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Subject: Annual Radiological Environmental Operating Report

AmerGen Energy Company, LLC (AmerGen) is submitting the 2002 Annual Radiological Environmental Operating Report for Clinton Power Station. This submittal is provided in accordance with the requirements of section 5.6.2 of the Clinton Power Station Technical Specifications. This report covers the period from January 1, 2002 through December 31, 2002.

Respectfully,

Keith J. Polson
Plant Manager
Clinton Power Station

EET/blf

Attachment

cc: Regional Administrator - NRC Region III
NRC Senior Resident Inspector – Clinton Power Station
Office of Nuclear Facility Safety - Illinois Department of Nuclear Safety

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# Clinton Power Station 2002 Annual Radiological Environmental Operating Report

Exelon Nuclear

01 January 2002 – 31 December 2002

# ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

***CLINTON POWER STATION – DOCKET NUMBER 50-461***

Prepared by:

***Clinton Power Station***

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# EXECUTIVE SUMMARY

# I. EXECUTIVE SUMMARY

This report describes the Annual Radiological Environmental Monitoring Program [REMP] conducted around the Clinton Power Station [CPS] during the 2002 calendar year. The REMP was performed as required by the CPS Operating License issued by the United States Nuclear Regulatory Commission [NRC]. The objective of the REMP is to assess the radiological impact upon the surrounding environment due to the operation of the Clinton Power Station.

During 2002, 1,461 environmental samples were collected. These environmental samples represented; direct radiation, atmospheric, terrestrial, and aquatic environments including Clinton Lake surface water and public drinking water sampling. Subsequently, 1,794 analyses were performed on these environmental samples.

Analytical results from these environmental samples revealed the presence of natural radioactivity and radioactivity attributed to other historical nuclear events. The radioactivity levels detected were similar to the Pre-Operational levels found prior to the operation of CPS. The CPS Pre-Operational REMP Report documented natural background radionuclides and man-made radioactivity in the environment surrounding CPS.

Radiological environmental measurements taken during 2002 demonstrated that both operational and engineered controls on the radioactive effluents released from the plant functioned as they were designed. Any radioactivity that was detected in the environment at Indicator Locations was appropriately compared with both the measurements at Control Locations and Pre-Operational results.

There were zero (Ø) radioactive liquid releases from CPS during 2002. Releases of gaseous radioactive materials were accurately measured in plant effluents. There was no gaseous effluent releases that approached the limits specified in the CPS Offsite Dose Calculation Manual [ODCM]. The highest calculated offsite dose received by a member of the public due to the release of gaseous effluents from Clinton Power Station was less than 0.0021 mR [milli-Roentgen].

All comparisons among Operational Data and Pre-Operational Data showed that during 2002, the operation of Clinton Power Station had no measurable effects upon the surrounding environment.

# INTRODUCTION

# II. INTRODUCTION

The Radiological Environmental Monitoring Program [REMP] at Clinton Power Station [CPS] is designed to monitor the environment surrounding the plant for any radioactive material that may be released by CPS as a result of plant operations. The primary concern is what impact - if any - radioactive materials released from CPS may have on the general public.

## A. CHARACTERISTICS OF RADIATION

Atoms whose nuclei contain an excess of energy are called radioactive atoms. They release this excess energy by expelling electromagnetic or particulate radiation from their atomic centers to become stable [non-radioactive]. This process is called "radioactive decay". Gamma rays and X-rays are examples of electromagnetic radiation and are similar in many ways to visible light, microwaves, and radio waves. Particulate radiation may be either electrically charged such as an alpha or beta particle, or has no charge, like a neutron.

The term 'half-life' refers to the time required for half of a given amount of a radionuclide to decay. Some radionuclides have a half-life as short as a fraction of a second, while others have a half-life as long as millions of years. Radionuclides may decay directly into stable elements or may undergo a series of decays until they ultimately reach a stable element.

Radionuclides are found in nature such as radioactive uranium, thorium, carbon, and potassium, and may also be produced artificially in accelerators and nuclear reactors such as radioactive iodine, cesium, and cobalt.

| TYPICAL NATURALLY OCCURRING RADIONUCLIDES | TYPICAL MAN-MADE RADIONUCLIDES |
|---|---|
| Uranium | Iodine |
| Thorium | Cesium |
| Carbon | Cobalt |
| Potassium | Strontium |
| Lead | Barium |

The activity of a radioactive source is the average number of nuclear disintegrations [decay] of the source per unit of time. The unit of activity is called the curie. For example, a one-curie radioactive source undergoes 2.2 trillion disintegrations per minute. When compared against nuclear power plant effluents and environmental radioactivity however, this is a very large unit of measure. Therefore, two sub-fractional units - the microcurie and the picocurie - are more commonly used terms.

| | | |
|---|---|---|
| 1 curie (Ci) | = | 2,220,000,000,000 disintegrations / minute |
| 1 millicurie (mCi) | = | 2,220,000,000 disintegrations / minute |
| 1 microcurie (μCi) | = | 2,220,000 disintegrations / minute |
| 1 nanocurie (nCi) | = | 2,220 disintegrations / minute |
| 1 picocurie (pCi) | = | 2.22 disintegrations / minute |

The microcurie [μCi] is one millionth of a curie [Ci] and represents 2.2 million decays per minute. The picocurie [pCi] is one millionth of a microcurie and represents 2.2 decays per minute. Another way of comparing the pCi and the Ci is by using an analogy with distances. A picocurie would be the width of a pencil mark while a curie would be the equivalent of 100 trips around the earth.

Radioactivity is related to the half-life and the atomic mass of a radionuclide. For example, Uranium-235 ($U^{235}$) with a half-life of 704 million years requires over a half ton - 1,019 pounds - to equate to an activity of one curie. Whereas Iodine-131 ($I^{131}$) with a half-life of 8.04 days requires 0.0000000176 pounds to equate to an activity of one curie.

Any mechanism that can supply the energy necessary to ionize an atom, break a chemical bond or alter the chemistry of a living cell are capable of producing biological damage. Electromagnetic and particulate radiation can produce cellular damage in any of these ways. In assessing the biological effects of radiation, the type, energy, and amount of radiation must be considered.

External total body radiation involves exposure of all organs. Most background exposures are of this form. When radioactive elements enter the body through inhalation or ingestion, their distribution may not be uniform.

| TARGET TISSUE | NUCLIDE |
|---|---|
| | |
| Bone | Strontium-90 ($Sr^{90}$) |
| Kidney | Uranium-235 ($U^{235}$) |
| Thyroid | Iodine-131 ($I^{131}$) |
| Muscle and Liver Tissue | Cesium-137 ($Cs^{137}$) |
| Gastrointestinal Tract | Cobalt-60 ($Co^{60}$) |

For example, radio-iodine selectively concentrates in the thyroid gland, whereas radio-cesium collects in muscle and liver tissue and radio-strontium collect in mineralized bone. The quantity and the duration of time that the radionuclide remains in the body also influence the total dose to organs by a given radionuclide. When factoring radioactive decay and human metabolism factors, some radionuclides stay in the body for very short periods of time while others remain for years.

The amount of radiation dose that an individual receives is expressed in Rem. Since human exposure to radiation typically involves very small exposures, the millirem [mRem] is the unit most commonly used. One millirem is equal to one thousandth of a Rem.

## B. SOURCES OF RADIATION EXPOSURE

Many sources of radiation exposure exist. The most common and least controllable source is natural background radiation from cosmic rays and the earth which mankind has always lived with and always will. Every second of our lives, over seven thousand atoms undergo radioactive decay in the body of the average adult.

Radioactive elements have always been a part of our planet and everything that has come from the earth - including our own body - is therefore, naturally radioactive.

| Natural Radionuclides in the Earth's Crust | |
|---|---|
| Potassium-40 ($K^{40}$) | Radium-226 ($Ra^{226}$) |
| Uranium-238 ($U^{238}$) | Radon-222 ($Rn^{222}$) |
| Thorium-232 ($Th^{232}$) | Lead-204 ($Pb^{204}$) |

Examples of radioactive materials found in the Earth's crust today consists of radionuclides such as Potassium-40, Uranium-238, Thorium-232, Radium-226 and Radon-222. These radionuclides are introduced into the water, soil and air by such natural processes as volcanic activity, weathering, erosion and radioactive decay.

Some of the naturally occurring radionuclides - such as radon - are a significant source of radiation exposure to the general public. Radioactive radon is a chemically inert gas produced naturally in the ground as a part of the uranium and thorium decay series. Radon continues to undergo radioactive decay, producing new naturally radioactive materials called 'radon daughter products'. These new products - which are solid particles not gases - can adhere to surfaces such as dust particles contained in the air.

Concentrations of radon in the air vary and are affected by concentrations of uranium and thorium in the soil as well as altitude, soil porosity, temperature, pressure, soil moisture, rainfall, snow cover, atmospheric conditions and the time of the season. Radon can move through cracks and openings into basements of buildings and become trapped in small air volumes indoors. Thus, indoor radon concentrations are usually higher than those found outdoors. Building materials such as cinder blocks and concrete are radon sources. Radon can also be dissolved in well water and contribute to airborne radon in houses when released through showers or washing.

Dust containing radon daughter particles can be inhaled and deposited on the surface of an individual's lung. Radon daughters emit a high-energy alpha radiation dose to the inner lung lining. Table 1 shows the average annual effective dose due to radon radiation exposure.

About 300 cosmic rays originating from outer space pass through each person every second.

| Cosmic-Ray-Activated Radionuclides | |
| --- | --- |
| Beryllium-7 ($Be^7$) | Tritium ($H^3$) |
| Beryllium-10 ($Be^{10}$) | Sodium-22 ($Na^{22}$) |
| Carbon-14 ($C^{14}$) | Phosphorus-32 ($P^{32}$) |

The interaction of cosmic rays with atoms in the earth's atmosphere produces radionuclides such as Beryllium-7, Beryllium-10, Carbon-14, Tritium-3, and Sodium-22. Portions of these radionuclides become deposited on land or in water while the remainder stays suspended in the atmosphere.

Consequently, there are natural radioactive materials in the soil, water, air and building materials that contribute to radiation doses to the human body. Natural drinking water contains trace amounts of uranium and radium while milk contains measurable amounts of Potassium-40. Sources of natural radiation and their average contributing radiation doses are also summarized in Table 1. Figure 1 graphically shows the percentage contribution from principal sources of radiation exposure to the general population of the United States. Radiation exposure levels from natural radiation fluctuate with time and can also vary widely from location to location. The average individual in the United States receives approximately 300 mRem per year, just from naturally occurring background radiation sources.

