5

4.2.3 Dose/Exposure Analysis 4-6

4.2.4 Scenario Analysis 4-6

4.3 RESRAD Dose Assessment 4-8

4.3.1 Radiation Exposure Scenario Definition 4-9

4.3.2 Computer Code and Parameter Value Selection 4-9

4.4 Dose Assessment Results 4-11

5.0 Preliminary Remedial Action Goals 5-1

6.0 Conclusions and Recommendations 6-1

7.0 References 7-1

Tables

Figures

Appendices

List of Tables

Table	Title
3-1	ORISE – Radionuclide Concentrations in Ash and Soil Samples
3-2	B. Koh – Radionuclide Concentrations in Ash and Soil Samples
3-3	ORISE - Radionuclide Concentrations in Miscellaneous Soil, Sediment, and Newly Generated Ash Samples
3-4	ORISE - Gross Alpha and Gross Beta Activity in Water Samples
3-5	IT Corporation – Groundwater Sampling Results
4-1	Site-Specific Input Parameters for Modeling of Ash Lagoon

List of Figures

Figure	Title
1-1	Site Location Map
2-1	National Wetlands Inventory (NWI) Locations for the Northwest Vandergrift Quadrangle
3-1	Site Plan
3-2	Cross-Section A-A'
3-3	ORISE Surface and Hand Auger Soil Ash Lagoon Sampling Locations
3-4	B. Koh Surface and Geoprobe Ash Lagoon Soil Sampling Locations
3-5	Miscellaneous Sample Locations
3-6	Groundwater Contour Map – October 2001
3-7	Groundwater Contour Map – November 2001
4-1	RESRAD Calculation of Annual Dose – All Nuclides Summed and All Pathways Summed
4-2	RESRAD Calculation of Annual Dosage from Water Dependent & Independent Pathways – All Nuclides Summed

List of Appendices

Appendix	Title
A	Test Boring Logs and Monitoring Well Installation Details
B	TCLP Analytical Results (Chester Engineers 1991)
C	Groundwater Analytical Results (IT Corporation 2001)
D	GMS 3-Dimensional Scatter Point Module Representation of Ash Lagoon
E	Calculation of Uranium Mass in Ash Lagoon
F	RESRAD Sensitivity Analysis Results
G	RESRAD Summary Input and Output Files

List of Acronyms

Acronym	Title
ARAR	Applicable or relevant and appropriate requirements
CEDE	Committed Effective Dose Equivalent
CFR	Code of Federal Regulations
cm	centimeter
ESSAP	Environmental Survey and Site Assessment Program
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
GMS	Groundwater Modeling System
km	kilometer
KOH	B. Koh & Associates, Inc.
KVWPCA	Kiski Valley Water Pollution Control Authority
LLW	Low Level Waste
mrem	millirems
μR/hr	micro Roetgen per hour
MCL	Maximum Contaminant Level
MSL	mean sea level
NGVD	National Geodetic Vertical Datum
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
P	Paolustrine
PADER	Pennsylvania Department of Environment Resources
pCi/g	picocuries per gram
pCi/L	picocuries per liter
Ph	Philo silt loam
PRAG	Preliminary Remedial Action Goals
RESRAD	Residual Radioactivity Code
RI	Remedial Investigation
SCa	Sequetchia silt loam

TCLP	Toxicity Characteristic Leaching Procedure
TEDE	Total Effective Dose Equivalent
UB	Unconsolidated bottom
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USNRC	United States Nuclear Regulatory Commission
Z	Intermittently exposed/permanant
°F	degrees Fahrenheit

Executive Summary

The Kiski Valley Water Pollution Control Authority (KVWPCA) operates a wastewater treatment plant in Leechburg, Pennsylvania approximately 25 miles (40 kilometers [km]) northeast of Pittsburgh. The facility separates solids from raw sewage, which are then dewatered using a belt filtration press. From 1976 to 1993, the dewatered sludge was incinerated, sterilized, and converted to ash. This ash was mixed with water, forming a slurry, and transferred to an on-site lagoon for storage. The ash lagoon is located in the east end of the KVWPCA property and covers approximately 4,000 square meters. Currently, as dewatered sludge is generated, it is accumulated and disposed of in a municipal landfill on a batch-type basis.

The lagoon is underlain by native clay, is 2 to 3 meters deep at the center, and currently contains approximately 9,000 cubic meters of ash. The lagoon is surrounded by a berm which is 2 to 3 meters high on the north, west, and south sides, diminishing to ground level at the east end.

In August 1993, the Pennsylvania Department of Environmental Resources (PADER) notified the United States Nuclear Regulatory Commission (USNRC) that they had measured elevated uranium activity in a sludge ash sample obtained from the ash lagoon. In September 1994, PADER provided the USNRC a "split" sample for independent analysis. The sample was analyzed by the Oak Ridge Institute for Science and Education (ORISE) and results confirmed PADER's analysis. In September 1994, the USNRC conducted surface and subsurface sampling in the ash lagoon. Analysis of the samples from the ash lagoon indicated that some of the samples contained concentrations of enriched uranium exceeding 900 picocuries per gram (pCi/g) which is higher than unrestricted use guidelines typically used by the USNRC for uranium in soil (30 pCi/g).

ORISE also conducted a radiological characterization survey of the ash lagoon and adjacent property. This included groundwater, surface water, soil, and sediment sampling. Releases of radioactive material from the ash lagoon were nondetectable. This indicates that past and current radiation doses are negligibly low at points of potential exposure both within and beyond the area in which access by the public is controlled. B. Koh & Associates, Inc. (Koh), completed radiological characterization of the contents of the lagoon in 1998.

1.0 Introduction

The Kiski Valley Water Pollution Control Authority (KVWPCA) operates a wastewater treatment plant in Leechburg, Pennsylvania. The facility separates solids from raw sewage, which are then dewatered using a belt filtration press. The dewatered sludge is sent to a municipal landfill. From 1976 to 1993, this ash was mixed with water, forming a slurry, and transferred to an on-site lagoon for storage. Currently, as ash is generated, it is accumulated and disposed of in a municipal landfill on a batch-type basis.

The KVWPCA is located on Pine Camp Road in Leechburg, Allegheny Township, Westmoreland County, Pennsylvania. The site is approximately 23 miles (40 kilometers [km]) northeast of Pittsburgh in southwestern Pennsylvania near the border of Westmoreland and Armstrong counties (Figure 1-1). The site is situated on gently rolling to flat topography that slopes eastward along the southern bank of the Kiskiminetas River below and west of the Norfolk and Southern railroad tracks.

In August 1993, the Pennsylvania Department of Environmental Resources (PADER) notified the United States Nuclear Regulatory Commission (USNRC) that they had measured elevated uranium activity in a sludge ash sample obtained from the ash lagoon. In September 1994, PADER provided the USNRC a "split" sample for independent analysis. The sample was analyzed by the Oak Ridge Institute for Science and Education (ORISE) and results confirmed PADER's analysis. In September 1994, the USNRC conducted surface and subsurface sampling in the ash lagoon. Analysis of the samples from the ash lagoon indicated that some of the samples contained concentrations of enriched uranium exceeding 900 picocuries per gram (pCi/g) which is higher than the unrestricted use guidelines of 30 pCi/g typically used by the USNRC for enriched uranium in soil (USNRC, 1996).

1.1 Purpose and Scope of Remedial Investigation

The purpose of this Remedial Investigation (RI) report is to support the Feasibility Study (FS) by providing site characterization information and assessment of the no-response radiation dose from the resident farmer future use of the site. This report will establish a baseline for assessment of various remedial action alternatives and assessment of the compliance of those projected doses with 10 CFR Part 20, Subpart E limits. The projected doses are those that might

be expected from activities on the site consistent with successful implementation of remedial actions.

1.2 Program Objectives

The objective of this RI is to:

- Provide information concerning the physical characterization of the environmental setting and waste characterization for later use in the FS report.

- Draw conclusions concerning the types and quantities of waste present at the site, the potential for migration of contamination from the site, and the potential for adverse human health and environmental effects if no action is taken at the site and exposure occurs. This goal is achieved by evaluating (a) historical and operational information about the site, (b) potential contaminants of concern, (c) potential migration pathways, (d) potential receptors, (e) exposure, and (f) contaminant toxicity. The result of this evaluation is a characterization of the risks posed by the site through a baseline dose assessment if no action is taken at the site.

- Provide information concerning the preliminary screening of alternatives.

- Identify contaminant-specific and location-specific applicable or relevant and appropriate requirements (ARAR) for the contaminants of concern as identified by the dose assessment.

1.3 Report Organization

The remainder of this report is organized into the following sections. Section 2.0 discusses the characterization of environmental setting, includes the location of the site, and describes its characteristics on a regional and site-specific basis using available geographic, demographic, climate, topographic, geologic, and biological data. Section 3.0 describes the site history and current conditions and includes the results of the site investigations to date. Section 4.0 discusses the baseline dose assessment and the methodology used. Section 5.0 identifies the Preliminary Remedial Action Goals (PRAG). Section 6.0 presents the conclusions and recommendations of this report. References are included in Section 7.0.

2.0 Characterization of Environmental Setting

2.1 Geography

KVWPCA is located in Leechburg, Allegheny Township, Westmoreland County, Pennsylvania. The site is approximately 23 miles (40 km) northeast of Pittsburgh located in southwestern Pennsylvania near the border of Westmoreland and Armstrong counties. The site is situated on gently rolling to flat topography that slopes eastward along the southern bank of the Kiskiminetas River and is west of the Northern and Southern railroad tracks.

2.2 Demography

Land use within the vicinity of the site is mixed, consisting of medium-sized residential communities and individual rural residences, small farms with croplands and pastures, idle farmland, forestlands, and light industrial areas. Allegheny Township has a population of 8,002 people. The borough of Leechburg has a total of 1,193 housing units and Westmoreland County has seen a growth of 10 percent (152,200 to 167,700) from the 1990 to 2000 census count. There are expected to be three new housing developments and a commercial development within the next few years in Allegheny Township. The closest housing development and existing community are in Pine Run Camp, just west of KVWPCA. Some residences within this community are located within 600 feet (200 meters) west of the site. Several industrial buildings and a shopping complex are located within 1.5 miles (2 km) southwest of the site.

2.3 Current/Future Land Use

The site is currently used as a wastewater treatment facility and has an incinerator ash lagoon constructed in 1975. The treatment plant services thirteen participating municipalities from the surrounding area. Residential, commercial, and industrial wastewater is piped to the plant through a network of interceptor pipes and eight remote pumping stations. The system presently is designed to serve an equivalent population of 50,000 people. The treatment facility includes primary settling tanks for solids separation, fine bubble diffuser aeration tanks to sustain the activated sludge process, and final solids settling and chlorine application tanks for sterilization of treated wastewater prior to discharge.

The settled solids withdrawn from the primary tanks and the waste-activated sludge solids generated by the biological process are thickened, then aerobically digested prior to mechanical

dewatering by a belt filter press. From 1976 to 1993, the thickened and dewatered sludge plus grits and screenings were incinerated in a seven-hearth furnace. Prior to installation of the pneumatic dry ash handling system, ash from the incinerator collected in a hopper where it was mixed with water to form slurry. The slurry was then pumped to the ash lagoon via a discharge pipe. Use of the impoundment was discontinued in July 1993 with the installation of a dry ash handling system. Currently, as dewatered sludge is generated, it is accumulated and disposed of in a municipal landfill on a batch-type basis.

2.4 Meteorology and Climatology

Westmoreland County has a humid, continental-type climate, with temperatures ranging from an average of 14 degrees Fahrenheit (°F) to 82 °F. The predominant air mass influencing the climate is a polar, continental mass from Canada. It moves into the region from almost due south from the Hudson Bay region or the Canadian Rockies. In the summer, there are frequent invasions of air from the Gulf of Mexico, with resulting spells of warm, humid weather. The last spring temperature of 32 °F usually occurs in late April and the first in late October. There is a wide variation in the time of the first and last frosts over a radius of 25 miles (40 km) from the center of Pittsburgh due to terrain differences.

The average annual precipitation is about 37 inches and the distribution of precipitation is relatively even throughout the year. During the winter, approximately one-fourth of the precipitation occurs as snow. Measurable snow covers the ground an average of 33 days per year. The wettest weather at most of the climatologic stations in western Pennsylvania occurs in June and July.

Seven months of the year, April through October, have sunshine more than 50 percent of the possible time. During the remaining five months cloudiness is heavier because the track of migratory storms from west to east is closer to the area and because of the frequent periods of cloudy, showery weather associated with northwest winds from across the Great Lakes. Cold air drainage induced by the hills leads to the frequent formation of fog which can persist in the river valleys during the colder months.

2.5 Local and Regional Topography

The site is located in the central portion of the Appalachian Plateau physiographic province. This province is characterized by rounded hills and steep-sided valleys. The site is approximately 780 feet above mean seal level (MSL). The site latitude is 40 degrees 36 minutes north, and the longitude is 79 degrees 35 minutes west. The majority of the region is drained by the Allegheny River and tributaries, such as the Kiskiminetas River. The ground surface in the region is maturely dissected by large river valleys and tributaries in the areas between the large valleys. This regional drainage system features many and varied slopes, with small areas of nearly flat land along valley bottoms and in uplands.

The upland flats represent remnants of old erosional surfaces or peneplains. The Harrisburg peneplain, which has been identified in this region was formed in the Tertiary period, some time between 2 million and 60 million years ago. This peneplain occurs at an elevation of approximately 1,250 feet above MSL in northern Westmoreland County. Late Tertiary time was characterized by periods of relative quiet with gradual periods of uplift. These periods of uplift entrenched most of the major streams in the bedrock. The topography along the southwest side of the river has point bar deposits which is an indication of where the meandering river once flowed. These deposits consist of lower terrace deposits of gravel and sand with pebbles of igneous rocks.

2.6 Local and Regional Geology and Seismology

Soils in the site vicinity were developed on alluvial deposits in the stream valleys. Soil types found on the site are Philo silt loam (Ph) and Sequatchie silt loam (SeA). The Philo Series soils are located along the floodplain of the Kiskiminetas River and consist of deep, moderately well drained soils. The Sequatchie silt loam soils are low terrace deposits that are located along the banks of the Kiskiminetas River. The KVWPCA is located approximately mid-center on a bench terrace of the Kiskiminetas River.

Overburden deposits in the site vicinity consist of valley fill deposits, Pleistocene-aged sand and gravel deposits of glacio-fluvial origin, and clay deposits of Pleistocene and Recent age. Stratigraphically, the sand and gravel outwash deposits form the base of the alluvial sequence and overlie relatively flat-lying bedrock. The sand and gravel deposits are overlain by Recent alluvial fill.

The geological units in this region are Pennsylvanian Age, Allegheny Group. The Allegheny Group is composed of the Freeport Formation, Kittanning Formation, Vanport Limestone, and Clarion Formation and consists of cyclic sequences of sandstone, shale, limestone, clay, and coal. Above the Pennsylvanian units are Quaternary terrace deposits of clay, sand, and gravel.

The site lies on the western limb of a small anticlinal fold between the Duquesne-Fairmont Syncline and the eastern limb of the Leechburg-McHaddon Anticline. This small fold creates a slight dip of from 1 to 2 degrees to the southwest. The axial trace of this fold curves near the southwest portion of the site and plunges southward.

No active faults or other active tectonism has been reported within 30 miles (50 km) of the site. Historically, large earthquakes in eastern North America generally have occurred in three regions: the Mississippi Valley, the St. Lawrence Valley, and near Charleston, South Carolina. Pennsylvania is relatively free of seismic activity, although seismic events have been documented in the southeastern and northwestern parts of the state. By far the most active seismic zone in the state is the Lancaster seismic zone, approximately 200 miles southeast of the site. Since 1738, about 24 earthquakes have been reported in the Lancaster zone, with magnitudes ranging from 2.6 to 4.1 on the Richter scale. The northwest part of the state is the next most active, on a line from Erie southward along the Ohio border. Six earthquakes have been reported in this area between 1852 and 1985. One of them, with an epicenter at Conneaut Lake, approximately 75 miles from the site, had a reported magnitude of 3.2. No earthquake epicenters have been documented within 60 miles of the site.

The site area is believed to be relatively aseismic. It is in the interior of a stable cratonic plate, far from any plate boundaries, which are the focus of nearly all damaging earthquakes. The maximum credible earthquake for this region would be minor.

2.7 Groundwater Hydrology

The site generally drains into the Kiskiminetas River. Localized groundwater flows in an easterly direction towards the Kiskiminetas River. The bedrock of the Allegheny Group is a reliable source of small to moderate supplies of groundwater for domestic use. Groundwater occurs principally in the fractures and pore spaces of the sandstones and along the joints and

bedding planes in the shales. The alluvium in the site vicinity is generally permeable; however, well yields vary considerably depending upon the thickness and permeability of the deposits. The average well yield for the Allegheny Group is 5 gallons per minute, although higher yields have been reported for wells drilled into the sandstones.

Test boring logs for the four site monitoring wells (MW-1 through MW-4) indicate that the subsurface beneath the lagoon consists of alluvial fill comprised of clay, silty clay in the unsaturated zone, and sand and gravel deposits in the saturated zone. Groundwater was encountered in the test borings at depths ranging from 15 feet below ground surface at MW-1 to 26 feet below ground surface at MW-2 and MW-3. Site monitoring wells are screened above bedrock in alluvial fill and intercept the sand and gravel deposits. Test boring logs and well installation logs are provided in Appendix A.

Well yields seen in the site monitoring wells were less than 1 gallon per minute. Because sand and gravel deposits were only encountered at the bottom of the test boring for monitoring well MW-2, well yields in this well were insufficient for sampling during the most recent sampling event in October 2001.

2.8 Surface Water Hydrology

There are no surface impoundments or wetlands on site. The surface drainage from the site predominantly flows northeast directly into the Kiskiminetas River. According to the National Wetland Inventory Map for Northwest Vandergrift Quadrangle, the Kiskiminetas River is defined as a palustrine [P], unconsolidated bottom [UB], and intermittently exposed/permanent [Z] (Figure 2-1). There are two nearby tributaries of the Kiskiminetas River north and south of the site. Pine Run flows into the Kiskiminetas River south of the site and just north of the town of West Vandergrift. The other tributary is unnamed and is north of the site and the residential area of Pine Run Camp.

The Kiskiminetas River flows into the Allegheny River about 8 miles from the site and is a navigable river as defined by the United States Army Corps of Engineers. The river borders the site along the northeast side, and it flows in a northwest direction. Yellow Creek Lake, Conemaugh River, Loyalhanna Lake, and several other smaller reservoirs regulate the flow regime of the river. The highest daily mean flow for the Kiskiminetas River near Vandergrift

during the year 2000 was 9,890 ft^3/s and the lowest mean flow was 253 ft^3/s. The surface elevation of the site is 785 feet above MSL near the Kiskiminetas River and only varies slightly across the site.

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map for the area (FEMA, 1997) most of the site falls within the 100-year and 500-year floodplains. Although no base flood elevation is given for the site, a flood elevation of 789 feet (National Geodetic Vertical Datum [NGVD]) is given for the lower reach of Pine Run above the site. The top of the ash lagoon is given as 793.0 feet.

2.9 Natural Resources

There are two economic natural resources in the immediate area, coal and natural gas. Locally the Upper Freeport Coal has been deep mined in the outcrop areas surrounding the site. The deep-mined area surrounding the site is west of the Kiskiminetas River from the town of Oklahoma to the town of Bagdad.

A natural gas well is located on the site property. The gas well is owned by Apollo Gas Company and is identified as well No. 736.

2.10 Ecology

The terrestrial ecosystem of the area is characterized by the presence of deciduous wooded areas, croplands, orchards, and an old field located on the site itself. Kiskiminetas River borders the site on the northeastern side.

Western Pennsylvania, including Pittsburgh and surrounding areas, is considered part of the Western Allegheny Plateau. The region is characterized by hilly terrain. Omernik (1986) defines the natural vegetation type as mixed mesophytic forest which typically contains maple (Acer), buckeye (Aesculus), beech (Fagus), tuliptree (Liriodendron tulipifera), oak (Quercus), and linden (Tilia).

A vegetative community typical of disturbed areas is found on the site. These communities characteristically contain a large proportion of herbaceous biennial and perennial species including:

- Queen Anne's lace (Daucus carota)
- Teasal (Dipsacus sylvestris)
- White sweet clover (Melilotus alba)
- Yellow sweet clover (M. officinalis)
- Dandelion (Tavaxacum officinale)
- Milkweed (Aselepias syriaca)
- Chickory (Chicorium intybus)
- Crown vetch (Caronilla varia)
- Goldenrod (Solidago sp.)
- Common ragweed (Ambrosia artemisiifolia)
- Evening primrose (Oenothera biennis)
- Yarrow (Achillea millefolium)
- Pigweed (Amoranthus retroflex)
- Purslane (Portulaca olevacea)
- Black-eyed susan (Rudbeckia hirta)
- Spring beauty (Claytonia virginica)
- Trillium (Trillium sp.).

The presence of wooded areas, open fields, croplands, orchards, and small streams presents a diversity of habitat types, which could potentially support a wide diversity of wildlife. Mammal species found in western Pennsylvania which inhabit such areas include:

- Opossum (Didelphis marsupialis)
- Raccoon (Procyon lotor)
- Masked shrew (Sorex cinereus)
- Least shrew (Cryptotis parua)
- Hairytail mole (Parascalops breweri)
- Striped skunk (Mephitis mephitis)
- Woodchuck (Marmota monax)
- Red fox (Vulpes fulva)
- Gray fox (Urocyon cinereoargentcus)
- Eastern chipmunk (Tamias striatus)
- Eastern gray squirrel (Sciurus carolinensis)
- Fox squirrel (S. niger)
- Southern flying squirrel (Glaucomys volans)
- White-footed mouse (Peromyscus leucopus)
- Deer mouse (P. maniculatus)

- Meadow vole (Microtus pennsylvanicus)
- Pine vole (Pitymys pinetorum)
- Eastern cottontail (Sylvilaqus floridanus)
- Whitetail deer (Odocoileus virginianus)
- Long-tailed weasel (Mustela frenata)
- Black bear (Ursus americanus).

Bird species commonly found in this area of Pennsylvania include:

- Eeastern screech owl (Otus asia)
- Great horned owl (Bubo virginianus)
- Ruffed grouse (Bonasa umbellus)
- American crow (Corvus brachyrhynchos)
- Mourning dove (Zenaida macroura)
- Pileated woodpecker (Dryocopus pileatus)
- Red-headed woodpecker (Melanerpes erythrocephalus)
- Hairy woodpecker (Picoides villosus)
- Eastern wood pewee (Contopus virens)
- Red-eyed vireo (Vireo olivaceus)
- Yellow-throated vireo (V. flavifrons)
- American robin (Turdus migratorius)
- Northern oriole (Icterus galbula)
- Northern cardinal (Cardinalis cardinalis)
- Blue jay (Cyanocitta cristata)
- White-breasted nuthatch (Sitta carolinensis)
- Red-winged blackbird (Agelaius phoeniceus)
- European starling (Sturnus vulgaris).

Common fish species, which would be expected to inhabit the small streams near the site include:

- Fathead minnow (Pimephales promelas)
- Common shiner (Notropis carnatus)
- White sucker (Catostomus commersoni)
- Black bullhead (Ictalurus melas).

Common fish in the Kiskiminetas River include:

- Smallmouth bass (Micropterus dolomieu)
- Channel catfish (Ictalurus punctatus)

- Walleye (Stizostedion vitreum)
- Northern pike (Esox lucius)
- White bass (Morone chrysops)
- Muskellunge (Esox masquinongy)
- Comon carp (Cyprinus carpio)
- Common shiner (Notropis carnatus)
- Fathead minnow (Pimephales promelas).

3.0 Site History and Current Conditions

3.1 Site Description

3.1.1 Location and Description of KVWPCA Site

The KVWPCA facility is bounded on the north and east by the Kiskiminetas River and on the south and west by Norfolk and Southern railroad tracks (Figure 3-1). The Kiskiminetas River also forms the boundary of Armstrong County, immediately east of the plant. The treatment plant and the incinerator ash lagoon were constructed in 1975 on thirty-six acres of land owned by the KVWPCA. The KVWPCA purchased the property in 1972 to construct a wastewater treatment facility. Prior to its purchase, the land was used for farming.

The treatment plant services thirteen participating municipalities from the surrounding area. Residential, industrial, and commercial wastewater is piped to the plant through a network of interceptor pipes and eight remote pumping stations. The system, as presently built, is designed to serve an equivalent population of 50,000. The treatment facility includes primary settling tanks for solids separation, fine bubble diffuser aeration tanks to sustain the activated sludge process, and final solids settling and chlorine contact tanks for disinfection of the treated wastewater prior to discharge.

The settled solids withdrawn from the primary tanks and the waste-activated sludge solids generated by the biological process were concentrated and thickened prior to mechanical dewatering by a belt filter press. From 1976 to 1993, the dewatered sludge plus grits and screenings were incinerated in a seven-hearth furnace. This ash was mixed with water, forming slurry, and transferred via a discharge pipe to an on-site lagoon for storage.

3.1.2 Location and Description of Ash Lagoon

The ash lagoon occupies an area of approximately 2 acres on the KVWPCA property south of the treatment plant. The bottom of the ash lagoon basin was excavated into the native silty clay of the bench terrace of the Kiskiminetas River. The base of the lagoon is at approximately 783 feet MSL. The embankments are constructed of the same material and provided approximately 10 feet of free board prior to the deposition of ash. Elevation at the top of the embankments is 793 feet MSL. Figure 3-2 presents a representative cross section of the ash lagoon and

subsurface. In 1991, measurements by Chester Engineers (Chester) placed the thickness of ash as 0.5 meter (1.57 feet) at the outlet tower to 2.5 meters (8.42 feet) in the center of the lagoon. Chester estimated the total volume to be approximately 9,000 cubic meters (12,000 cubic yards). Use of the impoundment was discontinued in July 1993 with the installation of a dry ash handling system. Currently, as ash is generated, it is accumulated and disposed of in a municipal landfill as required.

In 1999, USNRC developed a 3-dimensional geospatial model of the ash lagoon using all data collected up to that time. The total volume of ash calculated from the 3-dimensional geospatial model was 8,953 cubic meters (11,711 cubic yards).

3.2 Summary of Existing Data

Chester performed initial characterization of the ash lagoon's contents in September 1991. Activities included the collection of composite samples of the entire thickness of the ash from four locations in the lagoon on September 13, 1991. Toxicity Characteristic Leaching Procedure (TCLP) analyses confirmed that the ash is not a hazardous waste. Results of the analyses are included in Appendix B.

In August 1994, PADER notified USNRC that they had measured elevated uranium activity in a sludge ash sample obtained from the ash lagoon. The following month, PADER provided the USNRC a "split" sample for independent analysis. ORISE analyzed this sample and results confirmed PADER's analysis. The USNRC subsequently conducted surface and subsurface sampling in the ash lagoon. Analysis of the samples from the ash lagoon indicated that some of the samples contained concentrations of enriched uranium exceeding 900 pCi/g, which is higher than unrestricted use guidelines typically used by the USNRC for enriched uranium in soil (30 pCi/g).

Two extensive sampling programs have been performed at the site. During the period of December 13 through December 15, 1994, the Environmental Survey and Site Assessment Program (ESSAP) of ORISE conducted a radiological characterization survey of the ash lagoon and adjacent property at the KVWPCA. A 70-meter by 95-meter sampling grid of the ash lagoon was established at 10-meter centers (Figure 3-3). Soil/ash samples were obtained from both surface and subsurface locations. Surface water and groundwater samples were also collected. Following the completion of the radiological characterization, the USNRC notified

the KVWPCA that they were not to release the ash from the site without prior authorization from the USNRC.

In June 1998, B. Koh & Associates (Koh) conducted additional surface and subsurface soil/ash sampling that extended into the top of the clay beneath the bottom of the ash lagoon. Koh used the same sampling grid plan as ORISE.

3.2.1 Lagoon Soil/Ash

3.2.1.1 USNRC Sampling

In December 1994, ESSAP conducted a radiological characterization of the ash lagoon and surrounding area that included a gamma surface scan over the entire lagoon as well as surface and subsurface soil/ash sampling. The surface scan utilized sodium iodide scintillation detectors coupled to rate meters with audible indicators. A total of 71 exposure rate measurements were performed, using the scintillation detectors, in the ash lagoon area. Results of the surface scan did not identify any locations of elevated direct radiation. Exposure rates ranged from 8 to 10 μR/h and averaged 9 μR/h, which are comparable to the background exposure rate range of 8 to 12 μR/h from the Apollo, Pennsylvania area.

Surface soil/ash samples were collected from 50 grid line intersections in the ash lagoon (Figure 3-3). Subsurface soil/ash samples were collected from 25 hand-augured boreholes in the ash lagoon. Borehole locations were selected based on the results of previous sampling performed by the USNRC, the predicted ash dispersal pattern from the influent point, and downhole scan results of previous boreholes closer to the influent point.

Samples were collected at the surface (0-15 centimeters deep), at approximately 1 meter (100 to 115 centimeters deep), at the interval of contamination as identified by the scintillation detector, and at the layer in contact with the underlying in-place clay. Borehole locations are indicated on Figure 3-3.

Samples and data were returned to the ESSAP laboratory in Oak Ridge, Tennessee for analysis and interpretation. A total of 136 soil/ash samples were analyzed by solid state gamma spectrometry and results reported in units of pCi/g. The radionuclides of interest were Uranium-

235 (U-235) and Uranium-238 (U-238); however, spectra were also reviewed for other identifiable photopeaks. Selected soil/ash samples were also analyzed by alpha spectrometry to determine the uranium ratios necessary for isotopic determination.

Concentration ranges for U-235, U-238, and total uranium from the surface (0 to 15 centimeters [cm]), from 100 to 115 cm, from 100 to 115 cm, and from 115 cm to the underlying clay are as follows:

U-235:	
0-15 cm:	<0.37 to 1.19 pCi/g
100-115 cm:	<0.39 to 20.93 pCi/g
115 cm to clay:	0.89 to 33.85 pCi/g
U-238:	
0-15 cm:	<4.00 to 7.69 pCi/g
100-115 cm:	6.16 to 94.81 pCi/g
115 cm to clay:	3.99 to 144.30 pCi/g
Total U:	
0-15 cm:	<13.09 to 34.00 pCi/g
100-115 cm:	<15.23 to 576.20 pCi/g
115 cm to clay:	24.49 to 922.85 pCi/g

Adding the U-234, U-235, and U-238 concentrations determined total uranium concentration in soil/ash samples. Because U-234 concentrations cannot be determined by gamma spectrometry, alpha spectrometry analysis was used to determine the ratio of U-234 to U-235. Five soil/ash samples were selected for this analysis on the basis of gamma spectrometry results. Ratios ranged from 21:1 to 26:1 and averaged 22:1. Therefore, total uranium concentrations, as determined by gamma spectrometry analyses, were calculated by multiplying the U-235 concentration by a factor of 22 and then adding the U-235 and U-238 concentrations. Sample results for U-235, U-238, and total uranium are summarized in Table 3-1.

Concentrations of other radionuclides are listed below.

- For surface ash and soils (0 to 15 cm): Co-60, <0.45 to 0.81 pCi/g; Cs-137, <0.39 pCi/g; Ra-226, <0.94 to 2.25 pCi/g; Am-241, <0.43 to 3.05 pCi/g; Th-228, 0.83 to 2.56 pCi/g; Th-232, <1.80 to 2.63 pCi/g; and total thorium, <4.32 to 4.70 pCi/g.

- For subsurface ash: Co-60, <0.33 to 22.97 pCi/g; Cs-137, <0.37 to 2.27 pCi/g; Ra-226, <0.61 to 2.41 pCi/g; Am-241, <0.80 to 1.92 pCi/g; Th-228, 0.97 to 2.29 pCi/g; Th-232, <2.07 to 2.52 pCi/g; and total thorium, <4.06 to 4.49 pCi/g.

3.2.1.2B. Koh Associates, Inc., Sampling

In June 1998, Koh of Owings Mills, Maryland, collected surface and/or subsurface samples using Geoprobe from 108 locations within the limits of the ash lagoon (Figure 3-4). A total of 155 soil/ash samples from 40 of the sampled locations were submitted for gamma spectrometry analysis to Outreach Laboratory of Broken Arrow, Oklahoma. Results were reported in units of pCi/g. The radionuclides of interest were U-235 and U-238; however, spectra were also reviewed for Cobalt-60. Selected soil/ash samples were also analyzed by alpha spectrometry to confirm the isotopic ratio of U-238, U-235, and U-234 reported by ORISE.

Concentration ranges for U-235, U-238, and total uranium from the surface and at one-foot intervals to the underlying clay at a depth of approximately 8 feet are as follows:

U-235:

0-1 ft:	<0.6 to 4.9 pCi/g
1-2 ft:	<1.0 to 3.1 pCi/g
2-3 ft:	<0.6 to 4.1 pCi/g
3-4 ft:	<0.8 to 20.0 pCi/g
4-5 ft:	1.1 to 11.0 pCi/g
5-6 ft:	1.3 to 11.9 pCi/g
6-7 ft:	<0.8 to 7.4 pCi/g
7-8 ft:	<0.5 to 25.7 pCi/g

U-238:

0-1 ft:	<1.3 to 9.3 pCi/g
1-2 ft:	<1.7 to 9.8 pCi/g
2-3 ft:	<1.4 to 17.3 pCi/g
3-4 ft:	<1.6 to 73.9 pCi/g
4-5 ft:	<3.0 to 43.5 pCi/g
5-6 ft:	5.7 to 33.5 pCi/g
6-7 ft:	<1.6 to 26.1 pCi/g
7-8 ft:	<1.1 to 95.5 pCi/g

Total U:

0-1 ft:	<8.8 to 122.0 pCi/g
1-2 ft:	<11.2 to 62.7 pCi/g
2-3 ft:	<15.2 to 107.1 pCi/g
3-4 ft:	<9.1 to 533.9 pCi/g
4-5 ft:	<22.4 to 296.5 pCi/g
5-6 ft:	<22.4 to 306.6 pCi/g
6-7 ft:	<14.9 to 196.3 pCi/g
7-8 ft:	<11.0 to 686.6 pCi/g

Adding the U-234, U-235, and U-238 concentrations determined concentrations of total uranium. Total uranium concentrations, as determined by gamma spectrometry analyses, were calculated by multiplying the U-235 concentration by a factor of 22, as determined by ORISE earlier, in order to calculate a concentration for U-234 and then adding the U-235 and U-238 concentrations. Sample results for U-235, U-238 and total uranium are summarized in Table 3-2.

3.2.2 Miscellaneous Soil/Sediment Sampling

In December 1994, ESSAP conducted a radiological characterization of the area outside of the ash lagoon. Five surface soil samples were collected from two areas outside the ash lagoon security fence. Both areas, one south of the fence adjacent to the ash lagoon, and one north of the lagoon, adjacent to Manhole No. 1, were reportedly previously landscaped with ash from the lagoon. One borehole (approximately 1 meter in depth) was hand augered at the outside bottom of the north berm and sampled from the bottom of the boring. Two sediment samples were collected from the Kiskiminetas River, one at the plant outfall and one from approximately 50 meters downstream of the outfall. One sample of newly generated ash was collected from the incinerator. Miscellaneous soil and sediment sampling locations are shown in Figure 3-5.

Concentration of uranium in miscellaneous soil, sediment, and newly generated ash samples are presented in Table 3-3. Concentrations of U-235 were all less than the minimum detectable limits. Concentrations of U-238 in soil and sediment ranged from 1.02 to 2.14 pCi/g. The concentration of U-238 in newly generated ash was <4.08 pCi/g. Total uranium for all miscellaneous samples ranged from <2.13 to <8.41 pCi/g.

3.2.3 Surface Water

Two surface water samples were collected as part of the ESSAP investigation. One water sample was collected from the Kiskiminetas River at the plant outfall, and one surface water sample was collected from the standing water in the depression in the eastern end of the ash lagoon. Sample locations are shown in Figure 3-5.

Samples were submitted to the ESSAP laboratory in Oak Ridge, Tennessee for analysis of gross alpha and gross beta parameters. Analytical results indicated that the standing water in the ash lagoon had alpha activity of <2.4 picocuries per liter (pCi/L) and beta activity of 8.4 pCi/L. Surface water taken from the Kiskiminetas River measured alpha activity of <1.5 pCi/L and beta activity at 2.8 pCi/L. Both samples were below the United States Environmental Protection Agency's (USEPA) drinking water limits (maximum contaminant level [MCL]) of 15 pCi/L for gross alpha and 50 pCi/L for gross beta. Surface water concentrations are presented in Table 3-4.

3.2.4 Groundwater

Chester conducted the initial groundwater investigation in 1992 (Chester, 1992). Four groundwater monitoring wells (MW-1, MW-2, MW-3, and MW-4) were installed around the perimeter of the ash lagoon during May 5 through 7, 1992. The locations of the monitoring wells are presented in Figure 3-6. The wells were developed and sampled on May 18, 1992. A second sampling event occurred on June 17, 1992.

Groundwater samples from the May 18th event were analyzed for volatile organics, inorganic parameters, and metals. No organic constituents were identified in concentrations exceeding the detection limit in these samples. However, slightly elevated concentrations of chromium, lead, and nickel were present in some of the monitoring wells.

Because of the slightly elevated metal concentrations detected during the first sampling event, the monitoring wells were resampled on June 17, 1992. Monitoring well MW-2 did not recover sufficiently to yield a representative sample. Therefore, only samples from monitoring wells MW-1, MW-3, and MW-4 were submitted for analysis of metals and inorganic parameters. Analytical results for this sample set indicated that the concentrations of chromium, lead, and

nickel were substantially reduced from the initial sampling event. Chester did not collect samples for radiological parameters during either sampling event.

All four monitoring wells were sampled as part of the ESSAP investigation. Samples were submitted to the ESSAP laboratory in Oak Ridge, Tennessee for analysis of gross alpha and gross beta parameters. Analytical results indicated that groundwater in MW-1, MW-2, MW-3, and MW-4 had alpha activities of <1.6 pCi/L, 3.5 pCi/L, <1.5 pCi/L, and <1.3 pCi/L, respectively, and had beta activities of 3.0 pCi/L, 4.9 pCi/L, 2.5 pCi/L, and <1.6 pCi/L, respectively. All groundwater samples were below the USEPA's drinking water limits (MCL) of 15 pCi/L for gross alpha and 50 pCi/L for gross beta. Groundwater concentrations are presented in Table 3-4.

On October 9, 2001, IT Corporation (IT) resampled the monitoring wells. All four wells were purged of a minimum of three volumes prior to sampling. With the exception of MW-2, which did not recover sufficiently for sample collection, samples were field filtered following collection and sent to BWXT Services, Inc., of Lynchburg, Virginia for analysis of gross alpha, gross beta, and isotopic uranium. Total uranium analytical results indicate that there have been no radiological impacts to groundwater from the ash lagoon. Complete analytical results are presented in Table 3-5 and laboratory reports are included in Appendix C.

3.2.5 Groundwater Elevations Response to River Stage

Beginning in October 2001, IT began measuring and recording groundwater and surface water elevations at the site. Measurements are taken at all four monitoring wells and at the Kiskiminetas River adjacent to the site.

The purpose of measuring these elevations is to evaluate the effects of changing surface water levels in the Kiskiminetas River to groundwater levels beneath the ash lagoon. In general, groundwater flow is easterly towards the Kiskiminetas River (Figures 3-6 and 3-7). As of this writing, no or only minor seasonal fluctuations in elevation have been observed.

4.0 Dose Assessment

Although KVWPCA is not a USNRC licensee, the regulatory framework under which a remediation plan would be reviewed and approved is 10 CFR Part 20, specifically Subpart E and §20.2002. The purpose of this RI report is to support the FS by providing assessment of the no response radiation dose from the "resident farmer" is future use of the site. This report will establish a baseline for assessment of possible remedial action alternatives and assessment of the compliance of those projected doses with 10 CFR Part 20, Subpart E limits. The projected doses are those that might be expected from activities on the site consistent with successful implementation of remedial actions.

Potential future radiation doses are computed from estimates of potential intake rates and exposure rates. Radiation doses from internal exposure (inhalation or ingestion) are computed using dose factors developed using current methodology, specifically those in Federal Guidance Report 11. In conformance with this guidance, the term "dose," as it is used in this report, means "committed effective dose equivalent" (CEDE) in reference to doses from internal exposure, "deep dose" in reference to external exposure, and "total effective dose equivalent" (TEDE) in reference to combined internal and external exposure. Doses totaled over all applicable exposure pathways are computed as a function of time after unrestricted release of the site (over a period up to 1,000 years) for each potentially important receptor. The peak value for each receptor is retained for comparison to dose limits. In probabilistic assessments, a distribution of doses is calculated for each time period, and a corresponding mean dose is derived for each time period. The maximum value of the computed mean doses (termed "peak-of-the-means" in USNRC guidance) is selected for comparison to dose limits.

This assessment is focused on the estimation of radiation doses that might be received by a person as far as 1,000 years into the future. Thus, this assessment considers not only the current conditions at the site, but also considers projected conditions in the distant future as well. The assessment evaluates the most conservative use of the site and potential migration of radioactive materials through the environment over time, taking account of both natural processes and human activities that could be expected to alter the patterns or rates of nuclide movement.

The methodological approach used in this assessment is designed to comply with current Nuclear Regulatory Commission Guidance (USNRC, 1998a, USNRC, 1998b, USNRC, 2000a, USNRC, 2000b, Thomas, 2000). In general, the dose assessment process consists of the following steps:

- Development of a conceptual model of the physical site in its current state
- Identification of potential uses of the site by the resident farmer
- Modification of conceptual representations of the physical site, as appropriate
- Identification of potential exposure pathways
- Development of conceptual integrated exposure scenarios
- Selection of a computer model that reasonably represents the site conceptual model and the conceptual exposure scenarios
- Selection of appropriate input data for use in the computer model
- Use of the computer model to estimate projected radiation doses
- Interpretation of results, comparison of results to regulatory limits, and development of assessment conclusions.

4.1 Identification of Receptors

Residential farming was identified as the land use plausible in some circumstances likely to lead to the highest radiation doses, and is the basis for identification of potential exposure pathways. Consideration of any other potential use of the site would not add to the list of potential exposure pathways derived based on resident farming. Exposure scenarios for virtually any other use of the site can be constructed using a subset of the list of potential exposure pathways for resident farming.

4.2 Pathway Analysis

A comprehensive set of potential exposure pathways for consideration in defining dose assessment exposure scenarios has been developed based on the nuclides of interest, the distribution of the nuclides on the site, potential uses of the site, and potential environmental migration pathways. This list of potential exposure pathways is used below to construct site-

specific exposure scenarios for dose assessment. The potential exposure pathways are as follows:

1. Direct radiation from material in ash.

2. Resuspension of surface particulate material in air; inhalation.

3. Ingestion of ash.

4. Resuspension of surface particulate material in air; deposition or uptake in edible plant tissue; ingestion.

5. Uptake of material in ash through roots of edible plants; ingestion.

6. Resuspension of surface particulate material in air; deposition or uptake in edible plant tissue; ingestion by animal; ingestion of animal products.

7. Uptake of material in ash through roots of edible plants; ingestion by animal; ingestion of animal products.

8. Release of materials in ash to water flowing through the site; runoff to surface water; ingestion.

9. Release of materials in ash to water flowing through the site; runoff to surface water; uptake in water life; ingestion.

10. Release of materials in ash to infiltrating water; presence in groundwater; ingestion.

11. Release of materials in ash to infiltrating water; presence in groundwater; transport to surface water; ingestion by animal; ingestion of animal products.

12. Release of materials in ash to infiltrating water; presence in groundwater; transport to surface water; ingestion.

13. Release of materials in ash to infiltrating water; presence in groundwater; transport to surface as irrigation water; deposition or uptake in edible plant tissue; ingestion.

14. Release of materials in ash to infiltrating water; presence in groundwater; transport to surface as irrigation water; deposition or uptake in edible plant tissue; ingestion by animal; ingestion of animal products.

4.2.1 Source analysis

The source of radionuclides is the sludge ash contained within the ash lagoon. Total volume of ash in the lagoon (approximately 9,000 cubic meters) was calculated by USNRC using a 3-dimensional geospatial model of the KVWPCA ash lagoon (USNRC 1999) and by IT using the Groundwater Modeling System (GMS) 3-Dimensional Scatter Point Module from Boss International (Appendix D).

Radionuclides that were disposed in sufficient quantity to warrant evaluation of their potential contribution to dose include U-234, U-235, and U-238 and their short-lived progeny, which can be assumed to be present at equilibrium with parents. Long-lived products in the decay chains of these nuclides are also included in the assessment because they could become important contributors to radiation dose within the time period of interest. However, these nuclides are unlikely to be significant contributors in the first few hundred years. Typically present at near-equilibrium levels (i.e., activity levels roughly equivalent to activity levels of their U-238 or U-234 parents) in naturally occurring uranium deposits, these nuclides are separated from uranium in the conversion and enrichment processes.

Sampling results from the ORISE and Koh investigations indicate that concentration of total uranium in the ash ranges from less than 2.6 pCi/g to 923 pCi/g. IT calculated the average concentration for total uranium in the lagoon to be 78.7 pCi/g. Average concentrations of individual radionuclides were calculated as follows:

- U-238 at 12.6 pCi/g
- U-235 at 3.2 pCi/g
- U-234 at 62.8 pCi/g

Average concentrations were calculated through the use of geostatistical kriging as a means of interpolating values between sampled points. This was done in conjunction with the calculation of total volume. Kriging is based on a regionalized variable theory and is superior to other means of interpolation because it provides an optimal interpolation estimate for a given coordinate location, as well as a variance estimate for the interpolation value. A total of 291 sample data points, which were scattered over the lagoon and sampled at varying depths, were used in the data set to generate this value (Appendix D).

Mass determinations of uranium were made based on a mass of ash equal to 10,800 metric tons (using an ash density of 1.2 g/cm^3) and the average uranium concentrations identified above. Calculated total mass for each radionuclide is as follows:

- U-238 mass = 280,026 grams
- U-235 mass = 11,084 grams
- U-234 mass = 75.5 grams
- Total U mass = 291,186 grams

The USNRC definition of "source material" in 10 CFR § 20.1003 is "Uranium or thorium, or any combination thereof, in any physical or chemical form; or ores that contain by weight 0.05% or more of uranium, thorium, or any combination thereof." Total uranium makes only 0.0027 percent by weight of the lagoon mass and is therefore not considered source material (Appendix E).

4.2.2 Environmental Transport Analysis

The KVWPCA property discharges into drainage system, which flows into the Kiskiminetas River after a short run. The Kiskiminetas River is not currently used for drinking water supply or irrigation. The nearest downgradient municipal drinking water intake is in Freeport, on the Allegheny River, about 18 miles downstream of the ash lagoon.

No radionuclides traceable to the ash lagoon have been detected in groundwater or surface water outside the lagoon. Reducing conditions and strong retardation of the radionuclides in the underlying clay during site characterization have essentially confined the radioactive material inventory within a zone not beyond or below the physical boundaries of the ash lagoon. This is consistent with the results of batch leaching tests of the ash material conducted by the Oak Ridge National Laboratory (ORNL). These tests were conducted on ash samples collected by ESSAP that ranged in total uranium concentration from 659.36 to 922.85 pCi/g (USNRC, 1996).