In some areas of the United States, the dose from natural radiation is significantly higher. Residents of Colorado – 5,000 feet above sea level – will receive additional dose due to the increase of cosmic and terrestrial radiation levels. In fact, for every 1,000 feet in elevation above sea level, an individual will receive an additional one (1) mRem per year from cosmic radiation. In several areas of the world, high concentrations of mineral deposits result in natural background radiation levels of several thousand mRem per year.

In addition to natural background radiation, the average individual is exposed to radiation from a number of man-made sources. The largest of these sources come from medical diagnosis: X-rays, CAT-scans, fluoroscopic examinations and radio-pharmaceuticals. Approximately 160 million people in the United States are exposed to medical or dental X-rays in any given year. The annual dose to an individual from such irradiation averages approximately 53 mRem.

## TABLE 1

### COMMON SOURCES OF RADIATION

A. Average Annual Effective Dose Equivalent to the U.S. Population

| 1. Natural Sources | mRem |
|---|---|
| a. Radon | 200 |
| b. Cosmic, Terrestrial, Internal | 100 |
| **2. Man-Made Sources** | **mRem** |
| a. Medical | |
| X-ray Diagnosis | 39 |
| Nuclear Medicine | 14 |
| b. Consumer Products | 10 |
| c. Occupational | 1 |
| d. Miscellaneous Environmental | <1 |
| e. Nuclear Fuel Cycle | <1 |
| **Approximate Total** | **364** |

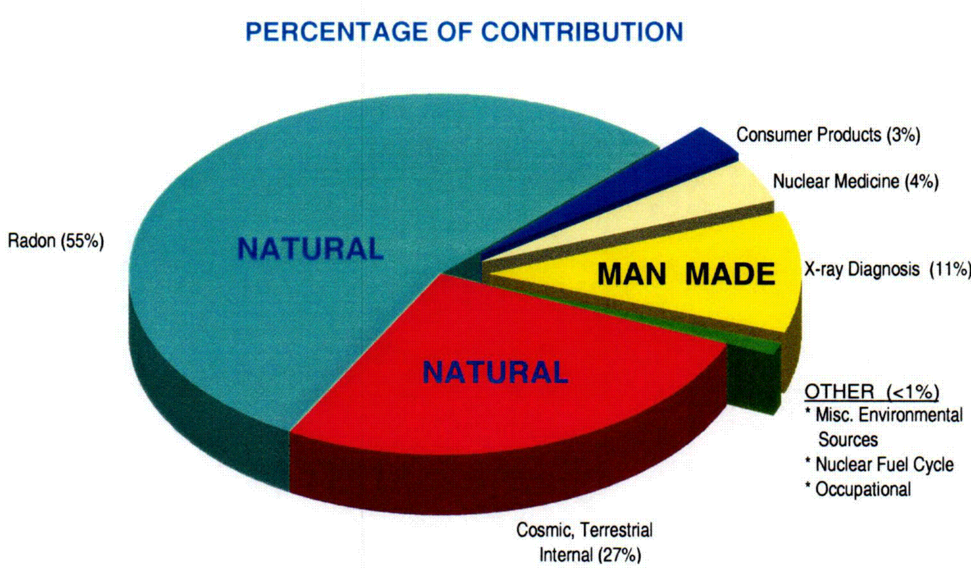


*FIGURE 1: DOSE CONTRIBUTIONS TO THE U.S. POPULATION FROM PRINCIPAL SOURCES OF RADIATION EXPOSURE*



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Smaller doses from man-made sources come from consumer products – such as televisions, smoke detectors, and fertilizers – as well as fallout from prior nuclear weapons testing, the production of nuclear power and its associated fuel cycle.

'Fallout' commonly refers to the radioactive debris that settles to the surface of the earth following the detonation of a nuclear weapon. Fallout is dispersed throughout the environment but can be washed down to the Earth's surface by rain or snow.

| Radionuclides Found in Fallout | |
|---|---|
| Iodine-131 ($I^{131}$) | Strontium-90 ($Sr^{90}$) |
| Strontium-89 ($Sr^{89}$) | Cesium-137 ($Cs^{137}$) |

There are approximately 200 radionuclides produced in the nuclear weapon detonation process with a number of these detected as fallout. The radionuclides found in fallout that produce the majority of the fallout radiation exposures to man are Iodine-131, Strontium-89, Strontium-90, and Cesium-137.

## C. DESCRIPTION OF THE CLINTON POWER STATION

The Clinton Power Station [CPS] is located in Harp Township, DeWitt County, Illinois. It is approximately six (6) miles east of Clinton, Illinois.

The station – including the V-shaped cooling lake – coupled with the surrounding AmerGen Energy Company, LLC owned land encloses approximately 13,730 acres. This includes the 4,895 acre, man-made cooling lake and about 452 acres of property not owned by AmerGen. The plant is situated on approximately 150 acres on the northern arm of the lake. The cooling water discharge flume - which discharges to the eastern arm of the lake - occupies an additional 130 acres. Although the nuclear reactor, supporting equipment and associated electrical generation and distribution equipment lie in Harp Township, portions of the aforementioned 13,730 acre plot reside within Wilson, Rutledge, DeWitt, Creek, Nixon and Santa Anna Township[s].

The cooling lake was formed by constructing an earthen dam near the confluence of Salt Creek and at the North Fork of Salt Creek. The resulting lake has an average depth of 15.6 feet which includes an ultimate heat sink of approximately 590 acre-feet. The ultimate heat sink provides for a sufficient water volume and cooling capacity for approximately 30 days of operation without any makeup water.

Through arrangements made with the Illinois Department of Conservation, Clinton Lake and much of the area immediately adjacent to the lake are used for public recreation activities including swimming, boating, water-skiing, hunting and fishing. Recreational facilities exist at

Clinton Lake and accommodate up to 11,000 people per day during peak usage periods. The outflow from Clinton Lake falls into Salt Creek and then flows in a westerly direction for about 56 miles before joining in with the Sangamon River. The Sangamon River drains into the Illinois River that enters the Mississippi River near Grafton, Illinois. The closest use of downstream water for drinking purposes is approximately 242 river miles downstream from Clinton Lake at Alton, Illinois as verified from the Illinois Environmental Protection Agency Public Water Service. Although some farms throughout the Salt Creek drainage area use irrigation water downstream of Clinton Lake, this irrigation water is drawn from wells and not directly from the waters of Salt Creek.

Approximately 810,000 individuals live within 50 miles of the Clinton Power Station. Over half are located in the major metropolitan centers of Bloomington - Normal which is located approximately 23 miles to the north-northwest, Champaign - Urbana which is located approximately 31 miles towards the east, Decatur which is located approximately 22 miles to the south-southwest and Springfield which is located approximately 48 miles to the west-southwest. The nearest city is Clinton, the county seat of DeWitt County. The estimated population of Clinton is approximately 8,000 residents. Outside of the urban areas, most of the land within 50 miles of the Clinton Power Station is used for farming. The principal crops grown are corn and soybeans.

## D. NUCLEAR REACTOR OPERATIONS

The fuel of a nuclear reactor is made of the element uranium in the form of uranium oxide. The fuel produces power by the process called 'fission'. During fission, the uranium atom absorbs a neutron and splits to produce fission products, heat, radiation and free neutrons. The free neutrons travel in the reactor core and further absorption of neutrons by uranium permits the fission process to continue. As the fission process continues, more fission products, more radiation, more heat and more neutrons are produced and a sustained reaction occurs. The heat produced is extracted from the fuel to produce steam, which subsequently drives a turbine generator to produce electricity.

The fission products are predominantly radioactive. They are unstable elements that emit radiation as they change from unstable to stable elements. Stable atoms in the materials that make up the components and structures of the reactor may absorb neutrons that are not absorbed by the uranium fuel. In such cases, stable atoms often become radioactive. This process is called 'activation' and the radioactive atoms, which result, are called 'activation products'.

| Fission Products | Activation Products |
|---|---|
| Cesium-137 ($Cs^{137}$) | Cobalt-60 ($Co^{60}$) |
| Barium-140 ($Ba^{140}$) | Manganese-54 ($Mn^{54}$) |
| Cerium-144 ($Ce^{144}$) | Iron-59 ($Fe^{59}$) |
| Strontium-90 ($Sr^{90}$) | Zinc-65 ($Zn^{65}$) |

The reactor at the Clinton Power Station is a Boiling Water Reactor [BWR]. Figure 2 provides a basic plant schematic for the Clinton Power Station and shows the separation of the cooling water from plant water systems. In this type of reactor, the fuel is formed into small ceramic pellets that are loaded into sealed fuel rods.

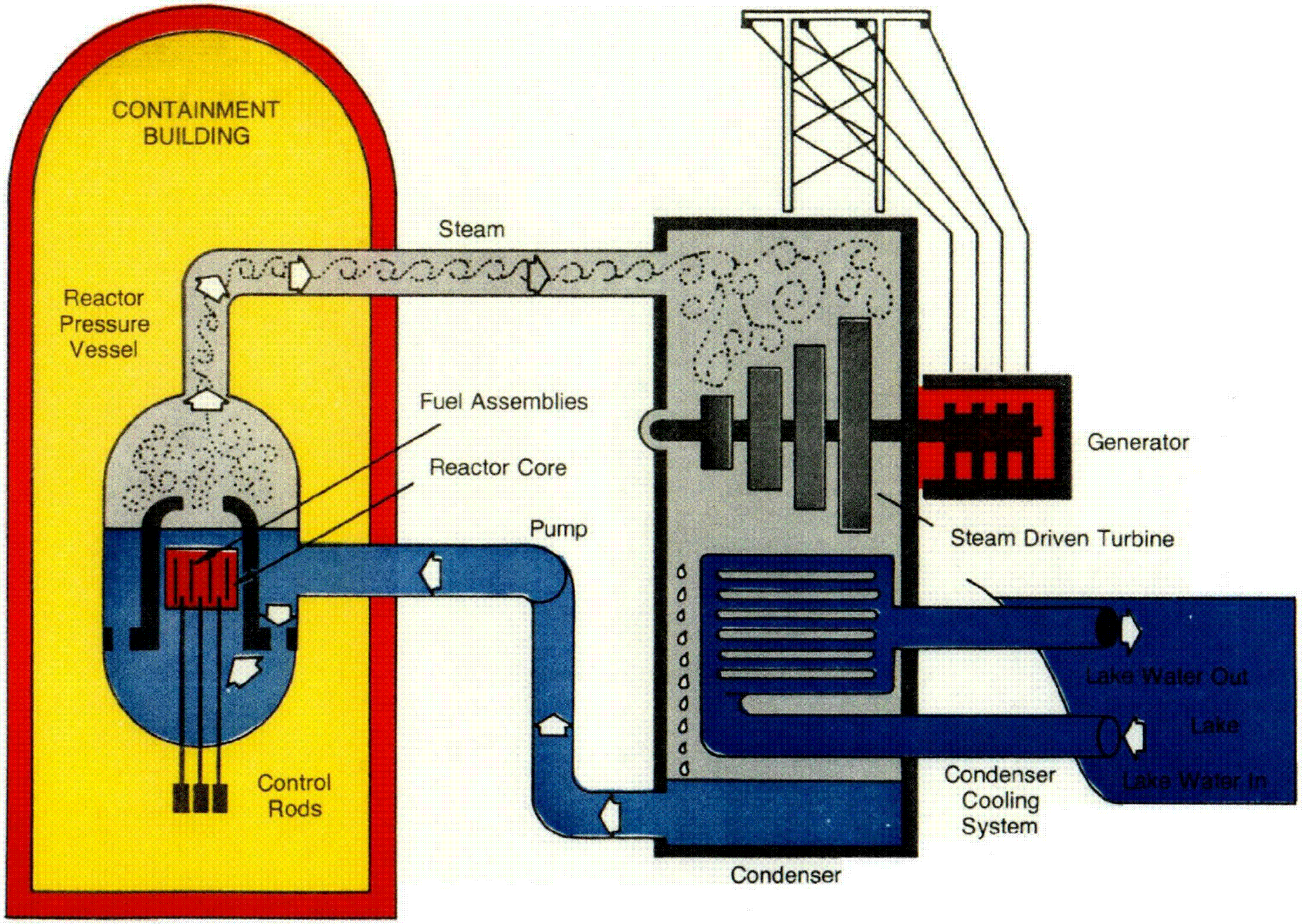


**FIGURE 2: CLINTON POWER STATION BASIC PLANT SCHEMATIC**



C02

The fuel rods are arranged in arrays, called bundles, which are supported within the massive steel reactor vessel.

The voids between the fuel rods are filled with water. The heat released during the fission of fuel atoms is transferred to the water surrounding the fuel rods. A type of pump that has no moving parts - a jet pump - and recirculation water pumps are used to force the water to circulate through the fuel bundles to assure even cooling and heat removal from the fuel rods. Some of the water that absorbs heat from the fuel rods is changed to steam. The steam is used to drive a turbine that is coupled to a generator, thereby completing the conversion of nuclear energy released during fission into electricity.

After the steam passes through the turbine, it is condensed back into water and returned to the reactor vessel to repeat the cycle. As the water circulates through the reactor pressure vessel, corrosion allows trace quantities of the component and structure surfaces to mix into the water. The corroded material also contains radioactive substances known as activated corrosion products. Radioactive fission and activation products are normally confined to the primary coolant system although small leaks from the primary system may occur.

## E. CONTAINMENT OF RADIOACTIVITY

During normal operating conditions, essentially all of the radioactivity is contained within the first of several barriers - that collectively - prevent radioactivity from escaping into our environment.

The fuel cladding - metal tubes - provides the first barrier. The ceramic fuel pellets are sealed within zircaloy metal tubes. There is a small gap between the fuel and the cladding where noble gases and volatile nuclides collect.

The reactor pressure vessel and the steel piping of the primary coolant system provide the second barrier. The reactor pressure vessel is a 70 foot high vessel with steel walls ranging from four (4) to seven (7) inches thick that encases the reactor core. The reactor pressure vessel and the steel piping provide containment for all radionuclides in the primary coolant.

The Containment Building provides the third barrier. The Containment Building has a steel-lined, four (4) foot thick reinforced concrete wall which completely enclose the reactor pressure vessel and vital auxiliary equipment. This structure provides a third line of defense against the uncontrolled release of radioactive materials to the environment. The massive concrete walls also serve to absorb much of the radiation emitted during reactor operations or from radioactive materials created during reactor operations.

## F. SOURCES OF RADIOACTIVE EFFLUENTS

In an operating nuclear power plant, most of the fission products are retained within the fuel and fuel cladding. However, the fuel manufacturing process leaves traces of uranium on the exterior of the fuel tubes. Fission products from the eventual fission of these traces may be released to the primary coolant. Other small amounts of radioactive fission products are able to diffuse or migrate through the fuel cladding and into the primary coolant. Trace quantities of the corrosion products from component and structural surfaces that have been activated, also get into the primary coolant.

Demineralizers from the water purification systems remove many soluble fission and activation products such as radioactive iodines, strontiums, cobalts and cesiums. Noble gas fission products, activated atmospheric gases introduced with reactor feedwater and some of the volatile fission products such as iodine and bromine, carry over from the reactor pressure vessel to the condenser.

The steam jet air ejectors remove the gases from the condenser and transfer them to the off-gas treatment system. Within the off-gas treatment system, these gases are held up by adsorption on specially treated charcoal beds to allow radioactive gases to decay before they are released through the main ventilation exhaust stack.

Small releases of radioactive liquids from valves, piping, or equipment associated with the primary coolant system may occur in the Containment, Auxiliary, Turbine, Rad Waste and Fuel Buildings. Noble gases become part of the gaseous wastes while the remaining radioactive liquids are collected in sumps and processed for reuse. Processed primary coolant water that does not meet chemical specifications for reuse may also become wastewater. These represent the principal sources of liquid effluents.

Information about radioactive effluents can be found in the Annual Radioactive Effluent Release Report. This report contains a detailed description of all radioactive releases from CPS and the resulting radiation doses for the reporting period.

## G. RADIOACTIVE WASTE PROCESSING

In a normal operating nuclear power plant, radioactive liquid and gaseous wastes are collected, stored and then processed through treatment systems to remove or reduce most of their radioactivity (excluding tritium) prior to reuse within the plant or discharged to the environment. These processing systems are required by the Clinton Power Station [CPS] Offsite Dose Calculation Manual [ODCM] to be installed and operable to help ensure all releases of radioactive liquid and gaseous effluents are **A**s **L**ow **A**s **R**easonably **A**chievable [ALARA]. As a matter of Station Policy, CPS strives to be a zero (Ø) liquid release plant and was able to accomplish that commitment throughout 2002.

The liquid waste treatment systems consist of filters, demineralizers and evaporators. Liquid wastes are routed through the waste evaporators to be degassed and distilled thereby reducing their volume and concentrating their radioactivity. The distillates are further treated through demineralizers and filters and transferred to the waste evaporator condensate storage tanks. Liquid wastes are processed through the appropriate portions of the liquid waste treatment system to provide assurance that the releases of radioactive materials in liquid effluents will be kept ALARA.

Liquid wastes may be discharged into the plant cooling water stream that varies from approximately 5,000 gallons per minute - when the unit is shutdown - to 567,000 gallons per minute when the unit is at full power. If a planned release were to occur, liquid effluents would be thoroughly mixed with - and diluted by - the plant cooling water as it traverses down a 3.4 mile discharge canal before entering Clinton Lake east of DeWitt County Road 14.

The Clinton Power Station Offsite Dose Calculation Manual requires that liquid effluents will not have a higher concentration of any radioisotope than which is established for continuous exposure to the general public. This requirement is satisfied at the point in which the liquid effluent is first introduced to the cooling water flow. Thus, this additional dilution – which occurs along the 3.4 mile cooling water canal - further reduces the original concentration[s] of radioisotopes by 1/73 [at minimum flow during unit shutdown] and by 1/1890 [at maximum flow during unit operation] prior to the water entering Clinton Lake.

The concentrated radioactive solids captured from the liquid waste treatment system are processed and temporarily stored on-site until scheduled for shipment off-site for disposal at a licensed low-level waste disposal facility.

The gaseous effluents from the main condenser are held up in the off-gas charcoal beds for a minimum of 46 hours. With most of the radionuclides present having a radioactive half-life of less than eight (8) hours, this hold up process allows for their radioactive decay. If the gaseous effluents from the ventilation exhaust system for the Containment Building and Secondary Containment structure exceed conservatively established set points, these effluents are processed through charcoal beds and High Efficiency Particulate Air [HEPA] filters within the Standby Gas Treatment System before being released to the environment.

The combination of HEPA filters and charcoal bed filtration is rated to be 95% efficient for removing iodines and greater than 99% efficient for removing any particulate material that is larger than one micron [one millionth of one inch] in diameter.

# RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

## III. RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

### A. Program Description

The Clinton Power Station is required to maintain a Radiological Environmental Monitoring Program [REMP] in accordance with the Code of Federal Regulations (CFR) Title 10, Section 20.1501 and Criterion 64 of CFR Title 10, Part 50, Appendix A. The program was developed using the following guidance published by the United States Nuclear Regulatory Commission [USNRC]:

- Regulatory Guide 4.1, "Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants"
- USNRC Radiological Assessment Branch Technical Position on Radiological Environmental Monitoring (1979)

The REMP is an extensive program of sampling, measuring and analyzing that was instituted to monitor the radiological impact of reactor operation[s] on the surrounding environment. Objectives of the program include the following:

- identification, measurement and evaluation of existing radionuclides in the environment of the Clinton Power Station and fluctuations in radioactivity levels that may occur
- evaluation of the measurements to determine the impact of Clinton Power Station operations relative to the local radiation environment
- collection of data needed to refine environmental radiation transport models used in offsite dose calculations
- verification that radioactive material containment systems are functioning to minimize environmental releases to levels that are ALARA
- demonstration of compliance with regulations and the Clinton Power Station Offsite Dose Calculation Manual

Implicit in these objectives are the requirements to trend and assess radiation exposure rates and radioactivity concentrations in the environment that may contribute to radiation exposure to the public. The program consists of two (2) phases, Pre-Operational [Pre-Op] and Operational.

The Pre-Operational portion of the program was initiated in May 1980 and was completed on 27 February 1987 to establish the baseline for the local radiation environment. Assessment of the operational impact of the Clinton Power Station on the radiation environment is based on data collected since the beginning of reactor operation[s]. The operational phase implements confirmatory measurements to verify that the in-station controls for the release of radioactive material are functioning as designed.

AmerGen Energy Company, LLC currently maintains a contract with Environmental Inc. Midwest Laboratory, for the analysis of all radiological environmental samples. Environmental Inc. is located in Northbrook, Illinois. Samples are currently collected by AmerGen Energy Company personnel and then shipped to the Environmental, Inc. laboratory for analysis. After analysis, environmental samples are saved at the laboratory for a specified period of time in case any additional follow up analysis is required. Analytical results are then reported back monthly to CPS for review by the ODCM Program Owner.

Current regulatory guidance recommends evaluating direct pathways, or the highest trophic level in a dietary pathway, that contribute to an individual's dose. Figure 3 shows the basic pathways of gaseous and liquid radioactive effluents to the public. The "important pathways" selected are based primarily on how radionuclides move through the environment that will eventually expose the public – taking into consideration - man's use of the environment. The scope of the program includes the monitoring of five (5) environmental elements:

- direct radiation
- atmospheric
- aquatic
- terrestrial environments
- ground and surface water

Each pathway is monitored at "Indicator" and "Control" Locations. Indicator Locations are generally within a ten (10) mile radius of the station that is expected to mimic station effects, if any exist. Control Locations are located greater than ten (10) miles from the plant - far enough away – so as not to be influenced by station operations. These Control Location samples provide the basis by which to measure any fluctuations in radioactivity from Indicator Locations relative to natural phenomena and fallout. Thus any increase in radioactive material concentration from an Indicator Location may be - due in part - to station operations.