The location of nearby perimeter groundwater monitoring wells is shown in Figure 3-1 and selected information on these wells has been provided in Table 4-1. Depth to groundwater beneath the base of the lagoon ranges from approximately 10 feet (3 meters) in the western corner of the lagoon to approximately 13 feet (4 meters) beneath the eastern edge of the lagoon.

4.2.3 Dose/Exposure Analysis

A comprehensive set of potential exposure pathways for consideration in defining dose assessment exposure scenarios has been developed based on the nuclides of interest, the distribution of the nuclides on the site, potential uses of the site, and potential environmental migration pathways. The list of potential exposure pathways presented above is used to construct site-specific exposure scenarios for dose assessment.

Exposure to residual radioactive material in soils on the site could occur through one or more of four terrestrial pathways, depending on the location of soils containing residual radioactive material with respect to the ground surface. If residual radioactive material were contained within soils near the ground surface, exposure could occur from radiation emitted directly from radioactive material in place in the soil, from dusts, or from food products containing radioactive material taken up from soils. In addition, to the extent that groundwater and surface water in the vicinity of the site could be sources of site radioactive materials, radiation exposure could result from use of these resources for consumption, irrigation, stock watering, or some combination of these uses.

4.2.4 Scenario Analysis

Potential uses of the site are identified in this section and are used to define site conceptual models (which can be affected by site uses) and exposure scenarios for dose assessment purposes.

Future potential radiation doses from radioactive materials at the site will depend to a considerable extent on how the site is used in the future. The potential uses of the site depend upon development of the broader area surrounding the site, site characteristics, and, to a considerable extent, the remedial actions implemented. Modifications of site conditions resulting from use of the site and from natural processes occurring over the passage of long periods of time also need to be considered in developing site conceptual models for dose assessment purposes. This section describes the development of site conceptual models and exposure scenarios used for the radiation dose assessment.

Land use within the vicinity of the ash lagoon has been identified as mixed, consisting of medium-sized residential communities and individual rural residences, small industrial facilities,

small farms with croplands and pastures, and idle farmland. Farmland in the site vicinity is largely used for cultivation of corn, wheat, and hay. However, no farms are located within a mile of the site. The closest residential community is Pine Run Camp. Some residences within this community are located within several hundred feet of the ash lagoon. Many residents in the area have small gardens. Projections of future local land use indicate no great changes from present usage. Thus, based only on area development trends, the most probable future land use for the site is residential development or light industry. Resident farming, while not likely, would be plausible.

Based on development trends in the area, use of the site for light industrial or residential development would seem most likely if there were no restrictions on use of the site. Residential use would most likely result in higher doses because of the relatively higher likelihood of exposure (by redistribution of lagoon contents through basement excavation, for example), and the relatively longer duration of exposure that would be experienced by a resident as opposed to a worker. But radiation doses would likely be highest for residential use coupled with agricultural and groundwater use that might be expected for a resident farmer, for example. Of all plausible site uses, resident farming would result in the greatest opportunity for exposure to site radioactive material by providing the largest number of potential exposure pathways and by providing near-maximum exposure duration. Evaluation of the available land area and land quality at the site suggests that such use is unlikely, but plausible, for situations in which use restrictions are not applied.

Resident farming would be plausible for the site if released without restrictions. Resident farming is the land use likely to result in the highest radiation doses from use of the site and resident farmers are likely to represent the critical population group from the annual radiation dose standpoint.

USNRC guidance specifies that exposure scenarios defined for dose assessment be defined in such a way that they are the most conservative (highest dose) scenarios plausible at the site (Thomas, 2000, USNRC, 2000a). In addition, 10 CFR 20, Subpart E, imposes separate limits for different situations:

- License termination with no restrictions on use—25 mrem per year
- License termination with restrictions on use—institutional controls imposing restrictions in place—25 mrem per year
- License termination with restrictions on use—institutional controls imposing restrictions lost—100 mrem per year

For license terminations with restrictions on use, compliance with both dose limits must be demonstrated. These factors are considered in the identification of future uses of the site.

The resident farmer exposure is the only scenario to be evaluated in the dose assessment. USNRC guidance was used to define resident farmer exposure scenario for radiation dose assessment (Thomas, 2000; USNRC, 1998a, 2000a, and 2000b). In this scenario, because the concentration of ash lagoon radionuclides in the surface layer is minimal, the average concentration of radionuclides is considered in order to achieve the most conservative exposure scenario requirements of the USNRC. This is done in order to maximize the dosage through direct contact to the resident farmer.

The process of identifying other potential site uses was not evaluated in this report. Individual exposure pathways associated with other potential exposure scenario will be evaluated in the FS of anticipated remedial alternatives. Once the outlines of the exposure scenario to be used in the dose assessment was established, values for RESRAD Rev. 6.1 computer code input parameters were selected.

4.3 RESRAD Dose Assessment

The computation of nuclide concentrations in media and radiation doses associated with exposure to those media is complex, and is usually performed using computer codes designed for the purpose. The RESRAD code (Gilbert, 1989; Yu, 1993,) was selected as suitable for evaluation of all pathways for the resident farmer exposure scenario in the KVWPCA ash lagoon case. Version 6.1 was used because it is the latest version with the capabilities necessary to implement current USNRC guidance for dose assessment.

Modifications of site conditions resulting from natural processes occurring over the passage of long periods of time need to be considered in developing site conceptual models for dose

assessment purposes. Residential land use might imply excavation of lagoon material, for example, in basement construction for residential use. Time-related changes of potential importance would include erosion, biointrusion, and the effects of changes in lagoon geochemistry on concentration of lagoon nuclides in leachate. Because of limitations with analyzing variable areas of contamination with the RESRAD code, an average value of uranium concentration for each radionuclide was calculated for the entire lagoon.

USNRC guidance (USNRC, 1998a, 2000a, and 2000b) was followed in the selection of input parameter values for the dose assessment. Conservative values were used for single-valued parameters where use of conservative single values would not invalidate the outcome. The most sensitive parameters were treated probabilistically, using distributions developed for the purpose (Cheng, 2000; Biwer, 2000; Beyeler, 1998).

4.3.1 Radiation Exposure Scenario Definition

The resident farmer exposure is the only scenario to be evaluated in the dose assessment.

The average concentration of ash lagoon radionuclides is considered.

4.3.2 Computer Code and Parameter Value Selection

Definition of the outlines of a radiation exposure scenario tends to fix the values of some important parameters in the dose assessment process. However, because models and parameters vary between codes, selection of a code to use for dose assessment is necessary to allow compilation of a list of input parameters and selection of appropriate values for exposure scenarios to be evaluated. The RESRAD code (Gilbert, 1989; Yu, 1993) was selected as suitable for evaluation of all pathways for all exposure scenarios in the ash lagoon case. The RESRAD code groups some of the exposure pathways identified in Section 4.2. The code also assigns shorthand names to pathways.

Input parameters specific to the lagoon contents were derived from measured values, analytical results, and referenced literature. All pathways were left open with the exception of Radon, which is normally not included in USNRC dose assessment. Measured input parameters include the area and thickness of the ash. Input parameters from analytical results include the uranium concentration and leaching data for the ash. Leaching data were used by the USNRC in order to

calculate a distribution coefficient for the uranium in the ash of 1,400. This value was used by the USNRC in the 1996 draft doze assessment (USNRC, 1996). Referenced literature was used to derive a value for the density of the ash (U.S. DOT, 1998).

The unsaturated zone is 3.5 meters feet thick beneath the lagoon. Additional data from boring logs (Chester Engineers, 1992 and American Geotechnical & Environmental Services, 2001) describe the material as clay and silty clay and the United States Department of Agriculture (USDA) soil survey describes it as silty clay loam. Table E.2 of the RESRAD Manual for Rev. 6.0 gives Saturated Hydraulic Conductivity (K) values of 32.6 m/yr for clay and 53.6 m/yr for silty clay. For the unsaturated zone, RESRAD generally uses one tenth of the saturated K value or 3.26 and 5.36. For the purposes of this assessment, 4.31 m/year was used. For the effective porosity value (Table E.8 of the RESRAD Manual for Rev.6.0), the mean value (0.13) of clay (0.06) and silt (0.20) was used. For the soil-specific exponential b parameter, the mean value (9.09) for silty clay (10.40) and silty clay loam (7.75) were used. The distribution coefficient for uranium radionuclides in the unsaturated zone (1,600) was selected for clay from Table E.3.

The saturated zone, based on boring log data from on-site monitoring wells MW-1, MW-2, MW-3, and MW-4, is composed of sand and gravel. The K value for sand in Table E.2 of 5,550 m/yr was used. Sand for the saturated zone b parameter at a value of 4.05 was also used. For the total porosity and effective porosity, the value for coarse sand in Table E.8 of 0.39 and 0.30, respectively, was used.

A complete list of site-specific inputs used for this assessment is included in Table 4-1.

A sensitivity analysis using the RESRAD code examined the most uncertain parameters. Input parameters of ash density and the distribution coefficient of the unsaturated zone were treated probabilistically. These parameters were selected because they were not directly determined through analysis or direct measurement of site conditions. For density, truncated normal distribution of parameters ranging from an upper range of 2.4 to a lower range of 0.6 was used. For the distribution coefficient of the unsaturated zone, triangular distributions of parameters was used with ranges with an upper, middle, and lower range of 51,200 cm^3/g, 1,600 cm^3/g, and 50 cm^3/g, respectively. Results of this sensitivity analysis are presented in Appendix F.

4.4 Dose Assessment Results

Results of RESRAD modeling indicate that in the resident farmer scenario, calculated annual doses are highest at the beginning and diminish slowly with time. Annual doses at the end of the first year reach a peak level of 8.43 mrem per year. At the end of 1,000 years, dose levels drop to 7.93 mrem per year. Results of the dose modeling for all nuclides and with all pathways summed are presented graphically in Figure 4-1. Summary input and output files for the RESRAD run are provided in Appendix G.

External radiation, inhalation, and plant ingestion were all-important pathways for the resident farmer scenario. Pathways that present the greatest dose exposure to the resident are the water-independent pathways. Water-dependent pathways (those associated with groundwater and surface water) do not present any significant dose exposure. Figure 4-2 presents the summed dosage of the water-dependent and independent pathways.

Results of the sensitivity analyses for ash density and the distribution coefficient for the unsaturated zone indicate that changes to either have no significant effects on the dose assessment results.

5.0 Preliminary Remedial Action Goals

PRAGs are normally set for each constituent of concern and for each medium of concern. The PRAG is set at whichever of the following values is the lowest: (1) health-based criteria for carcinogenic effects or for systemic toxic effects, (2) the lowest chemical-specific ARARs, or (3) ecologically based criteria.

Media of concern include soils, sediments, groundwater, and surface water. Constituents of concern at the KVWPCA site include the uranium radionuclides of U-234, U-235, and U-238. No other radionuclides were detected at levels in excess of any established Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) soil cleanup criteria and no radionuclides were detected in any groundwater or surface water samples at or above the MCLs. Therefore, the PRAGs will be based on either a risk-based criteria or an ARAR. The only identified ARAR is the dosage limit established by USNRC's implementation of the rule for License Termination. The dosage limit is also a health-based criteria of 25 mrem per year.

Alternative remedial actions under consideration for the ash lagoon but not evaluated in this assessment will be described in detail in the FS, but are described briefly below:

1. No further action; the KVWPCA ash lagoon would remain in its current configuration with no monitoring, maintenance, or institutional controls.
2. Stabilization and capping on-site.
3. Disposal at a municipal landfill.
4. Disposal at licensed LLW disposal facility.
5. Partial separation and disposal at LLW disposal facility and on site.

6.0 Conclusions and Recommendations

The KVWPCA plant is located approximately mid-center on a bench terrace adjacent to the Kiskiminetas River. The site is within 100- and 500-year floodplains; however, the top of berm surrounding the ash lagoon is above both. Geologically the site is considered to be aseismic and low permeability silty clays underlie the lagoon.

USNRC's leaching data of the ash material indicates that the radionuclides contained in the ash are not mobile. This is consistent with the sampling data, which indicates that no migration of radionuclides beyond the limits of the ash lagoon has occurred.

RESRAD modeling evaluated the existing site conditions in order to assess baseline conditions. This is the equivalent of the no-action alternative. Since a no-action alternative assumes the site is released for unrestricted use, the resident farmer scenario was reasonable for the dose assessment. Doses were evaluated over a period of 1,000 years using all migration pathways available in the RESRAD computer code. The analysis shows a maximum peak dose to be below USNRC's unrestricted release criteria of 25 mrem per year. Results indicated a maximum dose of 8.43 mrem per year occurring at the end of the first year.

The RESRAD model indicates that only the water independent pathways contribute to the dose. Water-dependent pathways are not a factor in the dose assessment due to the immobile conditions of the uranium in the sewage sludge ash. In 1996, USNRC performed RESRAD modeling of the ash lagoon that indicated the water-dependent and independent pathways both contributed to the resulting dose. The results are different from those obtained by the USNRC in the May 1996 report for the following reasons:

- Site-specific input parameters are different for the unsaturated zone. USNRC used a thickness of less than 1 meter compared to the measured thickness of approximately 3.5 meters. USNRC also used a default distribution coefficient of 50 for the unsaturated zone compared to the recommended value of 1,600 for clay in the RESRAD manual. The increased thickness and increase in the distribution coefficient both contribute to the elimination of the water-dependant pathways.

- The concentration of uranium (367 pCi/g) used by USNRC in the ash lagoon was an arithmetic average of concentrations taken from 36 samples in the lower part of the lagoon. At that time, USNRC's estimated volume of ash with concentrations over 200 pCi/g was 3,200 cubic meters or approximately one third of the total volume of the lagoon.

- USNRC's dose assessment assumed that only the bottom third of the lagoon was left in place and that the remaining material had the concentration of 367 pCi/g.

In 1999, additional sampling by KOH allowed USNRC to create a 3-dimensional geospatial model of the lagoon. This model calculated the overall volume of ash in the lagoon to be approximately 9,000 cubic meters of which only 1,100 cubic meters was comprised of uranium concentrations in excess of 200 pCi/g. The model also indicated that these concentrations were not limited to the bottom depths in the lagoon. Using the current data set of 291 analytical data points, IT also generated a 3-dimensional geospatial model of the ash lagoon's contents. The result corresponded with USNRC's estimated volume of 9,000 cubic meters. In addition, IT used the model to calculate an average uranium concentration for the entire lagoon of 78.7 pCi/g for use in the RESRAD model.

Current conditions indicate that conditions inside and surrounding the lagoon do not promote migration of radionuclides beyond the limits of the lagoon. The geologic stability of the site combined with the height of the berm indicates that the existing lagoon can contain radionuclides in the event of a naturally occurring catastrophic event.

The overall stability of the ash lagoon combined with the low dosage attributed to the lagoon indicates that the lagoon, in its present condition, presents little threat to human health and the environment.

7.0 References

Ahnell, G., Dunn Geoscience Corporation, December 22, 1989, letter to Mark Terril, U.S. EPA.

American Geotechnical & Environmental Services, Inc, November 2001, "Geotechnical Engineering Report for the Kiski Waste Water Plant, Westmoreland County, Pennsylvania."

Beyeler, W. E., T. J. Brown, S. C. Hareland, N. Olague, D. Brosseau, E. Kalinina, D. P. Gallegos, and P.A. Davis, 1998, "Review of Parameter Data for the NUREG/CR-5512 Residential Farmer Scenario and Probability Distributions for the DandD Parameter Analysis," letter report for USNRC Project JCN W6227, Sandia National Laboratories.

Biwer, B. M., S. Kamboj, J. -J. Cheng, E. Gnanapragasam, C. Yu, J. Arnish, D. LePoire, Y. -Y. Wang, J. P. Butler, H. Hartmann, and S. Y. Chen, March 2000, "Parameter Distributions for Use in RESRAD and RESRAD-BUILD Computer Codes," letter report for NRC Project Y6112, Argonne National Laboratory.

Blair, Frank E., 1992, Weather of United States Cities, Gale Research, Inc.

Burt, William H. and R. P. Grossenheider, 1964, **A Field Guide to the Mammals**, Houghton Mifflin Company, Boston, Massachusetts.

Cheng, J. –J, S. Kamboj, C. Yu, B. M. Biwer, J. Arnish, D. LePoire, E. Gnanapragasam, and S. Y. Chen, October 1999, "Selection of RESRAD and RESRAD-BUILD Input Parameters for Detailed Distribution Analysis," letter report for NRC Project Y6112, Argonne National Laboratory, October, 1999.

Chester Engineers, December 18, 1991, "Interim Report, Ash Lagoon Investigations," Kiski Valley Water Pollution Control Authority, Leechburg, Pennsylvania.

Chester Engineers, August 1992, "Ground Water Investigation, Incinerator Ash Lagoon," Kiski Valley Water Pollution Control Authority, Leechburg, Pennsylvania.

D'Appolonia, Inc., February 1984, "Letter Report – Supplemental Data Report, Ash Residue Testing Program," prepared for PPG Industries, Inc., Pittsburgh, Pennsylvania.

Dunn Geoscience Corporation., September 1989, "Phase II Comprehensive Site Investigation and Endangerment Assessment, Hranica Site, Buffalo Township, Pennsylvania," prepared for PPG Industries, Inc.

Dunn Geoscience Corporation, 1990, "Phase II Comprehensive Site Investigation and Endangerment Assessment, Hranica Site, Buffalo Township, Pennsylvania," prepared for PPG Industries, Inc.

Federal Emergency Management Agency (FEMA), August 5, 1997, **FIRM Flood Insurance Rate Map, Westmoreland County, Pennsylvania**, Panel 102 of 875, Map No. 42129C0102 D.

Federal Register, November 24, 1985, Vol. 50, No. 229, pp. 48886-48957.

Federal Register 56, July 18, 1991, "National Primary Drinking Water Regulations; Radionuclides; Proposed Rule," pp. 33050-33127.

Federal Register 65, April 21, 2000, "National Primary Drinking Water Regulations; Radionuclides; Notice of Data Availability; Proposed Rule," pp. 21575-21628.

Foster, S. A. and P. C. Chrostowski, June 22 through 27, 1986, "Integrated Household Exposure Model for Use of Tap Water Contaminated with Volatile Organic Chemicals," presented at the 79th Annual Meeting of the Air Pollution Control Association, Minneapolis, Minnesota.

Gilbert, T. L., C. Yu, Y. C. Yuan, A. J. Zielen, M. J. Jusko, and A. Wallo, June 1989, "A Manual for Implementing Residual Radioactive Material Guidelines," ANL/ES-160, Argonne National Laboratory, Argonne, Illinois.

Ioven, Dawn, U.S. EPA Technical Support Section, November 14, 1989, letter to Garth Connor, Regional Project Manager.

IT Corporation, 1987, "Comprehensive Site Report, Hranica Waste Disposal Site, Saver, Pennsylvania," prepared for PPG Industries, Inc., Pittsburgh, Pennsylvania.

Kiski Valley Water Pollution Control Authority, February 1997, Ash Lagoon, Closure, 15 pp.

Lagoy, P. K., 1987, "Estimated Soil Ingestion Rates for Use in Risk Assessment," **Risk Analysis Journal**, Vol. 7, 355-359.

LePoire, D., J. Arnish, E. Gnanapragasam, S. Kamboj, B. M. Biwer, J. –J. Cheng, C. Yu, and S. Y. Chen, June 2000, "Probabilistic Modules For The RESRAD And RESRAD-BUILD Computer Codes," ANL/EAD/TM-91, Environmental Assessment Division, Argonne National Laboratory.

Metcalf & Eddy, Inc., 1991, **Wastewater Engineering Treatment, Disposal, and Reuse**, Third Edition, McGraw-Hill Publishing Company, 1334 pp..

Niering, William A. and N.C. Olmstead, 1979, **The Audubon Society Field Guide to North American Wildflowers, Eastern Region**, Alfred A. Knopf, New York.

Oak Ridge Institute for Science and Education, May 1995, "Characterization Survey of the Ash Lagoon and Adjacent Property, Kiski Valley Water Pollution Control Authority, Leechburg, Pennsylvania," prepared for the U.S. Nuclear Regulatory Commission, Region I Office.

Omernik, James M., 1986, Ecoregions of the United States, U.S. EPA, Supplement to the Annals of the Association of American Geographers, Vol. 77, No. 1.

Omernik, James M., 1987, Ecoregions of the Northeast States, Environmental Research Laboratory, U.S. EPA, Corvallis, Oregon.

Poiger, H. and C. Schlatter, 1980, "Influence of Solvents and Absorbents on Dermal Intestinal Absorption of TCDD," **Food Cosmetology and Toxicology**, 18:455-481.

Parks Shallow Land Disposal Facility, May 1995, "Site Characterization Report," Rev. 4.

Pennsylvania Department of Environmental Protection, 1988, Coal Resources of Westmoreland County, Bureau of Topographic and Geologic Survey.

Schaum, J., 1984, "Risk Analysis of TCDD Contaminated Soil," Office of health and Environmental Assessment, EPA/600/8-84/031.

Stauffer, Jr., Jay, Jeffrey Boltz, and Laura White, 1995, The Fishes of West Virginia.

Sutton, Ann and M. Sutton, 1985, **Eastern Forests, The Audubon Society Nature Guides**, Alfred A. Knopf, Inc., New York.

Thomas, D., W. Hareland, W. Beyeler, D. Brosseau, J. Cochran, T. Feeney, T. Brown, P. Pohl, R. Haaker, and B. Fogleman, 2000, "Process for Developing Alternate Scenarios at NRC Sites Involved in D & D and License Termination," Sandia National Laboratories.

U.S. Census Bureau, Census 2000 Redistricting Data (Public law 94-171), Summary File, Geographic Comparison Table.

U.S. Census Bureau, Census 2000 Housing Units, Quick Facts.

U.S. Department of Transportation (U.S. DOT), 1998, "Sewage Sludge Ash – Material Description," Turner Fairbank Highway Research Center, www.tfhre.gov/hnr20/recycle/waste/, McLean, Virginia.

U.S. Environmental Protection Agency (U.S. EPA), 1985, Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Groundwater, EPA/600/6-85-002a.

U.S. Environmental Protection Agency (U.S. EPA), 1986, Quality Criteria for Water, Office of Water Regulations and Standards, EPA/440/5-86-001, Washington, DC.

U.S. Environmental Protection Agency (U.S. EPA), 1988, Superfund Exposure Assessment Manual, Office of Remedial Response, EPA/540/1□88/001, Washington, DC.

U.S. Environmental Protection Agency (U.S. EPA), 1989a, Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A, Solid Waste and Emergency Response, OS-230.

U.S. Environmental Protection Agency (U.S. EPA), 1989b, Exposure Factors Handbook, Office of Health and Environmental Assessment, EPA/600/8□89/043.1, Washington, DC.

USNRC, May, 1996, "Draft Dose Assessment for Kiski Valley Water Pollution Control Authority, Kiski Valley, Pennsylvania," U.S. Nuclear Regulatory Commission, Washington D.C.

USNRC, July 1998a, "Decision Methods for Dose Assessment to Comply with Radiological Criteria for License Termination," NUREG-1549 (draft), U.S. Nuclear Regulatory Commission, Washington D.C.

USNRC, August 1998b, "Demonstrating Compliance with the Radiological Criteria for License Termination," Draft Regulatory Guide DG-4006, U.S. Nuclear Regulatory Commission, Washington D.C.

USNRC, May 11, 1998, letter to Mr. Robert N. Kossak, Manager, Kiski Valley Water Pollution Control Authority from Robert A. Nelson, Chief Special Projects Section, Decommissioning Branch, Division of Waste Management, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington D.C.

USNRC, June 2000a, "Standard Review Plan for the Review of Decommissioning Plans and Other Information Submitted to Support the Release of Nuclear Facilities," Section 5.0, **Dose Modeling Evaluations**, U.S. Nuclear Regulatory Commission, Washington D.C.

USNRC, May 2000b, "Standard Review Plan for the Review of Decommissioning Plans and Other Information Submitted to Support the Release of Nuclear Facilities," Appendix C, **Technical Basis for Dose Modeling Evaluation**, U.S. Nuclear Regulatory Commission, Washington D.C.

United States Geological Survey and United States Department of the Interior, Water Resources Data, Pennsylvania Water Year 2000, Ohio and St. Lawrence River Basins, Volume 3.

Yu, C., Zielen, A. J., Cheng, J. -J., Yuan, Y. C., Jones, L. G., LePoire, D. J., Wang, Y. Y., Loureiro, C. O., Gnanapragasam, E., Faillace, E., Wallo, A., Williams, W. A., and Peterson, H., September 1993, "Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0," ANL/EA/RP-81333.

Yu, C., A. J. Zielen, J. –J. Cheng, D. J. LePoire, E. Gnanapragasam, S. Kamboj, J. Arnish, A. Wallo III, W. A. Williams, and H. Peterson, "User's Manual for RESRAD Version 6," ANL/EAD-4, 458 pp.

TABLES

Table 3-1
Oak Ridge Institute for Science and Education (ORISE)
RADIONUCLIDE CONCENTRATIONS IN SURFACE ASH AND SOIL SAMPLES
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Location		Sample	Radionuclide Concentration (pCi/g)					
Northing	Easting	Depth	Total Uranium	+/-	U-238	+/-	U-235	+/-
0	0	0-15	<2.60		0.59	1.06	<0.09	
0	20	0-15	<3.83		1.67	1.22	<0.09	
0	40	0-15	<4.22		1.24	1.15	<0.13	
0	60	0-15	<2.86		0.81	1.03	<0.09	
0	80	0-15	<3.78		1.71	1.73	<0.09	
10	20	0-15	<13.89		5.22	2.86	<0.38	
10	40	0-15	20.27	4.80	3.52	1.86	0.73	0.19
10	60	0-15	<8.50		3.15	1.89	<0.23	
10	80	0-15	<8.57		3.61	2.75	<0.22	
10	95	0-15	<4.16		1.20	1.55	<0.13	
20	0	0-15	<5.37		<2.13		<0.14	
20	10	0-15	16.90	5.08	4.65	2.93	0.53	0.18
20	20	0-15	22.98	4.89	4.42	2.37	0.81	0.19
20	30	0-15	<9.83		4.03	2.44	<0.25	
20	40	0-15	<11.02		4.90	2.57	<0.27	
20	60	0-15	18.75	5.09	3.67	2.72	0.66	0.19
20	90	0-15	<3.39		1.13	0.94	<0.10	
25	15	0-15	21.93	5.33	6.35	2.69	0.68	0.20
25	15	100-115	56.88	5.30	12.65	2.11	1.92	0.21
25	15	200-215	242.44	9.18	41.76	4.19	8.73	0.36
25	25	0-15	<12.47		4.66	2.42	<0.34	
25	25	100-115	60.17	5.71	12.70	2.83	2.06	0.22
25	25	200-215	195.76	8.06	32.83	3.61	7.08	0.31
25	35	0-15	19.15	4.10	2.74	1.72	0.71	0.16
25	35	100-115	<15.23		6.16	2.66	<0.39	
25	35	200-215	227.71	9.46	42.10	4.48	8.07	0.36
30	10	0-15	<8.55		2.78	2.23	<0.25	
30	15	0-15	<9.56		3.47	2.43	<0.26	
30	15	100-115	68.71	6.34	12.13	2.82	2.46	0.25
30	15	160-175	833.44	17.94	134.70	7.23	30.38	0.71
30	15	200-215	444.45	10.41	73.23	5.06	16.14	0.40
30	20	0-15	<16.94		<3.25		0.59	0.16
30	25	0-15	19.82	4.83	2.68	2.50	0.75	0.18
30	25	100-115	51.23	4.97	12.11	2.18	1.70	0.19
30	25	200-220	241.18	7.57	38.78	3.52	8.80	0.29
30	30	0-15	21.12	6.14	4.94	3.26	0.70	0.23
30	40	0-15	14.50	4.18	1.76	2.10	0.55	0.16
30	50	0-15	17.66	4.31	3.12	2.21	0.63	0.16
30	60	0-15	28.58	4.76	6.33	2.29	0.97	0.18
30	80	0-15	12.78	3.39	2.85	2.11	0.43	0.12
30	90	0-15	3.15	2.22	1.50	1.16	0.07	0.08
32	38	0-15	<10.69		4.27	2.27	<0.28	
32	38	100-115	50.84	5.08	9.83	2.48	1.78	0.19
32	38	200-215	149.84	6.71	29.18	3.37	5.25	0.25
35	5	0-15	<8.63		3.18	1.76	<0.24	
35	5	100-115	576.20	12.03	94.81	4.48	20.93	0.49
35	5	150-170	74.44	4.39	14.00	2.01	2.63	0.17
35	15	0-15	<12.97		4.89	1.96	<0.35	
35	15	100-115	52.96	5.50	11.38	2.82	1.81	0.21
35	15	150-170	721.71	14.62	112.90	6.39	26.47	0.57
35	15	200-215	699.86	14.22	112.90	6.32	25.52	0.55
35	25	0-15	23.27	4.10	5.13	2.39	0.79	0.14
35	25	100-115	86.56	7.37	16.69	3.61	3.04	0.28

Table 3-1
Oak Ridge Institute for Science and Education (ORISE)
RADIONUCLIDE CONCENTRATIONS IN SURFACE ASH AND SOIL SAMPLES
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Location		Sample	Radionuclide Concentration (pCi/g)					
Northing	Easting	Depth	Total Uranium	+/-	U-238	+/-	U-235	+/-
35	25	150-170	697.24	14.95	120.40	6.89	25.08	0.58
35	25	200-215	842.15	15.27	130.30	6.96	30.95	0.59
35	35	0-15	17.91	4.26	1.65	2.21	0.71	0.16
35	35	100-115	126.18	7.30	24.43	3.22	4.42	0.28
35	35	150-170	310.31	9.96	52.24	4.72	11.09	0.38
35	35	200-215	203.12	7.92	34.78	4.14	7.32	0.29
35	45	0-15	18.90	4.62	4.22	2.65	0.64	0.16
35	45	100-115	55.65	6.03	11.14	2.59	1.94	0.24
35	45	200-215	69.62	3.95	13.02	2.22	2.46	0.14
37	32	0-15	<13.09		7.69	2.57	<0.37	
37	32	100-115	181.60	8.76	31.25	4.34	6.54	0.33
37	32	150-170	769.21	13.77	123.60	5.27	28.07	0.55
37	32	200-215	197.72	6.09	32.30	2.83	7.19	0.23
40	10	0-15	13.69	3.74	1.95	1.78	0.51	0.14
40	20	0-15	<12.27		4.02	2.91	<0.36	
40	30	0-15	<8.65		2.52	1.97	<0.27	
40	40	0-15	<9.42		3.38	2.48	<0.26	
40	50	0-15	<13.87		<4.90		<0.39	
40	70	0-15	<7.72		1.52	1.91	<0.27	
45	5	0-15	22.30	4.34	3.65	1.81	0.81	0.17
45	5	100-115	311.83	10.48	53.31	5.34	11.24	0.39
45	5	115-130	922.85	16.26	144.30	6.93	33.85	0.64
45	5	160-180	24.49	3.08	3.99	1.78	0.89	0.11
45	15	0-15	14.12	4.97	1.90	1.86	0.53	0.20
45	15	100-115	51.00	6.17	9.60	2.79	1.80	0.24
45	15	150-170	313.25	10.71	40.47	4.90	11.86	0.41
45	15	200-215	46.71	3.30	9.11	1.32	1.64	0.13
45	25	0-15	<11.09		<4.00		<0.31	
45	25	100-115	69.21	5.62	12.56	2.24	2.46	0.22
45	25	150-170	659.36	15.46	102.30	7.04	24.22	0.60
45	25	200-215	262.96	7.97	37.93	3.61	9.78	0.31
45	35	0-15	24.00	5.43	4.30	2.72	0.86	0.20
45	35	100-115	135.96	7.56	25.15	3.21	4.82	0.30
45	35	145-160	718.55	14.15	110.20	4.76	26.45	0.58
45	35	190-215	322.84	9.10	53.28	3.84	11.72	0.36
45	40	0-15	15.89	6.20	2.92	4.05	0.56	0.20
45	40	100-115	120.69	7.56	25.75	3.83	4.13	0.28
45	40	150-170	454.79	12.91	72.99	6.09	16.60	0.49
45	40	200-215	163.84	6.45	30.85	2.98	5.78	0.25
45	45	0-15	10.61	3.85	1.78	1.83	0.38	0.15
45	45	100-115	115.86	7.73	18.68	3.84	4.23	0.29
45	45	200-215	251.63	9.83	40.14	4.17	9.20	0.39
50	0	0-15	<6.54		1.68	1.64	<0.21	
50	10	0-15	<10.43		2.89	1.87	<0.33	
50	20	0-15	<5.71		<2.94		<0.25	
50	30	0-15	23.03	5.31	6.15	3.13	0.73	0.19
50	40	0-15	<11.81		5.14	2.26	<0.29	
50	50	0-15	<7.65		2.36	1.64	<0.23	
50	70	0-15	<8.27		2.98	2.37	<0.23	
50	80	0-15	<3.82		1.52	1.48	<0.10	
55	5	0-15	23.59	4.00	2.94	2.03	0.90	0.15
55	5	100-115	344.39	12.49	59.19	5.79	12.40	0.48
55	5	190-215	69.45	4.62	14.13	2.46	2.41	0.17

Table 3-1
Oak Ridge Institute for Science and Education (ORISE)
RADIONUCLIDE CONCENTRATIONS IN SURFACE ASH AND SOIL SAMPLES
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Location		Sample	Radionuclide Concentration (pCi/g)					
Northing	Easting	Depth	Total Uranium	+/-	U-238	+/-	U-235	+/-
55	15	0-15	22.55	3.66	3.01	1.46	0.85	0.15
55	15	110-115	132.96	8.80	22.81	4.09	4.79	0.34
55	15	190-210	69.64	4.39	12.19	2.36	2.50	0.16
55	25	0-15	20.57	4.08	3.28	2.02	0.75	0.15
55	25	100-115	165.54	9.58	28.71	4.55	5.95	0.37
55	25	170-190	362.56	9.24	55.05	4.35	13.37	0.35
55	35	0-15	7.75	2.32	0.65	1.29	0.31	0.08
55	35	100-115	109.06	7.49	19.91	2.95	3.88	0.30
55	35	135-160	654.46	15.41	120.40	7.51	23.22	0.59
55	35	160-210	493.21	9.65	81.28	3.84	17.91	0.39
55	45	0-15	<9.11		2.90	3.68	<0.27	
55	45	100-115	66.80	5.82	13.88	2.56	2.30	0.23
55	45	200-215	144.24	6.19	25.97	3.35	5.14	0.23
60	0	0-15	10.52	2.56	0.99	1.47	0.41	0.09
60	10	0-15	34.00	5.34	6.58	2.53	1.19	0.20
60	20	0-15	16.91	4.23	3.31	2.51	0.59	0.15
60	30	0-15	12.74	4.09	4.27	2.09	0.37	0.15
60	40	0-15	19.85	4.56	3.81	2.20	0.70	0.17
60	60	0-15	17.74	4.53	4.65	2.46	0.57	0.17
60	70	0-15	<4.18		1.19	1.45	<0.13	
65	5	0-15	<9.53		3.24	2.35	<0.27	
65	5	100-115	30.96	3.58	7.18	1.58	1.03	0.14
65	5	140-155	243.59	6.85	38.64	3.34	8.91	0.26
65	15	0-15	<7.98		1.77	2.51	<0.27	
65	15	100-115	107.82	7.35	17.87	3.16	3.91	0.29
65	15	115-150	194.07	6.75	33.74	3.22	6.97	0.26
70	0	0-15	<4.96		1.74	1.56	<0.14	
70	10	0-15	19.50	3.55	4.87	2.09	0.64	0.12
70	30	0-15	7.73	2.11	2.10	1.22	0.24	0.08
70	50	0-15	<4.48		2.36	1.41	<0.09	

Note:

ORISE determined by alpha spectrometry analysis that the ratio of U-234 to U-235 averaged 22:1. Therefore, total uranium was calculated by multiplying the U-235 concentrations by a factor of 23 and then adding the U-238 concentrations. in the total uranium concentration was calculated by propagating the errors in the U-238 and U-235 concentrations.

References:

Oak Ridge Institute for Science and Education (ORISE), Characterization Survey of the Ash Lagoon and Adjacent Property, Kiski Valley Water Pollution Control Authority, Leechburg, Pennsylvania, prepared for the U.S. Nuclear Regulatory Commission, Region

Table 3-2
B. Koh Associates, Inc.
RADIONUCLIDE CONCENTRATIONS IN SURFACE ASH AND SOIL SAMPLES
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Location		Sample	Radionuclide Concentration (pCi/g)					
Northing	Easting	Depth	Total Uranium	+/-	U-238	+/-	U-235	+/-
5	25	0-1	<13.7		<2.2		0.50	0.20
5	25	1-2	<11.2		<2.0		0.40	0.20
5	25	2-3	<15.2		<1.4		<0.6	
5	65	0-1	<11.2		<2.0		0.40	0.20
5	65	1-2	<24.7		<1.7		<1.0	
5	65	2-3	5.80		1.20	0.40	0.20	0.10
10	10	0-1	<14.1		<2.6		0.50	0.20
10	10	3-4	<22.9		<2.2		0.90	0.20
10	10	7-8	<12.8		<1.3		<0.5	
10	60	0-2	32.10		8.80	1.30	1.10	0.30
10	60	2-4	33.70		6.10	1.00	1.20	0.20
10	60	4-5	32.70		7.40	1.20	1.10	0.30
10	60	5-6	35.60		5.70	5.20	1.30	0.10
10	70	0-2	38.10		8.20	1.20	1.30	0.30
10	70	2-4	60.30		7.40	0.40	2.30	0.20
15	15	0-1	<18.1		<2.0		0.70	0.20
15	15	3-4	<25.1		<2.1		<1.0	
15	15	7-8	<11.0		<1.8		0.40	0.20
15	35	0-1	<17.4		<1.3		0.70	0.20
15	35	3-4	<9.1		<2.2		0.30	0.20
15	35	6-7	31.40	5.00	3.80	2.00	1.20	0.20
15	55	0-1	<22.6		<1.9		<0.9	
15	55	1-3	39.50		9.60	1.10	1.30	0.30
15	55	3-4	<13.5		<2.0		0.50	0.20
15	55	4-5	36.80				1.60	0.30
15	55	5-6	88.70		15.10	1.00	3.20	0.20
15	55	6-7	59.80				2.60	0.10
15	65	0-2	<27.5		<2.2		<1.1	
15	65	2-4	<20.4		<2.0		<0.8	
15	65	4-6	35.50		5.60	0.90	1.30	0.20
15	65	6-8	<81.1		<2.9		3.40	0.60
20	10	0-1	<25.3		<2.3		1.00	0.30
20	10	3-4	<44.2		<2.8		1.80	0.30
20	10	5-6	244.30	14.50	25.80	4.50	9.50	0.60
20	30	0-1	<16.4		<2.6		0.60	0.30
20	30	3-4	59.30	9.60	8.70	2.80	2.20	0.40
20	30	6-7	158.00	11.80	24.60	9.60	5.80	0.30
20	60	0-2	18.10		4.30	1.10	0.60	0.20
20	60	2-4	27.60				1.20	0.30
20	60	4-6	70.10		1.10	0.90	3.00	0.30
20	60	6-8	2.30				0.10	0.10
25	5	0-1	<29.7		<2.1		<1.2	
25	5	2-3	<20.7		<2.3		0.80	0.20
25	5	3-4	<53.8		<3.2		2.20	0.30
25	15	0-1	<15.4		<1.6		0.60	0.20
25	15	1-2	<20.3		<1.9		0.80	0.20
25	15	2-3	19.00	4.90	5.20	1.80	0.60	0.20
25	15	3-4	<34.9		<2.7		1.40	0.20
25	15	4-5	71.60	9.70	7.20	3.00	2.80	0.40
25	15	5-6			6.20	2.50	2.30	0.50

Table 3-2
B. Koh Associates, Inc.
RADIONUCLIDE CONCENTRATIONS IN SURFACE ASH AND SOIL SAMPLES
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Location		Sample	Radionuclide Concentration (pCi/g)					
Northing	Easting	Depth	Total Uranium	+/-	U-238	+/-	U-235	+/-
25	15	6-7	137.90	10.00	22.90	3.90	5.00	0.40
25	15	7-8	<20.4		<2.0		0.80	0.20
25	35	0-1	<20.0		<1.6		<0.8	
25	35	1-2	<13.4		<1.9		0.50	0.20
25	35	2-3	<16.1		<2.3		0.60	0.20
25	35	3-4	<25.1		<2.1		1.00	0.20
25	35	4-6	<22.4		<1.7		<0.9	
25	35	6-8	<64.5		<4.7		2.60	0.10
25	65	0-2	20.40		6.60	9.40	0.60	0.30
25	65	2-4	27.60				1.20	0.30
25	65	4-5	27.60				1.20	0.20
25	65	5-8	6.90				0.30	0.10
30	10	0-1	<34.6		<2.4		1.40	0.30
30	10	3-4	111.20	12.60	19.20	5.10	4.00	0.50
30	10	5-6	226.7	7.0	33.50	5.30	8.40	0.20
30	20	0-1	<15.7		<1.9		0.60	0.10
30	20	3-4	34.50	5.40	9.20	2.80	1.10	0.20
30	20	7-8	686.60	22.30	95.50	8.30	25.70	0.90
30	40	0-1	<20.5		<2.1		0.80	0.20
30	40	3-4	<15.4		<1.6		0.60	0.10
30	40	6-7	<20.2		<1.8		<0.8	
30	80	surface	45.70		8.90	2.20	1.60	0.20
30	80	surface	107.00		3.50	1.10	4.50	0.10
32	38	0-1	<37.4		<2.9		<1.5	
32	38	1-2	<30.4		<2.8		1.20	0.30
32	38	2-3	<32.5		<2.6		1.30	0.20
32	38	3-4	<34.5		<2.3		1.40	0.30
32	38	4-6	149.00	12.30	22.50	4.50	5.50	0.50
32	38	6-7	72.60	7.30	3.60	2.40	3.00	0.30
32	38	7-8	<17.3		<1.2		<0.7	
35	5	0-1	<18.2		<2.1		<0.7	
35	5	3-4	251.30	9.40	32.80	1.70	9.50	0.40
35	5	5-6	217.00	9.50	28.40	2.20	8.20	0.40
35	15	0-1	<15.3		<1.5		<0.6	
35	15	1-2	<11.2		<2.0		0.40	0.20
35	15	2-3	98.30	9.80	8.60	3.50	3.90	0.40
35	15	3-4	<67.5		<3.1		2.80	0.30
35	15	4-5	<51.3		<3.0		2.10	0.40
35	15	7-8	<12.7		<1.2		<0.5	
40	20	0-1	<29.6		<2.0		<1.2	
40	20	3-4	<34.5		<2.3		1.40	0.30
40	20	4-5	63.30	9.60	10.40	2.80	2.30	0.40
40	40	0-1	<18.5		<2.4		0.70	0.20
40	40	3-4	48.90	23.10	5.20	2.00	1.90	1.00
40	40	4-5	296.50	5.60	43.50	5.10	11.00	0.10
40	60	0-1	<22.7		<2.0		<0.9	
40	60	3-4	<27.2		<1.9		<1.1	
40	60	6-7	<24.6		<1.6		<1.0	
45	5	0-1	<20.0		<1.6		<0.8	
45	5	3-4	61.40	9.60	6.20	2.70	2.40	0.40

Table 3-2
B. Koh Associates, Inc.
RADIONUCLIDE CONCENTRATIONS IN SURFACE ASH AND SOIL SAMPLES
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Location		Sample	Radionuclide Concentration (pCi/g)					
Northing	Easting	Depth	Total Uranium	+/-	U-238	+/-	U-235	+/-
45	5	5-6	306.60	8.00	32.90	4.00	11.90	0.30
45	25	0-1	<27.0		<1.70		<1.1	
45	25	1-2	<36.6		<2.1		1.50	0.30
45	25	2-3	57.5	7.3	6.90	2.50	2.20	0.30
45	25	3-4	103.00	4.70	15.60	4.10	3.80	0.10
45	25	4-5	209.90	14.10	14.40	3.10	8.50	0.60
45	25	7-8	<47.8		<1.8		2.00	0.20
45	45	2-3	<25.2		<2.2		1.00	0.20
45	45	3-4	65.20	8.60	12.30	5.20	2.30	0.30
45	45	4-5	204.70	5.30	29.90	4.80	7.60	0.10
45	45	5-6	63.00	3.00	12.40	1.90	2.20	0.10
45	45	6-8	<14.9		<1.1		<0.6	
45	45	7-8	<15.1		<1.3		<0.6	
45	55	1-2	<11.2		<2.0		0.40	0.20
45	55	3-4	<23.0		<2.3		<0.9	
45	55	6-8	<38.9		<2.1		1.60	0.20
45	65	0-1	<45.1		<3.7		<1.8	
45	65	3-4	<27.2		<1.9		<1.1	
45	65	6-8	<22.6		<1.9		<0.9	
50	10	0-1	<11.1		<1.9		0.40	0.20
50	10	3-4	<35.0		<2.8		1.40	0.40
50	10	7-8	<15.4		<1.6		0.60	0.20
50	30	0-1	<13.5		<2.0		0.50	0.20
50	30	3-4	81.10	18.60	9.80	2.40	3.10	0.80
50	30	6-7	196.30	4.50	26.10	3.90	7.40	0.10
55	25	0-1	<25.6		<2.6		1.00	0.30
55	25	1-2	62.70	7.40	9.80	2.60	2.30	0.30
55	25	2-3	51.60	7.80	10.20	3.70	1.80	0.30
55	25	3-4	133.50	3.80	18.50	3.00	5.00	0.10
55	45	0-1	<29.3		<4.0		1.10	0.30
55	45	1-2	<74.5		<3.2		3.10	0.40
55	45	2-3	90.90	12.10	17.30	3.90	3.20	0.50
55	45	3-4	99.30	4.40	18.80	3.80	3.50	0.10
55	45	4-5	71.30	7.30	9.20	2.40	2.70	0.30
55	45	5-6	156.20	4.60	25.10	4.00	5.70	0.10
55	45	6-7	67.10	3.20	7.30	2.20	2.60	0.10
55	45	7-8	<14.9		<1.1		<0.6	
55	65	0-1	<20.2		<1.8		<0.8	
55	65	1-2	<18.6		<2.5		0.70	0.20
55	65	2-3	12.70	2.60	3.50	1.30	0.40	0.10
60	10	0-1	122.00	9.9	9.30	3.60	4.90	0.40
60	10	3-4	64.30	7.20	6.80	2.00	2.50	0.30
60	10	7-8	<17.3		<1.2		<0.7	
60	30	0-1	<8.8		<1.9		0.30	0.20
60	30	2-3	<25.1		<2.1		1.00	0.30
60	30	3-4	74.90	14.00	1.30	2.50	3.20	0.60
65	25	0-1	<25.60		<2.6		1.00	0.30
65	25	2-3	107.10	7.60	12.80	3.20	4.10	0.30
65	25	3-4	533.90	5.10	73.90	2.20	20.00	0.20
65	45	0-1	<20.3		<1.9		<0.8	

Table 3-2
B. Koh Associates, Inc.
RADIONUCLIDE CONCENTRATIONS IN SURFACE ASH AND SOIL SAMPLES
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Location		Sample	Radionuclide Concentration (pCi/g)					
Northing	Easting	Depth	Total Uranium	+/-	U-238	+/-	U-235	+/-
65	45	2-3	<27.7		<2.4		1.10	0.30
65	45	3-4	<20.2		<1.8		<0.8	

Note:

ORISE determined by alpha spectrometry analysis that the ratio of U-234 to U-235 averaged 22:1. Therefore, uranium was calculated by multiplying the U-235 concentrations by a factor of 23 and then adding the U-238 concentrations. The error in the total uranium concentration was calculated by propagating the errors in the U-U-235 concentrations.

References:

B. Koh & Associates, Analytical Results, March 1999, October 1998.

TABLE 3-3
ORISE RADIONUCLIDE CONCENTRATIONS IN MISCELLANEOUS SOIL, SEDIMENT, AND NEWLY GENERATED ASH SAMPLES
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Location	Sample Depth	Radionuclide Concentration (pCi/g)					
		Total Uranium [a]	+/-	U-238	+/-	U-235	+/-
5 m south of Manhole No. 1	surface	<2.13		1.02	1.12	<0.09	
2 m north of Manhole No. 1	surface	<3.67		1.76	1.69	<0.15	
1 m east of gate	surface	<3.05		1.48	1.53	<0.09	
3 m south of south fence	surface	<2.44		1.17	0.97	<0.10	
Perimeter north of berm @foot of berm	1 meter	<4.08		1.99	1.55	<0.10	
Current ash sample [c]	grab	<8.41		<4.08		<0.25	
At plant outfall	sediment	<4.39		2.14	1.72	<0.11	
50 m downstream from outfall	sediment	<2.86		1.39	0.92	<0.08	

[a] Total uranium was calculated by multiplying the U-238 concentration by a factor of 2 and adding the U-235 concentration.
[b] Uncertainties represent the 95% confidence level, based only on counting statistics.
[c] Sample collected from ash furnace.

Reference: Oak Ridge Institute for Science and Education, Final Report, Characterization Survey of the Ash Lagoon and Adjacent Property, Kiski Valley Water Pollution Control Authority, Leechburg, Pennsylvania Site, May 30, 1995.

TABLE 3-4
ORISE GROSS ALPHA AND GROSS BETA ACTIVITY IN WATER SAMPLES
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Location	Concentration (pCi/L)			
	Alpha Activity	+/-	Beta Activity	+/-
Standing water in lagoon	<2.4		8.4	1.4*
Monitoring well No. 1	<1.6		3.0	1.1
Monitoring well No. 2	3.5	1.1	4.9	1.1
Monitoring well No. 3	<1.5		2.5	1.0
Monitoring well No. 4	<1.3		<1.6	
Kiski River 10 m below outfall	<1.5		2.8	1.0
Purge water from monitoring well Nos. 1 and 2	<2.4		4.1	1.4
Purge water from monitoring well Nos. 3 and 4	<1.9		3.5	1.1

* Uncertainties represent the 95 percent confidence level, based only on counting statistics.

Notes:

ORISE monitoring well locations listed above are labeled incorrectly from the Chester Engineers locations. IT is using monitoring well location numbers identified by Chester Engineers in Figure 3-1.

Reference: Oak Ridge Institute for Science and Education, Final Report, Characterization Survey of the Ash Lagoon and Adjacent Property, Kiski Valley Water Pollution Control Authority, Leechburg, Pennsylvania, Site, May 30, 1995.

TABLE 3-5
IT CORPORATION GROUNDWATER SAMPLING RESULTS
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Location	Concentration (pCi/L)					
	Gross Alpha[a]	Gross Beta[a]	U-234[b]	U-235[b]	U-238[b]	Total Uranium[b]
MW-1	0.60	2.20	0.10	0.09	0.10	0.15
MW-3	0.71	1.78	0.10	0.10	0.10	0.16
MW-4	0.92	2.04	0.09	0.09	0.09	0.14
MW-4 Duplicate	0.73	1.89	0.09	0.10	0.10	0.15
Rinsate	0.46	1.82	0.15	0.12	0.10	0.22

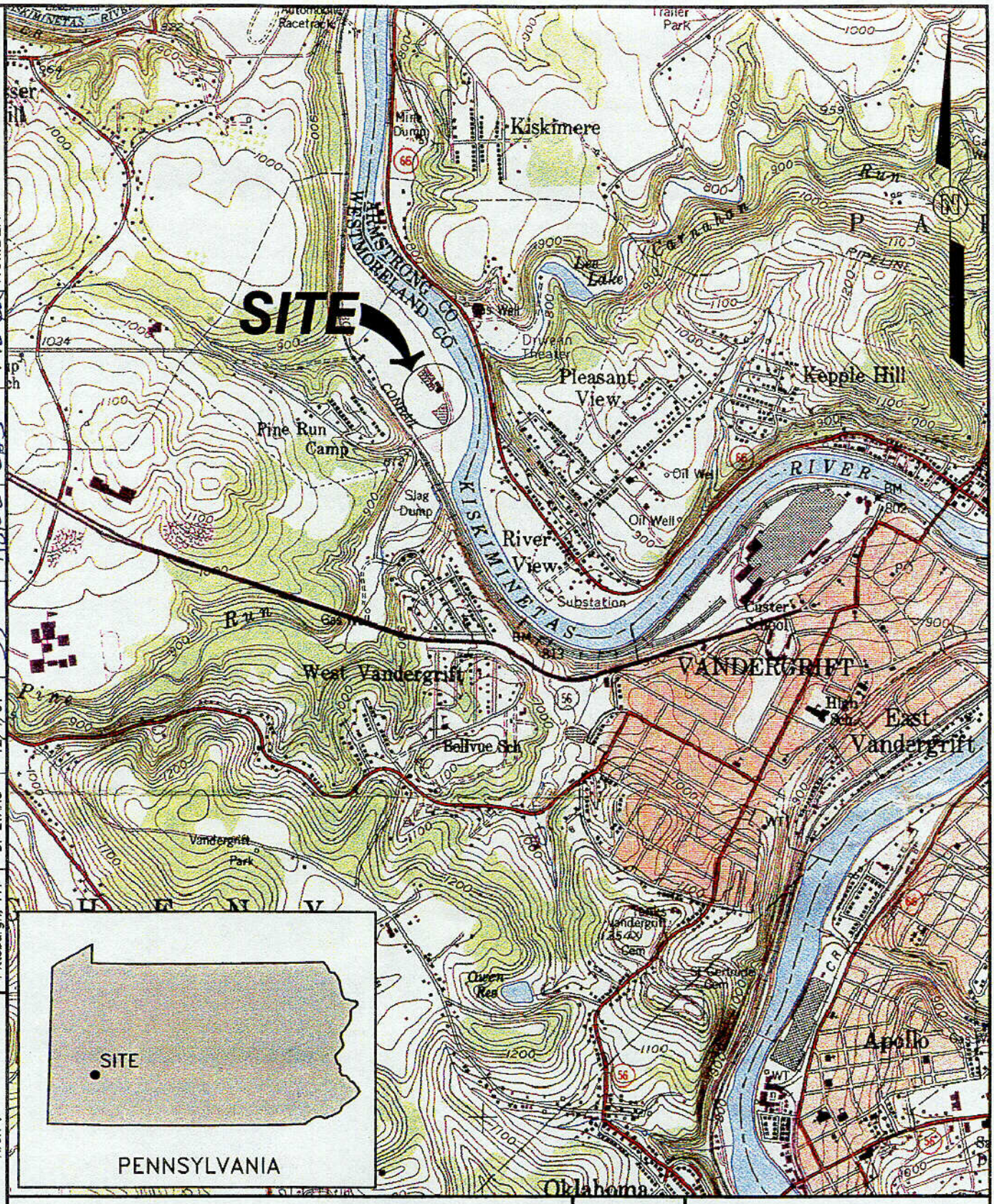
[a] Gross alpha and gross beta were analyzed using EPA Method SW846-9310.

[b] U-234, U-235, U-236, and total uranium were analyzed using Alpha Spectrometry.

Table 4-1
Site Specific Input Parameters for Dose Modeling of Ash Lagoon
Kiski Valley Water Pollution Control Authority
Leechburg, Pennsylvania

Input Parameter	Input Value	Reference
Area of Contaminated Zone (m^2)	4,000	Measured Value
Thickness of Contaminated Zone (m)	2	Measured Value
Length parallel to aquifer flow (m)	100	Approximate length under lagoon and berms
Basic radiation dose limit (mrem/yr)	25	Default
Initial concentration U-234 (pCi/g)	62.9	Avg. concentration
Initial concentration U-235 (pCi/g)	3.2	Avg. concentration
Initial concentration U-238 (pCi/g)	12.6	Avg. concentration
Density of contaminated zone (g/cm^3)	1.2	U.S. DOT Turner-Fairbank Highway Research Center, Sewage Sludge Ash Material Description -http://www.tfhrc.gov/hnr20/recycle/waste/ss1.htm
Contaminated zone erosion rate (m/yr)	0.001	Default
Contaminated zone total porosity	0.4	Default
Contaminated zone field capacity	0.2	Default
Contaminated zone hydraulic conductivity (m/yr)	10	Default
Contaminated zone b parameter	5.3	Default
Average annual wind speed (m/sec)	2	Default
Evapotranspiratin coefficient	0.5	Default
Precipitation (m/yr)	1	Default
Irrigation (m/yr)	0.76	Draft - Dose Assessment for KVWPCA, USNRC, May 1996
Watershed area for nearby stream or pond (m^2)	743,200	U.S.G.S. 7.5' Vandergrift Quandrangle
Density of saturated zone (g/cm^3)	1.63	Draft - Dose Assessment for KVWPCA, USNRC, May 1996
Saturated zone total porosity	0.39	Table E.3; RESRAD Version 6.0 Manual
Saturated zone effective porosity	0.3	Table E.3; RESRAD Version 6.0 Manual
Saturated zone field capacity	0.2	Default
Saturated zone hydraulic conductivity (m/yr)	5,500	Table E.2; RESRAD Version 6.0 Manual
Saturated zone hydraulic gradient	0.02	Measured Value (5/18/92, 6/17/92, 11/8/01) (same value as default)
Saturated zone b parameter	4.05	Table E.2; RESRAD Version 6.0 Manual
Water table drop rate (m/yr)	0.001	Default
Well Pump intake depth (m below water table)	10	Default
Model: Nondispersion (ND) or Mass-Balance (MB)	ND	selection criteria for lagoon size over 1000 m^2 (RESRAD Ver. 6.0 manual)
Well pumping rate (m^3/yr)	250	Default
Number of unsaturated zone strata	1	Site specific field conditions
Unsaturated zone thickness (m)	3.5	Ground Water Investigation, August 1992, Chester Engineers
Unsaturated zone density (g/cm^3)	1.63	Draft - Dose Assessment for KVWPCA, USNRC, May 1996
Unsaturated zone total porosity	0.4	Table E.8; RESRAD Version 6.0 Manual (same value as default)
Unsaturated zone effective porosity	0.2	Table E.8; RESRAD Version 6.0 Manual (same value as default)
Unsaturated zone field capacity	0.2	Default
Unsaturated zone soil specific b parameter	9.08	Table E.2; RESRAD Version 6.0 Manual (avg. of silty clay & silty clay loam)
Unsaturated zone hydraulic conductivity (m/yr)	4.31	Table E.2; RESRAD Version 6.0 Manual (avg. of silty clay & silty clay loam)
Distribution coefficients for U-234:		
Contaminated zone (cm^3/g)	1,400	leaching data from Draft - Dose Assessment for KVWPCA, USNRC, May 1996
Unsaturated zone (cm^3/g)	1,600	Table E.3; RESRAD Version 6.0 Manual (geometric mean for clay)
Saturated zone (cm^3/g)	35	Table E.3; RESRAD Version 6.0 Manual (geometric mean for sand)
Distribution coefficients for U-235:		
Contaminated zone (cm^3/g)	1,400	leaching data from Draft - Dose Assessment for KVWPCA, USNRC, May 1996
Unsaturated zone (cm^3/g)	1,600	Table E.3; RESRAD Version 6.0 Manual (geometric mean for clay)
Saturated zone (cm^3/g)	35	Table E.3; RESRAD Version 6.0 Manual (geometric mean for sand)
Distribution coefficients for U-238:		
Contaminated zone (cm^3/g)	1,400	leaching data from Draft - Dose Assessment for KVWPCA, USNRC, May 1996
Unsaturated zone (cm^3/g)	1,600	Table E.3; RESRAD Version 6.0 Manual (geometric mean for clay)
Saturated zone (cm^3/g)	35	Table E.3; RESRAD Version 6.0 Manual (geometric mean for sand)

FIGURES



OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
Pittsburgh, PA	D. EVANS	12/4/01	SS	1/18/02	JAS	1-18-02	829509-A4

Image: KISKIMAGE
Xref: .

O:\Project\829509\829509A4.dwg
Plot Date/Time: 12/19/01 08:50am
Format Revised: 12/15/99

SCALE

0 2,000 4,000 FEET

REFERENCE:

U.S.G.S. TOPOGRAPHIC MAP, 7.5 MINUTE SERIES, VANDERGRIFT, PA QUADRANGLE, DATED: 1953, PHOTOREVISED: 1979, SCALE: 1"=2000'.

IT CORPORATION

KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

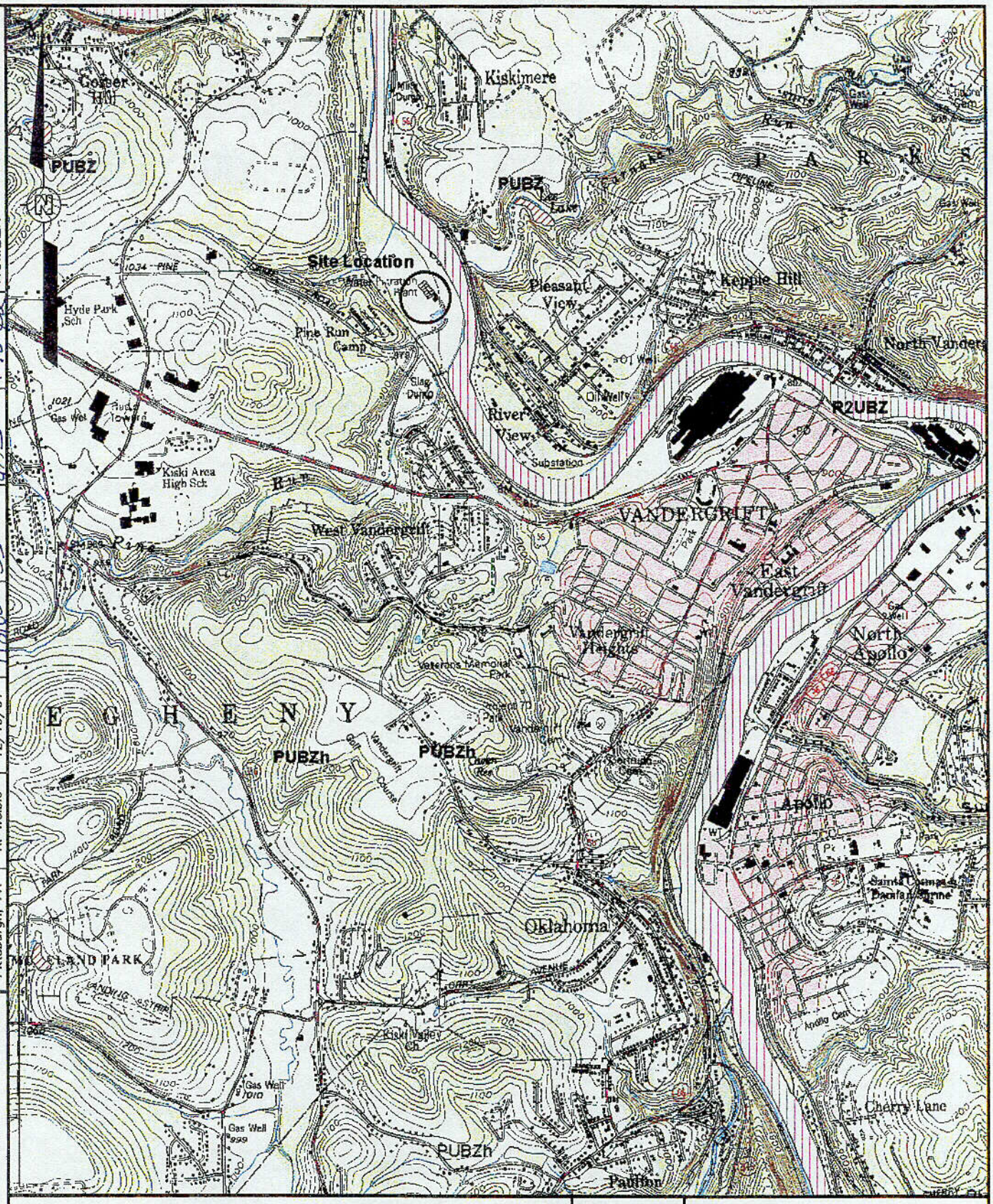
FIGURE 1-1

SITE LOCATION MAP

KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

C01

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	R. Weible 12/19/01	1/19/02 SS	HAS 1-18-02	829509-A9



NWI LEGEND

	R2UBZ		PUBZ		U
	L1UBZh		PUBZh		
	PEMY		PUBZx		

400 0 400 800 Feet

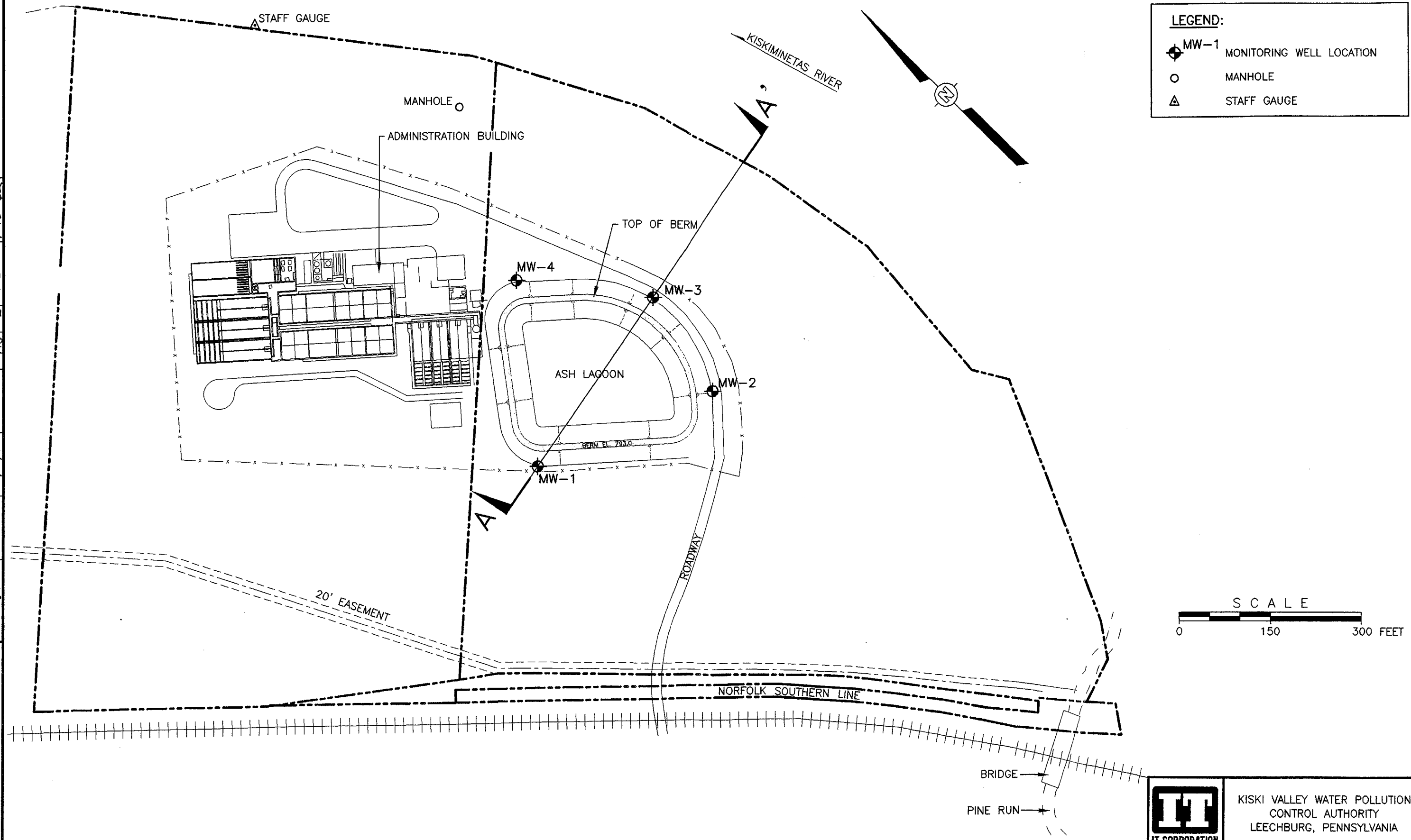
IT CORPORATION

KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

FIGURE 2-1
NWI LOCATIONS FOR THE NORTHWEST VANDERGRIFT QUADRANGLE
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

C02

O:\Project\829509\829509A9.dwg
Plot Date/Time: 12/20/01 10:33am
Plotted by: rweible
Image: NWIJP
Xref: .



REFERENCE:

CHESTER ENGINEERS DRAWING NO. 2735-472, SHEET 1 OF 1, DATED: 9/28/01, SCALE: 1"=100'.

IT CORPORATION

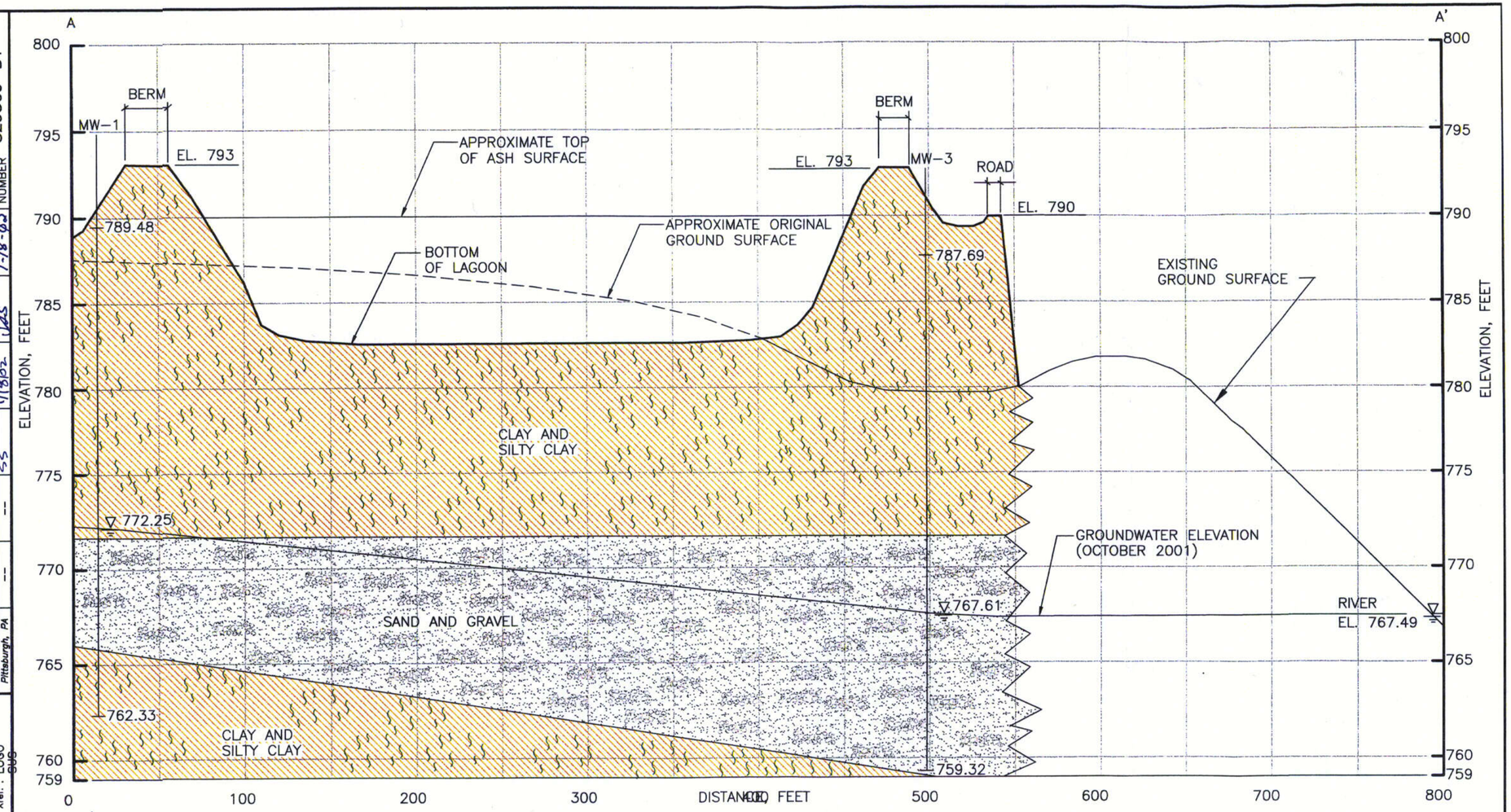
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

FIGURE 3-1
SITE PLAN
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	R. Weible 12/10/01	SS 1/16/02	JAS 1-18-02	829509-B2

O:\Project\829509\82950982.dwg
Plot Date/Time: 01/16/02 09:20am
Plotted by: rweible

Image: .
Xref: .



LEGEND:

- SAND
- CLAY
- GRAVEL
- SILT

HORIZONTAL SCALE: 0 50 100 FEET

VERTICAL SCALE: 0 5 10 FEET

IT CORPORATION

KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

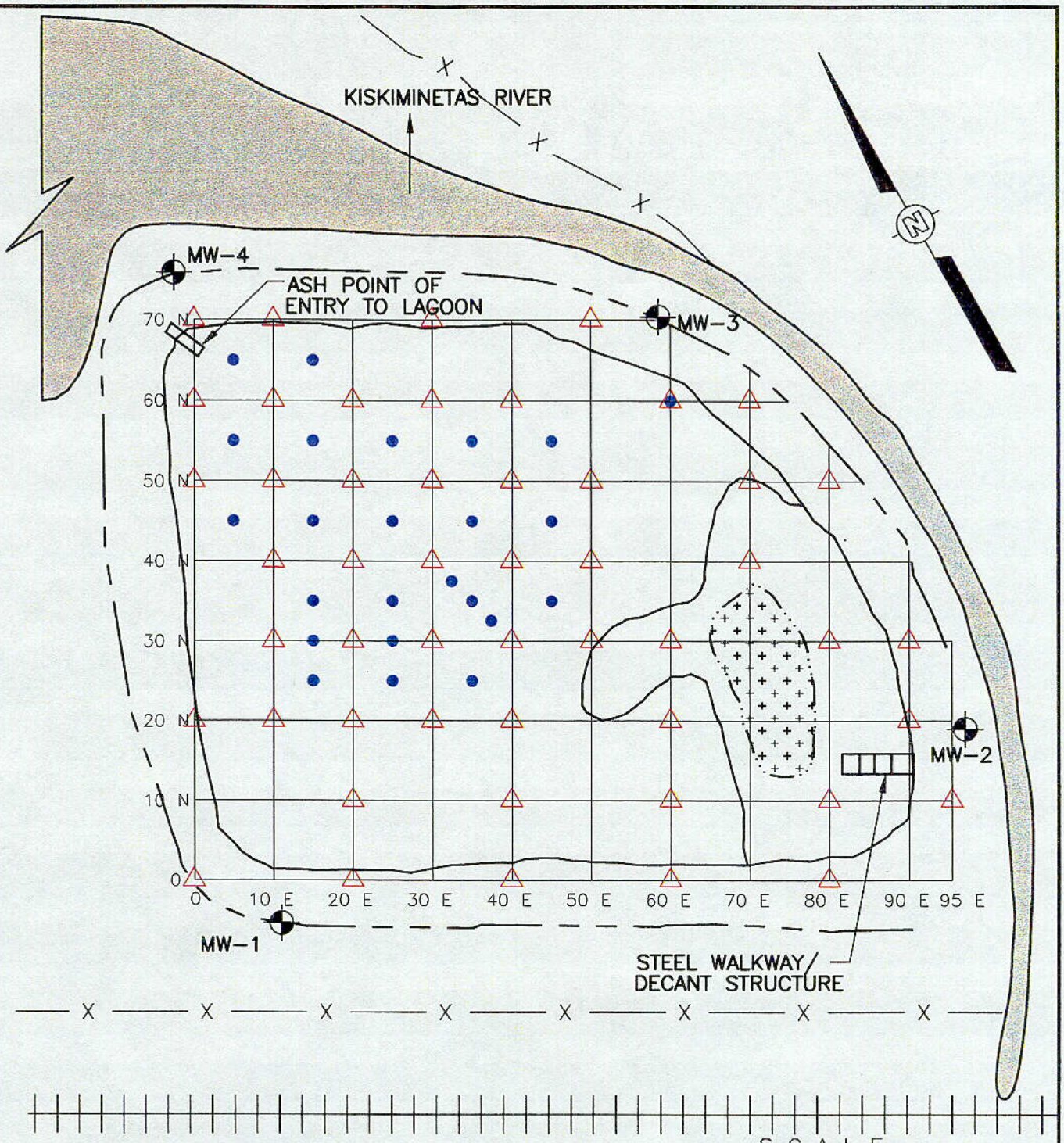
FIGURE 3-2
CROSS-SECTION A-A'
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

C03

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	--	SS 1/18/02	LLS 1-18-02	829509-B1

Image: BP
Xref: . LOGO BUS

O:\Project\829509\829509B1.dwg
Plot Date/Time: 12/19/01 04:17pm
Plotted by: Daevans



LEGEND:

- MW-1 — MONITORING WELL
- SURFACE SOIL SAMPLES
- HAND AUGER SOIL SAMPLES
- FENCE
- RAILROAD
- ASPHALT
- SEASONALLY WET AREA
- BERM BOUNDARY

SCALE: 0 — 15 — 30 METERS

SCALE: 0 — 60 — 120 FEET

NOTE: GRID SPACING IS 10 METERS x 10 METERS.

IT CORPORATION

KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY

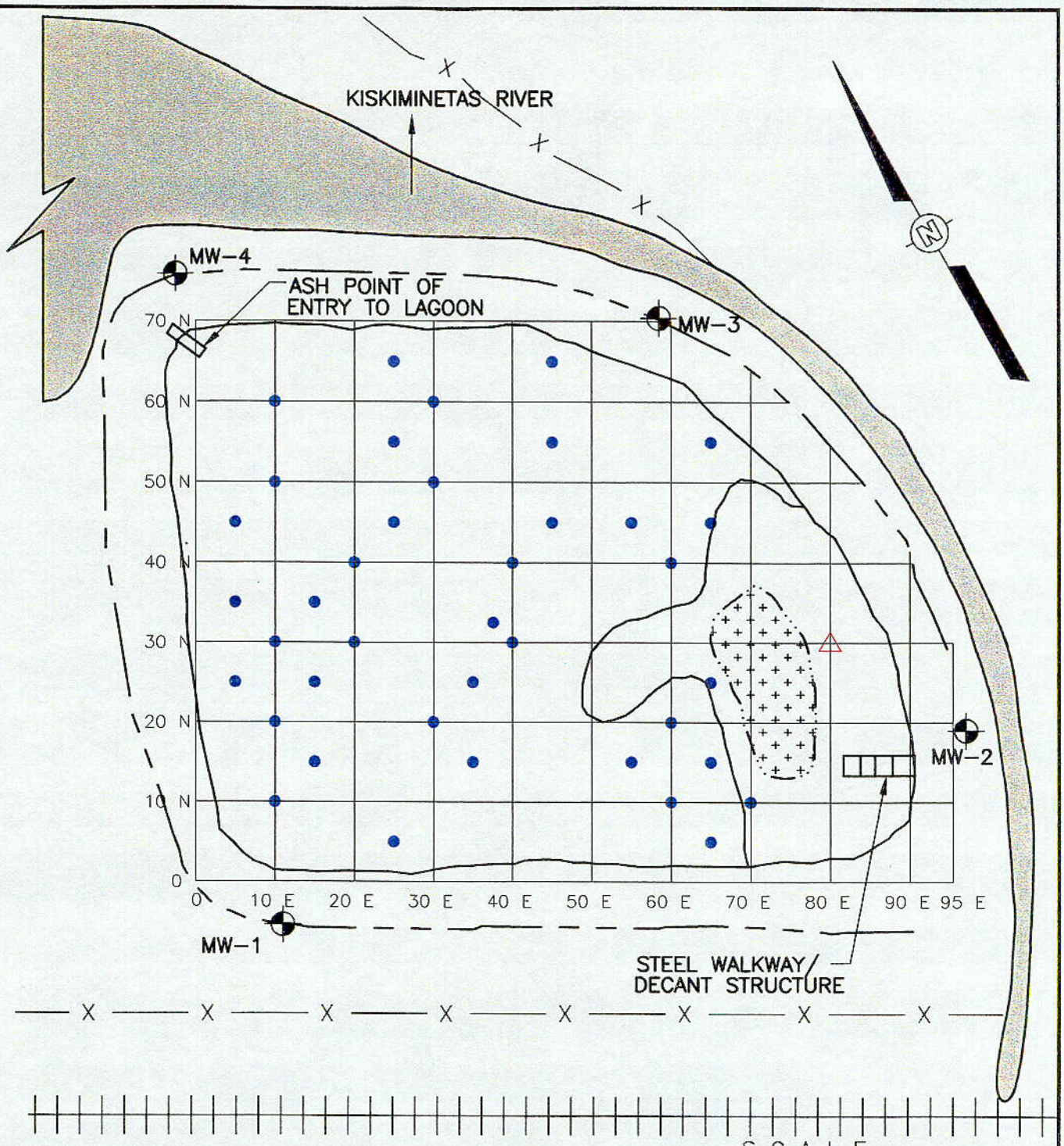
FIGURE 3-3
ORISE SURFACE & HAND AUGER SOIL SAMPLING LOCATIONS
FLY ASH LAGOON
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

C04

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	R.A.M. 9/07/01	JS	1-18-02	829509-A6

O:\Project\829509\829509A6.dwg
Plot Date/Time: 12/19/01 03:10pm
Plotted by: Daevans

Image: SCAN1
Xref: .



LEGEND:

MW-1	MONITORING WELL
△	SURFACE SOIL SAMPLES
●	GEOPROBE SOIL SAMPLES
— X —	FENCE
	RAILROAD
	ASPHALT
	SEASONALLY WET AREA
— — —	BERM BOUNDARY

SCALE
0 15 30 METERS

SCALE
0 60 120 FEET

NOTE:
GRID SPACING IS 10 METERS x 10 METERS.

IT CORPORATION

KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY

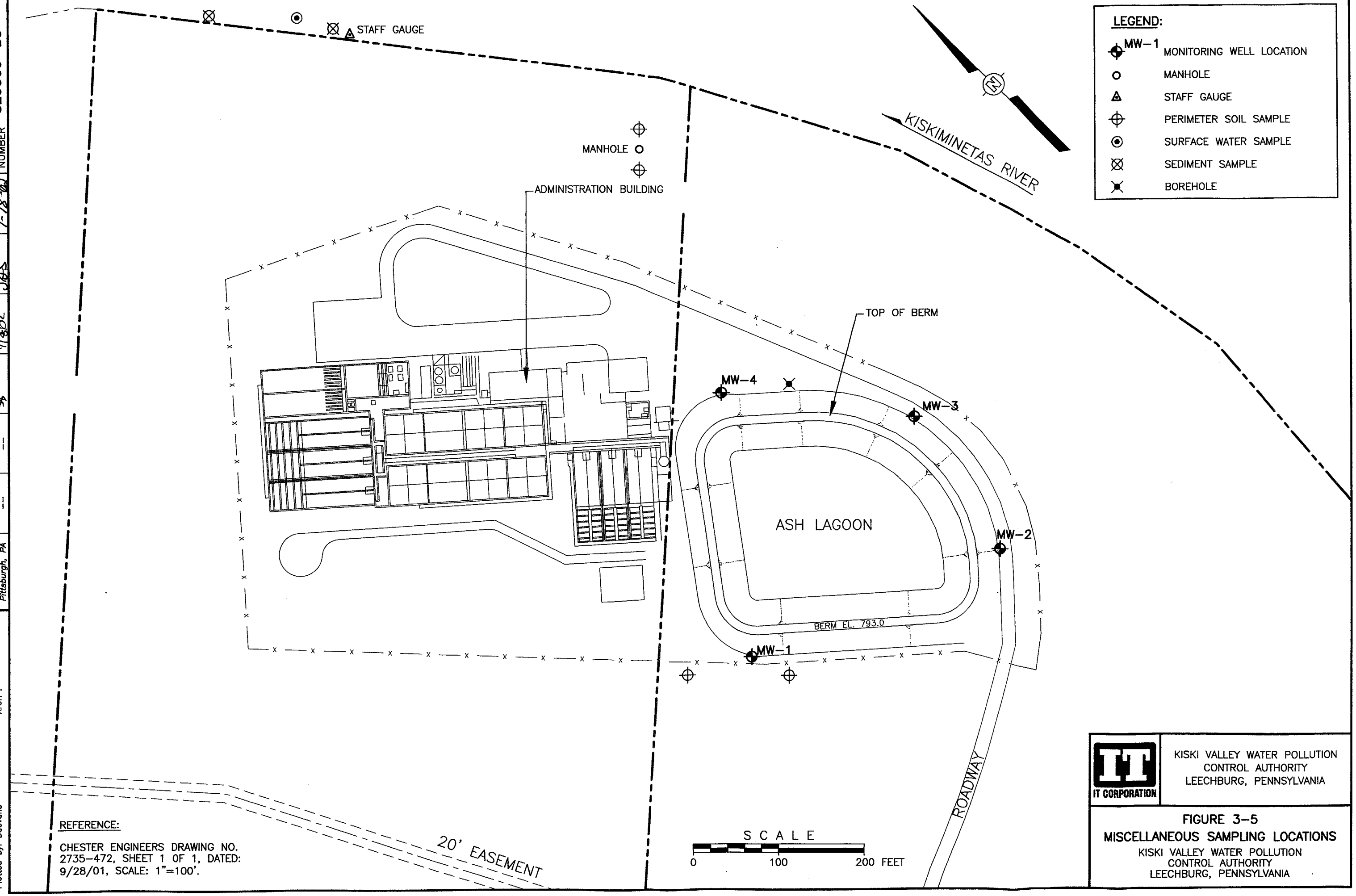
FIGURE 3-4
B. KOH & ASSOCIATES SURFACE AND GEOPROBE SOIL SAMPLING LOCATIONS
FLY ASH LAGOON
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

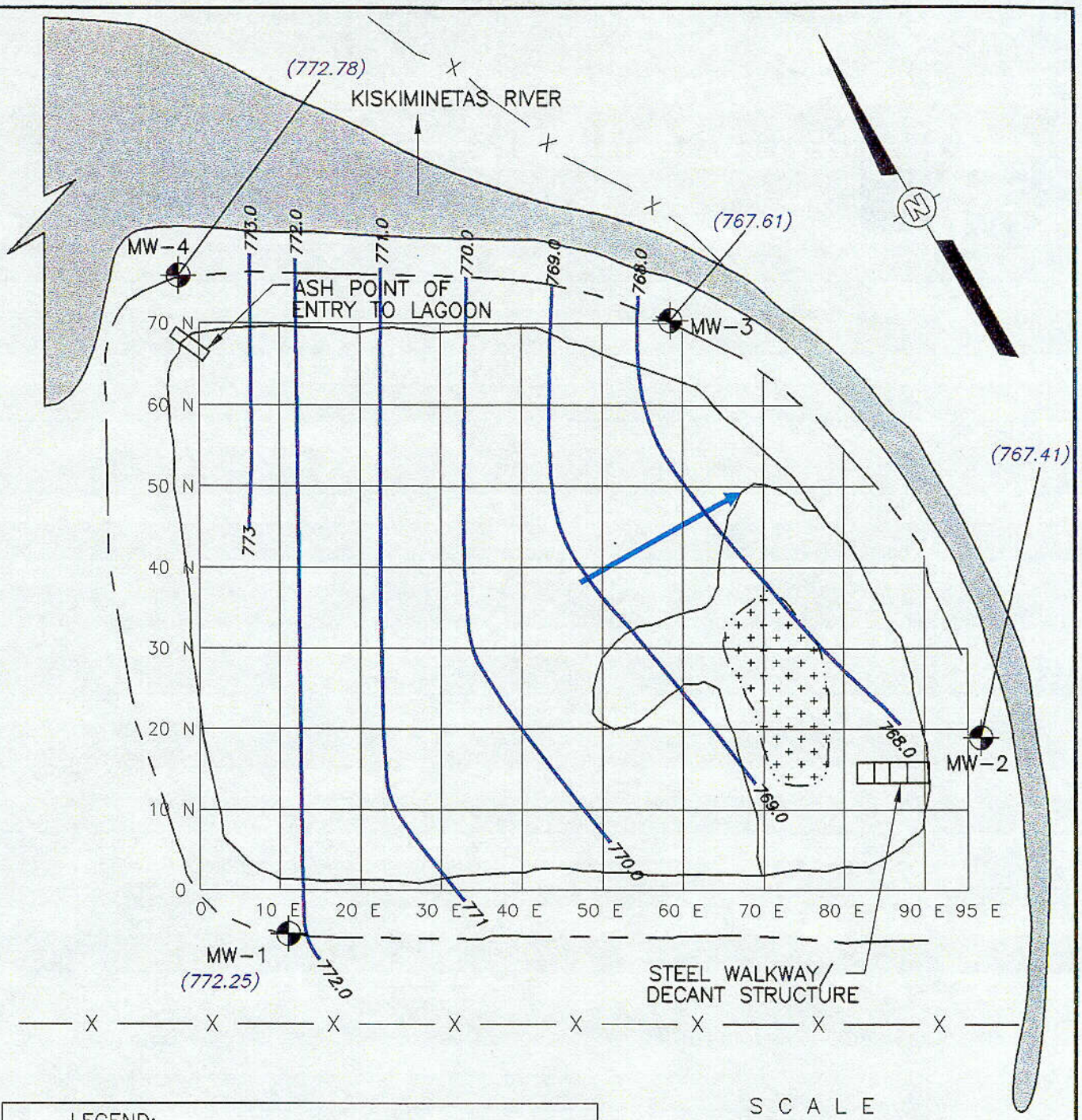
C05

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	R.A.M. 9/07/01	SS 12/18/02	JAS 1-18-02	829509-A5

Image: SCAN1
Xref: .

O:\Project\829509\829509A5.dwg
Plot Date/Time: 12/19/01 03:09pm
Plotted by: Daevans


STAFF GAUGE
MANHOLE
ADMINISTRATION BUILDING
KISKIMINETAS RIVER
N
TOP OF BERM
MW-4
MW-3
MW-2
MW-1
ASH LAGOON
BERM EL. 793.0
ROADWAY
20' EASEMENT
SCALE
0
100
200 FEET
LEGEND:
MW-1 MONITORING WELL LOCATION
MANHOLE
STAFF GAUGE
PERIMETER SOIL SAMPLE
SURFACE WATER SAMPLE
SEDIMENT SAMPLE
BOREHOLE
IT CORPORATION
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA
FIGURE 3-5
MISCELLANEOUS SAMPLING LOCATIONS
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA
REFERENCE:
CHESTER ENGINEERS DRAWING NO. 2735-472, SHEET 1 OF 1, DATED: 9/28/01, SCALE: 1"=100'.
OFFICE Pittsburgh, PA
DRAWN BY --
CHECKED BY
APPROVED BY
DRAWING NUMBER 829509-B3
O:\Project\829509\829509B3.dwg
Plot Date/Time: 12/19/01 11:18am
Plotted by: Daevans
Image: .
Xref: .



OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	R.A.M. 12/17/01	SS	JAS 1-18-02	829509-A7

LEGEND:

MW-1	MONITORING WELL
—— X ——	FENCE
	ASPHALT
	SEASONALLY WET AREA
— — —	BERM BOUNDARY
769.5	GROUNDWATER CONTOUR INTERVAL.

NOTE:

GRID SPACING IS 10 METERS x 10 METERS.

SCALE

0 15 30 METERS

SCALE

0 60 120 FEET

IT CORPORATION

KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY

FIGURE 3-6

GROUNDWATER CONTOUR MAP

OCTOBER 2001

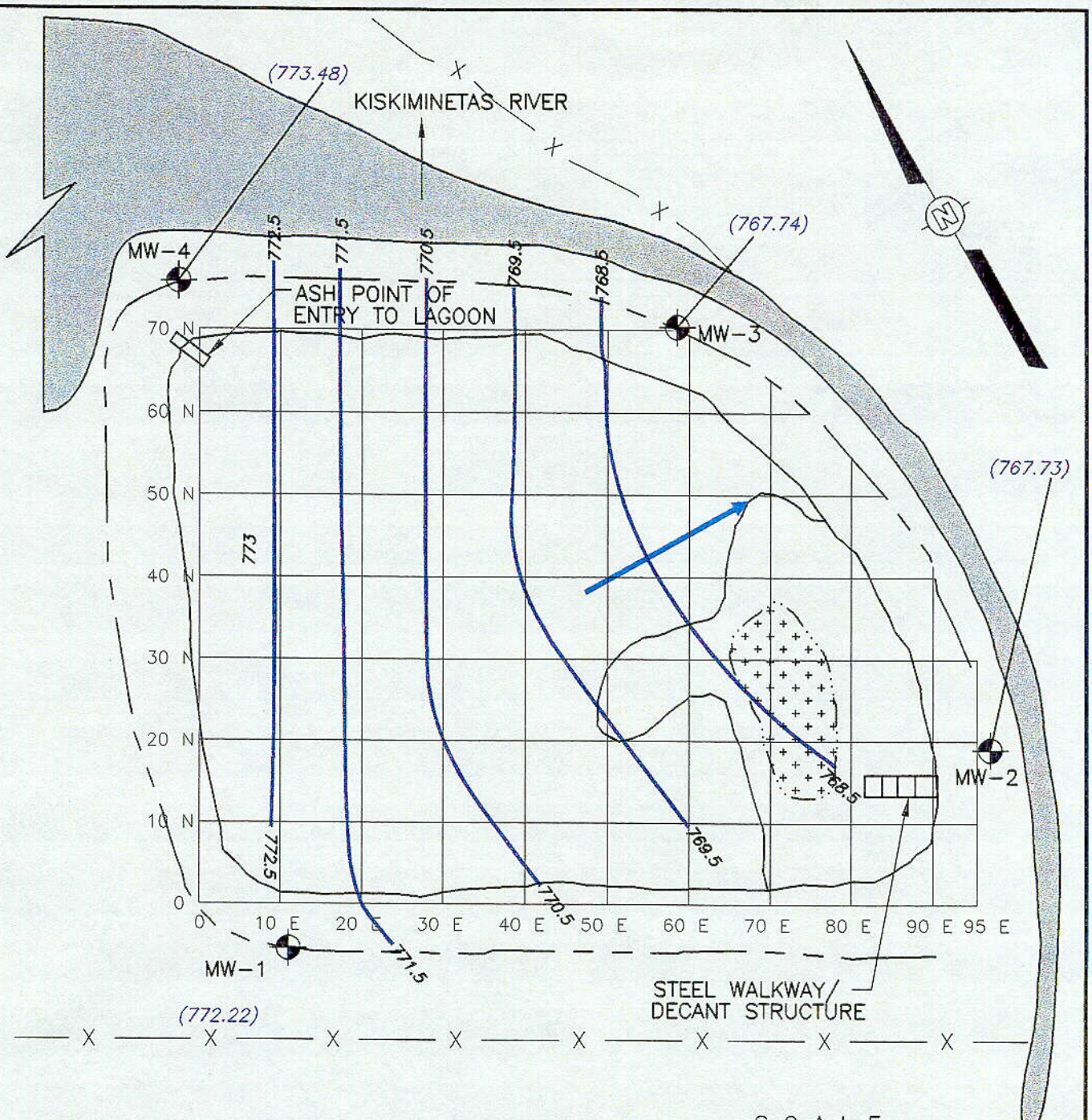
KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY

LEECHBURG, PENNSYLVANIA

COG

O:\Project\829509\829509A7.dwg
Plot Date/Time: 01/16/02 09:30am
Plotted by: rweible

Image: SCAN1
Xref: .