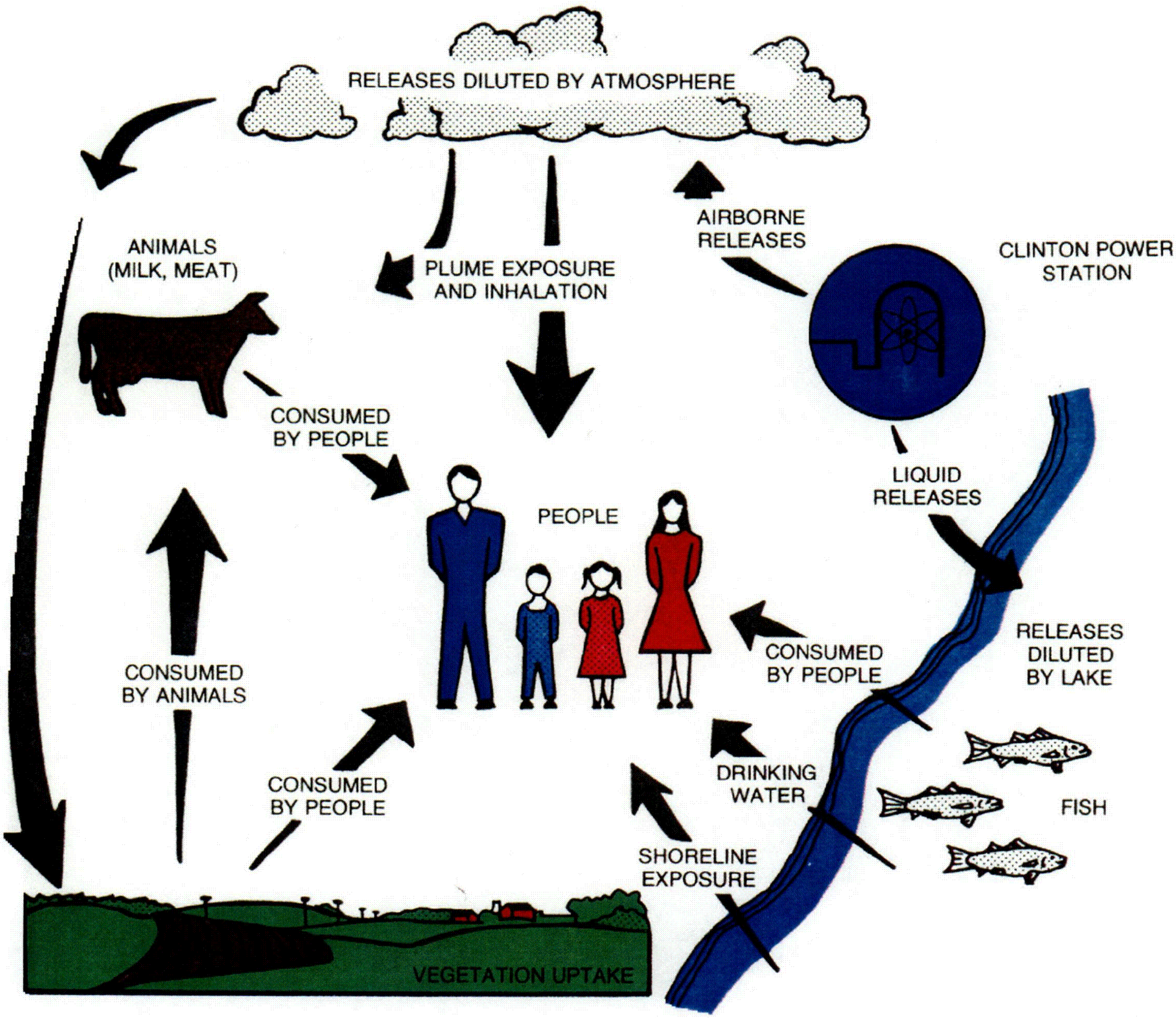


**FIGURE 3:** POTENTIAL EXPOSURE PATHWAYS OF MAN DUE TO RELEASES OF RADIOACTIVE MATERIAL TO THE ENVIRONMENT



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Sampling locations were established by considering site meteorology, area population distribution, site hydrology, and land use characteristics of the local area. These locations were selected primarily on the basis of where the highest predicted environmental concentrations would occur.

Locations of sampling stations are shown on maps in Figures 4 through 7. Table[s] 2-A and 2-B provide information on sample location, media sampled at each of these location[s], and a brief description of each location where samples were taken. The location is listed according to distance (in miles) and the meteorological compass sector in relationship to the Station Heating, Ventilation, and Air Conditioning [HVAC] Stack.