LEGEND:

MW-1	MONITORING WELL
— X —	FENCE
	ASPHALT
	SEASONALLY WET AREA
— — —	BERM BOUNDARY
769.5	GROUNDWATER CONTOUR INTERVAL.

NOTE:

GRID SPACING IS 10 METERS x 10 METERS.

SCALE

0 15 30 METERS

SCALE

0 60 120 FEET

IT CORPORATION

KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY

FIGURE 3-7

GROUNDWATER CONTOUR MAP
NOVEMBER 2001

KISKI VALLEY WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

C07

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	R.A.M. 12/17/01	SS 1/16/02	JDS 1-18-02	829509-A8

O:\Project\829509\829509A8.dwg
Plot Date/Time: 01/16/02 09:32am
Plotted by: rweible

Image: SCAN1
Xref: .

Figure 4-1
RESRAD Calculation of Annual Dose
Avg. Conc. of Total U at 78.6 pCi/g
All Nuclides Summed and All Pathyways Summed
KVWPCA Ash Lagoon
Leechburg, Pennsylvania

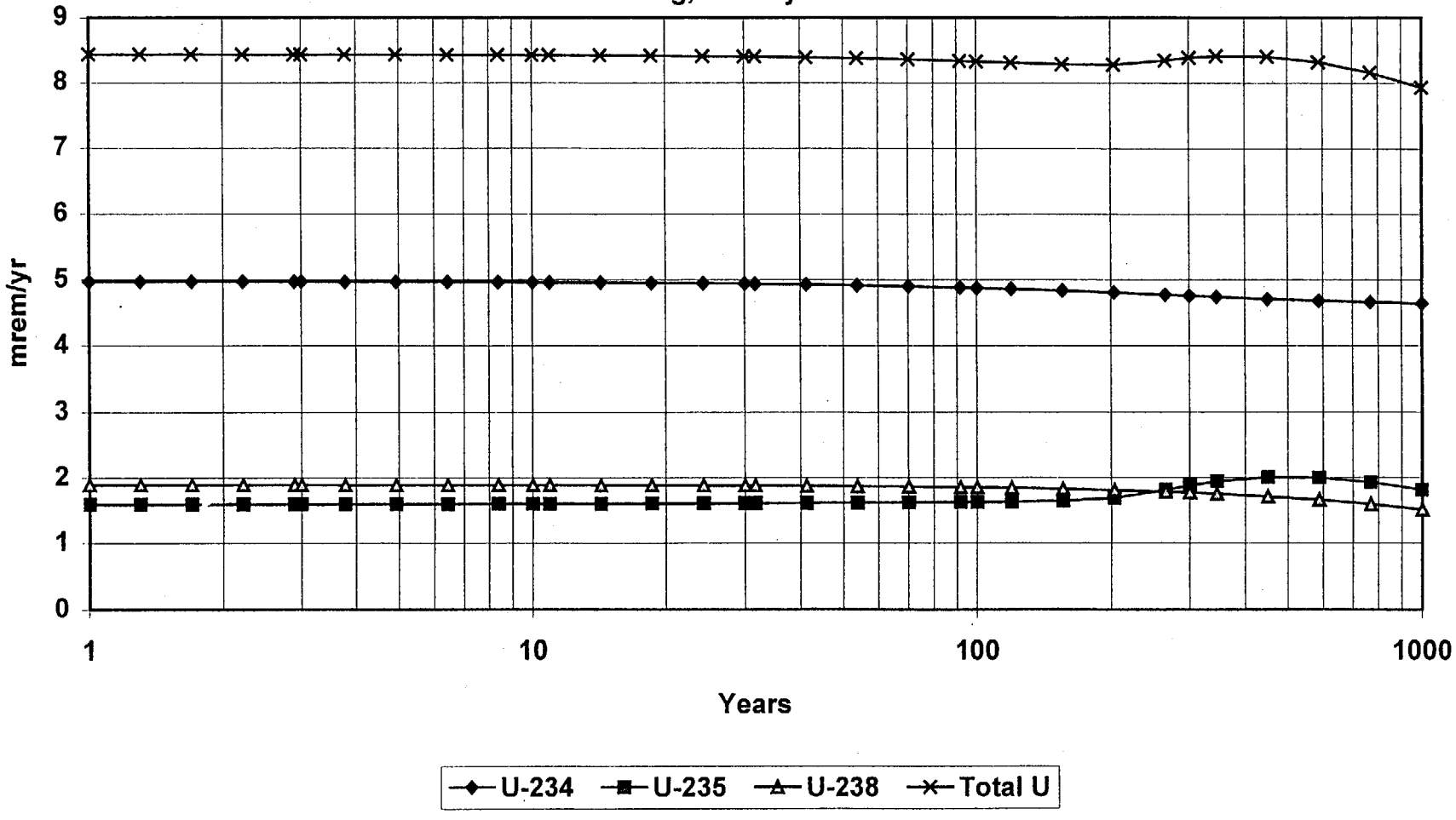
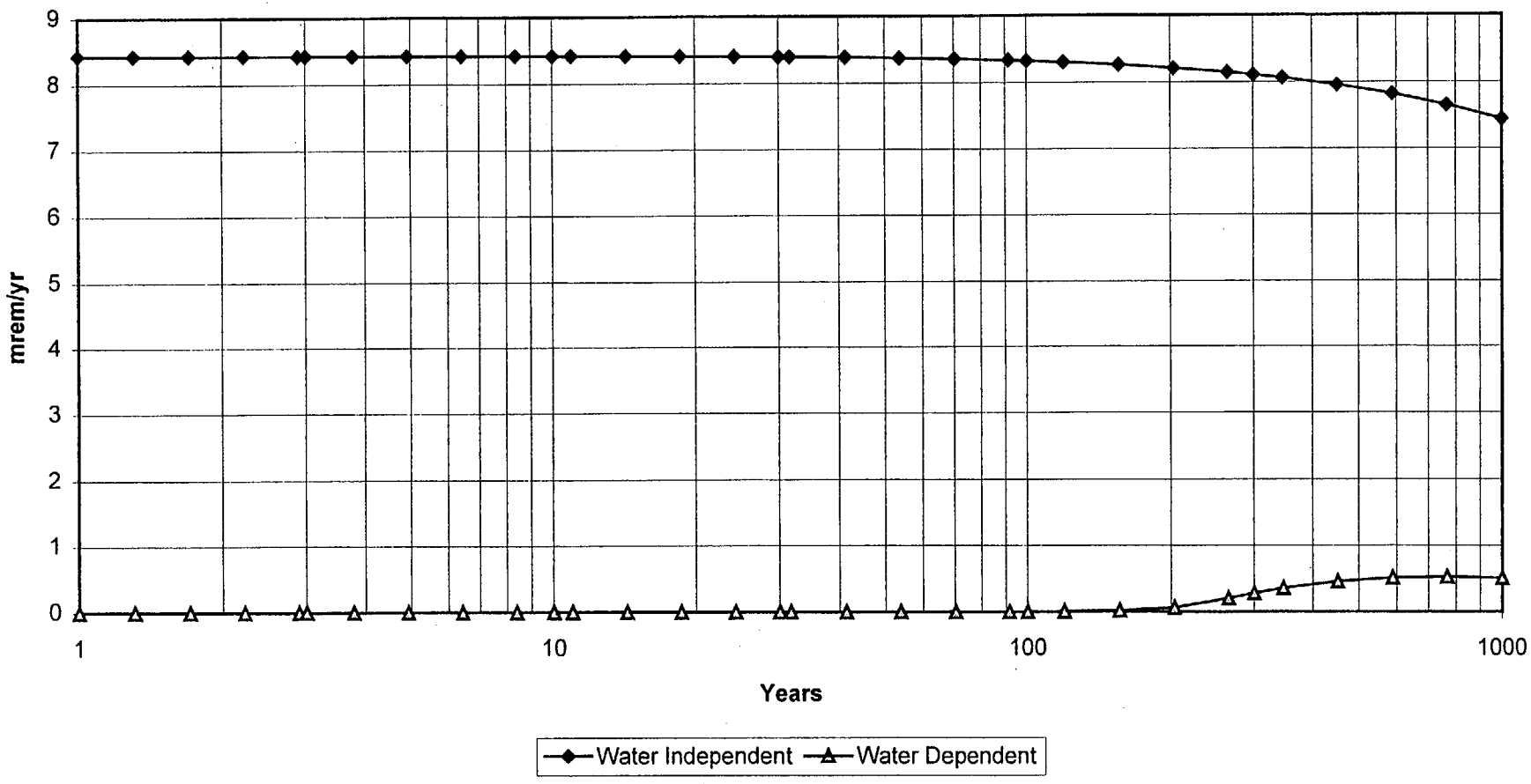


Figure 4-2
RESRAD Calculation of Annual Dosage from Water Dependent & Independent Pathways
Avg. Conc. of Total U at 78.6 pCi/g
All Nuclides Summed
KVWPCA Ash Lagoon
Leechburg, Pennsylvania



APPENDIX A

TEST BORING LOGS AND MONITORING WELL INSTALLATION DETAILS

The Chester Engineers

BORING LOG

Project	Job No.	Sheet No.	Hole No.
Kiski Valley Water Pollution Control Authority	2735-23	1 of 1	MW1U

Site	Coordinates	Angle from horizon	Bearing
Ash Lagoon Perimeter	---	---	---

Began	Completed	Driller	Drill make and model	Hole size	Overburden (ft.)	Rock (ft.)	Total depth (ft.)
5/5	5/6	GeoMechanics	CME-55	6"	---	---	28.5'

Core recovery (ft./%)	Core boxes	Samples	Elev. top of casing	Ground elev.	Depth/Elev. ground water	Depth/Elev. top of rock
---	---	5			20'	---

Sample hammer weight/Fall	Casing left in hole: Diameter/Length	Logged by:
140#/30"	Completed as monitoring well, MW1U.	Mary Washko

Sampler Type and Diameter	Sampler Advance/ Sample Recovery	Penetration blows 1st 6"	2nd 6"	3rd 6"	4th 6"	Elevation/ PID	Depth (ft.)	Sample	Description and Classification	Notes on: Water levels. Water return. Character of Drilling, etc.
SS/2"	18"/14"	8	6	6			5-6.5	1	Light-brown silty clay; organic fragments	Sample dry
SS/2"	18"/9"	3	3	2			10-11.5	2	Light-brown clay grading into greenish gray silty clay. Abundant organic fragments.	Sample moist
SS/2"	18"/4"	6	6	3			15-16.5	3	Yellow-brown sandy clay; coal fragments.	Sample wet.
SS/2"	18"/9"	7	10	20			20-21.5	4	Dark gray sand and gravel. Water at 20'.	Sample wet
SS/2"	18"/9"	11	8	8			25-26.5	5	Medium gray clay.	Sample moist
SS/2"	18"/10"	12	12	5			30-31.5		Medium gray clay; sample moist; sticky.	Sample moist.
									Boring completed as monitoring well, MW1U.	

SS = SPLIT SPOON; ST = SHELBY TUBE;
D = DENNISON; P = PITCHER; O = OTHER

Project: Kiski Valley Water Pollution Control Authority

Hole No. MW1U

The Chester Engineers

BORING LOG	Project: Kiski Valley Water Pollution Control Authority	Job No.: 2735-23	Sheet No.: 1 of 1	Hole No.: MW2

Site	Coordinates	Angle from horizon	Bearing
Ash Lagoon Perimeter	---	---	---

Began	Completed	Driller	Drill make and model	Hole size	Overburden (ft.)	Rock (ft.)	Total depth (ft.)
5/6	5/7	Geo-Mechanics	CME-55	6"	---	---	26'

Core recovery (ft./%)	Core boxes	Samples	Elev. top of casing	Ground elev.	Depth/Elev. ground water	Depth/Elev. top of rock
—	---	5	---		26'	---

Sample hammer weight/Fall	Casing left in hole: Diameter/Length	Logged by:
140#/30"	Completed as Monitoing Well 2	Mary Washko

Sampler Type and Diameter	Sampler Advance/ Sample Recovery	Penetration blows 1st 6"	2nd 6"	3rd 6"	4th 6"	Elevation/ PID	Depth (ft.)	Sample	Description and Classification	Notes on: Water levels, Water return, Character of Drilling, etc.
SS/2"	18"/14"	3	4	5			5-6.5	1	Medium-brown clay; dense organic fragments; thin sandy lenses	sample dry
SS/2"	18"/12"	5	9	11			10-11.5	2	Medium-brown clay; dense; organic fragments; some coal fragments	sample dry
SS/2"	18"/10"	7	5	5			15-16.5	3	Dark gray silty clay to clayey silt; organics	sample damp
SS/2"	18"/14"	7	4	3			20-21.5	4	Medium-brown clay; sandy lenses; large sandstone pebble in spoon	sample damp
SS/2"	6"/3"	10	50/1	—			25-26.5	5	Sand and gravel; clayey sand and gravel. Auger refusal at 27'.	water at 26'
									Completed as Monitoring Well MW2.	

SS = SPLIT SPOON; ST = SHELBY TUBE;
D = DENNISON; P = PITCHER; O = OTHER

Project: Kiski Valley Water Pollution Control Authority

Hole No.: MW2

The Chester Engineers

BORING LOG

Project	Job No.	Sheet No.	Hole No.
Kiski Valley Water Pollution Control Authority	2735-23	1 of 1	MW3

Site	Coordinates	Angle from horizon	Bearing
Ash Lagoon Perimeter	---	---	---

Began	Completed	Driller	Drill make and model	Hole size	Overburden (ft.)	Rock (ft.)	Total depth (ft.)
5/6	5/7	GeoMechanics	CME-55	6"	---	---	29'

Core recovery (ft./%)	Core boxes	Samples	Elev. top of casing	Ground elev.	Depth/Elev. ground water	Depth/Elev. top of rock
---	---	5			26'	---

Sample hammer weight/Fall	Casing left in hole: Diameter/Length	Logged by:
140#/30"	Completed as monitoring well, MW3.	Mary Washko

Sampler Type and Diameter	Sampler Advance/ Sample Recovery	Penetration blows 1st 6"	2nd 6"	3rd 6"	4th 6"	Elevation/ PID	Depth (ft.)	Sample	Description and Classification	Notes on: Water levels. Water return, Character of Drilling, etc.
SS/2"	18"/15"	6	6	7			5-6.5	1	Medium-brown silty clay; organic fragments	Sample dry
SS/2"	18"/10"	9	12	20			10-11.5	2	Sand and gravel; black organic layers; interbedded with medium-brown clay	Sample dry
SS/2"	18"/18"	3	3	4			15-16.5	3	Medium-brown silty clay; some gravel	Sample moist
SS/2"	18"/15"	9	12	12			20-21.5	4	Medium-brown sand and gravel	Sample moist
SS/2"	18"/18"	30	10	14			25-26.5	5	Medium-brown sand and gravel.	Water at 26'.
									Augered to 29'. Installed screen for for monitoring well at 29'.	

SS = SPLIT SPOON; ST = SHELBY TUBE;
D = DENNISON; P = PITCHER; O = OTHER

Project: Kiski Valley Water Pollution Control Authority

Hole No. MW3

The Chester Engineers

BORING LOG

Project	Job No.	Sheet No.	Hole No.
Kiski Valley Water Pollution Control Authority	2735-23	1 of 1	MW4

Site	Coordinates	Angle from horizon	Bearing
Ash Lagoon Perimeter	---	---	---

Began	Completed	Driller	Drill make and model	Hole size	Overburden (ft.)	Rock (ft.)	Total depth (ft.)
5/6	5/7	GeoMechanics	CME-55	6"	---	---	21'

Core recovery (ft./%)	Core boxes	Samples	Elev. top of casing	Ground elev.	Depth/Elev. ground water	Depth/Elev. top of rock
---	---	4			20'	---

Sample hammer weight/Fall	Casing left in hole: Diameter/Length	Logged by:
140#/30"	Completed as monitoring well, MW4.	Mary Washko

Sampler Type and Diameter	Sampler Advance/ Sample Recovery	Penetration blows 1st 6"	2nd 6"	3rd 6"	4th 6"	Elevation/ PID	Depth (ft.)	Sample	Description and Classification	Notes on: Water levels. Water return, Character of Drilling, etc.
SS/2"	18"/15"	7	4	6			5-6.5	1	Medium-brown silty clay; organic fragments	Sample dry
SS/2"	18"/15"	2	2	2			10-11.5	2	Medium-brown clayey silt; organic fragments	Sample moist
SS/2"	18"/9"	4	4	3			15-16.5	3	medium-brown sand grading into gray clay	Sample moist
SS/2"	18"/12"	7	10	13			20-21.5	4	Light gray sand and gravel.	Sample wet
									Completed as monitoring well MW4. Installed 10' screen at 21'.	

SS = SPLIT SPOON; ST = SHELBY TUBE;
D = DENNISON; P = PITCHER; O = OTHER

Project: Kiski Valley Water Pollution Control Authority

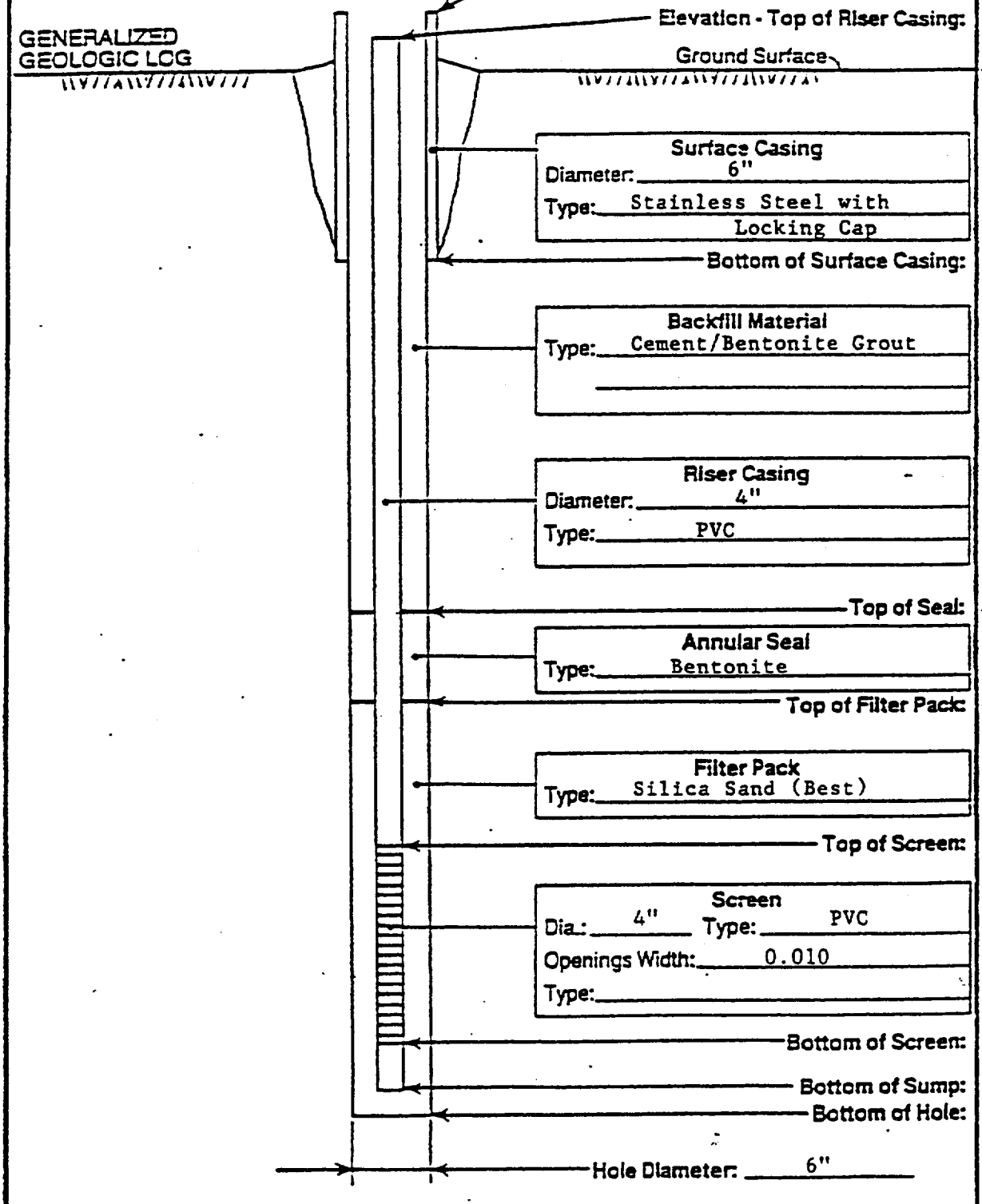
Hole No. MW4

Monitoring Well

PROJECT	WELL NO.
Kiski Valley Water Pollution Control Authority	MW1U

CHARGE NO.	SITE	COORDINATES
2735-23	Ash Lagoon	

BEGAN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
5/5/92	5/6/92	Mary Washko	Top of Casing Elevation



	DEPTH (ft)	ELEV. (MSL)
Elevation - Top of Surface Casing:	±2.5'	792.18
Elevation - Top of Riser Casing:	±2.0'	791.68
Ground Surface	0	789.68
Bottom of Surface Casing:	3.5	786.18
Top of Seal:	13.25	776.43
Top of Filter Pack:	15.25	774.43
Top of Screen:	17.25	772.43
Bottom of Screen:	27.25	762.43
Bottom of Sump:	28'	761.68
Bottom of Hole:	28'	761.68

REV. 9/87

The Chester Engineers

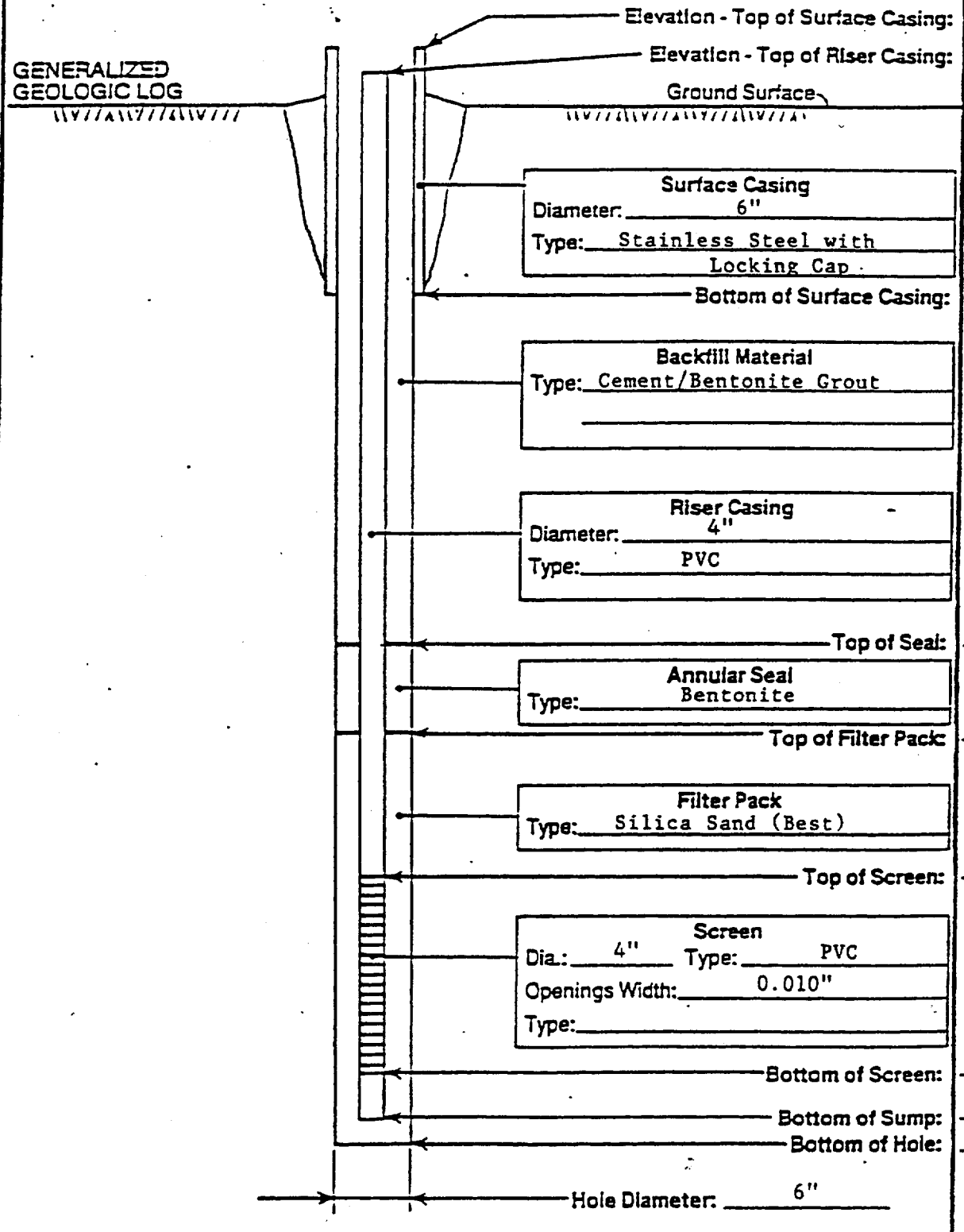
Monitoring Well

PROJECT	WELL NO.
Kiski Valley Water Pollution Control Authority	MW2

CHARGE NO.	SITE	COORDINATES
2735-23	Ash Lagoon	

BEGAN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
5/6/92	5/7/92	Mary Washko	Top of Casing Elevation

GENERALIZED GEOLOGIC LOG



	DEPTH (ft)	ELEV. (MSL)
Elevation - Top of Surface Casing:	2.5	795.48
Elevation - Top of Riser Casing:	2.0	794.98
Ground Surface	0	792.98
Bottom of Surface Casing:	3.5	789.48
Top of Seal:	13.55	779.43
Top of Filter Pack:	15.55	777.43
Top of Screen:	17.55	775.43
Bottom of Screen:	27.55	765.43
Bottom of Sump:	28.3	764.68
Bottom of Hole:	28.3	764.68

REV. 9/87

TheChesterEngineers

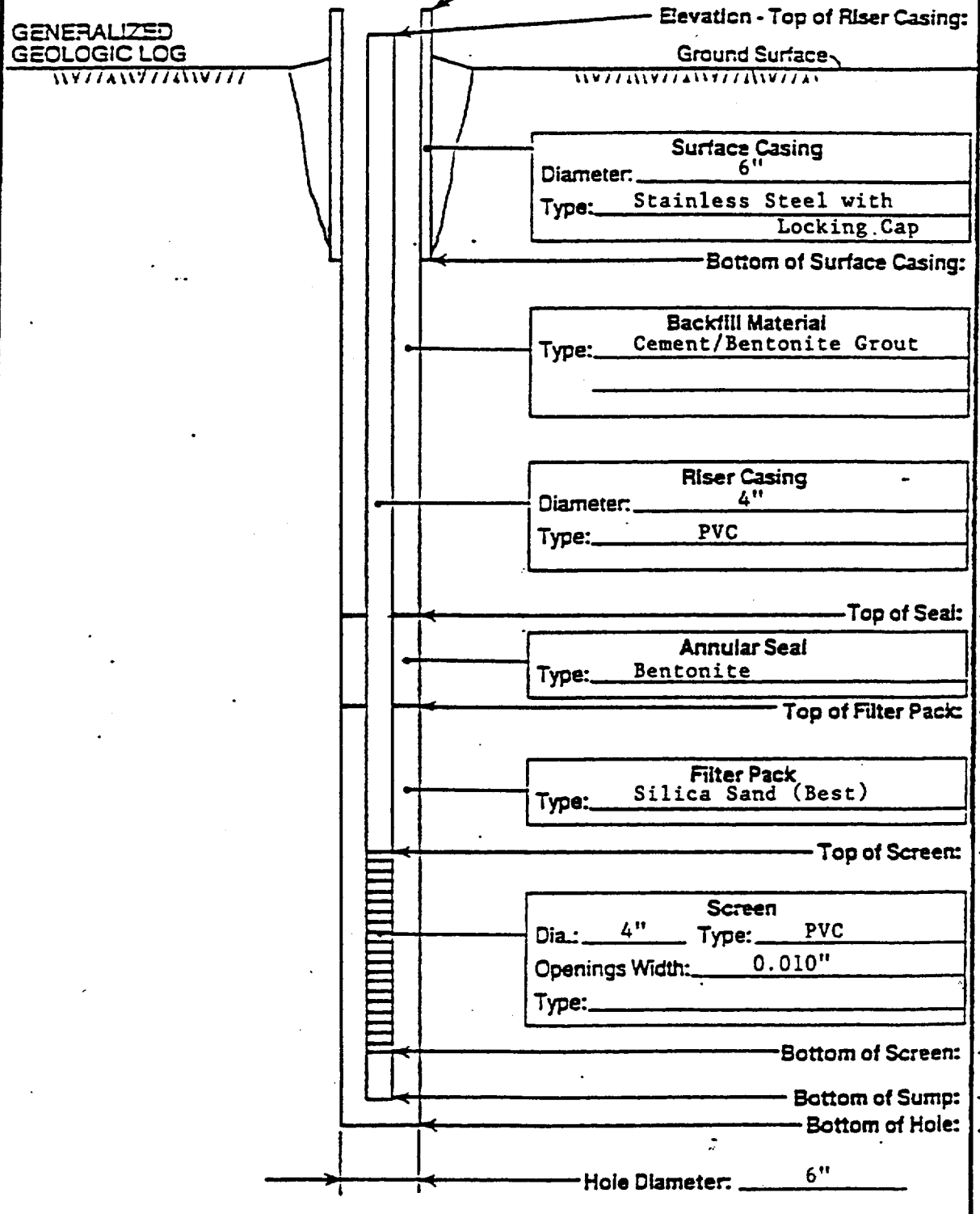
Monitoring Well

PROJECT	WELL NO.
Kiski Valley Water Pollution Control Authority	MW3

CHARGE NO.	SITE	COORDINATES
2735-23	Ash Lagoon	

BEGAN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
5/6/92	5/7/92	Mary Washko	Top of Casing Elevation

GENERALIZED GEOLOGIC LOG



	DEPTH (ft)	ELEV. (MSL)
Elevation - Top of Surface Casing:	2.5	789.96
Elevation - Top of Riser Casing:	2.0	789.46
Ground Surface	0	787.46
Bottom of Surface Casing:	3.5	783.96
Top of Seal:	15.95	771.51
Top of Filter Pack:	17.95	769.51
Top of Screen:	19.95	767.51
Bottom of Screen:	29.95	757.51
Bottom of Sump:	30.70	756.76
Bottom of Hole:	30.70	756.76

Surface Casing
Diameter: 6"
Type: Stainless Steel with Locking Cap

Backfill Material
Type: Cement/Bentonite Grout

Riser Casing
Diameter: 4"
Type: PVC

Annular Seal
Type: Bentonite

Filter Pack
Type: Silica Sand (Best)

Screen
Dia.: 4" Type: PVC
Openings Width: 0.010"
Type:

Hole Diameter: 6"

REV. 9/87

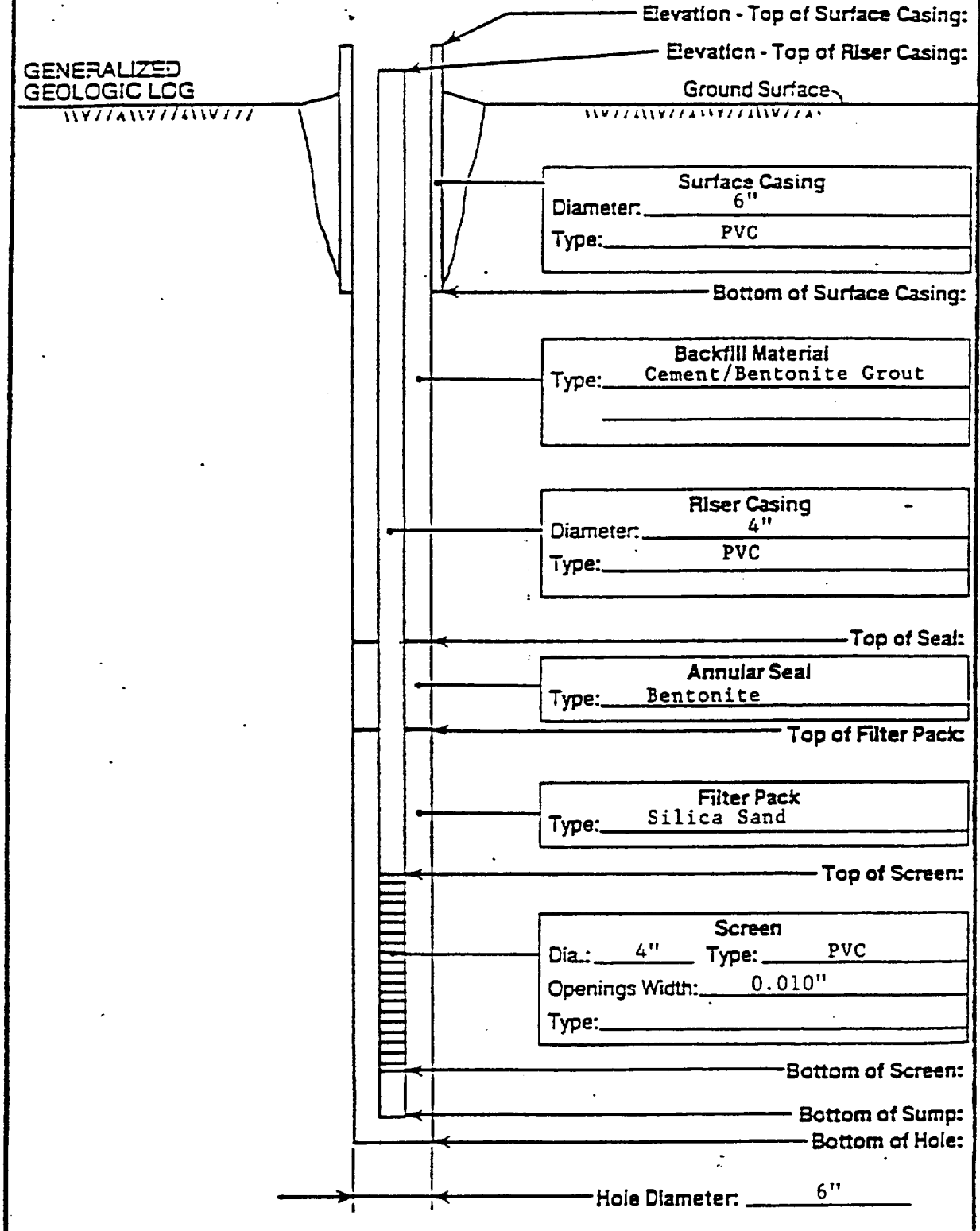
TheChesterEngineers

Monitoring Well

PROJECT	WELL NO.
Kiski Valley Water Pollution Control Authority	MW4

CHARGE NO.	SITE	COORDINATES
2735-23	Ash Lagoon	

BEGAN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
5/6/92	5/7/92	Mary Washko	Top of Casing Elevation



	DEPTH (ft)	ELEV. (MSL)
Elevation - Top of Surface Casing:	2.5	787.46
Elevation - Top of Riser Casing:	2.0	786.96
Ground Surface	0	784.96
Bottom of Surface Casing:	3.5	781.46
Top of Seal:	9.15	775.81
Top of Filter Pack:	11.15	773.81
Top of Screen:	13.15	771.81
Bottom of Screen:	23.15	761.81
Bottom of Sump:	23.9	761.06
Bottom of Hole:	23.9	761.06

APPENDIX B

TCLP ANALYTICAL RESULTS (CHESTER ENGINEERS 1991)

ChesterLab
A Division of
CHESTER LabNet
4990 Grand Avenue
Pittsburgh, PA 15225
Phone (412)-269-5708

Laboratory Analysis Report
For
KISKI VALLEY
WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Report Date: 10/11/91

ANALYSES

Source	S-1
Log Number 91-	11389
Date Collected	9/13/91
Time Collected	GRAB
Date Received	9/13/91
pH, UNITS	6.6
CORROSIVITY	NONCORROSIVE
REACTIVITY	NONREACTIVE
CYANIDE REACTIVITY, MG HCN/KG	<10
SULFIDE REACTIVITY, MG H2S/KG	<20
IGNITABILITY	NONIGNITABLE
FLASH POINT, DEG F	>200
TCLP VOLATILE EXTRACT	DONE
TCLP NONVOLATILE EXTRACT	DONE
ARSENIC, AS, PPM	4.2
BARIUM, BA, PPM	175
CADMIUM, CD, PPM	5.3
TOTAL CHROMIUM, CR, PPM	66
LEAD, PB, PPM	145
MERCURY, HG, PPM	0.23
NICKEL, NI, PPM	197
SELENIUM, SE, PPM	<1
SILVER, AG, PPM	4.5

273522

* Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
* "Less-than" (<) values are indicative of detection limit.

ChesterLab
A Division of
CHESTER LabNet
4990 Grand Avenue
Pittsburgh, PA 15225
Phone (412)-269-5708

Laboratory Analysis Report
For
KISKI VALLEY
WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Report Date: 10/11/91

ANALYSES

Source	TCLP VOLATILE EXTRACTION OF LOG #91-11389	TCLP NONVOLATILE EXTRACTION OF LOG #91-11389
Log Number 91-	11393	11397
Date Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Time Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Date Received	9/13/91	9/13/91
WEIGHT EXTRACTED, GRAMS	25	100
INITIAL FILTRATE, ML	0	0
EXTRACTION FLUID	#1	#1
EXTRACT pH, UNITS	5.2	5.2
ARSENIC, AS, MG/L	--	<0.03
BARIUM, BA, MG/L	--	0.34
CADMIUM, CD, MG/L	--	0.01
TOTAL CHROMIUM, CR, MG/L	--	<0.01
LEAD, PB, MG/L	--	0.05
MERCURY, HG, MG/L	--	<0.0002
NICKEL, NI, MG/L	--	1.9
SELENIUM, SE, MG/L	--	<0.04
SILVER, AG, MG/L	--	<0.01
BENZENE, UG/L	<5	--
CARBON TETRACHLORIDE, UG/L	<5	--
CHLOROBENZENE, UG/L	<5	--
CHLOROFORM, UG/L	<5	--
1,2-DICHLOROETHANE, UG/L	<5	--
1,1-DICHLOROETHYLENE, UG/L	<5	--
TETRACHLOROETHYLENE, UG/L	<5	--
TRICHLOROETHYLENE, UG/L	<5	--
VINYL CHLORIDE, UG/L	<5	--
METHYL ETHYL KETONE, UG/L	<5	--
PENTACHLOROPHENOL, UG/L	--	<10
2,4,6-TRICHLOROPHENOL, UG/L	--	<10

273522

* Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
* "Less-than" (<) values are indicative of detection limit.

Laboratory Analysis Report
For
KISKI VALLEY
WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Report Date: 10/11/91

ANALYSES
(Continued)

Source	TCLP VOLATILE EXTRACTION OF LOG #91-11389	TCLP NONVOLATILE EXTRACTION OF LOG #91-11389
Log Number 91-	11393	11397
Date Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Time Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Date Received	9/13/91	9/13/91
1,4-DICHLOROBENZENE, UG/L	--	<10
2,4-DINITROTOLUENE, UG/L	--	<10
HEXACHLOROBENZENE, UG/L	--	<10
HEXACHLOROBUTADIENE, UG/L	--	<10
HEXACHLOROETHANE, UG/L	--	<10
NITROBENZENE, UG/L	--	<10
m-CRESOL, UG/L	--	<10
o-CRESOL, UG/L	--	<10
p-CRESOL, UG/L	--	<10
PYRIDINE, UG/L	--	<10
2,4,5-TRICHLOROPHENOL, UG/L	--	<10

273522

* Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
* "Less-than" (<) values are indicative of detection limit.

ChesterLab
A Division of
CHESTER LabNet
4990 Grand Avenue
Pittsburgh, PA 15225
Phone (412)-269-5708

Laboratory Analysis Report
For
KISKI VALLEY
WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Report Date: 10/11/91

ANALYSES

Source	S-2
Log Number 91-	11390
Date Collected	9/13/91
Time Collected	GRAB
Date Received	9/13/91
pH, UNITS	5.4
CORROSIVITY	NONCORROSIVE
REACTIVITY	NONREACTIVE
CYANIDE REACTIVITY, MG HCN/KG	<10
SULFIDE REACTIVITY, MG H2S/KG	<20
IGNITABILITY	NONIGNITABLE
FLASH POINT, DEG F	>200
TCLP VOLATILE EXTRACT	DONE
TCLP NONVOLATILE EXTRACT	DONE
ARSENIC, AS, PPM	3.1
BARIUM, BA, PPM	647
CADMIUM, CD, PPM	2.7
TOTAL CHROMIUM, CR, PPM	718
LEAD, PB, PPM	145
MERCURY, HG, PPM	0.06
NICKEL, NI, PPM	460
SELENIUM, SE, PPM	<1
SILVER, AG, PPM	3.0

273522

* Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
* "Less-than" (<) values are indicative of detection limit.

ChesterLab
A Division of
CHESTER LabNet
4990 Grand Avenue
Pittsburgh, PA 15225
Phone (412)-269-5708

Laboratory Analysis Report
For
KISKI VALLEY
WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Report Date: 10/11/91

ANALYSES

Source	TCLP VOLATILE EXTRACTION OF LOG #91-11390	TCLP NONVOLATILE EXTRACTION OF LOG # 91-11390
Log Number 91-	11394	11398
Date Collected	XXXXXXXXXXXXX	XXXXXXXXXXXXX
Time Collected	XXXXXXXXXXXXX	XXXXXXXXXXXXX
Date Received	9/13/91	9/13/91
WEIGHT EXTRACTED, GRAMS	25	100
INITIAL FILTRATE, ML	0	0
EXTRACTION FLUID	#1	#1
EXTRACT pH, UNITS	5.1	5.0
ARSENIC, AS, MG/L	--	<0.03
BARIUM, BA, MG/L	--	0.17
CADMIUM, CD, MG/L	--	0.02
TOTAL CHROMIUM, CR, MG/L	--	<0.01
LEAD, PB, MG/L	--	0.25
MERCURY, HG, MG/L	--	<0.0002
NICKEL, NI, MG/L	--	1.0
SELENIUM, SE, MG/L	--	<0.04
SILVER, AG, MG/L	--	<0.01
BENZENE, UG/L	<5	--
CARBON TETRACHLORIDE, UG/L	<5	--
CHLOROBENZENE, UG/L	<5	--
CHLOROFORM, UG/L	<5	--
1,2-DICHLOROETHANE, UG/L	<5	--
1,1-DICHLOROETHYLENE, UG/L	<5	--
TETRACHLOROETHYLENE, UG/L	<5	--
TRICHLOROETHYLENE, UG/L	<5	--
VINYL CHLORIDE, UG/L	<5	--
METHYL ETHYL KETONE, UG/L	<5	--
PENTACHLOROPHENOL, UG/L	--	<10
2,4,6-TRICHLOROPHENOL, UG/L	--	<10

273522

* Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
* "Less-than" (<) values are indicative of detection limit.

Laboratory Analysis Report
For
KISKI VALLEY
WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Report Date: 10/11/91

ANALYSES
(Continued)

Source	TCLP VOLATILE EXTRACTION OF LOG #91-11390	TCLP NONVOLATILE EXTRACTION OF LOG # 91-11390
Log Number 91-	11394	11398
Date Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Time Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Date Received	9/13/91	9/13/91
1,4-DICHLOROBENZENE, UG/L	--	<10
2,4-DINITROTOLUENE, UG/L	--	<10
HEXACHLOROBENZENE, UG/L	--	<10
HEXACHLOROBUTADIENE, UG/L	--	<10
HEXACHLOROETHANE, UG/L	--	<10
NITROBENZENE, UG/L	--	<10
m-CRESOL, UG/L	--	<10
o-CRESOL, UG/L	--	<10
p-CRESOL, UG/L	--	<10
PYRIDINE, UG/L	--	<10
2,4,5-TRICHLOROPHENOL, UG/L	--	<10

273522

* Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
* "Less-than" (<) values are indicative of detection limit.

ChesterLab
A Division of
CHESTER LabNet
4990 Grand Avenue
Pittsburgh, PA 15225
Phone (412)-269-5708

Laboratory Analysis Report
For
KISKI VALLEY
WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Report Date: 10/11/91

ANALYSES

Source	S-3
Log Number 91-	11391
Date Collected	9/13/91
Time Collected	GRAB
Date Received	9/13/91
pH, UNITS	4.9
CORROSIVITY	NONCORROSIVE
REACTIVITY	NONREACTIVE
CYANIDE REACTIVITY, MG HCN/KG	<10
SULFIDE REACTIVITY, MG H2S/KG	<20
IGNITABILITY	NONIGNITABLE
FLASH POINT, DEG F	>200
TCLP VOLATILE EXTRACT	DONE
TCLP NONVOLATILE EXTRACT	DONE
ARSENIC, AS, PPM	4.5
BARIUM, BA, PPM	635
CADMIUM, CD, PPM	3.6
TOTAL CHROMIUM, CR, PPM	1,700
LEAD, PB, PPM	150
MERCURY, HG, PPM	0.06
NICKEL, NI, PPM	666
SELENIUM, SE, PPM	<1
SILVER, AG, PPM	<0.5

273522

* Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
* "Less-than" (<) values are indicative of detection limit.

ChesterLab
A Division of
CHESTER LabNet
4990 Grand Avenue
Pittsburgh, PA 15225
Phone (412)-269-5708

Laboratory Analysis Report
For
KISKI VALLEY
WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Report Date: 10/11/91

ANALYSES

Source	TCLP VOLATILE EXTRACTION OF LOG #91-11391	TCLP NONVOLATILE EXTRACTION OF LOG #91-11391
Log Number 91-	11395	11399
Date Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Time Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Date Received	9/13/91	9/13/91
WEIGHT EXTRACTED, GRAMS	25	100
INITIAL FILTRATE, ML	0	0
EXTRACTION FLUID	#1	#1
EXTRACT pH, UNITS	5.0	5.0
ARSENIC, AS, MG/L	--	<0.03
BARIUM, BA, MG/L	--	0.12
CADMIUM, CD, MG/L	--	0.01
TOTAL CHROMIUM, CR, MG/L	--	<0.01
LEAD, PB, MG/L	--	0.07
MERCURY, HG, MG/L	--	<0.0002
NICKEL, NI, MG/L	--	1.3
SELENIUM, SE, MG/L	--	<0.04
SILVER, AG, MG/L	--	<0.01
BENZENE, UG/L	<5	--
CARBON TETRACHLORIDE, UG/L	<5	--
CHLOROBENZENE, UG/L	<5	--
CHLOROFORM, UG/L	<5	--
1,2-DICHLOROETHANE, UG/L	<5	--
1,1-DICHLOROETHYLENE, UG/L	<5	--
TETRACHLOROETHYLENE, UG/L	<5	--
TRICHLOROETHYLENE, UG/L	<5	--
VINYL CHLORIDE, UG/L	<5	--
METHYL ETHYL KETONE, UG/L	<5	--
PENTACHLOROPHENOL, UG/L	--	<10
2,4,6-TRICHLOROPHENOL, UG/L	--	<10

273522

* Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
* "Less-than" (<) values are indicative of detection limit.

Laboratory Analysis Report
For
KISKI VALLEY
WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Report Date: 10/11/91

ANALYSES
(Continued)

Source	TCLP VOLATILE EXTRACTION OF LOG #91-11391	TCLP NONVOLATILE EXTRACTION OF LOG #91-11391
Log Number 91-	11395	11399
Date Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Time Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Date Received	9/13/91	9/13/91
1,4-DICHLOROBENZENE, UG/L	--	<10
2,4-DINITROTOLUENE, UG/L	--	<10
HEXACHLOROBENZENE, UG/L	--	<10
HEXACHLOROBUTADIENE, UG/L	--	<10
HEXACHLOROETHANE, UG/L	--	<10
NITROBENZENE, UG/L	--	<10
m-CRESOL, UG/L	--	<10
o-CRESOL, UG/L	--	<10
p-CRESOL, UG/L	--	<10
PYRIDINE, UG/L	--	<10
2,4,5-TRICHLOROPHENOL, UG/L	--	<10

273522

* Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
* "Less-than" (<) values are indicative of detection limit.

ChesterLab
A Division of
CHESTER LabNet
4990 Grand Avenue
Pittsburgh, PA 15225
Phone (412)-269-5708

Laboratory Analysis Report
For
KISKI VALLEY
WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Report Date: 10/11/91

ANALYSES

Source	S-4
Log Number 91-	11392
Date Collected	9/13/91
Time Collected	GRAB
Date Received	9/13/91
pH, UNITS	5.2
CORROSIVITY	NONCORROSIVE
REACTIVITY	NONREACTIVE
CYANIDE REACTIVITY, MG HCN/KG	<10
SULFIDE REACTIVITY, MG H2S/KG	<20
IGNITABILITY	NONIGNITABLE
FLASH POINT, DEG F	>200
TCLP VOLATILE EXTRACT	DONE
TCLP NONVOLATILE EXTRACT	DONE
ARSENIC, AS, PPM	6.7
BARIUM, BA, PPM	730
CADMIUM, CD, PPM	2.9
TOTAL CHROMIUM, CR, PPM	2,780
LEAD, PB, PPM	185
MERCURY, HG, PPM	0.05
NICKEL, NI, PPM	1,150
SELENIUM, SE, PPM	<1
SILVER, AG, PPM	<0.5

273522

* Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
* "Less-than" (<) values are indicative of detection limit.

ChesterLab
A Division of
CHESTER LabNet
4990 Grand Avenue
Pittsburgh, PA 15225
Phone (412)-269-5708

Laboratory Analysis Report
For
KISKI VALLEY
WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Report Date: 10/11/91

ANALYSES

Source	TCLP VOLATILE EXTRACTION OF LOG #91-11392	TCLP NONVOLATILE EXTRACTION OF LOG #91-11392
Log Number 91-	11396	11400
Date Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Time Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Date Received	9/13/91	9/13/91
WEIGHT EXTRACTED, GRAMS	25	100
INITIAL FILTRATE, ML	0	0
EXTRACTION FLUID	#1	#1
EXTRACT pH, UNITS	5.1	5.0
ARSENIC, AS, MG/L	--	<0.03
BARIUM, BA, MG/L	--	0.16
CADMIUM, CD, MG/L	--	0.01
TOTAL CHROMIUM, CR, MG/L	--	0.01
LEAD, PB, MG/L	--	0.05
MERCURY, HG, MG/L	--	<0.0002
NICKEL, NI, MG/L	--	1.3
SELENIUM, SE, MG/L	--	<0.04
SILVER, AG, MG/L	--	<0.01
BENZENE, UG/L	<5	--
CARBON TETRACHLORIDE, UG/L	<5	--
CHLOROBENZENE, UG/L	<5	--
CHLOROFORM, UG/L	<5	--
1,2-DICHLOROETHANE, UG/L	<5	--
1,1-DICHLOROETHYLENE, UG/L	<5	--
TETRACHLOROETHYLENE, UG/L	<5	--
TRICHLOROETHYLENE, UG/L	<5	--
VINYL CHLORIDE, UG/L	<5	--
METHYL ETHYL KETONE, UG/L	<5	--
PENTACHLOROPHENOL, UG/L	--	<10
2,4,6-TRICHLOROPHENOL, UG/L	--	<10

273522

* Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
* "Less-than" (<) values are indicative of detection limit.

Laboratory Analysis Report
For
KISKI VALLEY
WATER POLLUTION CONTROL AUTHORITY
LEECHBURG, PENNSYLVANIA

Report Date: 10/11/91

ANALYSES
(Continued)

Source	TCLP VOLATILE EXTRACTION OF LOG #91-11392	TCLP NONVOLATILE EXTRACTION OF LOG #91-11392
Log Number 91-	11396	11400
Date Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Time Collected	XXXXXXXXXXXXXX	XXXXXXXXXXXXXX
Date Received	9/13/91	9/13/91
1,4-DICHLOROBENZENE, UG/L	--	<10
2,4-DINITROTOLUENE, UG/L	--	<10
HEXACHLOROBENZENE, UG/L	--	<10
HEXACHLOROBUTADIENE, UG/L	--	<10
HEXACHLOROETHANE, UG/L	--	<10
NITROBENZENE, UG/L	--	<10
m-CRESOL, UG/L	--	<10
o-CRESOL, UG/L	--	<10
p-CRESOL, UG/L	--	<10
PYRIDINE, UG/L	--	<10
2,4,5-TRICHLOROPHENOL, UG/L	--	<10

273522

* Unless otherwise noted, analyses are in accordance with the methods and procedures outlined and approved by the Environmental Protection Agency and conform to quality assurance protocol.
* "Less-than" (<) values are indicative of detection limit.

APPENDIX C

GROUNDWATER ANALYTICAL RESULTS (IT CORPORATION 2001)

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

BWXT Services, Inc. - NEL Services · 2016 Mt. Athos Rd. · Lynchburg, VA 24504-5447 · (434) 522-5165 · Fax (434) 522-6860

Report Date:	November 6, 2001	**Report #:**	0110047	**NELS Contract #:**	1194-002-2819
Customer:	IT Corp.	**Customer Contact:**	Joe Scalamogna	**Customer Authorization #:**	
Project Description:	KVWPCA Water Samples	**Sample Description:**		See attached COC/Analysis Request	
Sample Receipt Date:	October 12, 2001	**Sample Collection/Reference Date:**		See attached COC/Analysis Request	
Chain of Custody #:	566906	**Total pages in this report:**		3 **including** 1 **page(s) of attachments**	

Comments: Sample seals were present and intact but were not tamper proof. SW846-9310 and EPA 900 are equivalent methods. Samples were preserved with HNO_3 upon receipt.

Customer Sample ID	NELS Sample ID	Analysis Method	Analyte	Result	2 Sigma Uncertainty	MDA	Units [1]	Preparation Date	Analysis Date	Comments
Sample 1	0110047-01	SW846 9310	Gross Alpha	MDA	NA	0.46	pCi/L	10/18/2001	10/24/2001	
Sample 1	0110047-01	SW846 9310	Gross Beta	MDA	NA	1.82	pCi/L	10/18/2001	10/22/2001	
Sample 1	0110047-01	Alpha Spec	U-234	MDA	NA	0.15	pCi/L	10/22/2001	10/25/2001	
Sample 1	0110047-01	Alpha Spec	U-235	MDA	NA	0.12	pCi/L	10/22/2001	10/25/2001	
Sample 1	0110047-01	Alpha Spec	U-238	MDA	NA	0.10	pCi/L	10/22/2001	10/25/2001	
Sample 1	0110047-01	Alpha Spec	Total Uranium	MDA	NA	0.22	pCi/L	10/22/2001	10/25/2001	
Sample 2	0110047-02	SW846 9310	Gross Alpha	MDA	NA	0.60	pCi/L	10/18/2001	10/24/2001	
Sample 2	0110047-02	SW846 9310	Gross Beta	MDA	NA	2.20	pCi/L	10/18/2001	10/22/2001	
Sample 2	0110047-02	Alpha Spec	U-234	MDA	NA	0.10	pCi/L	10/22/2001	10/25/2001	
Sample 2	0110047-02	Alpha Spec	U-235	MDA	NA	0.09	pCi/L	10/22/2001	10/25/2001	
Sample 2	0110047-02	Alpha Spec	U-238	MDA	NA	0.10	pCi/L	10/22/2001	10/25/2001	
Sample 2	0110047-02	Alpha Spec	Total Uranium	MDA	NA	0.15	pCi/L	10/22/2001	10/25/2001	
Sample 3	0110047-03	SW846 9310	Gross Alpha	MDA	NA	0.92	pCi/L	10/18/2001	10/24/2001	
Sample 3	0110047-03	SW846 9310	Gross Beta	MDA	NA	2.04	pCi/L	10/18/2001	10/22/2001	
Sample 3	0110047-03	Alpha Spec	U-234	MDA	NA	0.09	pCi/L	10/22/2001	10/25/2001	
Sample 3	0110047-03	Alpha Spec	U-235	MDA	NA	0.09	pCi/L	10/22/2001	10/25/2001	
Sample 3	0110047-03	Alpha Spec	U-238	MDA	NA	0.09	pCi/L	10/22/2001	10/25/2001	
Sample 3	0110047-03	Alpha Spec	Total Uranium	MDA	NA	0.14	pCi/L	10/22/2001	10/25/2001	

[1] All results are reported "as received" unless otherwise specified: (d) = dry weight, (w) = wet weight

BWXT Services, Inc. - NEL Services · 2016 Mt. Athos Rd. · Lynchburg, VA 24504-5447 · (434) 522-5165 · Fax (434) 522-6860

Customer Sample ID	NELS Sample ID	Analysis Method	Analyte	Result	2 Sigma Uncertainty	MDA	Units [1]	Preparation Date	Analysis Date	Comments
Sample 4	0110047-04	SW846 9310	Gross Alpha	MDA	NA	0.73	pCi/L	10/18/2001	10/24/2001	
Sample 4	0110047-04	SW846 9310	Gross Beta	MDA	NA	1.89	pCi/L	10/18/2001	10/23/2001	
Sample 4	0110047-04	Alpha Spec	U-234	MDA	NA	0.09	pCi/L	10/22/2001	10/25/2001	
Sample 4	0110047-04	Alpha Spec	U-235	MDA	NA	0.10	pCi/L	10/22/2001	10/25/2001	
Sample 4	0110047-04	Alpha Spec	U-238	MDA	NA	0.10	pCi/L	10/22/2001	10/25/2001	
Sample 4	0110047-04	Alpha Spec	Total Uranium	MDA	NA	0.15	pCi/L	10/22/2001	10/25/2001	
Sample 5	0110047-05	SW846 9310	Gross Alpha	MDA	NA	0.71	pCi/L	10/18/2001	10/24/2001	
Sample 5	0110047-05	SW846 9310	Gross Beta	MDA	NA	1.78	pCi/L	10/18/2001	10/23/2001	
Sample 5	0110047-05	Alpha Spec	U-234	MDA	NA	0.10	pCi/L	10/22/2001	10/25/2001	
Sample 5	0110047-05	Alpha Spec	U-235	MDA	NA	0.10	pCi/L	10/22/2001	10/25/2001	
Sample 5	0110047-05	Alpha Spec	U-238	MDA	NA	0.10	pCi/L	10/22/2001	10/25/2001	
Sample 5	0110047-05	Alpha Spec	Total Uranium	MDA	NA	0.16	pCi/L	10/22/2001	10/25/2001	

Data Released By: _____ **Date:** 11/6/2001

Name /Title: Ken Vara / Project Manager

Unless noted as a comment, this report meets all requirements of NELAC

[1] All results are reported "as received" unless otherwise specified: (d) = dry weight, (w) = wet weight

BWXT Services, Inc. - NEL Services · 2016 Mt. Athos Rd. · Lynchburg, VA 24504-5447 · (434) 522-5165 · Fax (434) 522-6860

the igroup

0110047 **ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD***

Reference Document No. 566906
Page 1 of 1

Project Name/No.[1] KWPCA
Sample Team Members[2] S Seger / J Scalamogna
Profit Center No.[3]
Project Manager[4] Gary Galliot
Purchase Order No.[6]
Required Report Date[11]

Samples Shipment Date[7] 10/19/01
Lab Destination[8] BWXT
Lab Contact[9] KEN Yara
Project Contact/Phone[12] Joe Scalamogna
Carrier/Waybill No.[13] ~~FED~~ EX

Bill to:[5] IT Corp
2790 MOSSIDE BLVD
Monroeville, PA

Report to:[10] Joe Scalamogna
IT Corp
2790 MOSSIDE BLVD
Monroeville PA 15146

ONE CONTAINER PER LINE

Sample Number[14]	Sample Description/Type[15]	Date/Time Collected[16]	Container Type[17]	Sample Volume[18]	Pre-servative[19]	Requested Testing Program[20]	Condition on Receipt[21]	Disposal Record No.[22]
SAMPLE 1	Water	10/9/01 11:25	poly	2L	HNO3 pH<2	(900) GROSS ALPHA GROSS BETA (900) Total Uranium (908) Isotopic Uranium (908)		
SAMPLE 2		11:50					FOR LAB USE ONLY	
SAMPLE 3		14:30						
SAMPLE 4		14:40						
SAMPLE 5		15:20					FOR LAB USE ONLY	
~~SAMPLE 6~~	VOIA							

Special Instructions:[23] REFER TO NEL-1-2819 REVISION 1

Possible Hazard Identification:[24] Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☒

Sample Disposal:[25] Return to Client ☐ Disposal by Lab ☒ Archive _____ (mos.)

Turnaround Time Required:[26] Normal ☒ Rush ☐

QC Level:[27] I. ☐ II. ☐ III. ☒ Project Specific (specify): LEVEL III

1. Relinquished by[28] (Signature/Affiliation) Susan Seger	Date: 10/10/01 Time: 9:15 am	1. Received by[28] (Signature/Affiliation) [illegible]	Date: 10-12-01 Time: 1030
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments:[29] FIELD FILTERED

MCA 3/15/91

White: To accompany samples
Yellow: Field copy
*See back of form for special instructions.

(1) All results are reported "as received" unless otherwise specified: (d) = dry weight, (w) = wet weight

APPENDIX D

GMS 3-DIMENSIONAL SCATTER MODULE REPRESENTATION OF ASH LAGOON

The three-dimensional distribution of radioactivity of Uranium in Kiski Ash Lagoon was mapped using geostatistical capabilities provided by computer software package GMS. The Groundwater Modeling System (GMS) is a comprehensive package which provides tools for every phase of a groundwater simulation including site characterization, model development, postprocessing, calibration, and visualization. The GMS 3D Scatter Point Module is a tool to interpolate from groups of 3D scatter points to any of the other data types (meshes, grids). The following interpolation schemes are supported.

- *Inverse Distance Weighted (IDW)* - Includes constant, gradient hyperplane, and quadratic nodal functions. Several subset search options.
- *Natural Neighbor* - Technique based on natural neighbors computed from Thiessen polyhedral. Works well with clustered data.
- *Kriging* - Ordinary and universal kriging routines from the GSLIB software package. Graphical variogram editing. Anisotropy.
- *Log Interpolation*

Three-dimensional interpolation is useful for setting up input data for analysis codes. Three-dimensional interpolation can be used to generate a data set to be used for initial conditions such as groundwater heads and chemical concentrations from a limited set of measured scatter points. Three-dimensional interpolation is also useful for site characterization.

A total of 291 sampling data points were used in the calculations. These data points were obtained from soil sampling scattered over the lagoon area at different depths. The volume of ashes were divided into 35x45x12 uniform blocks. The dimension of the blocks are 2 meter long, 2 meter wide and 0.2 meter thick. Radioactivity of Uranium within each block was assumed to be constant, and was calculated through interpolation from measured scattering data points. Kriging method was used to for interpolation calculations. Some blocks next to the lagoon dikes were eliminated from the ash domain to implement lagoon's 3:1 slope. There are total of 11273 active blocks represent the entire ash domain, and average radioactivity values were calculated from these active blocks for Uranium and its isotopes (attached tables). The attached color coded contours represent the distributions of radioactivity of total Uranium in plane and cross section views.

The calculated average radioactivity

chmical	volume	average concentration
	(m3)	(pCi/g)
U-235	9018.4	3.236187163
U-238	9018.4	12.63874124
U-total	9018.4	78.67514769

Input data - scattering data points.

id	x	y	z	Total_Uranium	U-238	U-235
1	0	0	2.3634	2.6	0.59	0.09
2	0	20	2.3634	5.37	2.13	0.14
3	0	50	2.3634	6.54	1.68	0.21
4	0	60	2.3634	10.52	0.99	0.41
5	0	70	2.3634	4.96	1.74	0.14
6	5	25	1.3884	53.8	3.2	2.2
7	5	25	1.6884	20.7	2.3	0.8
8	5	25	2.2884	29.7	2.1	1.2
9	5	35	0.7884	217	24.3	6.4
10	5	35	0.8384	74.44	14	2.63
11	5	35	1.3634	576.2	94.81	20.93
12	5	35	1.3884	251.3	32.8	9.5
13	5	35	2.2884	18.2	2.1	0.7
14	5	35	2.3634	8.63	3.18	0.24
15	5	45	0.7384	24.49	3.99	0.89
16	5	45	0.7884	306.6	32.9	11.9
17	5	45	1.2134	922.85	144.3	33.85
18	5	45	1.3634	311.83	53.31	11.24
19	5	45	1.3884	61.4	6.2	2.4
20	5	45	2.2884	20	1.6	0.8
21	5	45	2.3634	22.3	3.65	0.81
22	5	55	0.4134	69.45	14.13	2.41
23	5	55	1.3634	344.39	59.19	12.4
24	5	55	2.3634	23.59	2.94	0.9
25	5	65	0.9634	243.59	38.64	8.91
26	5	65	1.3634	30.96	7.18	1.03
27	5	65	2.3634	9.53	3.24	0.27
28	10	10	0.1884	12.8	1.3	0.5
29	10	10	1.3884	22.9	2.2	0.9
30	10	10	2.2884	14.1	2.6	0.5
31	10	20	0.7884	244.3	25.8	9.5
32	10	20	1.3884	44.2	2.8	1.8
33	10	20	2.2884	25.3	2.3	1
34	10	20	2.3634	16.9	4.65	0.53
35	10	30	0.7884	226.7	33.5	8.4
36	10	30	1.3884	111.2	19.2	4
37	10	30	2.2884	34.6	2.4	1.4
38	10	30	2.3634	8.55	2.78	0.25
39	10	40	2.3634	13.69	1.95	0.51
40	10	50	0.1884	15.4	1.6	0.6
41	10	50	1.3884	35	2.8	1.4
42	10	50	2.2884	11.1	1.9	0.4
43	10	50	2.3634	10.43	2.89	0.33
44	10	60	0.1884	17.3	1.2	0.7
45	10	60	1.3884	64.3	6.8	2.5
46	10	60	2.2884	122	9.3	4.9
47	10	60	2.3634	34	6.58	1.19
48	10	70	2.3634	19.5	4.87	0.64

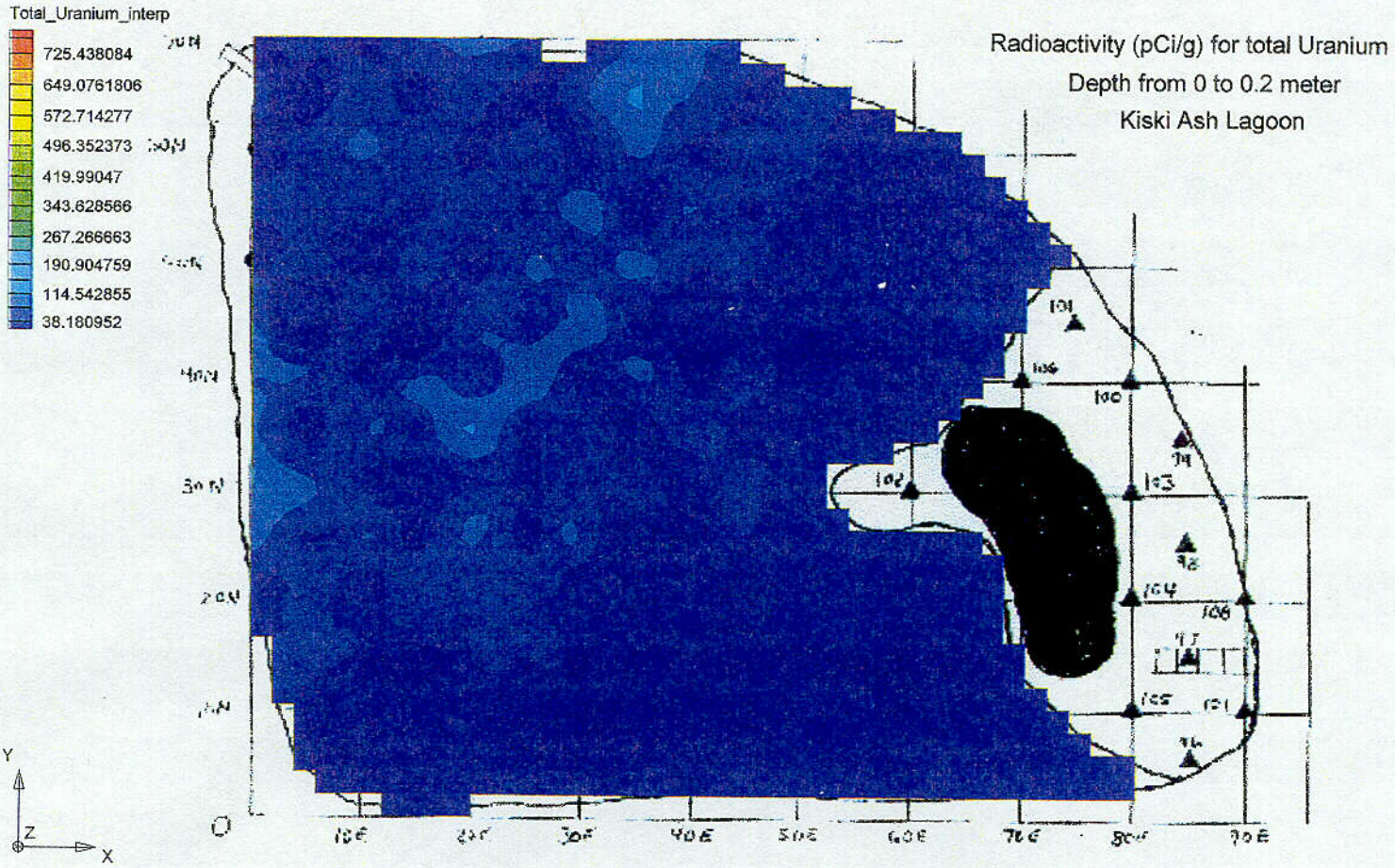
49	15	15	0.1884	11	1.8	0.4
50	15	15	1.3884	25.1	2.1	1
51	15	15	2.2884	18.1	2	0.7
52	15	25	0.1884	20.4	2	0.8
53	15	25	0.3634	242.44	41.76	8.73
54	15	25	0.4884	137.9	22.9	5
55	15	25	0.7884	110	6.2	2.3
56	15	25	1.0884	71.6	7.2	2.8
57	15	25	1.3634	56.88	12.65	1.92
58	15	25	1.3884	34.9	2.7	1.4
59	15	25	1.6884	19	5.2	0.6
60	15	25	1.9884	20.3	1.9	0.8
61	15	25	2.2884	15.4	1.6	0.6
62	15	25	2.3634	21.93	6.35	0.68
63	15	30	0.3634	444.45	73.23	16.14
64	15	30	0.7634	833.44	134.7	30.38
65	15	30	1.3634	68.71	12.13	2.46
66	15	30	2.3634	9.56	3.47	0.26
67	15	35	0.1884	12.7	1.2	0.5
68	15	35	0.3634	699.86	112.9	25.52
69	15	35	0.8384	721.71	112.9	26.47
70	15	35	1.0884	51.3	3	2.1
71	15	35	1.3634	52.96	11.38	1.81
72	15	35	1.3884	67.5	3.1	2.8
73	15	35	1.6884	98.3	8.6	3.9
74	15	35	1.9884	11.2	2	0.4
75	15	35	2.2884	15.3	1.5	0.6
76	15	35	2.3634	12.97	4.89	0.35
77	15	45	0.3634	46.71	9.11	1.64
78	15	45	0.8384	313.25	40.47	11.86
79	15	45	1.3634	51	9.6	1.8
80	15	45	2.3634	14.12	1.9	0.53
81	15	55	0.4384	69.64	12.19	2.5
82	15	55	1.3634	132.96	22.81	4.79
83	15	55	2.3634	22.55	3.01	0.85
84	15	65	1.1134	194.07	33.74	6.97
85	15	65	1.3634	107.82	17.87	3.91
86	15	65	2.3634	7.98	1.77	0.27
87	20	0	2.3634	3.83	1.67	0.09
88	20	10	2.3634	13.89	5.22	0.38
89	20	20	2.3634	22.98	4.42	0.81
90	20	30	0.1884	686.6	63.4	16.9
91	20	30	1.3884	34.5	9.2	1.1
92	20	30	2.2884	15.7	1.9	0.6
93	20	30	2.3634	16.94	3.25	0.59
94	20	40	1.0884	63.3	10.4	2.3
95	20	40	1.3884	34.5	2.3	1.4
96	20	40	2.2884	29.6	2	1.2
97	20	40	2.3634	12.27	4.02	0.36

98	20	50	2.3634	5.71	2.94	0.25
99	20	60	2.3634	16.91	3.31	0.59
100	25	5	1.6884	15.2	1.4	0.6
101	25	5	1.9884	11.2	2	0.4
102	25	5	2.2884	13.7	2.2	0.5
103	25	25	0.3634	195.76	32.83	7.08
104	25	25	1.3634	60.17	12.7	2.06
105	25	25	2.3634	12.47	4.66	0.34
106	25	30	0.3384	241.18	38.78	8.8
107	25	30	1.3634	51.23	12.11	1.7
108	25	30	2.3634	19.82	2.68	0.75
109	25	35	0.3634	842.15	130.3	30.95
110	25	35	0.8384	697.24	120.4	25.08
111	25	35	1.3634	86.56	16.69	3.04
112	25	35	2.3634	23.27	5.13	0.79
113	25	45	0.1884	47.8	1.8	2
114	25	45	0.3634	262.96	37.93	9.78
115	25	45	0.8384	659.36	102.3	24.22
116	25	45	1.0884	209.9	14.4	8.5
117	25	45	1.3634	69.21	12.56	2.46
118	25	45	1.3884	103	15.6	3.8
119	25	45	1.6884	57.5	6.9	2.2
120	25	45	1.9884	36.6	2.1	1.5
121	25	45	2.2884	27	1.7	1.1
122	25	45	2.3634	11.09	4	0.31
123	25	55	0.6384	362.56	55.05	13.37
124	25	55	1.3634	165.54	28.71	5.95
125	25	55	1.3884	133.5	18.5	5
126	25	55	1.6884	51.6	10.2	1.8
127	25	55	1.9884	62.7	9.8	2.3
128	25	55	2.2884	25.6	2.6	1
129	25	55	2.3634	20.57	3.28	0.75
130	25	65	1.3884	533.9	49.3	13.55
131	25	65	1.6884	107.1	12.8	4.1
132	25	65	2.2884	25.6	2.6	1
133	30	20	0.4884	158	24.6	5.8
134	30	20	1.3884	59.3	8.7	2.2
135	30	20	2.2884	16.4	2.6	0.6
136	30	20	2.3634	9.83	4.03	0.25
137	30	30	2.3634	21.12	4.94	0.7
138	30	40	2.3634	8.65	2.52	0.27
139	30	50	0.4884	196.3	26.1	7.4
140	30	50	1.3884	81.1	9.8	3.1
141	30	50	2.2884	13.5	2	0.5
142	30	50	2.3634	23.03	6.15	0.73
143	30	60	1.3884	74.9	1.3	3.2
144	30	60	1.6884	25.1	2.1	1
145	30	60	2.2884	8.8	1.9	0.3
146	30	60	2.3634	12.74	4.27	0.37

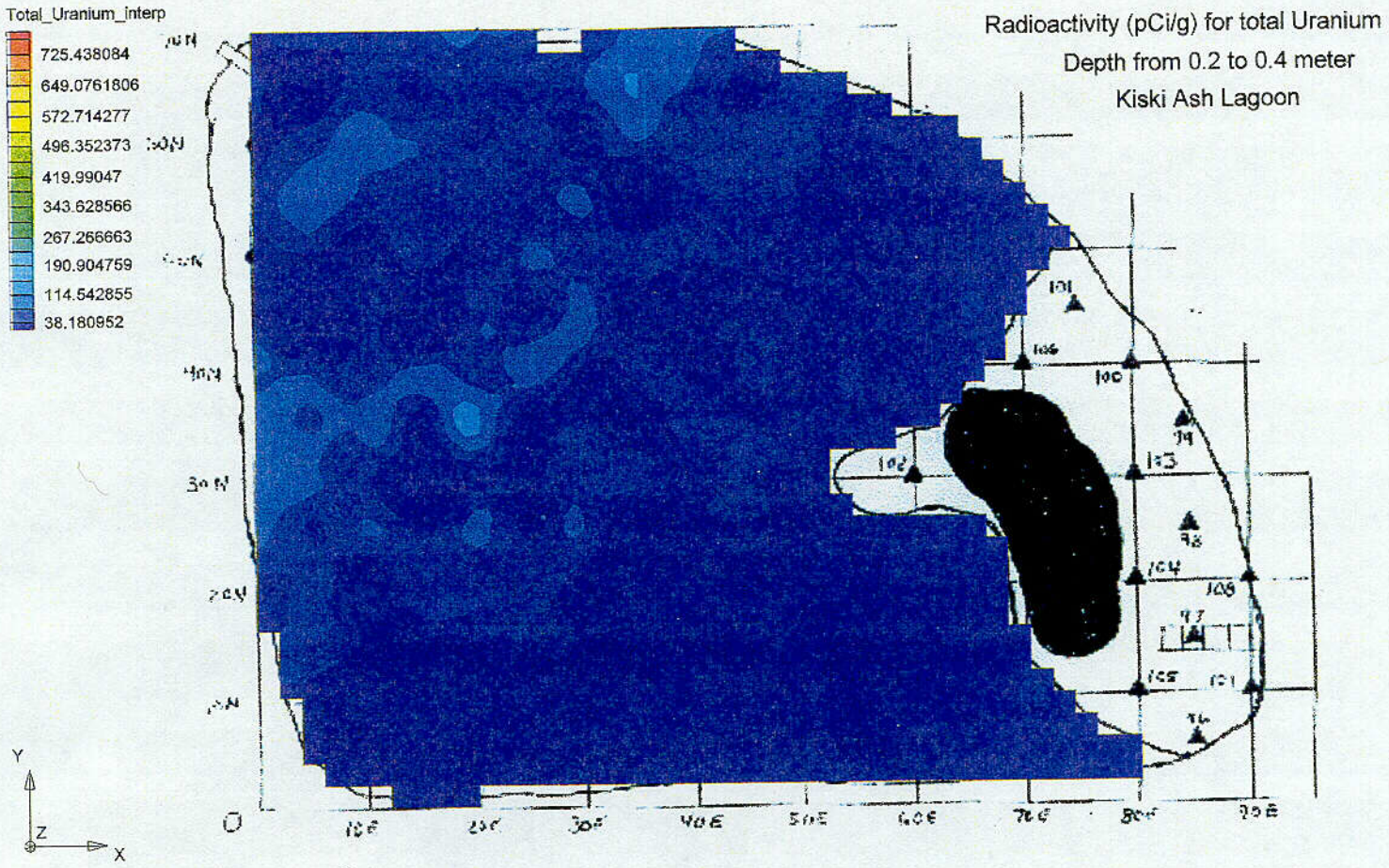
147	30	70	2.3634	7.73	2.1	0.24
148	32	37	0.3634	197.72	32.3	7.19
149	32	37	0.8384	769.21	123.6	28.07
150	32	37	1.3634	181.6	31.25	6.54
151	32	37	2.3634	13.09	7.69	0.37
152	35	15	0.4884	31.4	3.8	1.2
153	35	15	1.3884	9.1	2.2	0.3
154	35	15	2.2884	17.4	1.3	0.7
155	35	25	0.3384	64.5	4.7	2.6
156	35	25	0.3634	227.71	42.1	8.07
157	35	25	0.9384	22.4	1.7	0.9
158	35	25	1.3634	15.23	6.16	0.39
159	35	25	1.3884	25.1	2.1	1
160	35	25	1.6884	16.1	2.3	0.6
161	35	25	1.9884	13.4	1.9	0.5
162	35	25	2.2884	20	1.6	0.8
163	35	25	2.3634	19.15	2.74	0.71
164	35	35	0.3634	203.12	34.78	7.32
165	35	35	0.8384	310.31	52.24	11.09
166	35	35	1.3634	126.18	24.43	4.42
167	35	35	2.3634	17.91	1.65	0.71
168	35	45	0.4134	322.84	53.28	11.72
169	35	45	0.9134	718.55	110.2	26.45
170	35	45	1.3634	135.96	25.15	4.82
171	35	45	2.3634	24	4.3	0.86
172	35	55	0.5884	493.21	81.28	17.91
173	35	55	0.9634	654.46	120.4	23.22
174	35	55	1.3634	109.06	19.91	3.88
175	35	55	2.3634	7.75	0.65	0.31
176	38	32	0.1884	17.3	1.2	0.7
177	38	32	0.3634	149.84	29.18	5.25
178	38	32	0.4884	72.6	3.6	3
179	38	32	0.9384	149	22.5	5.5
180	38	32	1.3634	50.84	9.83	1.78
181	38	32	1.3884	34.5	2.3	1.4
182	38	32	1.6884	32.5	2.6	1.3
183	38	32	1.9884	30.4	2.8	1.2
184	38	32	2.2884	37.4	2.9	1.5
185	38	32	2.3634	10.69	4.27	0.28
186	40	0	2.3634	4.22	1.24	0.13
187	40	10	2.3634	20.27	3.52	0.73
188	40	20	2.3634	11.02	4.9	0.27
189	40	30	0.4884	20.2	1.8	0.8
190	40	30	1.3884	15.4	1.6	0.6
191	40	30	2.2884	20.5	2.1	0.8
192	40	30	2.3634	14.5	1.76	0.55
193	40	40	1.0884	296.5	43.5	11
194	40	40	1.3884	48.9	5.2	1.9
195	40	40	2.2884	18.5	2.4	0.7

196	40	40	2.3634	9.42	3.38	0.26
197	40	45	0.3634	163.84	30.85	5.78
198	40	45	0.8384	454.79	72.99	16.6
199	40	45	1.3634	120.69	25.75	4.13
200	40	45	2.3634	15.89	2.92	0.56
201	40	50	2.3634	11.81	5.14	0.29
202	40	60	2.3634	19.85	3.81	0.7
203	45	35	0.3634	69.62	13.02	2.46
204	45	35	1.3634	55.65	11.14	1.94
205	45	35	2.3634	18.9	4.22	0.64
206	45	45	0.1884	15.1	1.3	0.6
207	45	45	0.3384	14.9	1.1	0.6
208	45	45	0.3634	251.63	40.14	9.2
209	45	45	0.7884	63	12.4	2.2
210	45	45	1.0884	204.7	29.9	7.6
211	45	45	1.3634	115.86	18.68	4.23
212	45	45	1.3884	65.2	12.3	2.3
213	45	45	1.6884	25.2	2.2	1
214	45	45	2.3634	10.61	1.78	0.38
215	45	55	0.1884	14.9	1.1	0.6
216	45	55	0.3634	144.24	25.97	5.14
217	45	55	0.4884	67.1	7.3	2.6
218	45	55	0.7884	156.2	25.1	5.7
219	45	55	1.0884	71.3	9.2	2.7
220	45	55	1.3634	66.8	13.88	2.3
221	45	55	1.3884	99.3	18.8	3.5
222	45	55	1.6884	90.9	17.3	3.2
223	45	55	1.9884	74.5	3.2	3.1
224	45	55	2.2884	29.3	4	1.1
225	45	55	2.3634	9.11	2.9	0.27
226	45	65	1.3884	20.2	1.8	0.8
227	45	65	1.6884	27.7	2.4	1.1
228	45	65	2.2884	20.3	1.9	0.8
229	50	30	2.3634	17.66	3.12	0.63
230	50	40	2.3634	13.87	4.9	0.39
231	50	50	2.3634	7.65	2.36	0.23
232	50	70	2.3634	4.48	2.36	0.09
233	55	15	0.4884	59.8		2.6
234	55	15	0.7884	88.7	15.1	3.2
235	55	15	1.0884	36.8		1.6
236	55	15	1.3884	13.5	2	0.5
237	55	15	1.8384	39.5	9.6	1.3
238	55	15	2.2884	22.6	1.9	0.9
239	55	45	0.3384	38.9	2.1	1.6
240	55	45	1.3884	23	2.3	0.9
241	55	45	1.9884	11.2	2	0.4
242	60	0	2.3634	2.86	0.81	0.09
243	60	10	0.7884	35.6	5.7	1.3
244	60	10	1.0884	32.7	7.4	1.1

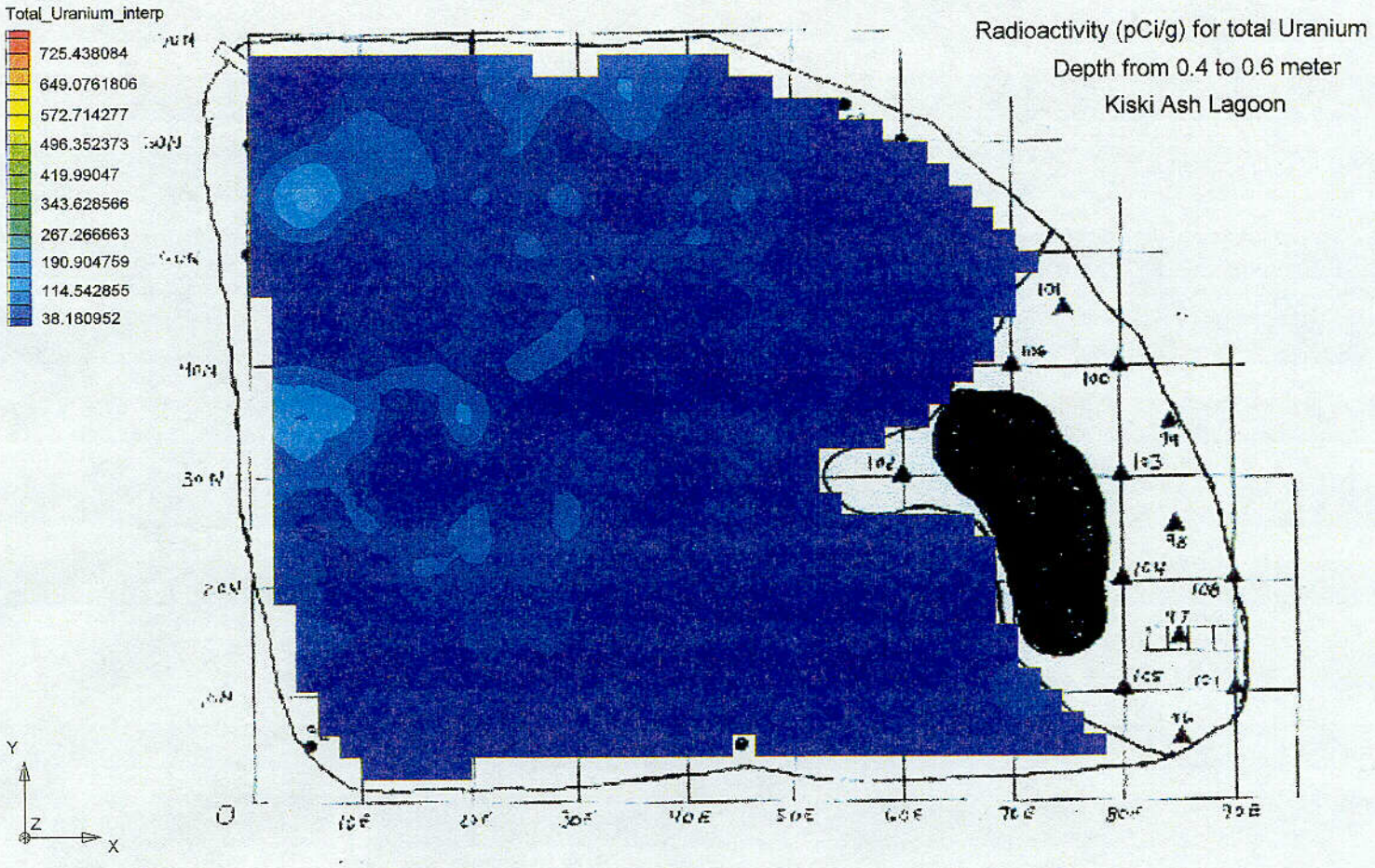
245	60	10	1.5384	33.7	6.1	1.2
246	60	10	2.1384	32.1	8.8	1.1
247	60	10	2.3634	8.5	3.15	0.23
248	60	20	0.3384	2.3		0.1
249	60	20	0.9384	70.1	1.1	3
250	60	20	1.5384	27.6		1.2
251	60	20	2.1384	18.1	4.3	0.6
252	60	20	2.3634	18.75	3.67	0.66
253	60	30	2.3634	28.58	6.33	0.97
254	60	40	0.4884	24.6	1.6	1
255	60	40	1.3884	27.2	1.9	1.1
256	60	40	2.2884	22.7	2	0.9
257	60	60	2.3634	17.74	4.65	0.57
258	65	5	1.6884	5.8	1.2	0.2
259	65	5	1.9884	24.7	1.7	1
260	65	5	2.2884	11.2	2	0.4
261	65	15	0.3384	81.1	2.9	3.4
262	65	15	0.9384	35.5	5.6	1.3
263	65	15	1.5384	20.4	2	0.8
264	65	15	2.1384	27.5	2.2	1.1
265	65	25	0.4884	6.9		0.3
266	65	25	1.0884	27.6		1.2
267	65	25	1.5384	27.6		1.2
268	65	25	2.1384	20.4	6.6	0.6
269	65	45	0.3384	22.6	1.9	0.9
270	65	45	1.3884	27.2	1.9	1.1
271	65	45	2.2884	45.1	3.7	1.8
272	65	55	1.6884	12.7	3.5	0.4
273	65	55	1.9884	18.6	2.5	0.7
274	65	55	2.2884	20.2	1.8	0.8
275	70	10	1.5384	60.3	7.4	2.3
276	70	10	2.1384	38.1	8.2	1.3
277	70	40	2.3634	7.72	1.52	0.27
278	70	50	2.3634	8.27	2.98	0.23
279	70	60	2.3634	4.18	1.19	0.13
280	80	0	2.3634	3.78	1.71	0.09
281	80	10	2.3634	8.57	3.61	0.22
282	80	30	2.3634	12.78	2.85	0.43
283	80	30	2.4384	45.7	8.9	1.6
284	80	30	2.4384	107	3.5	4.5
285	80	50	2.3634	3.82	1.52	0.1
286	90	20	2.3634	3.39	1.13	0.1
287	90	30	2.3634	3.15	1.5	0.07
288	95	10	2.3634	4.16	1.2	0.13

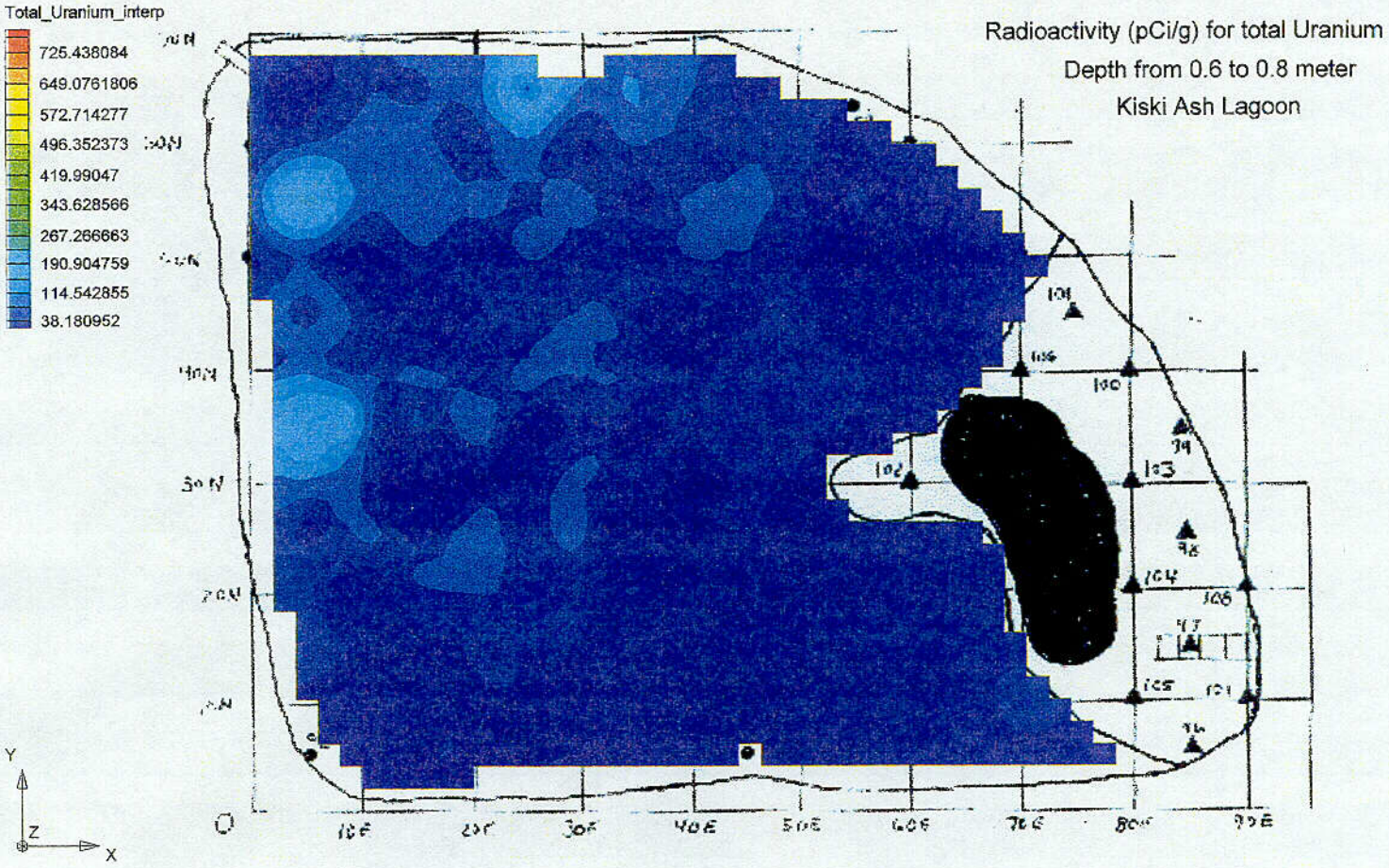

Total_Uranium_interp
725.438084
649.0761806
572.714277
496.352373
419.99047
343.628566
267.266663
190.904759
114.542855
38.180952
Radioactivity (pCi/g) for total Uranium
Depth from 0 to 0.2 meter
Kiski Ash Lagoon
Y
Z
X