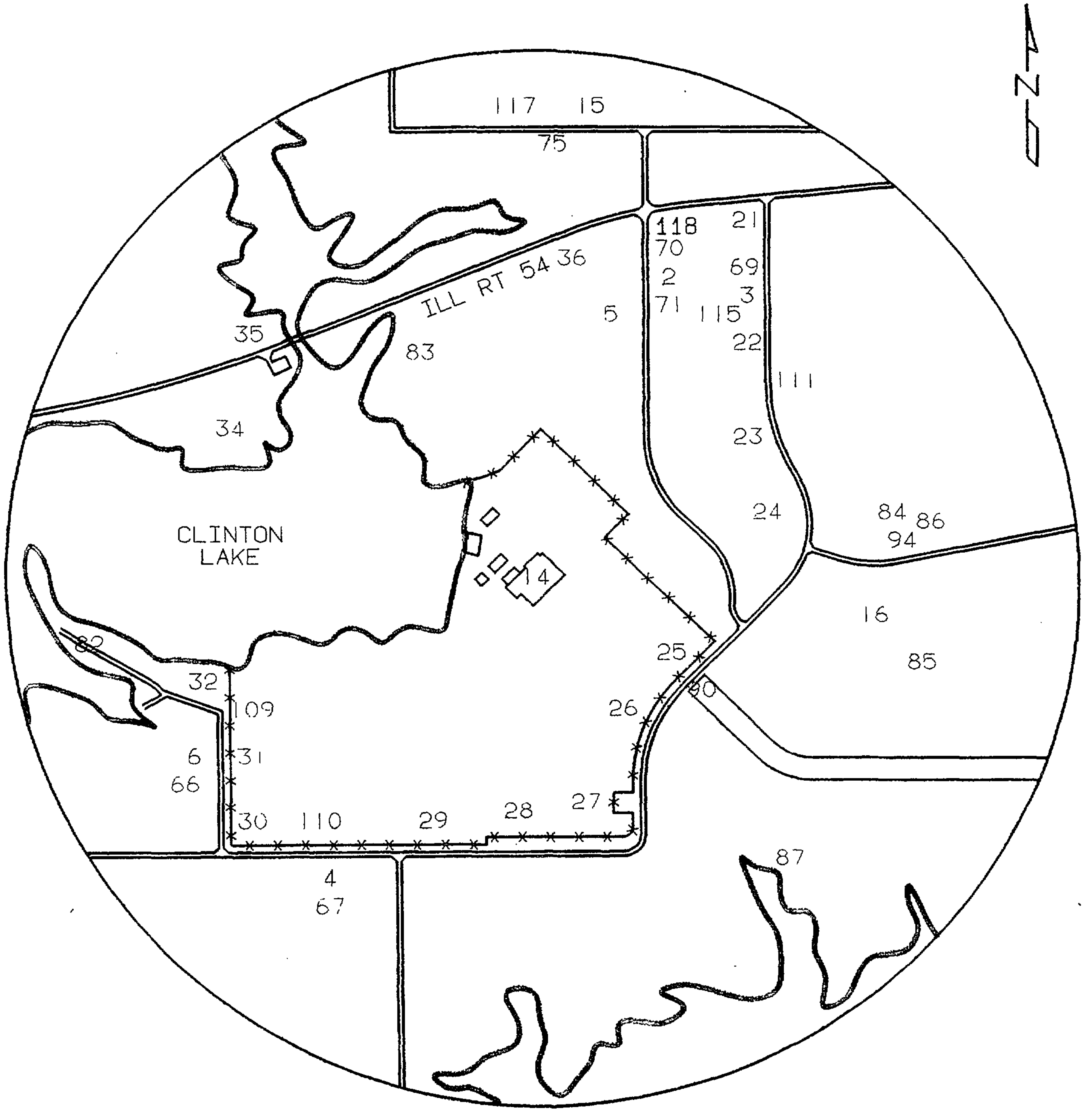



*FIGURE 4: REMP SAMPLE LOCATIONS WITHIN 1 MILE*

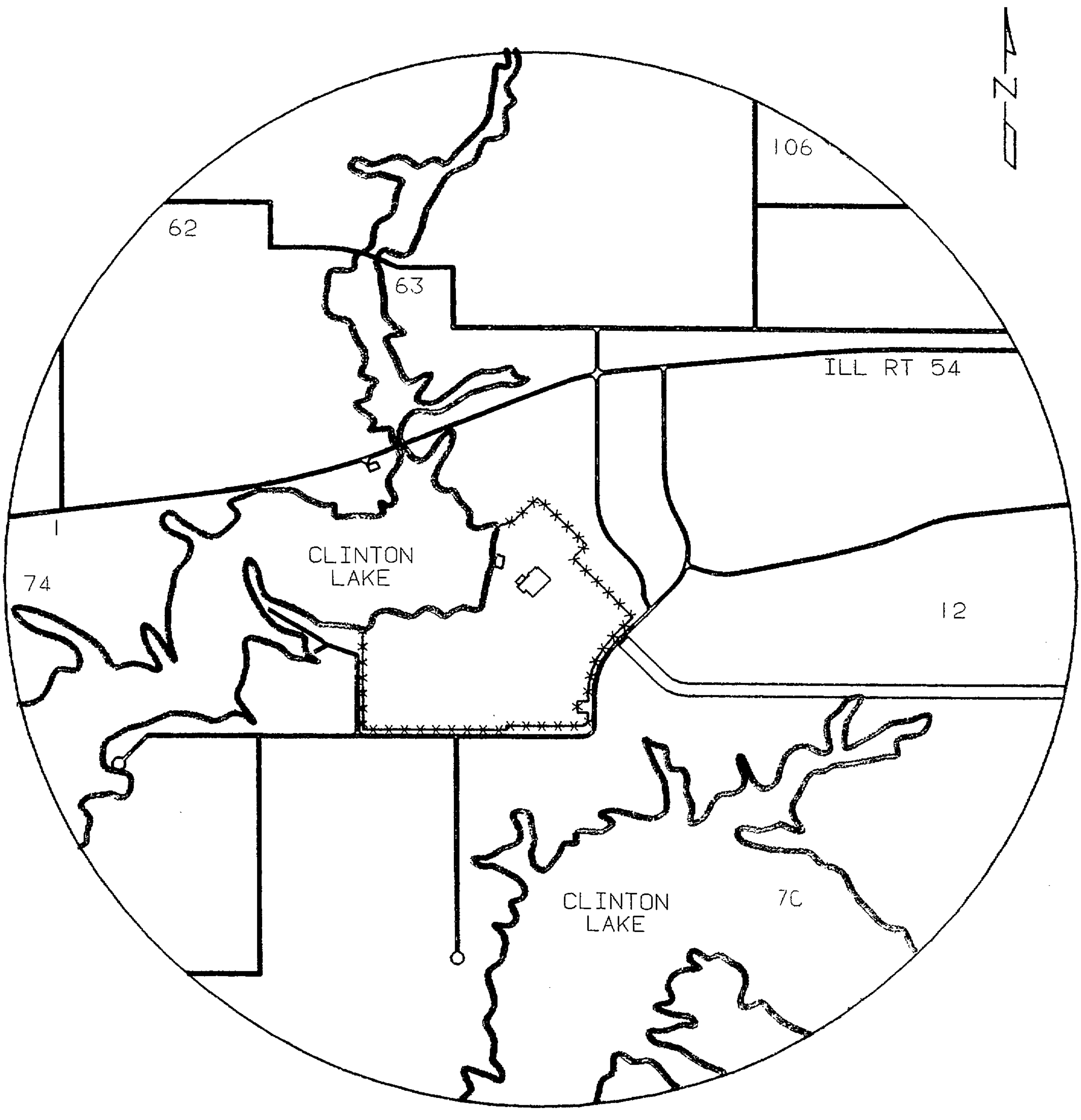



FIGURE 5: REMP SAMPLE LOCATIONS FROM 1 - 2 MILES

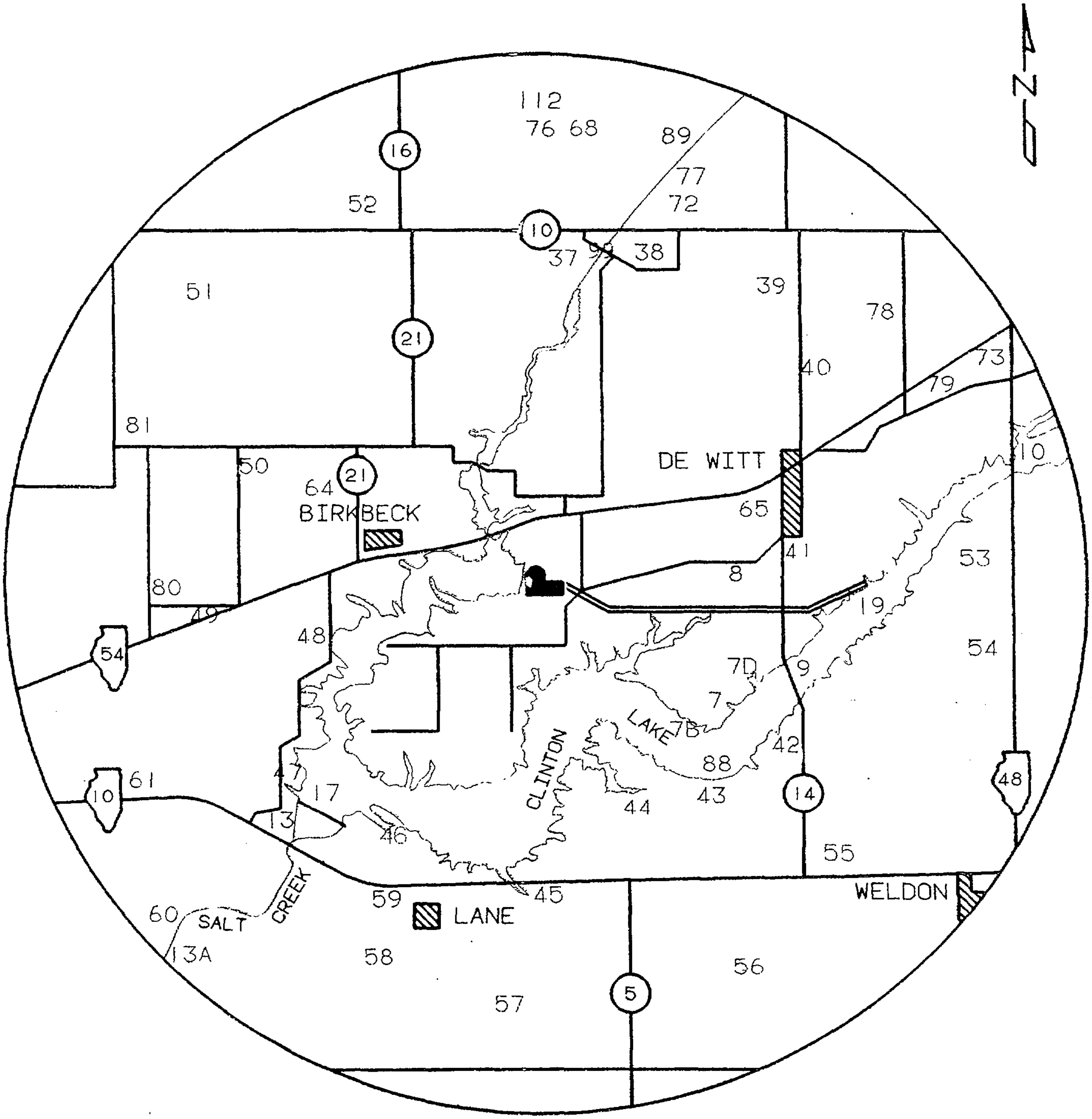



*FIGURE 6: REMP SAMPLE LOCATIONS FROM 2 - 5 MILES*

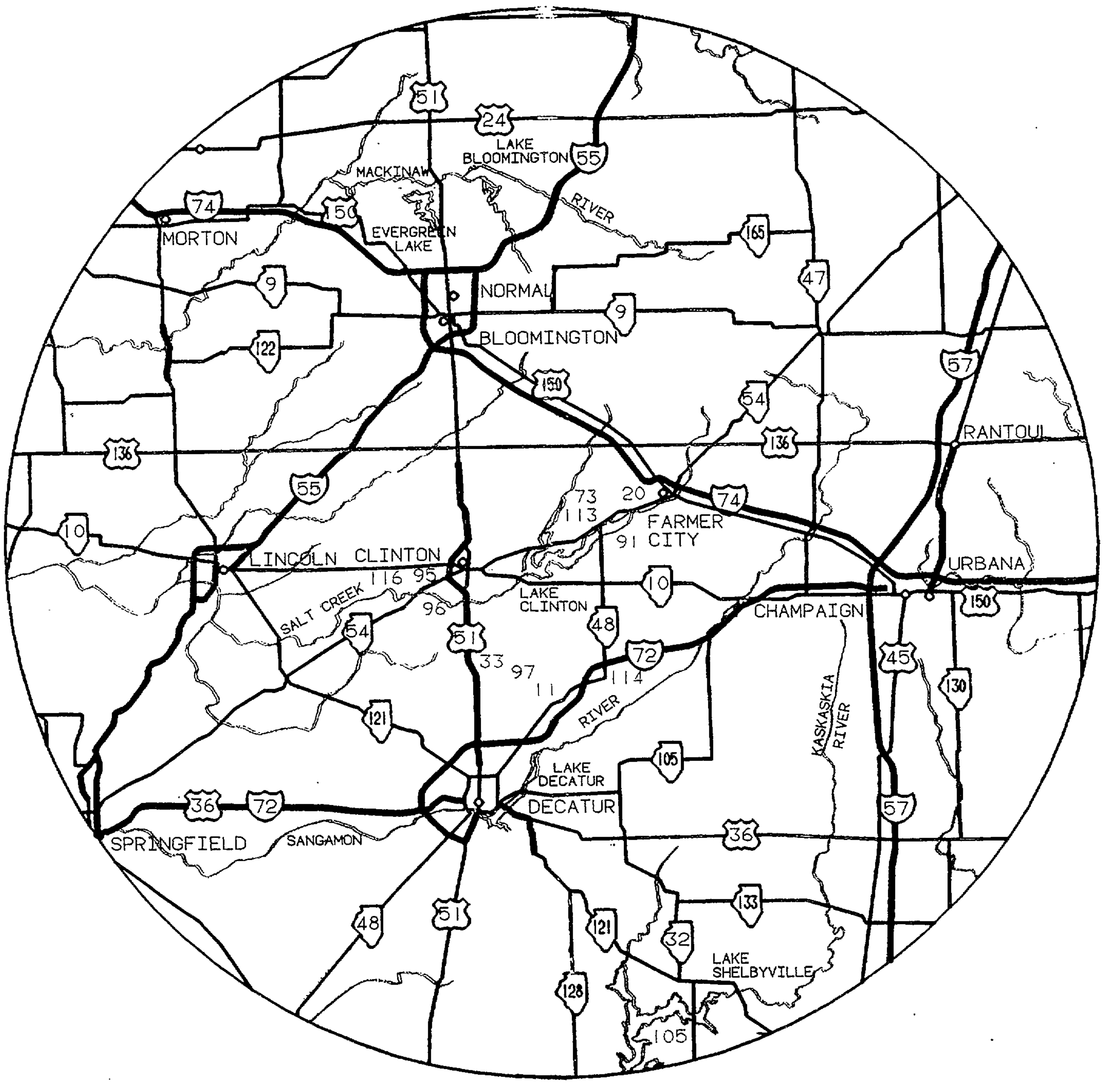



FIGURE 7: REMP SAMPLE LOCATIONS GREATER THAN 5 MILES

## TABLE 2-A

CPS RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

### TLD Sites

| Station Code | Description | Sector | Distance (miles) | Station Code | Description | Sector | Distance (miles) |
|---|---|---|---|---|---|---|---|
| CL-15 | Supplemental Control | N | 0.9 | CL-44 | Inner Ring | SSE | 2.3 |
| CL-36 | Inner Ring | N | 0.6 | CL-56 | Outer Ring | SSE | 4.1 |
| CL-37 | Special Interest | N | 3.4 | CL-114 | Supplemental Control | SSE | 12.5 |
| CL-75 | Special Interest | N | 0.9 | CL-11 | Control | S | 16 |
| CL-76 | Outer Ring | N | 4.6 | CL-45 | Inner Ring | S | 2.8 |
| CL-3 | Supplemental Control | NE | 0.7 | CL-57 | Outer Ring | S | 4.6 |
| CL-22 | Inner Ring | NE | 0.6 | CL-46 | Inner Ring | SSW | 2.8 |
| CL-78 | Outer Ring | NE | 4.8 | CL-58 | Outer Ring | SSW | 4.3 |
| CL-2 | Supplemental Control | NNE | 0.7 | CL-97 | Supplemental Control | SSW | 10.3 |
| CL-5 | Inner Ring | NNE | 0.7 | CL-4 | Supplemental Control | SW | 0.8 |
| CL-77 | Outer Ring | NNE | 4.5 | CL-33 | Supplemental Control | SW | 11.7 |
| CL-99 | Supplemental Control | NNE | 3.5 | CL-47 | Inner Ring | SW | 3.3 |
| CL-23 | Inner Ring | ENE | 0.5 | CL-60 | Outer Ring | SW | 4.5 |
| CL-65 | Special Interest | ENE | 2.6 | CL-6 | Supplemental Control | WSW | 0.8 |
| CL-79 | Outer Ring | ENE | 4.5 | CL-48 | Inner Ring | WSW | 2.3 |
| CL-91 | Supplemental Control | ENE | 6.1 | CL-61 | Outer Ring | WSW | 4.5 |
| CL-8 | Supplemental Control | E | 2.2 | CL-1 | Inner ring | W | 1.8 |
| CL-24 | Inner Ring | E | 0.5 | CL-49 | Special Interest | W | 3.5 |
| CL-41 | Special Interest | E | 2.4 | CL-74 | Special Interest | W | 1.9 |
| CL-53 | Outer Ring | E | 4.3 | CL-80 | Outer Ring | W | 4.1 |
| CL-84 | Supplemental Control | E | 0.6 | CL-34 | Inner Ring | WNW | 0.8 |
| CL-42 | Inner Ring | ESE | 2.8 | CL-64 | Special Interest | WNW | 2.1 |
| CL-54 | Outer Ring | ESE | 4.6 | CL-81 | Outer Ring | WNW | 4.5 |
| CL-7 | Supplemental Control | SE | 2.3 | CL-35 | Inner Ring | NW | 0.7 |
| CL-43 | Inner Ring | SE | 2.8 | CL-51 | Outer Ring | NW | 4.4 |
| CL-55 | Outer Ring | SE | 4.1 | CL-52 | Outer Ring | NNW | 4.3 |
| CL-90 | Supplemental Control | SE | 0.4 | CL-63 | Inner Ring | NNW | 1.3 |

# TABLE 2-B

## CPS RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

| Station Code | Description | Air | Surface Water | Drinking Water | Food Products | Milk | Ground Water |
|---|---|---|---|---|---|---|---|
| CL-1 | Camp Quest (1.8 miles W) | • | | | | | |
| CL-2 | Site's main access road (0.7 miles NNE) | √ | | | | | |
| CL-3 | Site's secondary access road (0.7 miles NE) | √ | | | | | |
| CL-4 | Residence near recreation area (0.8 miles SW) | • | | | | | |
| CL-6 | CPS recreation area (0.8 miles WSW) | • | | | | | |
| CL-7 | Mascoutin Recreation Area (2.3 miles SE) | • | | | | | |
| CL-7D | Mascoutin Recreation Area (2.3 miles ESE) | | | | | | √ |
| CL-8 | DeWitt Cemetery (2.2 miles E) | √ | | | | | |
| CL-11* | Illinois Power substation (16 miles S) | √ | | | | | |
| CL-12 | DeWitt Pumphouse (1.6 miles E) | | | | | | √ |
| CL-13 | Salt Creek bridge on Rt.10 (3.6 miles SW) | | • | | | | |
| CL-14 | Station Service Building | | | √ | | | |
| CL-15 | Near residence on Rt. 900N (0.9 miles N) | √ | | | | | |
| CL-90 | Start of discharge flume (0.4 miles SE) | | √ | | | | |
| CL-91 | Parnell Boat Access (6.1 miles ENE) | | √ | | | | |
| CL-94 | Old Clinton Road (0.6 miles E) | • | | | | | |
| CL-99 | North Fork canoe access area (3.5 miles NNE) | | • | | | | |
| CL-114* | Residence in Cisco (12.5 miles SSE) | | | | √ | | |
| CL-115 | Site's secondary access road (0.7 miles NE) | | | | √ | | |
| CL-116 | Pasture in rural Kenney (14 miles WSW) | | | | | √ | |
| CL-117 | Resident north of site (0.9 miles N) | | | | √ | | |
| CL-118 | Site's main access road (0.7 miles NNE) | | | | √ | | |

| Station Code | Description | Grass | Fish | Shoreline Sediment |
|---|---|---|---|---|
| CL-1 | Camp Quest (1.8 miles W) | • | | |
| CL-2 | Site's main access road (0.7 miles NNE) | • | | |
| CL-7B | SE of site on Clinton Lake (2.1 miles SE) | | | √ |
| CL-8 | DeWitt Cemetery (2.2 miles E) | • | | |
| CL-19 | End of the discharge flume (3.4 miles E) | | √ | |
| CL-105* | Lake Shelbyville (50 miles S) | | √ | |
| CL-116 | Pasture in rural Kenney (14 miles WSW) | • | | |

*Control Location √ ODCM *required* samples • Supplemental samples

**Note:** Location[s] are listed by distance [in miles] along with meteorological sector from the Station's HVAC stack.

**TABLE 3-A**

CPS REMP REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

| Analysis | Water (pCi/l) | Airborne Particulate or Gases (pCi/m$^3$) | Fish (pCi/kg - wet) | Milk (pCi/l) | Food Products (pCi/kg - wet) |