C08

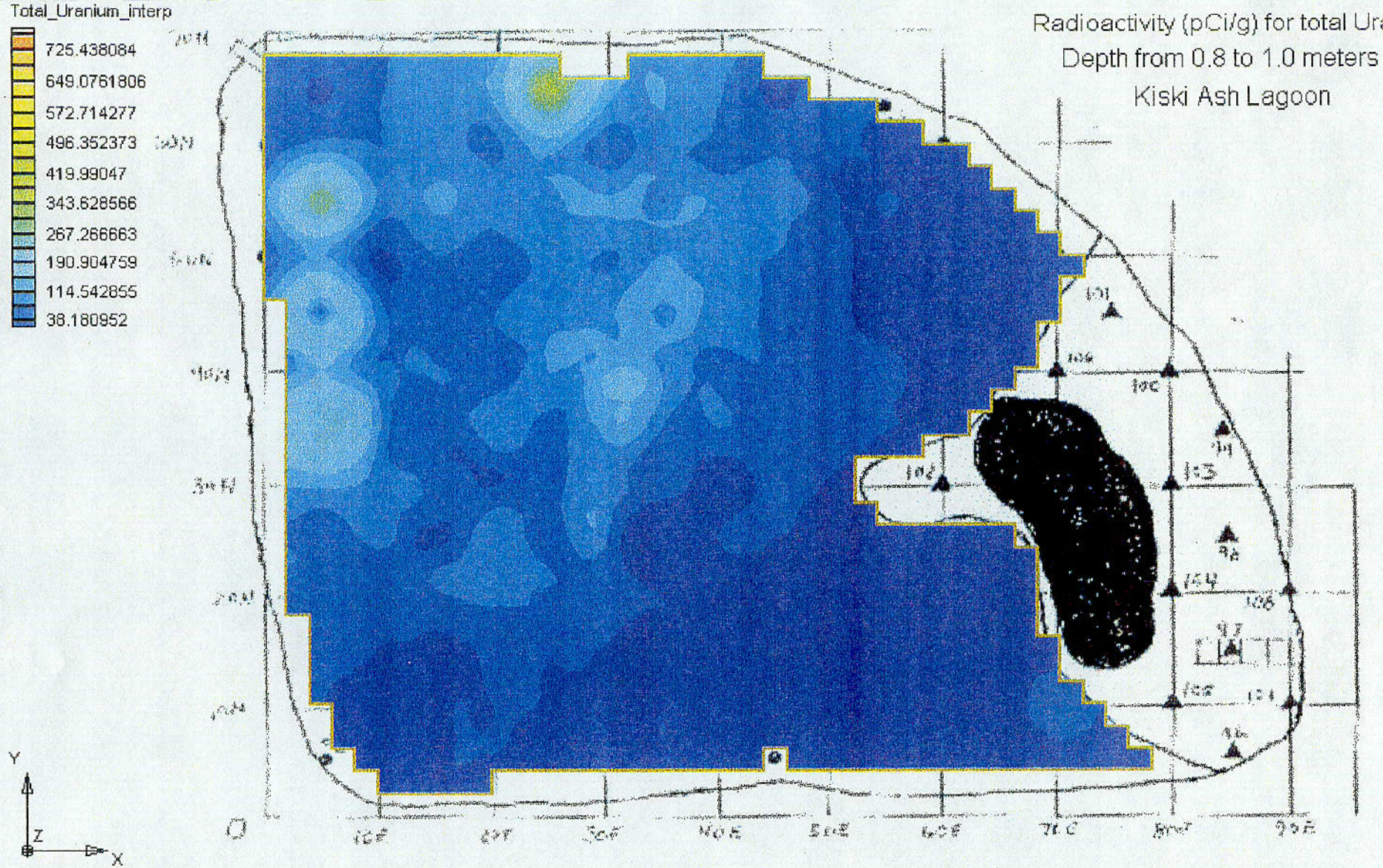

Radioactivity (pCi/g) for total Uranium
Depth from 0.2 to 0.4 meter
Kiski Ash Lagoon
Total_Uranium_interp
725.438084
649.0761806
572.714277
496.352373
419.99047
343.628566
267.266663
190.904759
114.542855
38.180952
Y
Z
X

C09

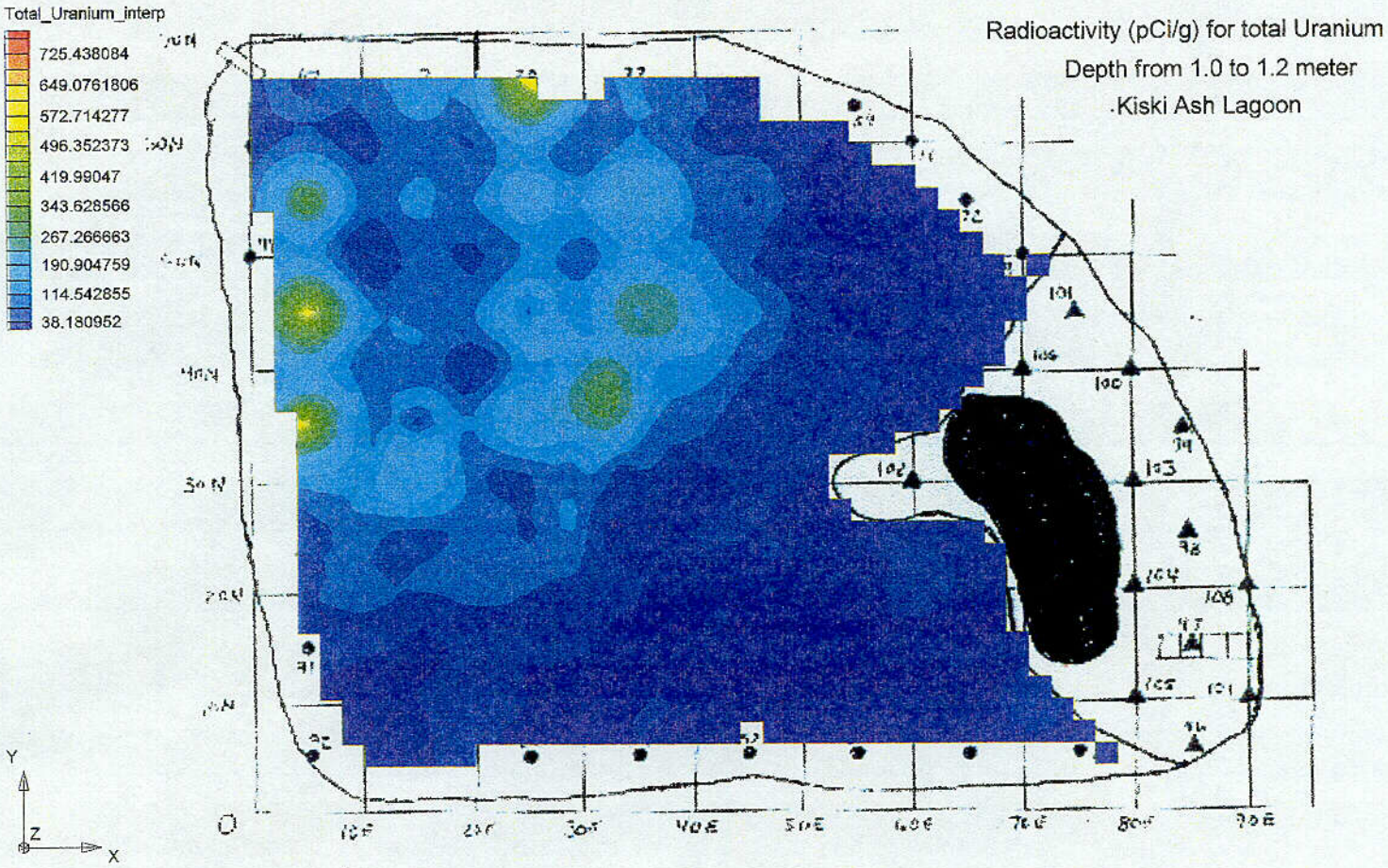

Radioactivity (pCi/g) for total Uranium
Depth from 0.4 to 0.6 meter
Kiski Ash Lagoon
Total_Uranium_interp
725.438084
649.0761806
572.714277
496.352373
419.99047
343.628566
267.266663
190.904759
114.542855
38.180952
Y
Z
X

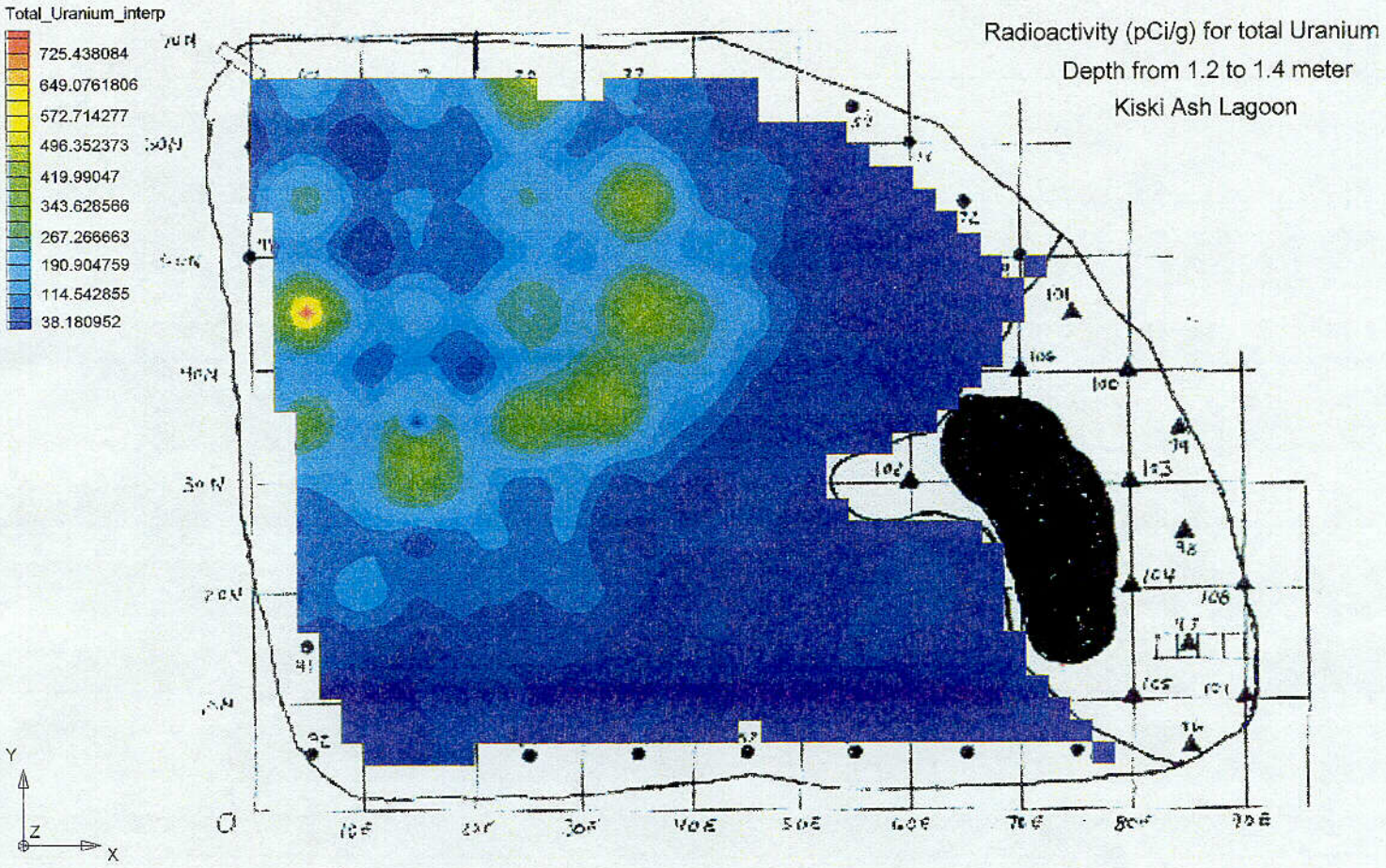

Radioactivity (pCi/g) for total Uranium
Depth from 0.6 to 0.8 meter
Kiski Ash Lagoon
Total_Uranium_interp
725.438084
649.0761806
572.714277
496.352373
419.99047
343.628566
267.266663
190.904759
114.542855
38.180952
Y
Z
X

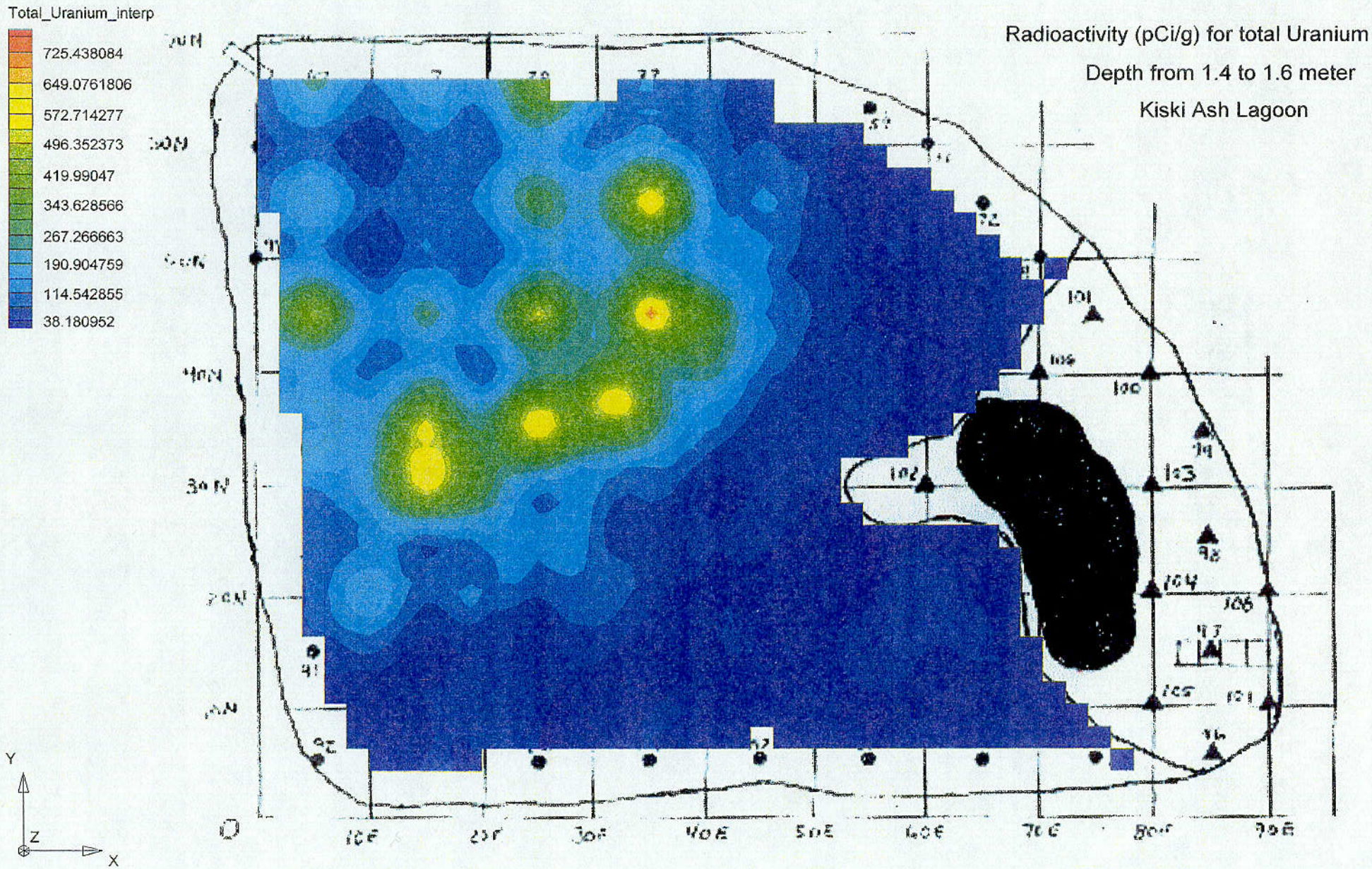
Radioactivity (pCi/g) for total Uranium
Depth from 0.8 to 1.0 meters
Kiski Ash Lagoon



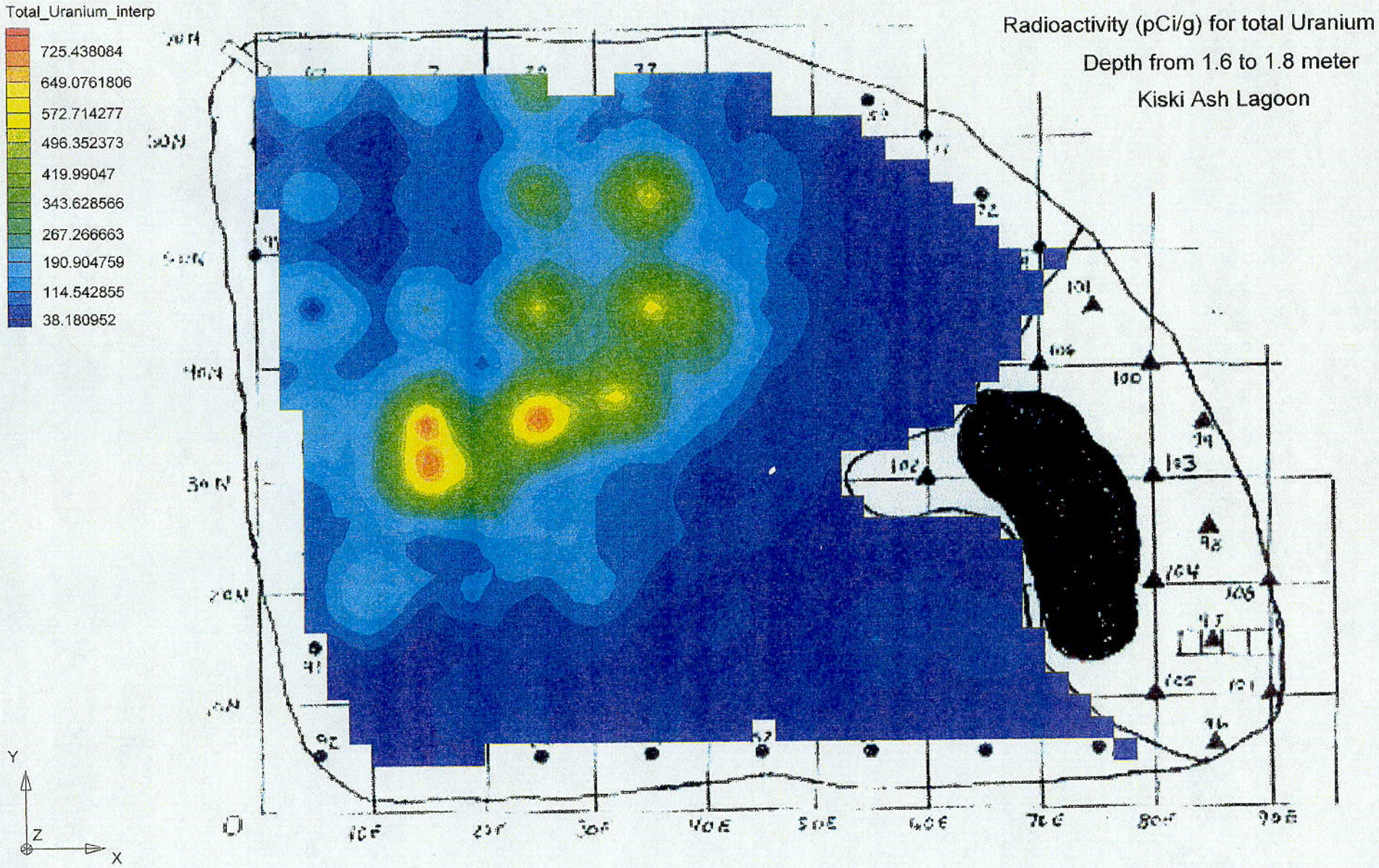
C12


Radioactivity (pCi/g) for total Uranium
Depth from 1.0 to 1.2 meter
Kiski Ash Lagoon
Total_Uranium_interp
725.438084
649.0761806
572.714277
496.352373
419.99047
343.628566
267.266663
190.904759
114.542855
38.180952
Y
Z
X

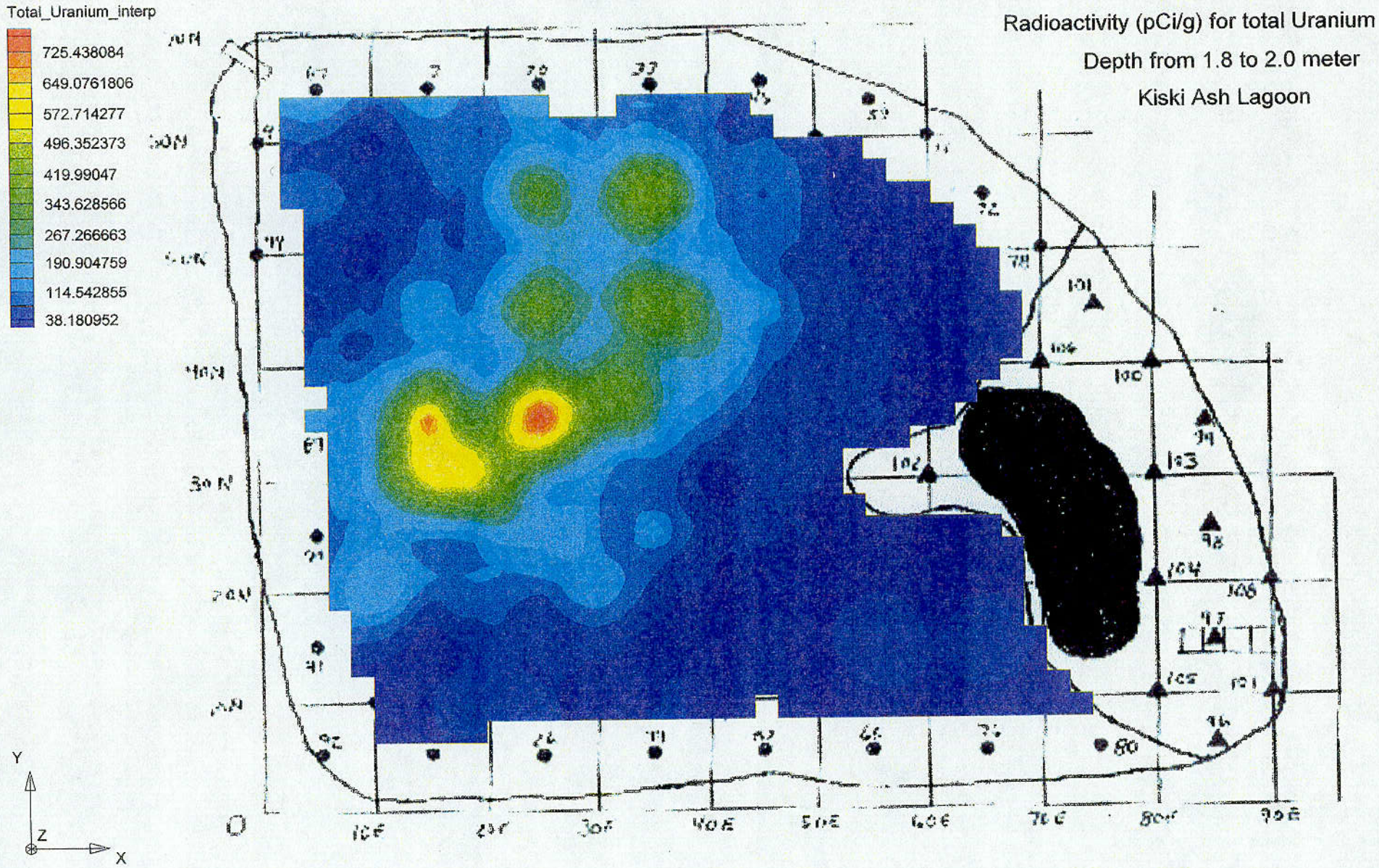

Radioactivity (pCi/g) for total Uranium
Depth from 1.2 to 1.4 meter
Kiski Ash Lagoon
Total_Uranium_interp
725.438084
649.0761806
572.714277
496.352373
419.99047
343.628566
267.266663
190.904759
114.542855
38.180952
Y
Z
X

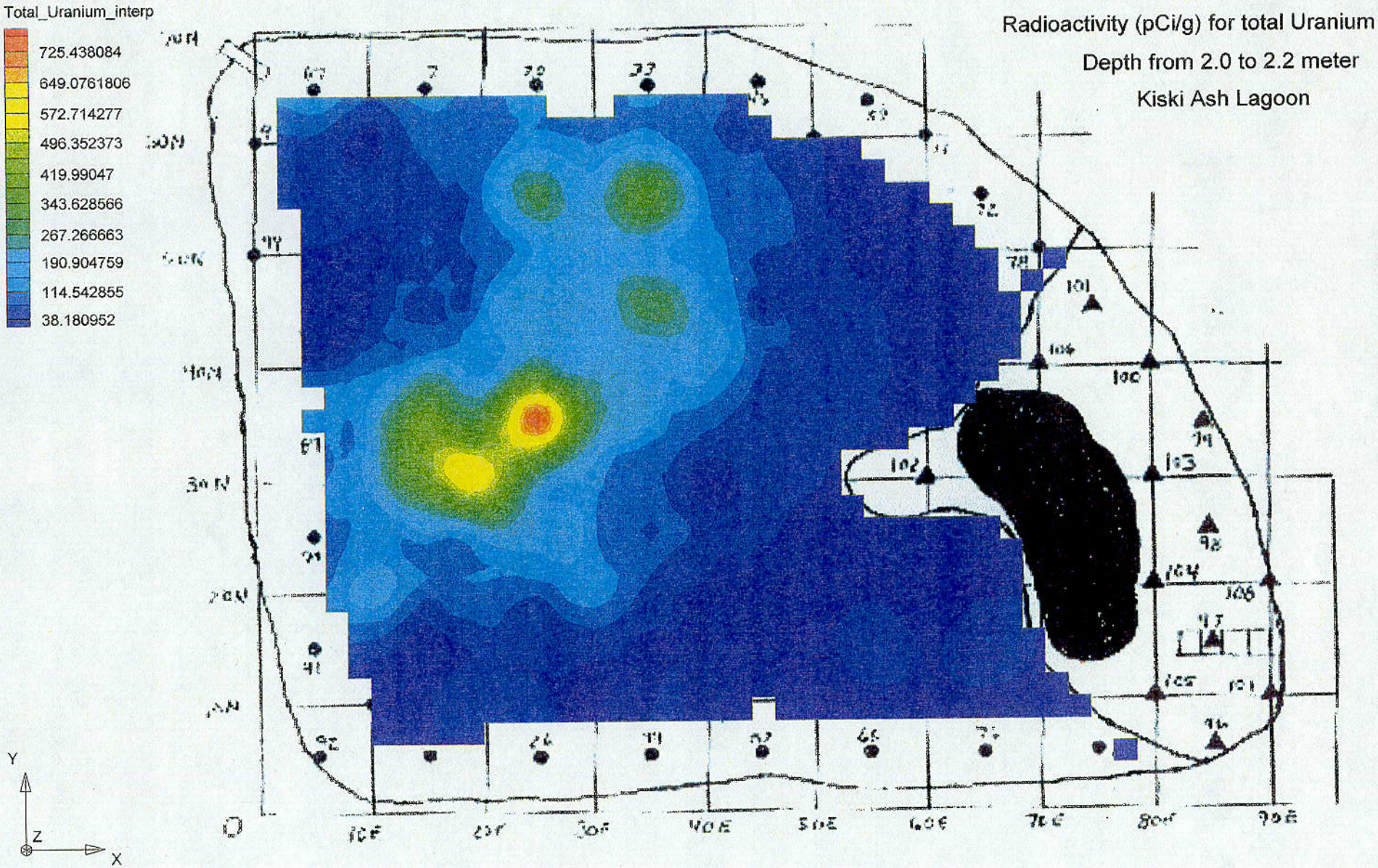

Radioactivity (pCi/g) for total Uranium
Depth from 1.4 to 1.6 meter
Kiski Ash Lagoon
Total_Uranium_interp
725.438084
649.0761806
572.714277
496.352373
419.99047
343.628566
267.266663
190.904759
114.542855
38.180952
Y
Z
X

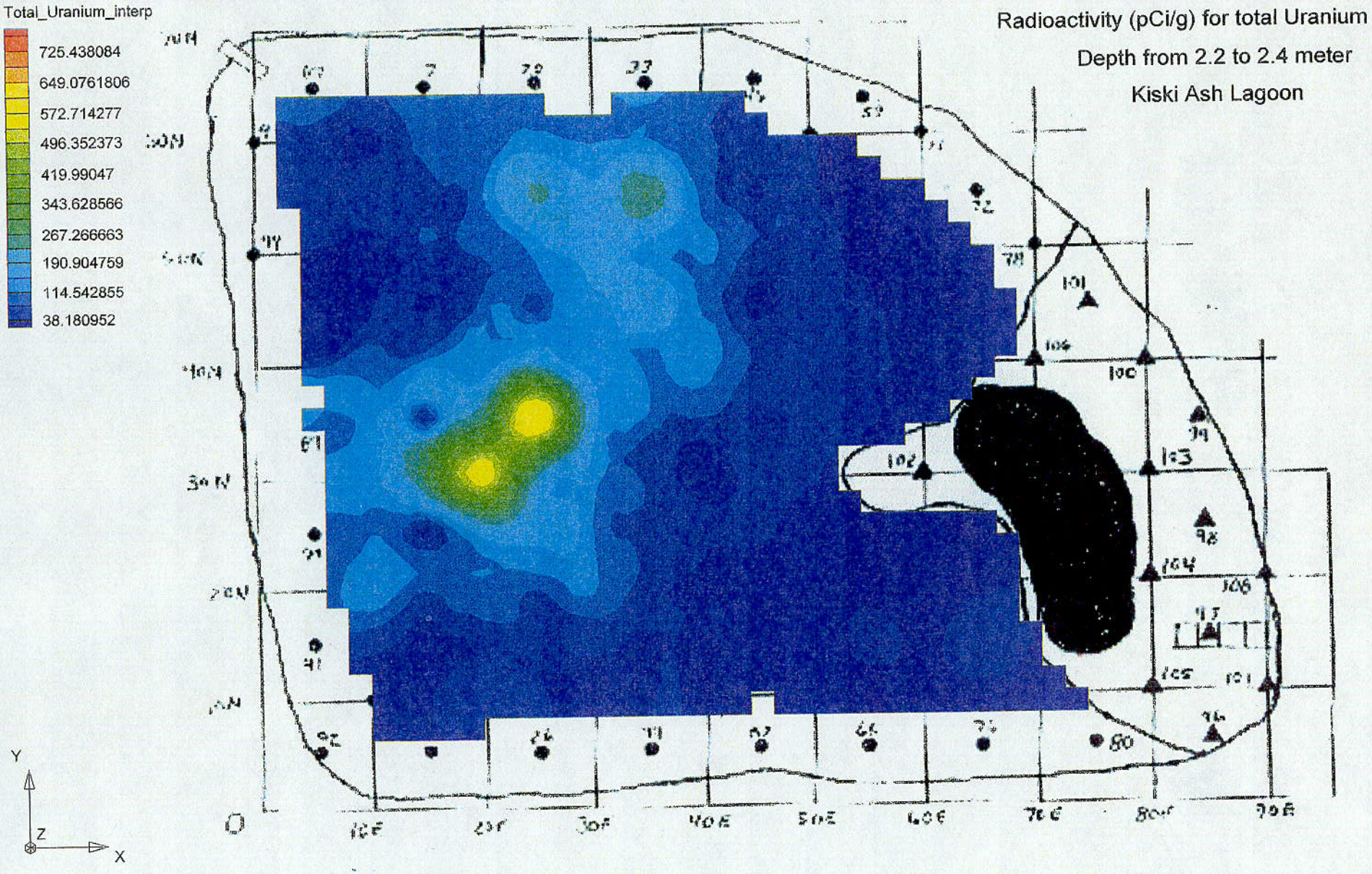
C15


Radioactivity (pCi/g) for total Uranium
Depth from 1.6 to 1.8 meter
Kiski Ash Lagoon
Total_Uranium_interp
725.438084
649.0761806
572.714277
496.352373
419.99047
343.628566
267.266663
190.904759
114.542855
38.180952
Y
Z
X

C16


Radioactivity (pCi/g) for total Uranium
Depth from 1.8 to 2.0 meter
Kiski Ash Lagoon
Total_Uranium_interp
725.438084
649.0761806
572.714277
496.352373
419.99047
343.628566
267.266663
190.904759
114.542855
38.180952
Y
Z
X


Radioactivity (pCi/g) for total Uranium
Depth from 2.0 to 2.2 meter
Kiski Ash Lagoon
Total_Uranium_interp
725.438084
649.0761806
572.714277
496.352373
419.99047
343.628566
267.266663
190.904759
114.542855
38.180952
Y
Z
X

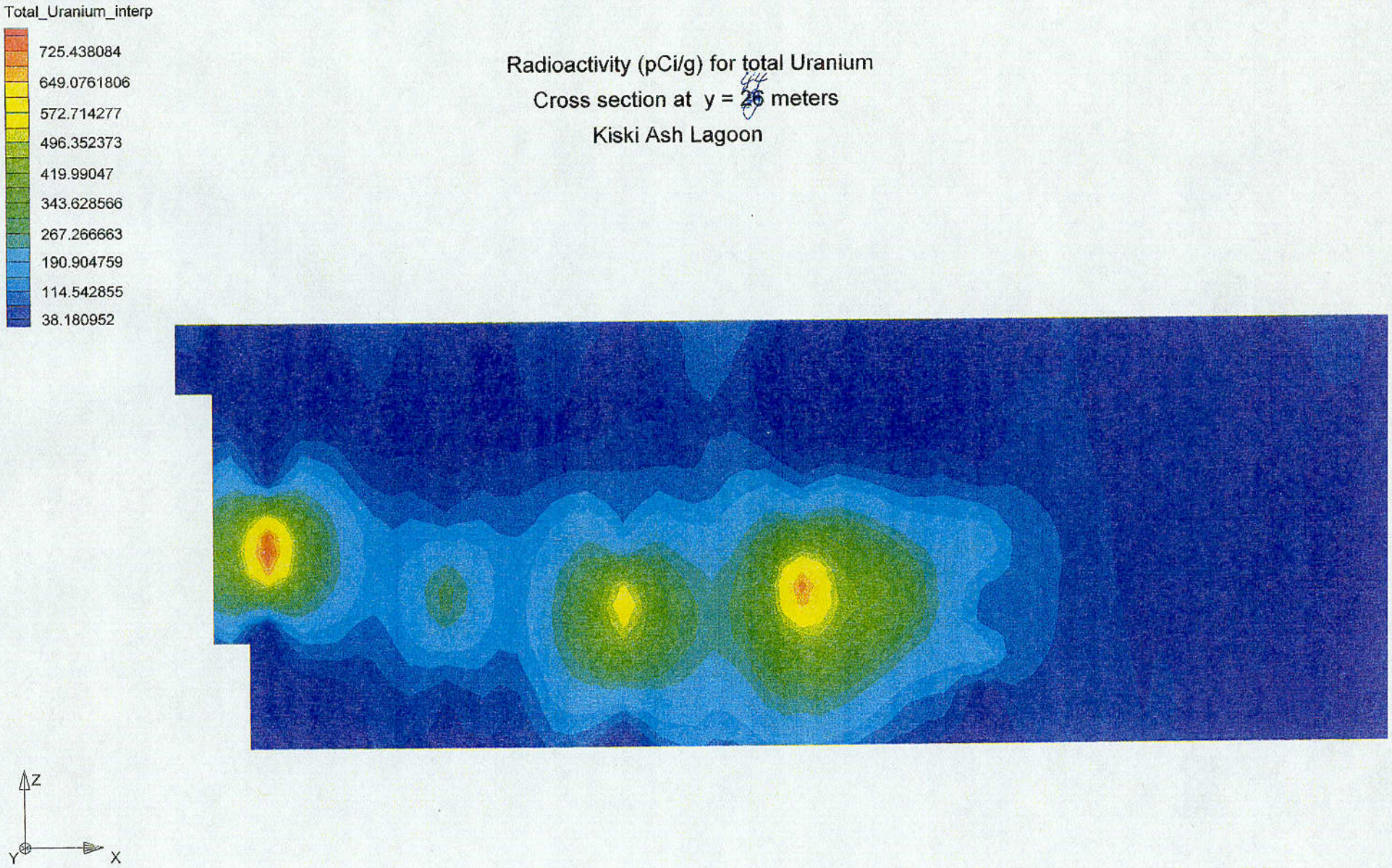

Radioactivity (pCi/g) for total Uranium
Depth from 2.2 to 2.4 meter
Kiski Ash Lagoon
Total_Uranium_interp
725.438084
649.0761806
572.714277
496.352373
419.99047
343.628566
267.266663
190.904759
114.542855
38.180952
Y
Z
X

C19

Radioactivity (pCi/g) for total Uranium

Cross section at y = ~~26~~ 44 meters

Kiski Ash Lagoon

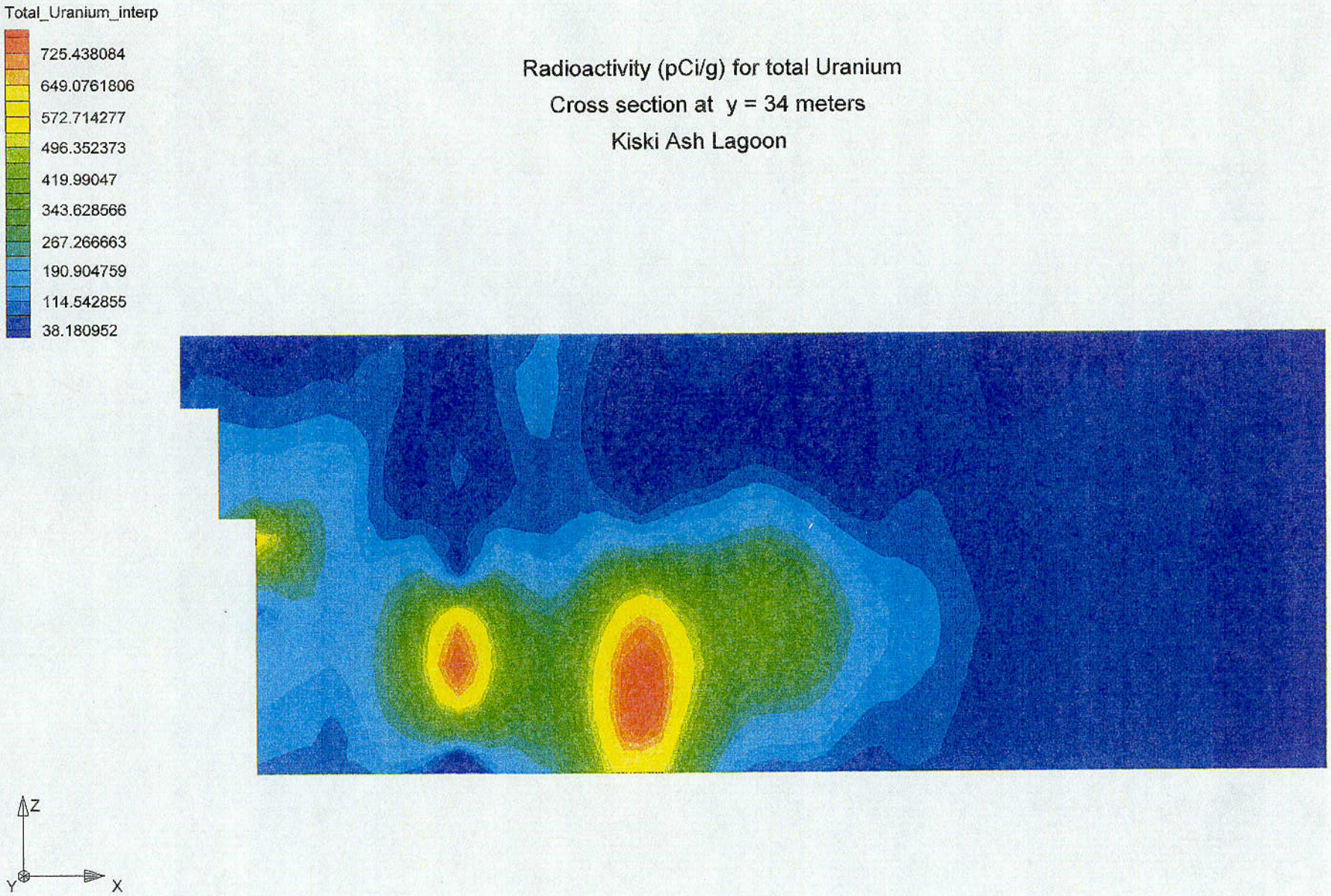


C20

Radioactivity (pCi/g) for total Uranium

Cross section at y = 34 meters

Kiski Ash Lagoon



C21

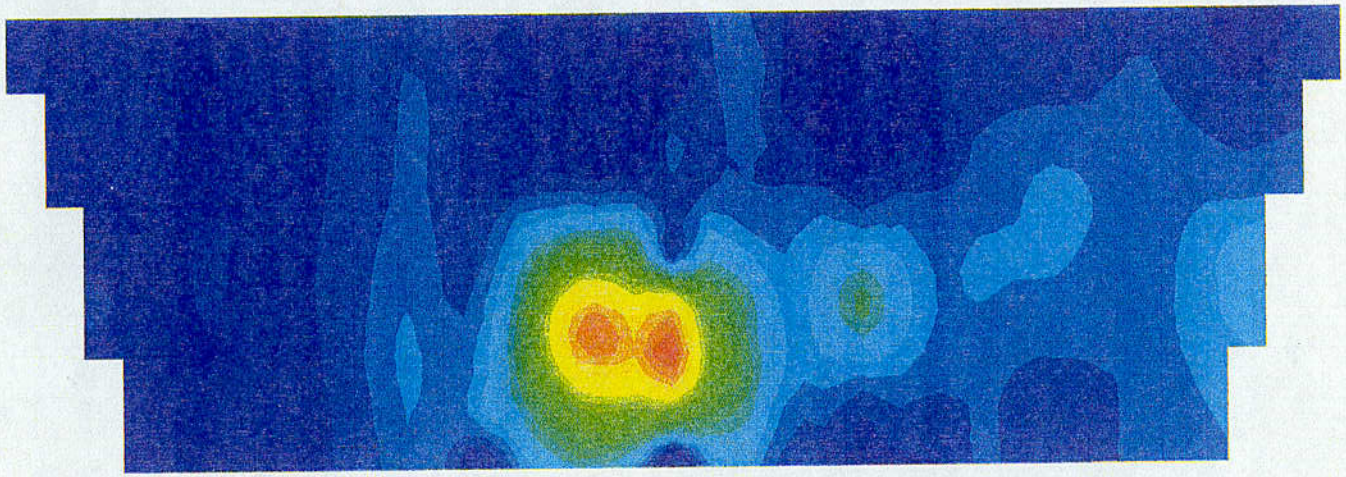
Total_Uranium_interp

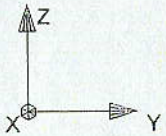
725.438084
649.0761806
572.714277
496.352373
419.99047
343.628566
267.266663
190.904759
114.542855
38.180952

Radioactivity (pCi/g) for total Uranium

Cross section at x = 16 meters

Kiski Ash Lagoon





C22

APPENDIX E

CALCULATION OF URANIUM MASS IN ASH LAGOON

Calculation of Uranium Mass in Ash Lagoon
Kiski Valley Water Pollution Control Authority
Leechburg, Pennsylvania

By activities:

	[1]Volume of Lagoon (m^3)	[2]Avg. Conc. (pCi/g)	[3]Bulk density of Ash	Total Mass of ash (grams)	[4]Total pCi (lagoon)	Total Ci (lagoon)	[5]Decay-rate in entire lagoon (d/s)	[7]Total Mass of Individual Isotopes (grams)
U-238	9000	12.6	1.2	1.08E+10	1.36E+11	0.13608	5.03E+09	**280,026.4**
U-235	9000	3.2	1.2	1.08E+10	3.46E+10	0.03456	1.28E+09	**11,084.3**
U-234	9000	62.9	1.2	1.08E+10	6.79E+11	0.67932	2.51E+10	**75.5**

	Half Life (years)	Half Life (sec)	grams/mole	[6]decay rate (d/s) per gram
U-238	4.46E+09	1.41E+17	238	1.80E+04
U-235	7.04E+08	2.22E+16	235	1.15E+05
U-234	2.45E+05	7.73E+12	234	3.33E+08

Total U in lagoon (grams): **291,186.1**

Percent Lagoon Mass as Total U: **2.70E-05**

Notes:

[1] Value determined by Chester Engineers, NRC and IT Corporation

[2] Value determine by IT Corporation

[3] Estimated value from U.S. DOT Turner-Fairbank Highway Research Center

[4] Total ash mass (g) multiplied by average radionuclude concentrations (pCi/g)

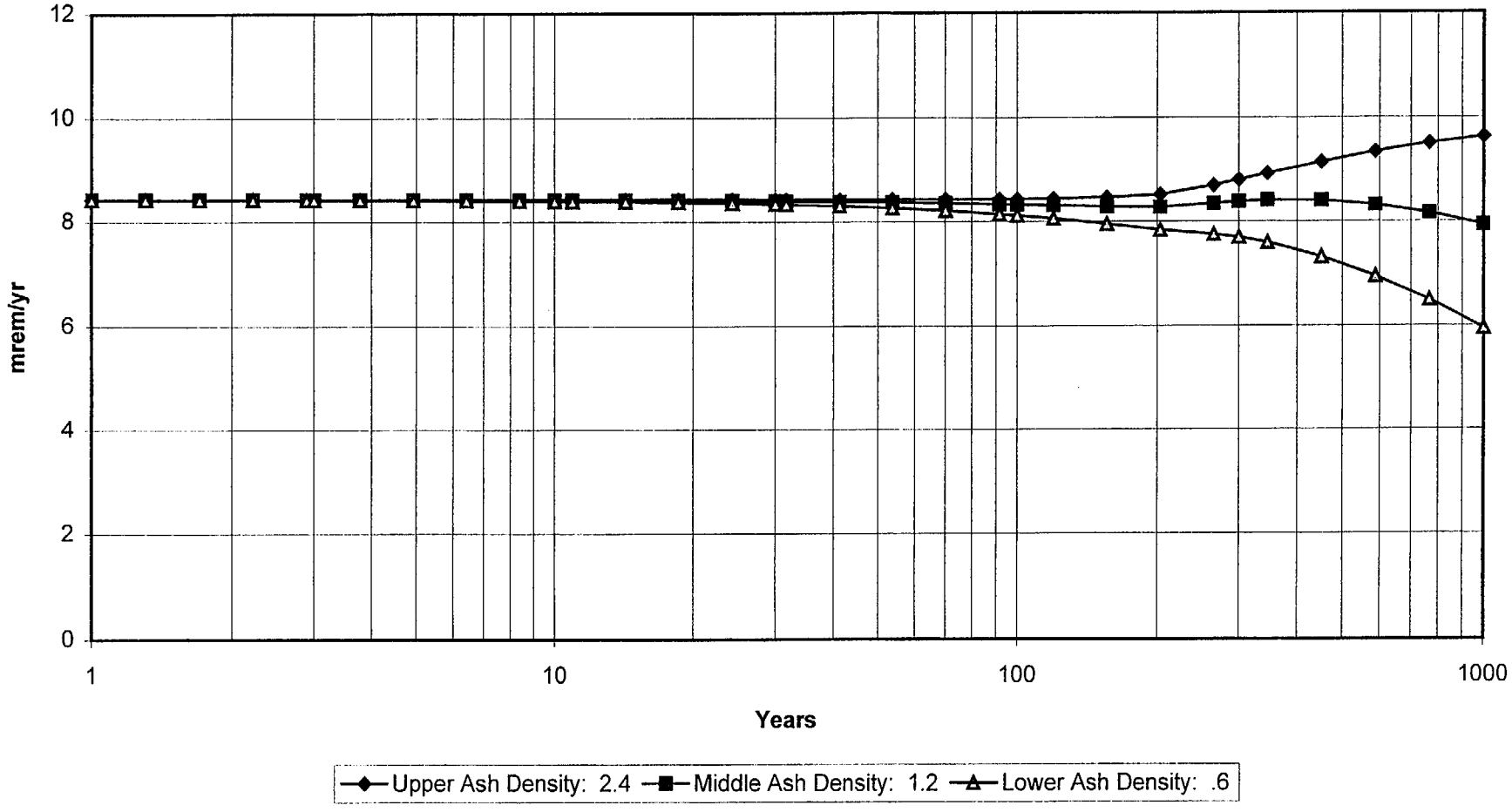
[5] Total curies in lagoon multiplied by decay rate per curie (d/s)