|---|---|---|---|---|---|
| $H^3$ | 20,000[a] | --- | --- | --- | --- |
| $Mn^{54}$ | 1,000 | --- | 30,000 | --- | --- |
| $Fe^{59}$ | 400 | --- | 10,000 | --- | --- |
| $Co^{58}$ | 1,000 | --- | 30,000 | --- | --- |
| $Co^{60}$ | 300 | --- | 10,000 | --- | --- |
| $Zn^{65}$ | 300 | --- | 20,000 | --- | --- |
| $Zr/Nb^{95}$ | 400[c] | --- | --- | --- | --- |
| $I^{131}$ | 2[b] | 0.9 | --- | 3 | 100 |
| $Cs^{134}$ | 30 | 10 | 1,000 | 60 | 1,000 |
| $Cs^{137}$ | 50 | 20 | 2,000 | 70 | 2,000 |
| $Ba/La^{140}$ | 200[c] | --- | --- | 300 | --- |

**a** If no drinking water pathway exists, a value of 30,000 pCi/l may be used.
**b** If no drinking water pathway exists, a value of 20 pCi/l may be used.
**c** Total for parent and daughter.

**TABLE 3-B**

DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS[d] LOWER LIMIT OF DETECTION (LLD)

| Analysis | Water (pCi/l) | Airborne Particulate or Gas (pCi/m$^3$) | Fish (pCi/kg – wet) | Milk (pCi/l) | Food Products (pCi/kg - wet) | Sediment (pCi/kg - dry) |
|---|---|---|---|---|---|---|
| Gross Beta | 4 | 0.01 | | | | |
| $H^3$ | 2,000[e] | | | | | |
| $Mn^{54}$ | 15 | | 130 | | | |
| $Fe^{59}$ | 30 | | 260 | | | |
| $Co^{58}$, $Co^{60}$ | 15 | | 130 | | | |
| $Zn^{65}$ | 30 | | 260 | | | |
| $Zr^{95}$ | 30 | | | | | |
| $Nb^{95}$ | 15 | | | | | |
| $I^{131}$ | 1[f] | 0.07 | | 1 | 60 | |
| $Cs^{134}$ | 15 | 0.05 | 130 | 15 | 60 | 150 |
| $Cs^{137}$ | 18 | 0.06 | 150 | 18 | 80 | 180 |
| $Ba^{140}$ | 60 | | | 60 | | |
| $La^{140}$ | 15 | | | 15 | | |

**d** This list does not mean these nuclides are the only ones considered. Other nuclides are identified and reported when applicable.
**e** If no drinking water pathway exists, a value of 3,000 pCi/l may be used.
**f** If no drinking water pathway exists, a value of 15 pCi/l may be used.

## Sample Analysis

Concentrations of radioactivity present in the environment will vary due to factors such as weather conditions, variations in the sampling collection technique and during sample analysis.

Several types of measurements may be performed to provide information about the types of radiation and radionuclides present. Analyses that are performed on environmental samples collected for the CPS REMP include the following:

- Gross alpha and beta analysis
- Gamma spectroscopy analysis
- Tritium analysis
- Strontium analysis
- Gamma dose (TLDs only)

A gross alpha and beta analysis measures the total amount of alpha and beta emitting radioactivity present in a sample. Both radiation[s] may be released by many different radionuclides. Gross activity measurements - while useful as a general trend indicator - are not used to establish specific radionuclide concentrations. Therefore, gross activity analysis will only indicate whether the sample contains normal or abnormal concentrations of alpha or beta emitting radioactivity and serves as a precursor in which to identify samples that may require additional follow up analysis.

Samples are primarily analyzed for plant-contributed radionuclides released to the environment. Irrespective of station operations and since naturally occurring radionuclides are abundant in all environmental samples, any positive result for a certain radionuclide, including gross alpha / beta measurements, will be discussed further in this section of the report.

## B. Direct Radiation Monitoring

Radionuclides present in the air – in addition to those deposited in or on top of the ground – cause human exposure by immersion in the atmosphere or by deposition on the ground. TLDs [Thermo-Luminescent Dosimeters] are used to measure the ambient gamma radiation levels at 54 locations surrounding Clinton Power Station.

TLDs are crystalline devices that store energy when they are exposed to radiation. They can be processed months after their exposure with a minimal loss of this collected information. This makes them well suited for quarterly environmental radiation measurements.

During TLD processing, stored energy is released as light and measured by a TLD reader. The light intensity is proportional to the radiation dose the TLD was exposed to. The TLDs used for environmental monitoring around the Clinton Power Station are capable of measuring environmental levels of radiation as low as approximately 20 mRem per quarter.

Monitoring stations are placed near the site boundary and approximately five (5) miles from the reactor, in locations representing the 16 meteorological compass sectors. Other locations are chosen to measure the radiation levels at places of special interest such as nearby residences, meeting places and population centers.

Control Locations are located further than ten (10) miles from the station so that they will not be influenced by station operations.

TLD measurements register the gamma ray exposure in milli-Roentgen [mR]. For reporting purposes mR is numerically equivalent to that of mRem. Consequently, these terms are used interchangeably throughout this Annual Report.