[6] Avagadro's number multiplied by grams per mole of radionuclide divided by half life (s) of radionucllide

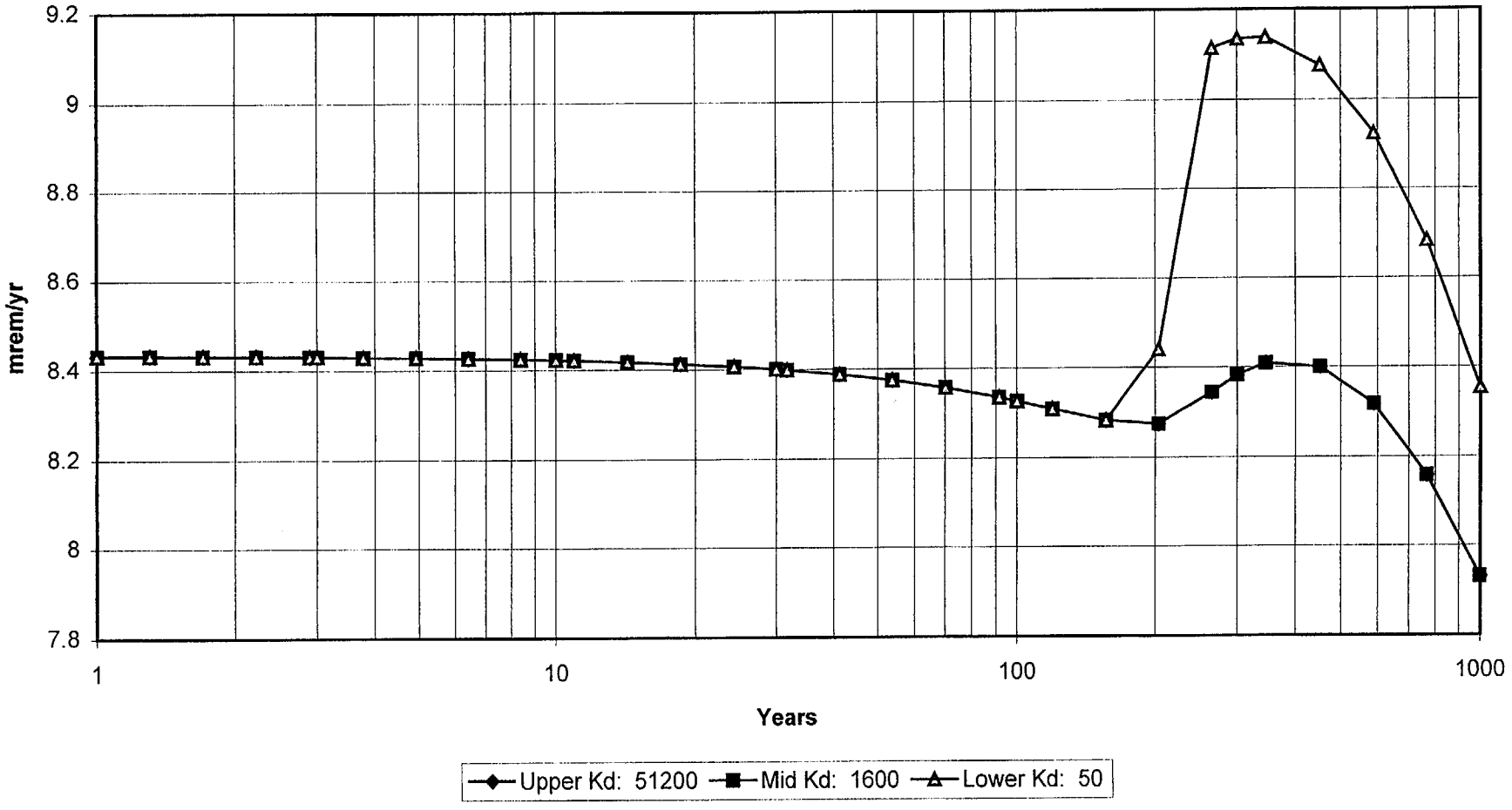
APPENDIX F

RESRAD SENSITIVITY ANALYSIS RESULTS

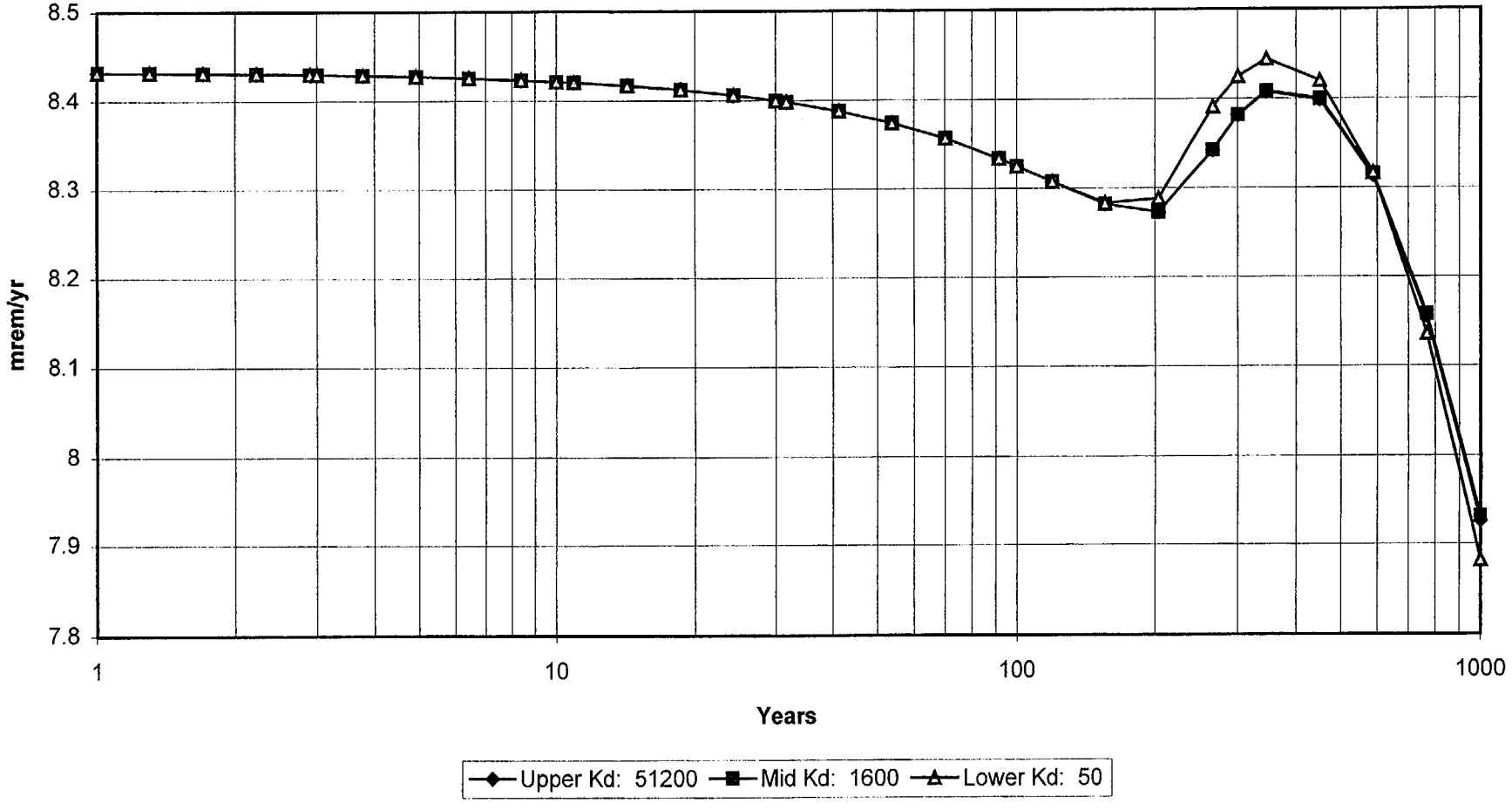
RESRAD Sensitivity Analysis on Density of Contaminated Zone
Avg. Conc. of Total U at 78.6 pCi/g
All Nuclides Summed and all Pathways Summed
KVWPCA Ash Lagoon
Leechburg, Pennsylvania



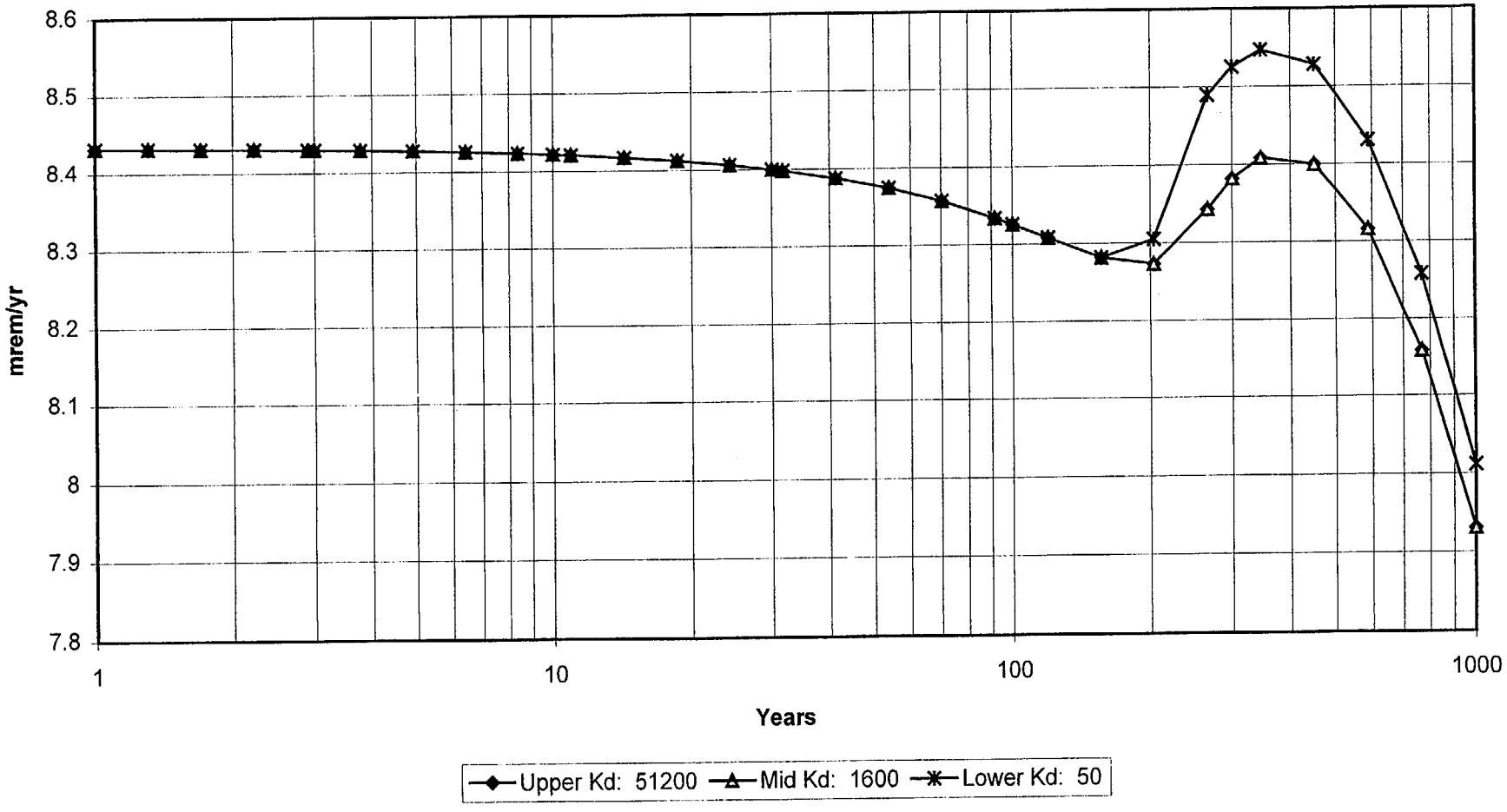
RESRAD Sensitivity Analysis on Unsaturated Zone Distribution Coefficient for U-234
Avg. Conc. of Total U at 78.6 pCi/g
All Pathways Summed
KVWPCA Ash Lagoon
Leechburg, Pennsylvania



RESRAD Sensitivity Analysis on Unsaturated Zone Distribution Coefficient for U-235
Avg. Conc. of Total U at 78.6 pCi/g
All Pathways Summed
KVWPCA Ash Lagoon
Leechburg, Pennsylvania



RESRAD Sensitivity Analysis on Unsaturated Zone Distribution Coefficient for U-238 Avg. Conc. of Total U at 78.6 pCi/g
All Pathways Summed
KVWPCA Ash Lagoon
Leechburg, Pennsylvania



Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Table of Contents

Part VI: Uncertainty Analysis

RESRAD Uncertainty Analysis Results

Probabilistic Input 2

Total Dose 3

Total Risk 4

Dose vs Pathway: Ground External 5

Dose vs Pathway: Inhalation (w/o Radon) 6

Dose vs Pathway: Radon (Water Ind.) 7

Dose vs Pathway: Plant (Water Ind.) 8

Dose vs Pathway: Meat (Water Ind.) 9

Dose vs Pathway: Milk (Water Ind.) 10

Dose vs Pathway: Soil Ingestion 11

Dose vs Pathway: Water Ingestion 12

Dose vs Pathway: Fish Ingestion 13

Dose vs Pathway: Radon (Water Dep.) 14

Dose vs Pathway: Plant (Water Dep.) 15

Dose vs Pathway: Meat (Water Dep.) 16

Dose vs Pathway: Milk (Water Dep.) 17

Cumulative Probability Summary..... 18

Summary of dose at graphical times, reptition 1..... 19

Summary of dose at graphical times, reptition 2..... 20

Summary of dose at graphical times, reptition 3..... 21

Peak of the mean dose at graphical times..... 22

Correlation and Regression coefficients (if any)..... 23

Probabilistic Input

Number of Sample Runs: 300

Number	Name	Distribution	Parameters			
1	DENSCZ	TRUNCATED NORMAL	1.52	.23	.001	.999
2	DCACTU1(6)	TRIANGULAR	50	1600	10000	
3	DCACTU1(7)	TRIANGULAR	50	1600	10000	
4	DCACTU1(8)	TRIANGULAR	50	1600	10000	

Probabilistic Results Summary . RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Total Dose Summary

Nuclide (j)	Peak Time	Peak Dose	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
			DOSE(j,t), mrem/yr							
U-234										
Min	0.00E+00	4.97E+00	4.97E+00	4.96E+00	4.96E+00	4.95E+00	4.93E+00	4.84E+00	4.66E+00	4.29E+00
Max	1.00E+03	5.41E+00	4.97E+00	4.97E+00	4.96E+00	4.96E+00	4.95E+00	4.92E+00	4.92E+00	5.41E+00
Avg	4.90E+02	5.03E+00	4.97E+00	4.97E+00	4.96E+00	4.96E+00	4.94E+00	4.89E+00	4.82E+00	4.94E+00
Std	5.00E+02	9.74E-02	6.96E-05	2.16E-04	5.10E-04	1.54E-03	4.46E-03	1.48E-02	4.79E-02	2.06E-01
U-235										
Min	4.37E+02	1.88E+00	1.58E+00	1.58E+00	1.58E+00	1.59E+00	1.59E+00	1.60E+00	1.80E+00	1.62E+00
Max	7.09E+02	2.43E+00	1.58E+00	1.58E+00	1.59E+00	1.59E+00	1.60E+00	1.64E+00	2.02E+00	2.35E+00
Avg	5.75E+02	2.15E+00	1.58E+00	1.58E+00	1.59E+00	1.59E+00	1.60E+00	1.63E+00	1.93E+00	2.00E+00
Std	5.13E+01	1.02E-01	2.33E-05	7.07E-05	1.67E-04	5.28E-04	1.75E-03	7.76E-03	3.96E-02	1.36E-01
U-238										
Min	0.00E+00	1.88E+00	1.88E+00	1.88E+00	1.88E+00	1.88E+00	1.87E+00	1.83E+00	1.73E+00	1.41E+00
Max	0.00E+00	1.88E+00	1.88E+00	1.88E+00	1.88E+00	1.88E+00	1.88E+00	1.86E+00	1.81E+00	1.76E+00
Avg	0.00E+00	1.88E+00	1.88E+00	1.88E+00	1.88E+00	1.88E+00	1.87E+00	1.85E+00	1.78E+00	1.57E+00
Std	0.00E+00	2.71E-05	2.71E-05	8.27E-05	1.94E-04	5.83E-04	1.69E-03	5.49E-03	1.58E-02	4.81E-02
∑ALL										
Min	0.00E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.38E+00	8.27E+00	8.19E+00	7.32E+00
Max	1.00E+03	9.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.76E+00	9.42E+00
Avg	5.34E+02	8.72E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.37E+00	8.54E+00	8.50E+00
Std	2.33E+02	2.05E-01	1.20E-04	3.69E-04	8.71E-04	2.65E-03	7.90E-03	2.80E-02	1.03E-01	3.88E-01

∑ALL is total dose summed for all nuclides.

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Risk Summary

Nuclide (j)	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
	RISK(j,t)							
U-234								
Min	4.82E-05	4.82E-05	4.82E-05	4.81E-05	4.78E-05	4.71E-05	4.59E-05	4.50E-05
Max	4.82E-05	4.82E-05	4.82E-05	4.81E-05	4.80E-05	4.79E-05	4.87E-05	5.87E-05
Avg	4.82E-05	4.82E-05	4.82E-05	4.81E-05	4.80E-05	4.76E-05	4.76E-05	5.28E-05
Std	0.00E+00	1.38E-09	4.23E-09	1.42E-08	4.26E-08	1.45E-07	5.06E-07	2.53E-06
U-235								
Min	3.14E-05	3.14E-05	3.14E-05	3.13E-05	3.12E-05	3.06E-05	2.92E-05	2.40E-05
Max	3.14E-05	3.14E-05	3.14E-05	3.14E-05	3.13E-05	3.12E-05	3.09E-05	2.89E-05
Avg	3.14E-05	3.14E-05	3.14E-05	3.14E-05	3.13E-05	3.10E-05	3.03E-05	2.69E-05
Std	0.00E+00	9.28E-10	2.79E-09	9.33E-09	2.84E-08	9.88E-08	3.09E-07	8.92E-07
U-238								
Min	2.97E-05	2.97E-05	2.97E-05	2.96E-05	2.95E-05	2.89E-05	2.73E-05	2.23E-05
Max	2.97E-05	2.97E-05	2.97E-05	2.97E-05	2.96E-05	2.94E-05	2.86E-05	2.70E-05
Avg	2.97E-05	2.97E-05	2.97E-05	2.97E-05	2.96E-05	2.92E-05	2.81E-05	2.47E-05
Std	0.00E+00	8.68E-10	2.63E-09	8.77E-09	2.62E-08	8.62E-08	2.49E-07	7.42E-07
∑ALL								
Min	1.09E-04	1.09E-04	1.09E-04	1.09E-04	1.08E-04	1.07E-04	1.02E-04	9.12E-05
Max	1.09E-04	1.09E-04	1.09E-04	1.09E-04	1.09E-04	1.08E-04	1.08E-04	1.14E-04
Avg	1.09E-04	1.09E-04	1.09E-04	1.09E-04	1.09E-04	1.08E-04	1.06E-04	1.04E-04
Std	0.00E+00	3.18E-09	9.65E-09	3.23E-08	9.73E-08	3.30E-07	1.06E-06	4.16E-06

∑ALL is total risk summed for all nuclides.

Proobabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Ground External

Nuclide (j)	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
	DOSE(i,j,t), mrem/yr							
U-234								
Min	1.43E-02	1.43E-02	1.43E-02	1.43E-02	1.48E-02	2.01E-02	5.17E-02	1.89E-01
Max	1.43E-02	1.43E-02	1.43E-02	1.44E-02	1.49E-02	2.10E-02	6.47E-02	3.39E-01
Avg	1.43E-02	1.43E-02	1.43E-02	1.44E-02	1.49E-02	2.07E-02	5.93E-02	2.69E-01
Std	2.11E-07	6.35E-07	1.49E-06	4.61E-06	1.69E-05	1.69E-04	2.40E-03	2.81E-02
U-235								
Min	1.35E+00	1.35E+00	1.34E+00	1.34E+00	1.34E+00	1.31E+00	1.24E+00	1.01E+00
Max	1.35E+00	1.35E+00	1.35E+00	1.34E+00	1.34E+00	1.33E+00	1.31E+00	1.20E+00
Avg	1.35E+00	1.35E+00	1.35E+00	1.34E+00	1.34E+00	1.33E+00	1.28E+00	1.13E+00
Std	1.99E-05	5.97E-05	1.39E-04	4.19E-04	1.23E-03	4.17E-03	1.24E-02	3.47E-02
U-238								
Min	9.47E-01	9.47E-01	9.46E-01	9.44E-01	9.39E-01	9.20E-01	8.68E-01	7.08E-01
Max	9.47E-01	9.47E-01	9.47E-01	9.46E-01	9.44E-01	9.35E-01	9.12E-01	8.34E-01
Avg	9.47E-01	9.47E-01	9.47E-01	9.45E-01	9.42E-01	9.30E-01	8.95E-01	7.86E-01
Std	1.40E-05	4.20E-05	9.80E-05	2.94E-04	8.50E-04	2.76E-03	7.93E-03	2.30E-02
∑ALL								
Min	2.31E+00	2.31E+00	2.31E+00	2.30E+00	2.29E+00	2.25E+00	2.16E+00	1.91E+00
Max	2.31E+00	2.31E+00	2.31E+00	2.30E+00	2.30E+00	2.29E+00	2.28E+00	2.38E+00
Avg	2.31E+00	2.31E+00	2.31E+00	2.30E+00	2.30E+00	2.28E+00	2.24E+00	2.18E+00
Std	3.41E-05	1.02E-04	2.39E-04	7.17E-04	2.09E-03	7.09E-03	2.27E-02	8.57E-02

∑ALL is total pathway dose summed for all nuclides.

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Inhalation (w/o Radon)

Nuclide (j)	DOSE(i,j,t), mrem/yr t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
U-234								
Min	5.78E-01	5.78E-01	5.78E-01	5.77E-01	5.73E-01	5.63E-01	5.33E-01	4.42E-01
Max	5.78E-01	5.78E-01	5.78E-01	5.78E-01	5.76E-01	5.72E-01	5.60E-01	5.20E-01
Avg	5.78E-01	5.78E-01	5.78E-01	5.77E-01	5.75E-01	5.69E-01	5.50E-01	4.90E-01
Std	8.55E-06	2.57E-05	5.98E-05	1.79E-04	5.19E-04	1.69E-03	4.86E-03	1.42E-02
U-235								
Min	2.74E-02	2.74E-02	2.74E-02	2.74E-02	2.76E-02	2.82E-02	2.78E-02	2.29E-02
Max	2.74E-02	2.74E-02	2.74E-02	2.75E-02	2.78E-02	2.92E-02	3.17E-02	3.18E-02
Avg	2.74E-02	2.74E-02	2.74E-02	2.75E-02	2.77E-02	2.88E-02	3.00E-02	2.75E-02
Std	4.07E-07	1.22E-06	2.89E-06	9.22E-06	3.42E-05	1.91E-04	7.29E-04	1.62E-03
U-238								
Min	1.04E-01	1.03E-01	1.03E-01	1.03E-01	1.03E-01	1.01E-01	9.50E-02	7.77E-02
Max	1.04E-01	1.04E-01	1.03E-01	1.03E-01	1.03E-01	1.02E-01	9.97E-02	9.15E-02
Avg	1.04E-01	1.04E-01	1.03E-01	1.03E-01	1.03E-01	1.02E-01	9.80E-02	8.61E-02
Std	1.53E-06	4.59E-06	1.07E-05	3.21E-05	9.29E-05	3.02E-04	8.68E-04	2.52E-03
∑ALL								
Min	7.09E-01	7.09E-01	7.08E-01	7.07E-01	7.04E-01	6.91E-01	6.56E-01	5.43E-01
Max	7.09E-01	7.09E-01	7.09E-01	7.08E-01	7.07E-01	7.03E-01	6.91E-01	6.43E-01
Avg	7.09E-01	7.09E-01	7.09E-01	7.08E-01	7.06E-01	6.99E-01	6.78E-01	6.04E-01
Std	1.05E-05	3.15E-05	7.34E-05	2.21E-04	6.46E-04	2.18E-03	6.45E-03	1.83E-02

∑ALL is total pathway dose summed for all nuclides.

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Radon (Water Ind.)

Nuclide (j)	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
	DOSE(i,j,t), mrem/yr							
U-234								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U-235								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U-238								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
∑ALL								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

∑ALL is total pathway dose summed for all nuclides.

Probabilistic results summary . RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Plant (Water Ind.)

Nuclide (j)	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
	DOSE(i,j,t), mrem/yr							
U-234								
Min	3.94E+00	3.94E+00	3.94E+00	3.93E+00	3.91E+00	3.84E+00	3.68E+00	3.26E+00
Max	3.94E+00	3.94E+00	3.94E+00	3.94E+00	3.93E+00	3.90E+00	3.88E+00	4.05E+00
Avg	3.94E+00	3.94E+00	3.94E+00	3.93E+00	3.92E+00	3.88E+00	3.80E+00	3.72E+00
Std	5.47E-05	1.71E-04	4.04E-04	1.22E-03	3.53E-03	1.17E-02	3.69E-02	1.45E-01
U-235								
Min	1.89E-01	1.90E-01	1.91E-01	1.95E-01	2.06E-01	2.35E-01	2.55E-01	2.15E-01
Max	1.89E-01	1.90E-01	1.91E-01	1.96E-01	2.09E-01	2.51E-01	3.26E-01	3.67E-01
Avg	1.89E-01	1.90E-01	1.91E-01	1.96E-01	2.08E-01	2.45E-01	2.95E-01	2.90E-01
Std	2.71E-06	8.80E-06	2.27E-05	9.01E-05	4.46E-04	3.10E-03	1.33E-02	2.81E-02
U-238								
Min	7.50E-01	7.50E-01	7.49E-01	7.48E-01	7.44E-01	7.29E-01	6.88E-01	5.63E-01
Max	7.50E-01	7.50E-01	7.50E-01	7.49E-01	7.47E-01	7.41E-01	7.23E-01	6.63E-01
Avg	7.50E-01	7.50E-01	7.50E-01	7.49E-01	7.46E-01	7.36E-01	7.10E-01	6.24E-01
Std	1.04E-05	3.25E-05	7.68E-05	2.32E-04	6.72E-04	2.19E-03	6.29E-03	1.83E-02
∑ALL								
Min	4.88E+00	4.88E+00	4.88E+00	4.87E+00	4.86E+00	4.80E+00	4.62E+00	4.04E+00
Max	4.88E+00	4.88E+00	4.88E+00	4.88E+00	4.88E+00	4.89E+00	4.93E+00	5.08E+00
Avg	4.88E+00	4.88E+00	4.88E+00	4.88E+00	4.87E+00	4.86E+00	4.81E+00	4.63E+00
Std	6.78E-05	2.12E-04	5.03E-04	1.54E-03	4.65E-03	1.69E-02	5.64E-02	1.91E-01

∑ALL is total pathway dose summed for all nuclides.

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Meat (Water Ind.)

Nuclide (j)	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
	DOSE(i,j,t), mrem/yr							
U-234								
Min	5.11E-02	5.11E-02	5.11E-02	5.10E-02	5.07E-02	4.98E-02	4.76E-02	4.21E-02
Max	5.11E-02	5.11E-02	5.11E-02	5.10E-02	5.09E-02	5.06E-02	5.02E-02	5.22E-02
Avg	5.11E-02	5.11E-02	5.11E-02	5.10E-02	5.08E-02	5.03E-02	4.93E-02	4.80E-02
Std	6.45E-07	2.14E-06	5.16E-06	1.57E-05	4.58E-05	1.51E-04	4.76E-04	1.86E-03
U-235								
Min	2.48E-03	2.53E-03	2.63E-03	2.98E-03	3.87E-03	6.00E-03	7.93E-03	6.96E-03
Max	2.48E-03	2.53E-03	2.63E-03	3.00E-03	3.98E-03	6.91E-03	1.20E-02	1.54E-02
Avg	2.48E-03	2.53E-03	2.63E-03	2.99E-03	3.94E-03	6.55E-03	1.02E-02	1.10E-02
Std	3.61E-08	1.47E-07	5.06E-07	3.11E-06	2.10E-05	1.67E-04	7.64E-04	1.58E-03
U-238								
Min	9.73E-03	9.73E-03	9.72E-03	9.70E-03	9.65E-03	9.46E-03	8.93E-03	7.30E-03
Max	9.73E-03	9.73E-03	9.73E-03	9.72E-03	9.70E-03	9.61E-03	9.38E-03	8.60E-03
Avg	9.73E-03	9.73E-03	9.73E-03	9.71E-03	9.68E-03	9.55E-03	9.21E-03	8.10E-03
Std	1.23E-07	4.07E-07	9.82E-07	2.99E-06	8.71E-06	2.84E-05	8.16E-05	2.37E-04
∑ALL								
Min	6.33E-02	6.34E-02	6.34E-02	6.36E-02	6.42E-02	6.52E-02	6.45E-02	5.63E-02
Max	6.33E-02	6.34E-02	6.35E-02	6.38E-02	6.46E-02	6.71E-02	7.16E-02	7.62E-02
Avg	6.33E-02	6.34E-02	6.34E-02	6.37E-02	6.45E-02	6.64E-02	6.87E-02	6.71E-02
Std	8.04E-07	2.69E-06	6.65E-06	2.18E-05	7.55E-05	3.47E-04	1.32E-03	3.67E-03

∑ALL is total pathway dose summed for all nuclides.

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Milk (Water Ind.)

Nuclide (j)	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
	DOSE(i,j,t), mrem/yr							
U-234								
Min	1.36E-01	1.36E-01	1.36E-01	1.36E-01	1.35E-01	1.32E-01	1.25E-01	1.05E-01
Max	1.36E-01	1.36E-01	1.36E-01	1.36E-01	1.36E-01	1.35E-01	1.32E-01	1.26E-01
Avg	1.36E-01	1.36E-01	1.36E-01	1.36E-01	1.35E-01	1.34E-01	1.29E-01	1.17E-01
Std	1.91E-06	5.93E-06	1.40E-05	4.21E-05	1.22E-04	3.99E-04	1.18E-03	3.82E-03
U-235								
Min	6.54E-03	6.54E-03	6.53E-03	6.52E-03	6.49E-03	6.36E-03	6.02E-03	4.91E-03
Max	6.54E-03	6.54E-03	6.54E-03	6.53E-03	6.52E-03	6.48E-03	6.34E-03	5.83E-03
Avg	6.54E-03	6.54E-03	6.53E-03	6.53E-03	6.51E-03	6.43E-03	6.22E-03	5.47E-03
Std	9.18E-08	2.84E-07	6.72E-07	2.03E-06	5.95E-06	2.00E-05	5.91E-05	1.67E-04
U-238								
Min	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.57E-02	2.52E-02	2.38E-02	1.95E-02
Max	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.58E-02	2.56E-02	2.50E-02	2.29E-02
Avg	2.59E-02	2.59E-02	2.59E-02	2.59E-02	2.58E-02	2.55E-02	2.45E-02	2.16E-02
Std	3.65E-07	1.13E-06	2.66E-06	8.02E-06	2.32E-05	7.56E-05	2.17E-04	6.31E-04
∑ALL								
Min	1.69E-01	1.69E-01	1.69E-01	1.68E-01	1.67E-01	1.64E-01	1.55E-01	1.29E-01
Max	1.69E-01	1.69E-01	1.69E-01	1.68E-01	1.68E-01	1.67E-01	1.63E-01	1.54E-01
Avg	1.69E-01	1.69E-01	1.69E-01	1.68E-01	1.68E-01	1.66E-01	1.60E-01	1.44E-01
Std	2.37E-06	7.34E-06	1.73E-05	5.22E-05	1.51E-04	4.95E-04	1.46E-03	4.62E-03

∑ALL is total pathway dose summed for all nuclides.

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Soil Ingestion

Nuclide (j)	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
	DOSE(i,j,t), mrem/yr							
U-234								
Min	2.47E-01	2.47E-01	2.47E-01	2.46E-01	2.45E-01	2.40E-01	2.28E-01	1.91E-01
Max	2.47E-01	2.47E-01	2.47E-01	2.47E-01	2.46E-01	2.44E-01	2.40E-01	2.27E-01
Avg	2.47E-01	2.47E-01	2.47E-01	2.46E-01	2.46E-01	2.43E-01	2.35E-01	2.13E-01
Std	3.65E-06	1.10E-05	2.56E-05	7.65E-05	2.22E-04	7.22E-04	2.11E-03	6.55E-03
U-235								
Min	1.19E-02	1.19E-02	1.19E-02	1.19E-02	1.21E-02	1.27E-02	1.28E-02	1.06E-02
Max	1.19E-02	1.19E-02	1.19E-02	1.20E-02	1.22E-02	1.32E-02	1.51E-02	1.56E-02
Avg	1.19E-02	1.19E-02	1.19E-02	1.19E-02	1.22E-02	1.30E-02	1.41E-02	1.32E-02
Std	1.77E-07	5.36E-07	1.29E-06	4.32E-06	1.74E-05	1.05E-04	4.19E-04	9.15E-04
U-238								
Min	4.70E-02	4.70E-02	4.70E-02	4.69E-02	4.66E-02	4.57E-02	4.31E-02	3.53E-02
Max	4.70E-02	4.70E-02	4.70E-02	4.69E-02	4.68E-02	4.64E-02	4.53E-02	4.15E-02
Avg	4.70E-02	4.70E-02	4.70E-02	4.69E-02	4.67E-02	4.61E-02	4.45E-02	3.91E-02
Std	6.95E-07	2.09E-06	4.86E-06	1.46E-05	4.22E-05	1.37E-04	3.94E-04	1.14E-03
∑ALL								
Min	3.06E-01	3.06E-01	3.05E-01	3.05E-01	3.04E-01	2.99E-01	2.84E-01	2.37E-01
Max	3.06E-01	3.06E-01	3.06E-01	3.06E-01	3.05E-01	3.04E-01	3.00E-01	2.84E-01
Avg	3.06E-01	3.06E-01	3.06E-01	3.05E-01	3.05E-01	3.02E-01	2.94E-01	2.65E-01
Std	4.52E-06	1.36E-05	3.17E-05	9.54E-05	2.81E-04	9.64E-04	2.92E-03	8.61E-03

∑ALL is total pathway dose summed for all nuclides.

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Water Ingestion

Nuclide (j)	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
	DOSE(i,j,t), mrem/yr							
U-234								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.77E-07	5.15E-02
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.06E-07	7.68E-02
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.85E-07	6.58E-02
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.21E-09	4.75E-03
U-235								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.79E-04	2.05E-01	2.75E-01
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-04	2.57E-01	5.69E-01
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.11E-04	2.36E-01	4.19E-01
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.15E-06	9.62E-03	5.52E-02
U-238								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.99E-11	7.43E-06
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.01E-08	1.10E-01
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-09	7.41E-04
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.20E-09	8.93E-03
∑ALL								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.79E-04	2.05E-01	3.26E-01
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.30E-04	2.57E-01	6.85E-01
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.11E-04	2.36E-01	4.86E-01
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.15E-06	9.62E-03	6.16E-02

∑ALL is total pathway dose summed for all nuclides.

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Fish Ingestion

Nuclide (j)	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
	DOSE(i,j,t), mrem/yr							
U-234								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.17E-08	3.90E-03
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.34E-08	5.80E-03
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.23E-08	4.97E-03
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.73E-10	3.59E-04
U-235								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.96E-05	8.87E-03	1.13E-02
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.22E-05	1.13E-02	2.34E-02
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-05	1.03E-02	1.72E-02
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.65E-07	4.45E-04	2.27E-03
U-238								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.37E-12	5.61E-07
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.06E-09	6.18E-04
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E-10	4.80E-06
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.48E-10	5.02E-05
∑ALL								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.96E-05	8.87E-03	1.52E-02
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.22E-05	1.13E-02	2.92E-02
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-05	1.03E-02	2.22E-02
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.65E-07	4.45E-04	2.64E-03

∑ALL is total pathway dose summed for all nuclides.

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Radon (Water Dep.)

Nuclide (j)	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
	DOSE(i,j,t), mrem/yr							
U-234								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U-235								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U-238								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
∑ALL								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

∑ALL is total pathway dose summed for all nuclides.

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Plant (Water Dep.)

Nuclide (j)	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
	DOSE(i,j,t), mrem/yr							
U-234								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-07	1.02E-02
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-07	1.52E-02
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-07	1.30E-02
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.36E-10	9.39E-04
U-235								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-04	4.02E-02	5.40E-02
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-04	5.05E-02	1.12E-01
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-04	4.63E-02	8.24E-02
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-06	1.89E-03	1.09E-02
U-238								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.34E-12	1.47E-06
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-08	2.16E-02
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.46E-10	1.46E-04
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-09	1.76E-03
∑ALL								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.53E-04	4.02E-02	6.42E-02
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-04	5.05E-02	1.35E-01
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-04	4.63E-02	9.56E-02
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-06	1.89E-03	1.21E-02

∑ALL is total pathway dose summed for all nuclides.

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Meat (Water Dep.)

Nuclide (j)	DOSE(i,j,t), mrem/yr t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
U-234								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.08E-09	3.89E-04
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.30E-09	5.80E-04
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.15E-09	4.97E-04
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.28E-11	3.59E-05
U-235								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-07	1.65E-03	2.88E-03
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.45E-07	1.92E-03	5.92E-03
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-07	1.82E-03	4.39E-03
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-09	4.82E-05	5.72E-04
U-238								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E-13	5.62E-08
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.87E-10	3.35E-04
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.72E-11	2.30E-06
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.83E-11	2.72E-05
∑ALL								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-07	1.65E-03	3.27E-03
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.45E-07	1.92E-03	6.50E-03
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-07	1.82E-03	4.89E-03
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.59E-09	4.82E-05	6.11E-04

∑ALL is total pathway dose summed for all nuclides.

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Probabilistic Dose vs Pathway(i): Milk (Water Dep.)

Nuclide (j)	t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
	DOSE(i,j,t), mrem/yr							
U-234								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.69E-09	3.40E-04
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.97E-09	5.07E-04
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.76E-09	4.34E-04
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.70E-11	3.15E-05
U-235								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-07	5.23E-05	6.70E-05
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.42E-07	6.64E-05	3.48E-04
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-07	6.06E-05	1.04E-04
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.66E-09	2.60E-06	2.09E-05
U-238								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.15E-13	4.93E-08
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.40E-10	9.74E-04
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-11	6.55E-06
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.75E-11	7.92E-05
∑ALL								
Min	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-07	5.23E-05	4.07E-04
Max	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.42E-07	6.64E-05	1.59E-03
Avg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E-07	6.07E-05	5.44E-04
Std	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.66E-09	2.60E-06	9.66E-05

∑ALL is total pathway dose summed for all nuclides.

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Cumulative Probability Summary for: Total Dose Over Pathways

Cumulative Probability	Dose(t), mrem/yr t= 0.00E+00	1.00E+00	3.00E+00	1.00E+01	3.00E+01	1.00E+02	3.00E+02	1.00E+03
0.025	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.39E+00	8.30E+00	8.28E+00	7.59E+00
0.050	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.40E+00	8.31E+00	8.34E+00	7.80E+00
0.075	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.40E+00	8.32E+00	8.37E+00	7.90E+00
0.100	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.40E+00	8.33E+00	8.40E+00	7.98E+00
0.125	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.40E+00	8.33E+00	8.42E+00	8.05E+00
0.150	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.40E+00	8.34E+00	8.43E+00	8.09E+00
0.175	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.40E+00	8.34E+00	8.45E+00	8.15E+00
0.200	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.41E+00	8.35E+00	8.46E+00	8.19E+00
0.225	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.41E+00	8.35E+00	8.47E+00	8.23E+00
0.250	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.41E+00	8.35E+00	8.48E+00	8.28E+00
0.275	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.41E+00	8.35E+00	8.49E+00	8.29E+00
0.300	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.41E+00	8.36E+00	8.49E+00	8.32E+00
0.325	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.41E+00	8.36E+00	8.50E+00	8.36E+00
0.350	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.36E+00	8.51E+00	8.39E+00
0.375	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.36E+00	8.52E+00	8.41E+00
0.400	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.36E+00	8.52E+00	8.43E+00
0.425	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.37E+00	8.53E+00	8.46E+00
0.450	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.37E+00	8.54E+00	8.49E+00
0.475	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.37E+00	8.54E+00	8.51E+00
0.500	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.37E+00	8.55E+00	8.54E+00
0.525	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.37E+00	8.56E+00	8.56E+00
0.550	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.37E+00	8.56E+00	8.58E+00
0.575	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.38E+00	8.57E+00	8.60E+00
0.600	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.38E+00	8.57E+00	8.63E+00
0.625	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.41E+00	8.38E+00	8.58E+00	8.65E+00
0.650	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.38E+00	8.59E+00	8.68E+00
0.675	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.38E+00	8.59E+00	8.70E+00
0.700	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.38E+00	8.60E+00	8.73E+00
0.725	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.39E+00	8.60E+00	8.75E+00
0.750	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.39E+00	8.61E+00	8.78E+00
0.775	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.39E+00	8.62E+00	8.81E+00
0.800	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.39E+00	8.62E+00	8.83E+00
0.825	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.39E+00	8.63E+00	8.86E+00
0.850	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.39E+00	8.64E+00	8.89E+00
0.875	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.40E+00	8.65E+00	8.93E+00
0.900	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.40E+00	8.66E+00	8.98E+00
0.925	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.40E+00	8.67E+00	9.02E+00
0.950	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.41E+00	8.68E+00	9.10E+00
0.975	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.42E+00	8.41E+00	8.71E+00	9.18E+00
1.000	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.76E+00	9.42E+00

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Summary of dose at graphical times, reptition 1

Dose statistics at graphical times, mrem/yr

Time Years	Minimum	Maximum	Mean	Median	90%	95%	97.5%	99%
0.00E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.00E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.30E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.70E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
2.22E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
2.89E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
3.00E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
3.78E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
4.92E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
6.42E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
8.38E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.00E+01	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.09E+01	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.43E+01	8.41E+00	8.43E+00	8.42E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.86E+01	8.40E+00	8.43E+00	8.42E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
2.42E+01	8.39E+00	8.43E+00	8.42E+00	8.42E+00	8.42E+00	8.42E+00	8.43E+00	8.43E+00
3.00E+01	8.39E+00	8.43E+00	8.41E+00	8.41E+00	8.42E+00	8.42E+00	8.42E+00	8.43E+00
3.16E+01	8.38E+00	8.43E+00	8.41E+00	8.41E+00	8.42E+00	8.42E+00	8.42E+00	8.43E+00
4.12E+01	8.37E+00	8.42E+00	8.40E+00	8.41E+00	8.42E+00	8.42E+00	8.42E+00	8.42E+00
5.38E+01	8.35E+00	8.42E+00	8.40E+00	8.40E+00	8.41E+00	8.42E+00	8.42E+00	8.42E+00
7.02E+01	8.32E+00	8.42E+00	8.39E+00	8.39E+00	8.41E+00	8.41E+00	8.42E+00	8.42E+00
9.15E+01	8.29E+00	8.42E+00	8.37E+00	8.38E+00	8.40E+00	8.41E+00	8.41E+00	8.42E+00
1.00E+02	8.27E+00	8.42E+00	8.37E+00	8.37E+00	8.40E+00	8.41E+00	8.41E+00	8.42E+00
1.19E+02	8.25E+00	8.42E+00	8.36E+00	8.36E+00	8.40E+00	8.41E+00	8.41E+00	8.42E+00
1.56E+02	8.20E+00	8.43E+00	8.35E+00	8.36E+00	8.40E+00	8.42E+00	8.42E+00	8.43E+00
2.03E+02	8.16E+00	8.48E+00	8.37E+00	8.37E+00	8.44E+00	8.46E+00	8.47E+00	8.48E+00
2.65E+02	8.19E+00	8.63E+00	8.47E+00	8.48E+00	8.57E+00	8.60E+00	8.62E+00	8.63E+00
3.00E+02	8.21E+00	8.73E+00	8.54E+00	8.55E+00	8.66E+00	8.69E+00	8.71E+00	8.73E+00
3.46E+02	8.20E+00	8.83E+00	8.60E+00	8.61E+00	8.75E+00	8.78E+00	8.81E+00	8.83E+00
4.51E+02	8.11E+00	9.00E+00	8.67E+00	8.69E+00	8.88E+00	8.93E+00	8.97E+00	9.00E+00
5.88E+02	7.94E+00	9.14E+00	8.67E+00	8.70E+00	8.97E+00	9.04E+00	9.09E+00	9.14E+00
7.67E+02	7.69E+00	9.23E+00	8.62E+00	8.65E+00	9.00E+00	9.10E+00	9.17E+00	9.23E+00
1.00E+03	7.36E+00	9.27E+00	8.50E+00	8.53E+00	8.98E+00	9.13E+00	9.21E+00	9.27E+00

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Summary of dose at graphical times, repetition 2

Dose statistics at graphical times, mrem/yr

Time Years	Minimum	Maximum	Mean	Median	90%	95%	97.5%	99%
0.00E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.00E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.30E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.70E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
2.22E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
2.89E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
3.00E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
3.78E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
4.92E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
6.42E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
8.38E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.00E+01	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.09E+01	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.43E+01	8.41E+00	8.43E+00	8.42E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.86E+01	8.40E+00	8.43E+00	8.42E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
2.42E+01	8.40E+00	8.43E+00	8.42E+00	8.42E+00	8.42E+00	8.42E+00	8.43E+00	8.43E+00
3.00E+01	8.39E+00	8.43E+00	8.41E+00	8.41E+00	8.42E+00	8.42E+00	8.42E+00	8.43E+00
3.16E+01	8.38E+00	8.43E+00	8.41E+00	8.41E+00	8.42E+00	8.42E+00	8.42E+00	8.43E+00
4.12E+01	8.37E+00	8.43E+00	8.40E+00	8.41E+00	8.42E+00	8.42E+00	8.42E+00	8.43E+00
5.38E+01	8.35E+00	8.43E+00	8.40E+00	8.40E+00	8.41E+00	8.42E+00	8.42E+00	8.43E+00
7.02E+01	8.32E+00	8.42E+00	8.39E+00	8.39E+00	8.41E+00	8.41E+00	8.42E+00	8.42E+00
9.15E+01	8.29E+00	8.42E+00	8.37E+00	8.38E+00	8.40E+00	8.41E+00	8.41E+00	8.42E+00
1.00E+02	8.28E+00	8.43E+00	8.37E+00	8.37E+00	8.40E+00	8.41E+00	8.41E+00	8.43E+00
1.19E+02	8.25E+00	8.43E+00	8.36E+00	8.36E+00	8.40E+00	8.41E+00	8.42E+00	8.43E+00
1.56E+02	8.21E+00	8.45E+00	8.35E+00	8.36E+00	8.40E+00	8.41E+00	8.43E+00	8.45E+00
2.03E+02	8.17E+00	8.50E+00	8.37E+00	8.37E+00	8.44E+00	8.45E+00	8.47E+00	8.50E+00
2.65E+02	8.21E+00	8.66E+00	8.47E+00	8.48E+00	8.58E+00	8.60E+00	8.62E+00	8.66E+00
3.00E+02	8.22E+00	8.76E+00	8.54E+00	8.55E+00	8.66E+00	8.68E+00	8.71E+00	8.76E+00
3.46E+02	8.22E+00	8.87E+00	8.60E+00	8.61E+00	8.75E+00	8.78E+00	8.81E+00	8.87E+00
4.51E+02	8.14E+00	9.06E+00	8.67E+00	8.69E+00	8.88E+00	8.93E+00	8.98E+00	9.06E+00
5.88E+02	7.97E+00	9.22E+00	8.68E+00	8.70E+00	8.97E+00	9.03E+00	9.11E+00	9.22E+00
7.67E+02	7.73E+00	9.34E+00	8.62E+00	8.65E+00	9.00E+00	9.09E+00	9.19E+00	9.34E+00
1.00E+03	7.41E+00	9.42E+00	8.50E+00	8.54E+00	8.98E+00	9.09E+00	9.21E+00	9.42E+00

Ver | | | /20 | | P

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Summary of dose at graphical times, reptition 3

Dose statistics at graphical times, mrem/yr

Time Years	Minimum	Maximum	Mean	Median	90%	95%	97.5%	99%
0.00E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.00E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.30E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.70E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
2.22E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
2.89E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
3.00E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
3.78E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
4.92E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
6.42E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
8.38E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.00E+01	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.09E+01	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.43E+01	8.41E+00	8.43E+00	8.42E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
1.86E+01	8.40E+00	8.43E+00	8.42E+00	8.42E+00	8.43E+00	8.43E+00	8.43E+00	8.43E+00
2.42E+01	8.39E+00	8.43E+00	8.42E+00	8.42E+00	8.42E+00	8.42E+00	8.43E+00	8.43E+00
3.00E+01	8.38E+00	8.43E+00	8.41E+00	8.41E+00	8.42E+00	8.42E+00	8.42E+00	8.43E+00
3.16E+01	8.38E+00	8.43E+00	8.41E+00	8.41E+00	8.42E+00	8.42E+00	8.42E+00	8.43E+00
4.12E+01	8.37E+00	8.43E+00	8.40E+00	8.41E+00	8.42E+00	8.42E+00	8.42E+00	8.43E+00
5.38E+01	8.35E+00	8.42E+00	8.40E+00	8.40E+00	8.41E+00	8.42E+00	8.42E+00	8.42E+00
7.02E+01	8.32E+00	8.42E+00	8.39E+00	8.39E+00	8.41E+00	8.41E+00	8.42E+00	8.42E+00
9.15E+01	8.28E+00	8.42E+00	8.37E+00	8.38E+00	8.40E+00	8.41E+00	8.41E+00	8.42E+00
1.00E+02	8.27E+00	8.42E+00	8.37E+00	8.37E+00	8.40E+00	8.41E+00	8.41E+00	8.42E+00
1.19E+02	8.24E+00	8.42E+00	8.36E+00	8.36E+00	8.40E+00	8.41E+00	8.41E+00	8.42E+00
1.56E+02	8.19E+00	8.44E+00	8.35E+00	8.36E+00	8.40E+00	8.41E+00	8.42E+00	8.44E+00
2.03E+02	8.16E+00	8.49E+00	8.37E+00	8.37E+00	8.44E+00	8.45E+00	8.47E+00	8.49E+00
2.65E+02	8.18E+00	8.65E+00	8.47E+00	8.48E+00	8.57E+00	8.60E+00	8.62E+00	8.65E+00
3.00E+02	8.19E+00	8.74E+00	8.54E+00	8.55E+00	8.66E+00	8.68E+00	8.71E+00	8.74E+00
3.46E+02	8.18E+00	8.85E+00	8.60E+00	8.61E+00	8.75E+00	8.78E+00	8.81E+00	8.85E+00
4.51E+02	8.09E+00	9.03E+00	8.67E+00	8.69E+00	8.88E+00	8.92E+00	8.97E+00	9.03E+00
5.88E+02	7.91E+00	9.18E+00	8.68E+00	8.70E+00	8.96E+00	9.03E+00	9.09E+00	9.18E+00
7.67E+02	7.66E+00	9.29E+00	8.62E+00	8.65E+00	9.00E+00	9.08E+00	9.17E+00	9.29E+00
1.00E+03	7.32E+00	9.35E+00	8.50E+00	8.53E+00	9.00E+00	9.11E+00	9.20E+00	9.35E+00

Ver t = 5/20 ^1 P

Probabilistic results summary : RESRAD Default Parameters

File : Kvwpca-avg.RAD

Peak of the mean dose (averaged over observations) at graphical times

Repetition	Time of peak mean dose	Peak mean dose
	Years	mrem/yr
1	5.878E+02	8.674E+00
2	5.878E+02	8.676E+00
3	5.878E+02	8.675E+00

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak of mean dose time Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.99	1	0.99	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	4	-0.01	4	0.00	4	0.03	4	0.00
Kd of U-235 in Unsaturated Zone 1	3	0.02	3	0.00	2	-0.09	2	0.00
Kd of U-238 in Unsaturated Zone 1	2	-0.03	2	0.00	3	0.07	3	0.00
R-SQUARE		0.98		0.98		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak of mean dose time Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.99	1	0.99	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	3	-0.13	3	-0.02	2	-0.08	2	0.00
Kd of U-235 in Unsaturated Zone 1	2	-0.19	2	-0.03	4	-0.04	4	0.00
Kd of U-238 in Unsaturated Zone 1	4	0.03	4	0.00	3	0.06	3	0.00
R-SQUARE		0.98		0.98		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : Default Parameters

Input File : Kvwpca-avg.RAD

Coefficients for peak of mean dose time Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.99	1	0.99	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	4	0.01	4	0.00	2	-0.10	2	0.00
Kd of U-235 in Unsaturated Zone 1	2	-0.28	2	-0.04	4	-0.04	4	0.00
Kd of U-238 in Unsaturated Zone 1	3	-0.12	3	-0.02	3	-0.05	3	0.00
R-SQUARE		0.98		0.98		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak All Pathways Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.98	1	0.98	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	3	-0.08	3	-0.01	4	-0.01	4	0.00
Kd of U-235 in Unsaturated Zone 1	2	-0.11	2	-0.02	2	-0.03	2	0.00
Kd of U-238 in Unsaturated Zone 1	4	-0.02	4	0.00	3	0.02	3	0.00
R-SQUARE		0.96		0.96		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak All Pathways Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =								
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.99	1	0.99	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	3	0.10	3	0.02	3	-0.02	3	0.00
Kd of U-235 in Unsaturated Zone 1	2	0.14	2	0.02	4	0.02	4	0.00
Kd of U-238 in Unsaturated Zone 1	4	0.04	4	0.01	2	0.09	2	0.00
R-SQUARE		0.97		0.97		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak All Pathways Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.98	1	0.98	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	4	-0.01	4	0.00	3	0.01	3	0.00
Kd of U-235 in Unsaturated Zone 1	2	0.25	2	0.05	2	0.21	2	0.01
Kd of U-238 in Unsaturated Zone 1	3	0.05	3	0.01	4	0.00	4	0.00
R-SQUARE		0.97		0.97		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak External Ground Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.43	1	0.43	1	0.55	1	0.55
Kd of U-234 in Unsaturated Zone 1	2	0.04	2	0.03	4	0.08	4	0.06
Kd of U-235 in Unsaturated Zone 1	3	-0.02	3	-0.01	2	0.10	2	0.09
Kd of U-238 in Unsaturated Zone 1	4	0.02	4	0.01	3	-0.09	3	-0.08
R-SQUARE		0.18		0.18		0.31		0.31

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak External Ground Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.45	1	0.44	1	0.53	1	0.52
Kd of U-234 in Unsaturated Zone 1	2	0.14	2	0.12	2	0.09	2	0.07
Kd of U-235 in Unsaturated Zone 1	3	0.08	3	0.07	4	-0.06	4	-0.05
Kd of U-238 in Unsaturated Zone 1	4	0.01	4	0.01	3	-0.07	3	-0.06
R-SQUARE		0.21		0.21		0.28		0.28

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak External Ground Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.43	1	0.42	1	0.51	1	0.50
Kd of U-234 in Unsaturated Zone 1	3	0.07	3	0.06	3	0.08	3	0.07
Kd of U-235 in Unsaturated Zone 1	2	0.11	2	0.10	2	-0.16	2	-0.14
Kd of U-238 in Unsaturated Zone 1	4	0.06	4	0.05	4	0.05	4	0.04
R-SQUARE		0.20		0.20		0.27		0.27

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Inhalation particles Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =								
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.57	1	0.57	1	0.50	1	0.50
Kd of U-234 in Unsaturated Zone 1	3	0.02	3	0.02	4	0.06	4	0.05
Kd of U-235 in Unsaturated Zone 1	2	0.08	2	0.07	2	0.07	2	0.06
Kd of U-238 in Unsaturated Zone 1	4	-0.02	4	-0.02	3	-0.06	3	-0.06
R-SQUARE		0.33		0.33		0.26		0.26

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Inhalation particles Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.54	1	0.53	1	0.47	1	0.47
Kd of U-234 in Unsaturated Zone 1	3	-0.05	3	-0.04	4	-0.03	4	-0.03
Kd of U-235 in Unsaturated Zone 1	2	-0.13	2	-0.11	2	-0.13	2	-0.12
Kd of U-238 in Unsaturated Zone 1	4	-0.03	4	-0.02	3	-0.05	3	-0.04
R-SQUARE		0.30		0.30		0.24		0.24

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Inhalation particles Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =								
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.56	1	0.54	1	0.48	1	0.47
Kd of U-234 in Unsaturated Zone 1	3	0.09	3	0.08	3	0.11	3	0.09
Kd of U-235 in Unsaturated Zone 1	2	-0.25	2	-0.21	2	-0.23	2	-0.20
Kd of U-238 in Unsaturated Zone 1	4	-0.08	4	-0.06	4	-0.04	4	-0.04
R-SQUARE		0.35		0.35		0.27		0.27

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Radon (WaterInd.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Radon (WaterInd.) Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =								
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : Default Parameters

Input File : Kvwpca-avg.RAD

Coefficients for peak Radon (WaterInd.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Plant (WaterInd.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.49	1	0.49	1	0.48	1	0.48
Kd of U-234 in Unsaturated Zone 1	2	0.04	2	0.04	4	-0.03	4	-0.02
Kd of U-235 in Unsaturated Zone 1	4	0.02	4	0.02	3	0.05	3	0.05
Kd of U-238 in Unsaturated Zone 1	3	-0.02	3	-0.02	2	-0.15	2	-0.13
R-SQUARE		0.24		0.24		0.24		0.24

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Plant (WaterInd.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.52	1	0.52	1	0.50	1	0.50
Kd of U-234 in Unsaturated Zone 1	2	0.15	2	0.13	3	0.08	3	0.07
Kd of U-235 in Unsaturated Zone 1	3	0.10	3	0.09	4	0.04	4	0.03
Kd of U-238 in Unsaturated Zone 1	4	-0.03	4	-0.03	2	-0.14	2	-0.12
R-SQUARE		0.29		0.29		0.27		0.27

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Plant (WaterInd.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.50	1	0.49	1	0.47	1	0.47
Kd of U-234 in Unsaturated Zone 1	3	0.09	3	0.08	4	0.03	4	0.02
Kd of U-235 in Unsaturated Zone 1	2	0.15	2	0.13	2	0.13	2	0.12
Kd of U-238 in Unsaturated Zone 1	4	0.07	4	0.06	3	0.13	3	0.11
R-SQUARE		0.27		0.27		0.25		0.25

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Meat (WaterInd.) Dose

Description of Probabilistic Variable	PCC Sig	PCC Coeff	SRC Sig	SRC Coeff	PRCC Sig	PRCC Coeff	SRRC Sig	SRRC Coeff
Coefficient =								
Repetition =	1		1		1		1	
Density of contaminated zone	1	0.99	1	0.99	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	3	0.02	3	0.00	2	0.11	2	0.00
Kd of U-235 in Unsaturated Zone 1	2	-0.02	2	0.00	3	0.06	3	0.00
Kd of U-238 in Unsaturated Zone 1	4	0.01	4	0.00	4	-0.06	4	0.00
R-SQUARE		0.98		0.98		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Meat (WaterInd.) Dose

Description of Probabilistic Variable	PCC Sig	PCC Coeff	SRC Sig	SRC Coeff	PRCC Sig	PRCC Coeff	SRRC Sig	SRRC Coeff
Coefficient =								
Repetition =	2		2		2		2	
Density of contaminated zone	1	0.99	1	0.99	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	2	0.15	2	0.02	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	3	0.14	3	0.02	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	4	-0.06	4	-0.01	0	0.00	0	0.00
R-SQUARE		0.98		0.98		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

T : Defau. meter:

Input File : Kvwpca-avg.RAD

Coefficients for peak Meat (WaterInd.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.99	1	0.99	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	4	0.03	4	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	2	0.22	2	0.03	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	3	0.11	3	0.01	0	0.00	0	0.00
R-SQUARE		0.98		0.98		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Milk (WaterInd.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Milk (WaterInd.) Dose

Description of Probabilistic Variable	PCC Sig	PCC Coeff	SRC Sig	SRC Coeff	PRCC Sig	PRCC Coeff	SRRC Sig	SRRC Coeff
Coefficient =								
Repetition =	2		2		2		2	
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Milk (WaterInd.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Soil Ingestion Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =								
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Soil Ingestion Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Soil Ingestion Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Water Ingestion Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =	1		1		1		1	
Repetition =								
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.99	1	0.99	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	2	-0.21	2	-0.04	3	-0.19	3	-0.01
Kd of U-235 in Unsaturated Zone 1	4	-0.15	4	-0.03	2	-0.36	2	-0.01
Kd of U-238 in Unsaturated Zone 1	3	-0.19	3	-0.03	4	-0.06	4	0.00
R-SQUARE		0.97		0.97		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Water Ingestion Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =								
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	1.00	1	1.00	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	3	-0.15	3	-0.01	4	0.05	4	0.00
Kd of U-235 in Unsaturated Zone 1	2	-0.42	2	-0.03	2	-0.40	2	-0.01
Kd of U-238 in Unsaturated Zone 1	4	0.04	4	0.00	3	-0.06	3	0.00
R-SQUARE		1.00		1.00		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Water Ingestion Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.99	1	0.98	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	4	0.11	4	0.02	4	0.06	4	0.00
Kd of U-235 in Unsaturated Zone 1	3	-0.23	3	-0.04	2	-0.29	2	-0.01
Kd of U-238 in Unsaturated Zone 1	2	-0.24	2	-0.04	3	-0.27	3	-0.01
R-SQUARE		0.97		0.97		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Fish Ingestion Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	1.00	1	1.00	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	3	-0.28	3	-0.01	3	-0.28	3	-0.01
Kd of U-235 in Unsaturated Zone 1	2	-0.32	2	-0.02	2	-0.48	2	-0.01
Kd of U-238 in Unsaturated Zone 1	4	-0.18	4	-0.01	4	-0.15	4	0.00
R-SQUARE		1.00		1.00		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Fish Ingestion Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	1.00	1	1.00	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	3	-0.28	3	-0.01	3	-0.05	3	0.00
Kd of U-235 in Unsaturated Zone 1	2	-0.43	2	-0.02	2	-0.37	2	-0.01
Kd of U-238 in Unsaturated Zone 1	4	0.07	4	0.00	4	0.04	4	0.00
R-SQUARE		1.00		1.00		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Fish Ingestion Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	1.00	1	1.00	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	4	-0.11	4	-0.01	4	-0.20	4	0.00
Kd of U-235 in Unsaturated Zone 1	2	-0.52	2	-0.03	2	-0.44	2	-0.01
Kd of U-238 in Unsaturated Zone 1	3	-0.25	3	-0.01	3	-0.24	3	-0.01
R-SQUARE		1.00		1.00		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Radon (WaterDep.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Radon (WaterDep.) Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =								
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Radon (WaterDcp.) Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =								
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Plant (WaterDep.) Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =								
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.99	1	0.99	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	2	-0.22	2	-0.04	3	-0.20	3	-0.01
Kd of U-235 in Unsaturated Zone 1	4	-0.16	4	-0.03	2	-0.39	2	-0.01
Kd of U-238 in Unsaturated Zone 1	3	-0.19	3	-0.03	4	-0.06	4	0.00
R-SQUARE		0.97		0.97		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Plant (WaterDep.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	1.00	1	1.00	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	3	-0.16	3	-0.01	4	0.05	4	0.00
Kd of U-235 in Unsaturated Zone 1	2	-0.43	2	-0.03	2	-0.39	2	-0.01
Kd of U-238 in Unsaturated Zone 1	4	0.03	4	0.00	3	-0.08	3	0.00
R-SQUARE		1.00		1.00		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Plant (WaterDep.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.99	1	0.98	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	4	0.11	4	0.02	4	0.06	4	0.00
Kd of U-235 in Unsaturated Zone 1	3	-0.23	3	-0.04	2	-0.31	2	-0.01
Kd of U-238 in Unsaturated Zone 1	2	-0.24	2	-0.04	3	-0.24	3	-0.01
R-SQUARE		0.97		0.97		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Meat (WaterDep.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	1.00	1	1.00	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	3	-0.22	3	-0.02	3	-0.21	3	-0.01
Kd of U-235 in Unsaturated Zone 1	2	-0.33	2	-0.02	2	-0.39	2	-0.02
Kd of U-238 in Unsaturated Zone 1	4	-0.10	4	-0.01	4	0.02	4	0.00
R-SQUARE		1.00		1.00		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Meat (WaterDep.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	1.00	1	1.00	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	3	-0.18	3	-0.01	3	-0.03	3	0.00
Kd of U-235 in Unsaturated Zone 1	2	-0.43	2	-0.03	2	-0.32	2	-0.02
Kd of U-238 in Unsaturated Zone 1	4	0.03	4	0.00	4	-0.02	4	0.00
R-SQUARE		1.00		1.00		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Meat (WaterDep.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	1.00	1	1.00	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	4	0.04	4	0.00	4	0.02	4	0.00
Kd of U-235 in Unsaturated Zone 1	2	-0.50	2	-0.04	2	-0.42	2	-0.02
Kd of U-238 in Unsaturated Zone 1	3	-0.29	3	-0.02	3	-0.30	3	-0.01
R-SQUARE		1.00		1.00		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Milk (WaterDep.) Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =								
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.55	1	0.54	1	0.99	1	0.99
Kd of U-234 in Unsaturated Zone 1	2	-0.22	2	-0.18	2	-0.37	2	-0.04
Kd of U-235 in Unsaturated Zone 1	4	-0.10	4	-0.08	3	-0.22	3	-0.02
Kd of U-238 in Unsaturated Zone 1	3	-0.18	3	-0.15	4	0.01	4	0.00
R-SQUARE		0.34		0.34		0.99		0.99

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters

Input File : Kvwpca-avg.RAD

Coefficients for peak Milk (WaterDep.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.86	1	0.85	1	0.97	1	0.96
Kd of U-234 in Unsaturated Zone 1	3	-0.20	3	-0.10	2	-0.23	2	-0.06
Kd of U-235 in Unsaturated Zone 1	2	-0.21	2	-0.11	3	-0.18	3	-0.05
Kd of U-238 in Unsaturated Zone 1	4	0.03	4	0.02	4	0.04	4	0.01
R-SQUARE		0.75		0.75		0.94		0.94

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak Milk (WaterDep.) Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.52	1	0.51	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	3	0.10	3	0.09	2	-0.48	2	-0.04
Kd of U-235 in Unsaturated Zone 1	4	-0.06	4	-0.05	3	-0.21	3	-0.01
Kd of U-238 in Unsaturated Zone 1	2	-0.18	2	-0.16	4	-0.05	4	0.00
R-SQUARE		0.30		0.30		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : [illegible] Default [illegible]meters

Input File : Kvwpca-avg.RAD

Coefficients for peak U-234 Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.87	1	0.87	1	0.93	1	0.93
Kd of U-234 in Unsaturated Zone 1	3	0.02	3	0.01	3	-0.05	3	-0.02
Kd of U-235 in Unsaturated Zone 1	2	-0.03	2	-0.01	2	-0.09	2	-0.03
Kd of U-238 in Unsaturated Zone 1	4	-0.01	4	-0.01	4	-0.02	4	-0.01
R-SQUARE		0.75		0.75		0.87		0.87

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak U-234 Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =	2		2		2		2	
Repetition =								
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.87	1	0.87	1	0.93	1	0.93
Kd of U-234 in Unsaturated Zone 1	3	0.10	3	0.05	3	0.08	3	0.03
Kd of U-235 in Unsaturated Zone 1	2	0.11	2	0.05	2	0.09	2	0.03
Kd of U-238 in Unsaturated Zone 1	4	-0.06	4	-0.03	4	0.08	4	0.03
R-SQUARE		0.77		0.77		0.87		0.87

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak U-234 Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	0.87	1	0.87	1	0.93	1	0.93
Kd of U-234 in Unsaturated Zone 1	4	-0.04	4	-0.02	2	-0.17	2	-0.06
Kd of U-235 in Unsaturated Zone 1	2	0.20	2	0.10	3	0.03	3	0.01
Kd of U-238 in Unsaturated Zone 1	3	0.09	3	0.05	4	0.01	4	0.00
R-SQUARE		0.77		0.77		0.87		0.87

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak U-235 Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	1.00	1	1.00	1	1.00	1	1.00
Kd of U-234 in Unsaturated Zone 1	4	-0.01	4	0.00	2	0.14	2	0.00
Kd of U-235 in Unsaturated Zone 1	2	0.05	2	0.00	3	-0.06	3	0.00
Kd of U-238 in Unsaturated Zone 1	3	-0.02	3	0.00	4	-0.06	4	0.00
R-SQUARE		0.99		0.99		1.00		1.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak U-235 Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =								
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	1.00	1	1.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	3	-0.13	3	-0.01	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	2	-0.15	2	-0.01	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	4	0.04	4	0.00	0	0.00	0	0.00
R-SQUARE		0.99		0.99		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak U-235 Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	3		3		3		3	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	1	1.00	1	1.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	4	0.00	4	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	2	-0.25	2	-0.02	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	3	-0.11	3	-0.01	0	0.00	0	0.00
R-SQUARE		0.99		0.99		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak U-238 Dose

Coefficient =	PCC		SRC		PRCC		SRRC	
Repetition =	1		1		1		1	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak U-238 Dose

	PCC		SRC		PRCC		SRRC	
Coefficient =								
Repetition =	2		2		2		2	
Description of Probabilistic Variable	Sig	Coeff	Sig	Coeff	Sig	Coeff	Sig	Coeff
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.

-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

Title : RESRAD Default Parameters
Input File : Kvwpca-avg.RAD

Coefficients for peak U-238 Dose

Description of Probabilistic Variable	PCC Sig	PCC Coeff	SRC Sig	SRC Coeff	PRCC Sig	PRCC Coeff	SRRC Sig	SRRC Coeff
Coefficient =								
Repetition =	3		3		3		3	
Density of contaminated zone	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-234 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-235 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
Kd of U-238 in Unsaturated Zone 1	0	0.00	0	0.00	0	0.00	0	0.00
R-SQUARE		0.00		0.00		0.00		0.00

-Rank is set to zero if the dose is zero or the correlation matrix is singular.
-R-SQUARE varies between 0 and 1 and is called the coefficient of determination; it provides a measure of the variation in the dependent variable (Dose) explained by regression on the independent variables.

APPENDIX G

RESRAD SUMMARY INPUT AND OUTPUT FILES

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary ... 2
Site-Specific Parameter Summary 4
Summary of Pathway Selections 9
Contaminated Zone and Total Dose Summary 10
Total Dose Components
Time = 0.000E+00 11
Time = 1.000E+00 12
Time = 3.000E+00 13
Time = 1.000E+01 14
Time = 3.000E+01 15
Time = 1.000E+02 16
Time = 3.000E+02 17
Time = 1.000E+03 18
Dose/Source Ratios Summed Over All Pathways 19
Single Radionuclide Soil Guidelines 19
Dose Per Nuclide Summed Over All Pathways 20
Soil Concentration Per Nuclide 21

Dose Conversion Factor (and Related) Parameter Summary
File: FGR 13 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(5)
B-1	U-234	1.320E-01	1.320E-01	DCF2(6)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(7)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(8)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(5)
D-1	U-234	2.830E-04	2.830E-04	DCF3(6)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(7)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(8)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(6,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(6,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(7,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(7,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	4.000E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	6.290E+01	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): U-235	3.200E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-238	1.260E+01	0.000E+00	---	S1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(8)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.200E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	7.600E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	7.432E+05	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.630E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	3.900E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.500E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	3.500E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.630E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	9.080E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	4.310E+00	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	1.400E+03	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	1.600E+03	5.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	3.500E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.321E-04	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	1.400E+03	5.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	1.600E+03	5.000E+01	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	3.500E+01	5.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.321E-04	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	1.400E+03	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	1.600E+03	5.000E+01	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	3.500E+01	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.321E-04	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.603E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.464E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.241E-03	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.625E-03	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.417E-06	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	1.051E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.500E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.100E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	-1.000E+00	1.000E+00	-1 shows non-circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	4.333E+00	5.000E+01	---	RAD SHAPE(1)
R017	Outer annular radius (m), ring 2:	8.667E+00	7.071E+01	---	RAD SHAPE(2)
R017	Outer annular radius (m), ring 3:	1.300E+01	0.000E+00	---	RAD SHAPE(3)
R017	Outer annular radius (m), ring 4:	1.733E+01	0.000E+00	---	RAD SHAPE(4)
R017	Outer annular radius (m), ring 5:	2.167E+01	0.000E+00	---	RAD SHAPE(5)
R017	Outer annular radius (m), ring 6:	2.600E+01	0.000E+00	---	RAD SHAPE(6)
R017	Outer annular radius (m), ring 7:	3.033E+01	0.000E+00	---	RAD SHAPE(7)
R017	Outer annular radius (m), ring 8:	3.467E+01	0.000E+00	---	RAD SHAPE(8)
R017	Outer annular radius (m), ring 9:	3.900E+01	0.000E+00	---	RAD SHAPE(9)
R017	Outer annular radius (m), ring 10:	4.333E+01	0.000E+00	---	RAD SHAPE(10)
R017	Outer annular radius (m), ring 11:	4.767E+01	0.000E+00	---	RAD SHAPE(11)
R017	Outer annular radius (m), ring 12:	5.200E+01	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	1.000E+00	1.000E+00	---	FRACA(1)
R017	Ring 2	1.000E+00	2.732E-01	---	FRACA(2)
R017	Ring 3	1.000E+00	0.000E+00	---	FRACA(3)
R017	Ring 4	1.000E+00	0.000E+00	---	FRACA(4)
R017	Ring 5	1.000E+00	0.000E+00	---	FRACA(5)
R017	Ring 6	1.000E+00	0.000E+00	---	FRACA(6)
R017	Ring 7	7.900E-01	0.000E+00	---	FRACA(7)
R017	Ring 8	5.900E-01	0.000E+00	---	FRACA(8)
R017	Ring 9	4.000E-01	0.000E+00	---	FRACA(9)
R017	Ring 10	1.700E-01	0.000E+00	---	FRACA(10)
R017	Ring 11	9.200E-02	0.000E+00	---	FRACA(11)
R017	Ring 12	2.700E-02	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.660E+02	1.600E+02	---	DIET(1)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Leafy vegetable consumption (kg/yr)	1.100E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	1.825E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.200E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.200E+00	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	1	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Summary : RESRAD Default Parameters File: Kvwpca-avg.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	4000.00 square meters	U-234	6.290E+01
Thickness:	2.00 meters	U-235	3.200E+00
Cover Depth:	0.00 meters	U-238	1.260E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	8.433E+00	8.432E+00	8.430E+00	8.422E+00	8.400E+00	8.325E+00	8.382E+00	7.930E+00
M(t):	3.373E-01	3.373E-01	3.372E-01	3.369E-01	3.360E-01	3.330E-01	3.353E-01	3.172E-01

Maximum TDOSE(t): 8.433E+00 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.429E-02	0.0017	5.781E-01	0.0686	0.000E+00	0.0000	3.940E+00	0.4671	5.111E-02	0.0061	1.362E-01	0.0162	2.469E-01	0.0293
U-235	1.346E+00	0.1596	2.741E-02	0.0033	0.000E+00	0.0000	1.894E-01	0.0225	2.475E-03	0.0003	6.538E-03	0.0008	1.185E-02	0.0014
U-238	9.471E-01	0.1123	1.035E-01	0.0123	0.000E+00	0.0000	7.501E-01	0.0889	9.732E-03	0.0012	2.594E-02	0.0031	4.701E-02	0.0056
Total	2.308E+00	0.2736	7.090E-01	0.0841	0.000E+00	0.0000	4.879E+00	0.5785	6.332E-02	0.0075	1.687E-01	0.0200	3.057E-01	0.0363

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.966E+00	0.5889
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.584E+00	0.1878
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.883E+00	0.2233
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.433E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.429E-02	0.0017	5.780E-01	0.0685	0.000E+00	0.0000	3.939E+00	0.4671	5.110E-02	0.0061	1.362E-01	0.0161	2.468E-01	0.0293
U-235	1.346E+00	0.1596	2.741E-02	0.0033	0.000E+00	0.0000	1.900E-01	0.0225	2.527E-03	0.0003	6.537E-03	0.0008	1.186E-02	0.0014
U-238	9.469E-01	0.1123	1.035E-01	0.0123	0.000E+00	0.0000	7.500E-01	0.0889	9.730E-03	0.0012	2.593E-02	0.0031	4.699E-02	0.0056
Total	2.307E+00	0.2736	7.089E-01	0.0841	0.000E+00	0.0000	4.879E+00	0.5786	6.336E-02	0.0075	1.686E-01	0.0200	3.057E-01	0.0363

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.965E+00	0.5888
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.584E+00	0.1879
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.883E+00	0.2233
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.432E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.429E-02	0.0017	5.777E-01	0.0685	0.000E+00	0.0000	3.937E+00	0.4670	5.108E-02	0.0061	1.361E-01	0.0161	2.467E-01	0.0293
U-235	1.345E+00	0.1596	2.741E-02	0.0033	0.000E+00	0.0000	1.912E-01	0.0227	2.631E-03	0.0003	6.534E-03	0.0008	1.188E-02	0.0014
U-238	9.465E-01	0.1123	1.035E-01	0.0123	0.000E+00	0.0000	7.496E-01	0.0889	9.725E-03	0.0012	2.592E-02	0.0031	4.697E-02	0.0056
Total	2.306E+00	0.2735	7.086E-01	0.0841	0.000E+00	0.0000	4.878E+00	0.5786	6.343E-02	0.0075	1.686E-01	0.0200	3.056E-01	0.0362

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.963E+00	0.5887
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.585E+00	0.1880
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.882E+00	0.2233
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.430E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.434E-02	0.0017	5.769E-01	0.0685	0.000E+00	0.0000	3.931E+00	0.4667	5.099E-02	0.0061	1.359E-01	0.0161	2.463E-01	0.0292
U-235	1.343E+00	0.1595	2.745E-02	0.0033	0.000E+00	0.0000	1.954E-01	0.0232	2.985E-03	0.0004	6.524E-03	0.0008	1.194E-02	0.0014
U-238	9.449E-01	0.1122	1.033E-01	0.0123	0.000E+00	0.0000	7.484E-01	0.0889	9.710E-03	0.0012	2.588E-02	0.0031	4.690E-02	0.0056
Total	2.302E+00	0.2734	7.076E-01	0.0840	0.000E+00	0.0000	4.875E+00	0.5788	6.369E-02	0.0076	1.683E-01	0.0200	3.052E-01	0.0362

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.955E+00	0.5884
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.587E+00	0.1885
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.879E+00	0.2231
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.422E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.487E-02	0.0018	5.744E-01	0.0684	0.000E+00	0.0000	3.913E+00	0.4659	5.077E-02	0.0060	1.353E-01	0.0161	2.453E-01	0.0292
U-235	1.338E+00	0.1592	2.766E-02	0.0033	0.000E+00	0.0000	2.073E-01	0.0247	3.908E-03	0.0005	6.497E-03	0.0008	1.217E-02	0.0014
U-238	9.406E-01	0.1120	1.028E-01	0.0122	0.000E+00	0.0000	7.450E-01	0.0887	9.665E-03	0.0012	2.576E-02	0.0031	4.668E-02	0.0056
Total	2.293E+00	0.2730	7.049E-01	0.0839	0.000E+00	0.0000	4.866E+00	0.5793	6.434E-02	0.0077	1.675E-01	0.0199	3.041E-01	0.0362

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.934E+00	0.5874
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.595E+00	0.1899
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.870E+00	0.2227
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.400E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.041E-02	0.0025	5.660E-01	0.0680	0.000E+00	0.0000	3.859E+00	0.4636	5.005E-02	0.0060	1.332E-01	0.0160	2.416E-01	0.0290
U-235	1.319E+00	0.1584	2.850E-02	0.0034	0.000E+00	0.0000	2.401E-01	0.0288	6.301E-03	0.0008	6.404E-03	0.0008	1.286E-02	0.0015
U-238	9.254E-01	0.1112	1.012E-01	0.0122	0.000E+00	0.0000	7.331E-01	0.0881	9.512E-03	0.0011	2.535E-02	0.0030	4.594E-02	0.0055
Total	2.265E+00	0.2720	6.956E-01	0.0836	0.000E+00	0.0000	4.833E+00	0.5805	6.586E-02	0.0079	1.649E-01	0.0198	3.004E-01	0.0361

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.871E+00	0.5851
U-235	7.969E-04	0.0001	4.054E-05	0.0000	0.000E+00	0.0000	1.560E-04	0.0000	1.392E-07	0.0000	2.323E-07	0.0000	1.614E+00	0.1939
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.841E+00	0.2211
Total	7.969E-04	0.0001	4.054E-05	0.0000	0.000E+00	0.0000	1.560E-04	0.0000	1.392E-07	0.0000	2.323E-07	0.0000	8.325E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	5.572E-02	0.0066	5.425E-01	0.0647	0.000E+00	0.0000	3.746E+00	0.4470	4.854E-02	0.0058	1.277E-01	0.0152	2.320E-01	0.0277
U-235	1.263E+00	0.1506	2.893E-02	0.0035	0.000E+00	0.0000	2.750E-01	0.0328	9.062E-03	0.0011	6.129E-03	0.0007	1.345E-02	0.0016
U-238	8.834E-01	0.1054	9.665E-02	0.0115	0.000E+00	0.0000	7.003E-01	0.0836	9.086E-03	0.0011	2.421E-02	0.0029	4.388E-02	0.0052
Total	2.202E+00	0.2627	6.681E-01	0.0797	0.000E+00	0.0000	4.722E+00	0.5633	6.668E-02	0.0080	1.580E-01	0.0189	2.893E-01	0.0345

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	7.833E-07	0.0000	4.215E-08	0.0000	0.000E+00	0.0000	1.541E-07	0.0000	6.130E-09	0.0000	7.745E-09	0.0000	4.753E+00	0.5670
U-235	2.213E-01	0.0264	9.638E-03	0.0011	0.000E+00	0.0000	4.351E-02	0.0052	1.744E-03	0.0002	5.678E-05	0.0000	1.871E+00	0.2233
U-238	8.973E-10	0.0000	6.627E-11	0.0000	0.000E+00	0.0000	1.697E-10	0.0000	5.046E-12	0.0000	5.576E-12	0.0000	1.758E+00	0.2097
Total	2.213E-01	0.0264	9.638E-03	0.0011	0.000E+00	0.0000	4.351E-02	0.0052	1.744E-03	0.0002	5.678E-05	0.0000	8.382E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.273E-01	0.0287	4.685E-01	0.0591	0.000E+00	0.0000	3.503E+00	0.4417	4.520E-02	0.0057	1.117E-01	0.0141	2.027E-01	0.0256
U-235	1.075E+00	0.1355	2.517E-02	0.0032	0.000E+00	0.0000	2.492E-01	0.0314	8.730E-03	0.0011	5.215E-03	0.0007	1.183E-02	0.0015
U-238	7.510E-01	0.0947	8.234E-02	0.0104	0.000E+00	0.0000	5.966E-01	0.0752	7.740E-03	0.0010	2.063E-02	0.0026	3.738E-02	0.0047
Total	2.053E+00	0.2589	5.760E-01	0.0726	0.000E+00	0.0000	4.349E+00	0.5484	6.167E-02	0.0078	1.375E-01	0.0173	2.520E-01	0.0318

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	5.898E-02	0.0074	4.461E-03	0.0006	0.000E+00	0.0000	1.165E-02	0.0015	4.456E-04	0.0001	3.894E-04	0.0000	4.635E+00	0.5844
U-235	3.408E-01	0.0430	1.399E-02	0.0018	0.000E+00	0.0000	6.704E-02	0.0085	3.575E-03	0.0005	8.312E-05	0.0000	1.800E+00	0.2270
U-238	8.397E-06	0.0000	6.336E-07	0.0000	0.000E+00	0.0000	1.659E-06	0.0000	6.349E-08	0.0000	5.572E-08	0.0000	1.496E+00	0.1886
Total	3.998E-01	0.0504	1.845E-02	0.0023	0.000E+00	0.0000	7.869E-02	0.0099	4.021E-03	0.0005	4.726E-04	0.0001	7.930E+00	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	7.895E-02	7.894E-02	7.890E-02	7.877E-02	7.840E-02	7.712E-02	7.358E-02	6.242E-02
U-234	Th-230	1.000E+00	3.807E-07	1.104E-06	2.542E-06	7.571E-06	2.189E-05	7.146E-05	2.084E-04	6.369E-04
U-234	Ra-226	1.000E+00	6.804E-09	4.882E-08	2.602E-07	2.314E-06	1.888E-05	1.823E-04	1.204E-03	6.383E-03
U-234	Pb-210	1.000E+00	4.619E-11	5.947E-10	6.227E-09	1.460E-07	2.919E-06	6.039E-05	5.676E-04	4.239E-03
U-234	∑DSR(j)		7.895E-02	7.894E-02	7.890E-02	7.878E-02	7.844E-02	7.743E-02	7.556E-02	7.368E-02
U-235	U-235	1.000E+00	4.948E-01	4.947E-01	4.945E-01	4.937E-01	4.914E-01	4.835E-01	4.615E-01	3.923E-01
U-235	Pa-231	1.000E+00	1.049E-04	3.249E-04	7.625E-04	2.249E-03	6.128E-03	1.621E-02	4.303E-02	5.889E-02
U-235	Ac-227	1.000E+00	6.863E-07	4.271E-06	2.069E-05	1.592E-04	9.644E-04	4.664E-03	8.026E-02	1.113E-01
U-235	∑DSR(j)		4.949E-01	4.950E-01	4.953E-01	4.961E-01	4.985E-01	5.043E-01	5.848E-01	5.625E-01
U-238	U-238	1.000E+00	1.495E-01	1.494E-01	1.494E-01	1.491E-01	1.484E-01	1.461E-01	1.394E-01	1.185E-01
U-238	U-234	1.000E+00	1.119E-07	3.357E-07	7.829E-07	2.345E-06	6.779E-06	2.198E-05	6.271E-05	1.773E-04
U-238	Th-230	1.000E+00	3.729E-13	2.482E-12	1.282E-11	1.131E-10	9.466E-10	1.015E-08	8.782E-08	8.709E-07
U-238	Ra-226	1.000E+00	4.750E-15	7.351E-14	8.694E-13	2.305E-11	5.502E-10	1.795E-08	3.762E-07	7.316E-06
U-238	Pb-210	1.000E+00	2.761E-17	7.282E-16	1.627E-14	1.122E-12	6.686E-11	4.993E-09	1.622E-07	4.378E-06
U-238	∑DSR(j)		1.495E-01	1.494E-01	1.494E-01	1.491E-01	1.485E-01	1.461E-01	1.395E-01	1.187E-01

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	3.166E+02	3.167E+02	3.169E+02	3.173E+02	3.187E+02	3.229E+02	3.309E+02	3.393E+02
U-235	5.051E+01	5.050E+01	5.048E+01	5.039E+01	5.015E+01	4.957E+01	4.275E+01	4.444E+01
U-238	1.672E+02	1.673E+02	1.674E+02	1.676E+02	1.684E+02	1.711E+02	1.792E+02	2.106E+02

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
U-234	6.290E+01	0.000E+00	7.895E-02	3.166E+02	7.895E-02	3.166E+02
U-235	3.200E+00	501 ± 1	6.269E-01	3.988E+01	4.949E-01	5.051E+01
U-238	1.260E+01	0.000E+00	1.495E-01	1.672E+02	1.495E-01	1.672E+02

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	4.966E+00	4.965E+00	4.963E+00	4.955E+00	4.931E+00	4.851E+00	4.628E+00	3.926E+00
U-234	U-238	1.000E+00	1.410E-06	4.229E-06	9.864E-06	2.954E-05	8.542E-05	2.769E-04	7.902E-04	2.234E-03
U-234	∑DOSE(j)		4.966E+00	4.965E+00	4.963E+00	4.955E+00	4.931E+00	4.851E+00	4.629E+00	3.929E+00
Th-230	U-234	1.000E+00	2.395E-05	6.943E-05	1.599E-04	4.762E-04	1.377E-03	4.495E-03	1.311E-02	4.006E-02
Th-230	U-238	1.000E+00	4.698E-12	3.128E-11	1.615E-10	1.425E-09	1.193E-08	1.278E-07	1.106E-06	1.097E-05
Th-230	∑DOSE(j)		2.395E-05	6.943E-05	1.599E-04	4.762E-04	1.377E-03	4.495E-03	1.311E-02	4.007E-02
Ra-226	U-234	1.000E+00	4.280E-07	3.071E-06	1.637E-05	1.455E-04	1.188E-03	1.147E-02	7.570E-02	4.015E-01
Ra-226	U-238	1.000E+00	5.985E-14	9.262E-13	1.095E-11	2.904E-10	6.933E-09	2.262E-07	4.740E-06	9.219E-05
Ra-226	∑DOSE(j)		4.280E-07	3.071E-06	1.637E-05	1.455E-04	1.188E-03	1.147E-02	7.571E-02	4.016E-01
Pb-210	U-234	1.000E+00	2.905E-09	3.740E-08	3.917E-07	9.186E-06	1.836E-04	3.799E-03	3.570E-02	2.667E-01
Pb-210	U-238	1.000E+00	3.479E-16	9.175E-15	2.050E-13	1.414E-11	8.425E-10	6.292E-08	2.044E-06	5.516E-05
Pb-210	∑DOSE(j)		2.905E-09	3.740E-08	3.917E-07	9.186E-06	1.836E-04	3.799E-03	3.571E-02	2.667E-01
U-235	U-235	1.000E+00	1.583E+00	1.583E+00	1.582E+00	1.580E+00	1.572E+00	1.547E+00	1.477E+00	1.255E+00
Pa-231	U-235	1.000E+00	3.357E-04	1.040E-03	2.440E-03	7.195E-03	1.961E-02	5.188E-02	1.377E-01	1.884E-01
Ac-227	U-235	1.000E+00	2.196E-06	1.367E-05	6.622E-05	5.095E-04	3.086E-03	1.493E-02	2.568E-01	3.563E-01
U-238	U-238	1.000E+00	1.883E+00	1.883E+00	1.882E+00	1.879E+00	1.870E+00	1.840E+00	1.757E+00	1.493E+00

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	6.290E+01	6.289E+01	6.286E+01	6.275E+01	6.246E+01	6.144E+01	5.862E+01	4.973E+01
U-234	U-238	1.000E+00	0.000E+00	3.571E-05	1.071E-04	3.564E-04	1.064E-03	3.490E-03	9.991E-03	2.828E-02
U-234	∑S(j):		6.290E+01	6.289E+01	6.286E+01	6.275E+01	6.246E+01	6.144E+01	5.863E+01	4.976E+01
Th-230	U-234	1.000E+00	0.000E+00	5.661E-04	1.698E-03	5.655E-03	1.692E-02	5.592E-02	1.637E-01	5.009E-01
Th-230	U-238	1.000E+00	0.000E+00	1.608E-10	1.446E-09	1.605E-08	1.440E-07	1.582E-06	1.379E-05	1.371E-04
Th-230	∑S(j):		0.000E+00	5.661E-04	1.698E-03	5.655E-03	1.692E-02	5.592E-02	1.637E-01	5.010E-01
Ra-226	U-234	1.000E+00	0.000E+00	1.224E-07	1.098E-06	1.205E-05	1.047E-04	1.034E-03	6.871E-03	3.511E-02
Ra-226	U-238	1.000E+00	0.000E+00	2.318E-14	6.243E-13	2.290E-11	6.016E-10	2.030E-08	4.295E-07	8.178E-06
Ra-226	∑S(j):		0.000E+00	1.224E-07	1.098E-06	1.205E-05	1.047E-04	1.034E-03	6.872E-03	3.512E-02
Pb-210	U-234	1.000E+00	0.000E+00	1.258E-09	3.331E-08	1.153E-06	2.593E-05	5.591E-04	5.311E-03	3.075E-02
Pb-210	U-238	1.000E+00	0.000E+00	1.790E-16	1.427E-14	1.668E-12	1.165E-10	9.198E-09	3.031E-07	6.944E-06
Pb-210	∑S(j):		0.000E+00	1.258E-09	3.331E-08	1.153E-06	2.593E-05	5.591E-04	5.311E-03	3.076E-02
U-235	U-235	1.000E+00	3.200E+00	3.199E+00	3.198E+00	3.193E+00	3.178E+00	3.127E+00	2.985E+00	2.537E+00
Pa-231	U-235	1.000E+00	0.000E+00	6.748E-05	2.011E-04	6.548E-04	1.839E-03	4.918E-03	8.552E-03	8.568E-03
Ac-227	U-235	1.000E+00	0.000E+00	1.058E-06	9.189E-06	9.034E-05	5.892E-04	2.725E-03	5.559E-03	5.725E-03
U-238	U-238	1.000E+00	1.260E+01	1.260E+01	1.259E+01	1.257E+01	1.251E+01	1.231E+01	1.175E+01	9.990E+00

BRF(i) is the branch fraction of the parent nuclide.

RESCALC.EXE execution time = 8170.11 seconds
Total water/soil iteration failures = 3.