A total of 216 TLD measurements were made throughout 2002. The average quarterly dose from our Indicator Location[s] was 21.3 mrem. At our Control Locations, the average quarterly dose was 20.8 mRem. These quarterly measurements ranged from 17.7 to 23.6 mRem for Indicator TLDs and 19.6 to 21.9 mRem for Control TLDs.

Figure 8 compares the 2002 quarterly TLD results with our Pre-Operational TLD quarterly averages.

Average doses (± 2 standard deviations) - broken down by calendar quarter - are shown in Table 4 for both Indicator and Control Locations.

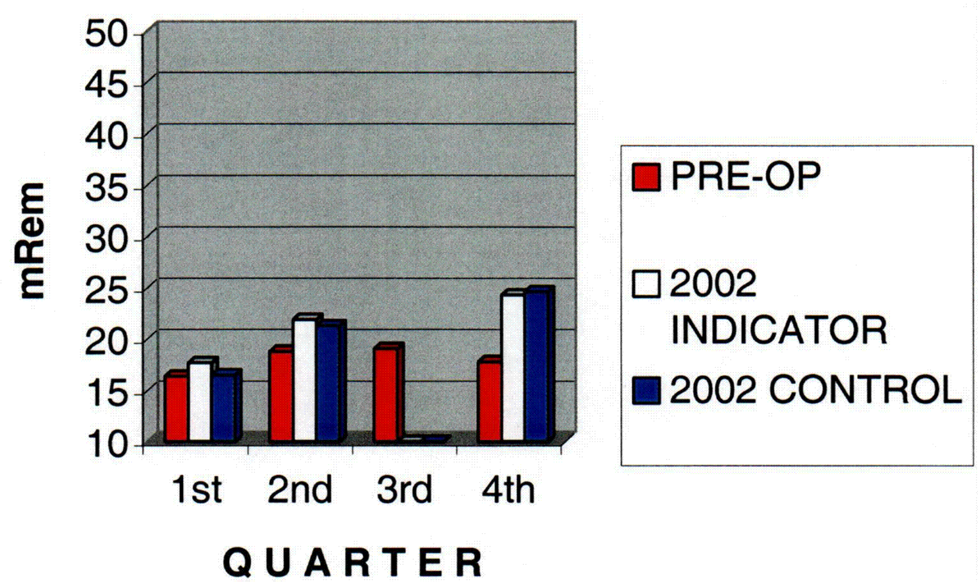
## TABLE 4

**AVERAGE QUARTERLY TLD RESULTS**
Average ± 2σ (mRem/quarter)

| QUARTERLY PERIOD | 2001 INDICATOR | 2002 INDICATOR | PREOP ALL SITES |
|---|---|---|---|
| 1st | 16.3 ± 2.7 | 17.7 ± 3.0 | 16.4 ± 2.9 |
| 2nd | 18.4 ± 2.9 | 21.9 ± 3.8 | 18.8 ± 3.2 |
| 3rd | 19.3 ± 3.5 | [see below] ▲ | 19.1 ± 4.7 |
| 4th | 18.6 ± 2.6 | 24.3 ± 3.1 | 17.8 ± 2.2 |
| **QUARTERLY PERIOD** | **2001 CONTROL** | **2002 CONTROL** | **PREOP ALL SITES** |
| 1st | 15.8 ± 1.3 | 16.5 ± 1.0 | 16.4 ± 2.9 |
| 2nd | 17.1 ± 2.8 | 21.3 ± 3.0 | 18.8 ± 3.2 |
| 3rd | 17.3 ± 3.3 | [see below] ▲ | 19.1 ± 4.7 |
| 4th | 17.6 ± 3.7 | 24.6 ± 4.5 | 17.8 ± 2.2 |

▲ Clinton's 3rd Quarter ODCM REMP TLD results – both Indicator and Control - were determined to be inaccurate from our Vendor. ODCM REMP TLD results were irradiated from an unknown external source of radiation during air transportation from California to Illinois prior to placement in the environment. This resulted in inconsistent readings after adding this unknown exposure to their quarterly environmental exposure.

**FIGURE 8: DIRECT RADIATION COMPARISON**




Given the above observations – and after factoring statistical variances - there were no significant increases in environmental gamma radiation levels resulting from station operations of the Clinton Power Station.

## C. Atmospheric Monitoring

The inhalation and ingestion of radionuclides in the air is a direct exposure pathway to man. A network of ten (10) active Air Sampling Stations around the Clinton Power Station monitor this pathway. There are nine (9) 'Indicator' Air Sampling Stations locations strategically placed in areas that are most likely to reveal any measurable effects due to the release of radioactive effluents from the Clinton Power Station. The 'Control' Air Sampling Station location is located approximately 16 miles south of the station in an area that is totally independent from any of the effects from station operation[s]. Historical meteorological data further supports that this 'Control' Air Sampling Station location is normally upwind from the station.

Mechanical air samplers are used to draw a continuous volume of air through a filter and charcoal cartridge collecting any particulates and radioiodines that may be present in the atmosphere. These samplers are equipped with a pressure-sensing flow regulator to maintain a constant sampling rate of air flow of about one (1) cubic foot per minute (CFM). The total volume is then calculated based upon the amount of time the air sampler was in operation coupled with this flow rate. The air sampling equipment is maintained and calibrated by Clinton Power Station personnel using reference standards that are traceable back to the National Institute of Standards and Technology (NIST).

Air samples are collected every week and analyzed for gross beta and $I^{131}$ activities. Quarterly, all air particulate filters collected throughout this period are combined and counted for gamma isotopic activity. Since the intent of particulate sampling is to measure airborne radioactivity released from the station, the counting of short-lived daughters - produced by the decay of naturally occurring radon and thoron - may otherwise mask any station contributions. Therefore, particulate filters are not analyzed for at least five (5) days after their collection. This allows for the radioactive decay of naturally occurring short-lived daughters, thus reducing their contribution interference to the overall gross beta activity.

Results from the gross beta airborne particulate analysis provides for comparisons between both Indicator and Control Locations – including those locations relative to spatial and temporal differences - throughout the year. These results are reported in units of pico-curies per cubic meter [pCi/$m^3$]. The calculated annual average was 0.025 pCi/$m^3$ for all Indicator Locations and 0.026 pCi/$m^3$ for the Control Location. These results are consistent with our Pre-Operational annual averages for both Indicator and Control Locations that were 0.027 pCi/$m^3$.

The location with the highest calculated annual average was measured at Indicator Location CL-8 that is located 2.2 miles East of the Clinton Power Station. This location had a monthly average concentration of 0.026 pCi/$m^3$. Individual location averages for the 2002-year are presented in Table 5.

Minor fluctuations in the gross beta concentrations were noted throughout 2002. The general trend for average weekly gross beta concentrations from the Indicator Locations correlated to the trend for the Control Locations throughout the monitoring period. This correlation is evidenced by the similarity of the trends in the average monthly gross beta concentrations contained within Figure 9. There were no significant differences observed between these individual locations. Monthly averages for both Indicator and Control Locations for the 2002 year are presented in Table 6.

Fluctuations observed in the gross beta activity over the year can be attributed to changes in the environment, specifically during seasonal changes.

All gross beta concentrations for the 2002-year were within normal background levels and no significant increases were noted as a result of station operations.

Naturally occurring $Be^7$ [Beryllium] was the only gamma-emitting radionuclide detected in the analysis of particulate filters.

No measurable contribution to the overall level of airborne particulate radioactivity was identified as a result of station operations. The radioactivity that was detected - naturally occurring $Be^7$ - is normally found in the environment and is consistent with the expected concentrations of natural radioactivity and fallout from prior atmospheric nuclear weapons testing.

## TABLE 5

ANNUAL AVERAGE GROSS BETA CONCENTRATIONS IN AIR PARTICULATES

Average ± 2σ (pCi/m$^3$)

| Station | Description | 2001 | 2002 |
|---|---|---|---|
| CL-1 | Camp Quest | 0.025 ± 0.009 | 0.025 ± 0.010 |
| CL-2 | Site's Main Access Road | 0.026 ± 0.008 | 0.026 ± 0.010 |
| CL-3 | Site's Secondary Access Road | 0.026 ± 0.010 | 0.026 ± 0.011 |
| CL-4 | Residence near Recreation Area | 0.025 ± 0.009 | 0.025 ± 0.010 |
| CL-6 | CPS Recreation Area | 0.026 ± 0.009 | 0.025 ± 0.010 |
| CL-7 | Mascoutin Recreation Area | 0.024 ± 0.010 | 0.025 ± 0.010 |
| CL-8 | DeWitt Cemetery | 0.027 ± 0.008 | 0.026 ± 0.011 |
| CL-11* | Illinois Power Substation | 0.026 ± 0.009 | 0.026 ± 0.012 |
| CL-15 | Near Residence on Route 900N | 0.025 ± 0.013 | 0.025 ± 0.011 |
| CL-94 | Old Clinton Road | 0.026 ± 0.009 | 0.025 ± 0.010 |

* Control Station

## TABLE 6

AVERAGE MONTHLY GROSS BETA CONCENTRATIONS IN AIR PARTICULATES

Average ± 2σ (pCi/m$^3$)

| MONTH | 2001 Indicator | 2002 Indicator | 2001 Control | 2002 Control |
|---|---|---|---|---|
| January | 0.033 ±0.004 | 0.032 ±0.003 | 0.033 ±0.014 | 0.032 ±0.013 |
| February | 0.029 ±0.003 | 0.023 ±0.001 | 0.027 ±0.007 | 0.022 ±0.014 |
| March | 0.021 ±0.003 | 0.023 ±0.003 | 0.022 ±0.009 | 0.022 ±0.013 |
| April | 0.022 ±0.004 | 0.020 ±0.002 | 0.023 ±0.008 | 0.018 ±0.009 |
| May | 0.019 ±0.004 | 0.017 ±0.002 | 0.019 ±0.013 | 0.018 ±0.007 |
| June | 0.021 ±0.003 | 0.021 ±0.002 | 0.021 ±0.009 | 0.023 ±0.010 |
| July | 0.025 ±0.004 | 0.027 ±0.004 | 0.026 ±0.004 | 0.030 ±0.016 |
| August | 0.026 ±0.003 | 0.022 ±0.002 | 0.027 ±0.007 | 0.022 ±0.013 |
| September | 0.026 ±0.002 | 0.029 ±0.004 | 0.026 ±0.006 | 0.031 ±0.017 |
| October | 0.022 ±0.003 | 0.027 ±0.003 | 0.021 ±0.011 | 0.030 ±0.015 |
| November | 0.033 ±0.004 | 0.030 ±0.003 | 0.033 ±0.036 | 0.031 ±0.023 |
| December | 0.029 ±0.002 | 0.032 ±0.003 | 0.028 ±0.011 | 0.034 ±0.017 |

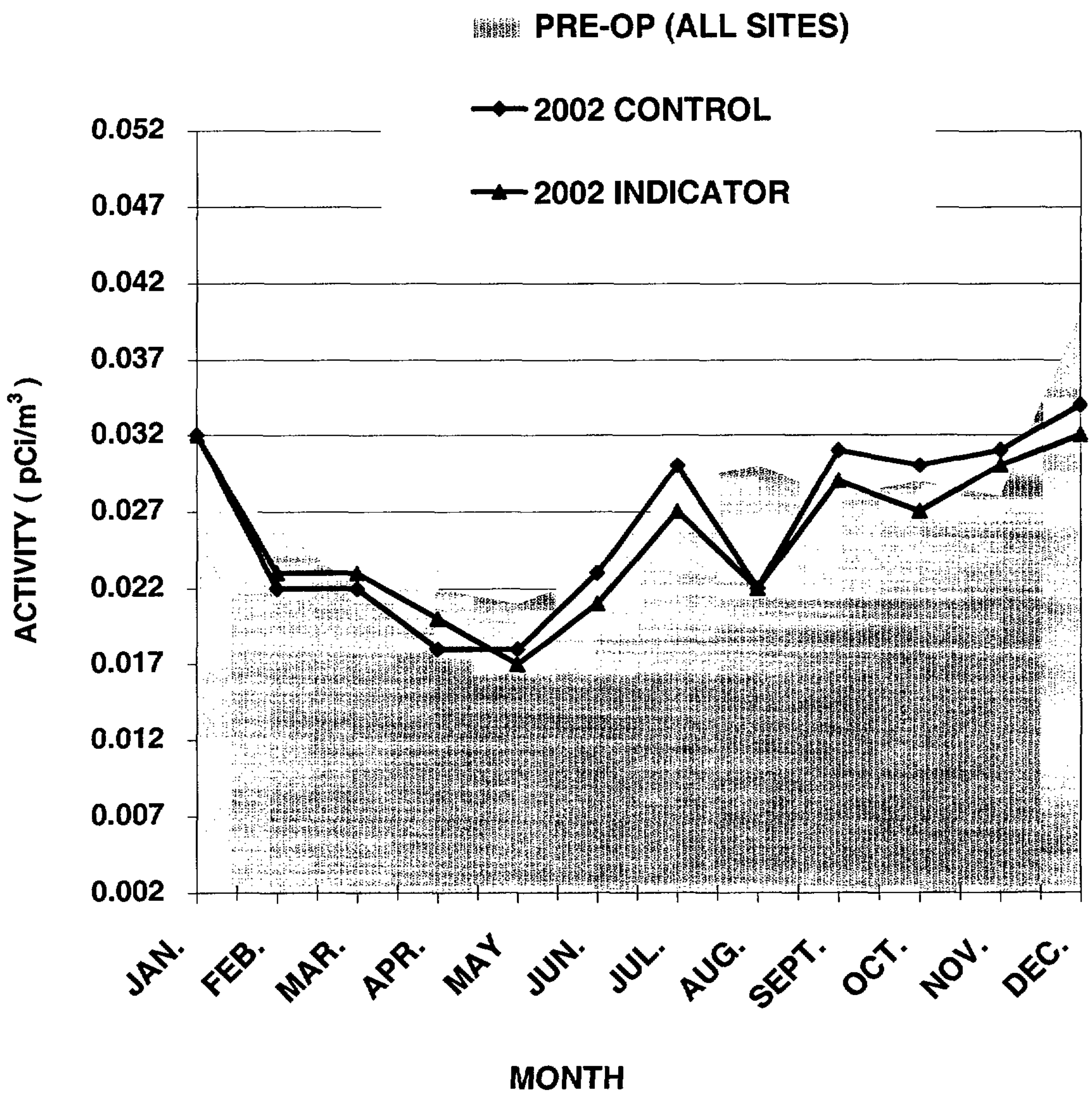



***FIGURE 9: AIR PARTICULATE GROSS BETA ACTIVITY COMPARISON***

## D. Aquatic Monitoring

The Clinton Power Station utilizes a man-made lake as the source of cooling water and returns this cooling water back to the same lake while most nuclear power stations use once-through flow methods from a river, an ocean or body of water much larger than Clinton Lake. If regulated radioactive liquid effluents were to be discharged from the Clinton Power Station into the cooling water outfall, long-lived radioisotopes could build up over a period time as the same water is reused on recurring trips through the station. Cooling water that exits from the plant will travel back into the eastern arm of Clinton Lake and then into the northern arm of the lake before returning back into the plant. Although the only user of Clinton Lake as a source of drinking water is CPS itself, Clinton Lake is a major recreational facility used for fishing, swimming, water skiing, boating and hunting.

Clinton Lake constitutes the primary environmental exposure pathway for radioactive materials from liquid effluents. Aquatic monitoring provides for the collection of fish and shoreline sediments to detect the presence of any radioisotopes related to the operation of the Clinton Power Station. These samples are analyzed for naturally occurring and man-made radioactive materials. Indicator samples were taken from various locations throughout Clinton Lake whereas the Control samples are obtained from Lake Shelbyville - approximately 50 miles south of Clinton Power Station – thus serving as an excellent data comparison to our station operations.

In addition to naturally occurring radioisotopes, $Sr^{90}$ was found in one sample. However, the overall concentration[s] of radionuclides in samples collected near the Clinton Power Station were comparable to the concentrations in samples collected from the Control Location at Lake Shelbyville. The presence of this $Sr^{90}$ fission product is attributable to previous nuclear weapons testing and fallout from the accident occurring at Chernobyl. The operation of Clinton Power Station had no measurable contribution to the radioactive inventory towards the aquatic environment.

### Fish

Various samples of fish are collected from Clinton Lake and Lake Shelbyville. From both lakes; our primary interest consists of largemouth bass, crappie, carp, and bluegill. The selections of these species are the fish most commonly harvested from the lakes by sporting fishermen. Fish will ingest both floating sediments and during feeding - prey on other organisms - that will also ingest sediments that may otherwise retain radionuclides. A radiological analysis from fish samples provides key information on the potential ingestion of radionuclides by humans via the aquatic pathway. These samples are collected semi-annually and analyzed by gamma spectroscopy.

The gamma spectroscopy analysis revealed that fish samples – from Clinton Lake and Lake Shelbeyville from 50 miles away – both identified the presence of naturally occurring $K^{40}$ [Potassium] in all species. All other analytical results were less than the Lower Limit of Detection (LLD) for each radionuclide of interest.

### Shoreline Sediments

Samples of shoreline sediments are collected at Clinton Lake. Radiological analyses of shoreline sediments provide information on any potential shoreline exposure to humans, determining long-term trends, and the accumulation of long-lived radionuclides from our environment. Samples are collected semi-annually and then analyzed for gross beta, gross alpha, $Sr^{90}$, and gamma isotopic activities.

Shoreline sediment samples are dried prior to analysis and the results are reported in pCi/g [pico-curies per gram] dry weight. Naturally occurring radioisotopes were present in samples taken at Clinton Lake. There was only one fission product - $Sr^{90}$ – that was detected from this Indicator Location. The activity detected was well within the range from that measured during our Pre-Operational period [see below].

| Isotope | Pre-Op Range (pCi/g dry) | 2001 Range (pCi/g dry) | 2002 Range (pCi/g dry) |
|---|---|---|---|
| $Sr^{90}$ | 0.011 - 0.056 | 0.011 – 0.027 | 0.013 – 0.042 |

## E. Terrestrial Monitoring

In addition to direct radiation, radionuclides that are present in our atmosphere expose individuals when they are deposited on plant and soil surfaces. Consuming animal products - such as meat and milk - subsequently ingest them either directly by man or indirectly. To monitor this food ingestion pathway, samples of green leafy vegetables, grass and milk are analyzed.

Surface vegetation samples are collected monthly during the growing season from a number of locations for the purpose of monitoring the potential buildup of atmospherically deposited radionuclides. Because the radionuclides of interest – relative to Clinton Power Station operations - are already present within our environment as a result of several decades of worldwide fallout or because they are naturally occurring, the presence of these radionuclides is anticipated from all of the samples that are collected. These samples are analyzed by gamma spectroscopy.

The gamma spectroscopy analysis revealed the presence of naturally occurring $K^{40}$ [Potassium] and $Be^{7}$ [Beryllium] in several samples. All other analytical results were less than the Lower Limit of Detection (LLD) for each radionuclide. The operation of Clinton Power Station had no measurable contribution to the radioactive concentration of the terrestrial environment.

## Milk

There is no known commercial production of milk for human consumption within a five (5) mile radius of the Clinton Power Station. However, milk samples are collected from a dairy located approximately 14 miles West-Southwest of the station (twice a month during May through October and once a month during November through April to coincide with the grazing seasons). These samples are analyzed for $I^{131}$, $Sr^{90}$, and gamma isotopic activities.

Results from these analyses showed $Sr^{90}$ concentrations ranging from 0.6 to 2.0 pCi/l [pico-curies per liter of milk]. And although not a REMP Sample, the analysis of $Sr^{90}$ on milk samples was added to the REMP early during the operational phase of the program and as such, no Pre-Operational data for this isotope is available [see below*]. There was no $I^{131}$ detected in any of the milk samples collected.

| Isotope | Pre-Op Range (pCi/l) | 2001 Range (pCi/l) | 2002 Range (pCi/l) |
|---|---|---|---|
| $Sr^{90}$ | *Not Available | 0.5 – 3.1 | 0.6 – 2.0 |

## Grass

In addition to milk samples, grass samples are also collected at three (3) Indicator Locations and at one (1) Control Location. These samples are collected twice a month during May through October and once a month during November through April (when available). Grass samples are analyzed for gamma isotopic activity including $I^{131}$.

The results from the analyses showed only naturally occurring $Be^7$ and $K^{40}$ in these samples. There was no $I^{131}$ detected in any of the grass samples collected.

## Vegetables

The Clinton Power Station obtains broadleaf vegetable samples from three (3) Indicator Locations and at one (1) Control Location. The Indicator Locations are located in the meteorological sectors with the highest potential for surface deposition and the Control Location is in a meteorological sector and distance – approximately 13 miles upwind - which is considered to be unaffected by station operations. Samples are collected once a month during the growing season (June through September) and are analyzed for gross beta and gamma isotopic activities including $I^{131}$.

The results from the analyses identified only naturally occurring $Be^7$ and $K^{40}$ from these samples. There was no $I^{131}$ detected in any of the vegetable samples collected.

## F. Water Monitoring

Water monitoring provides for the collection of drinking water, surface water, and ground water (well water) samples to detect the presence of any radioisotopes relative to station operations at the Clinton Power Station.

The only identified user of water from Clinton Lake for domestic purposes is the Clinton Power Station. Samples taken are analyzed for naturally occurring and man-made radioactive isotopes. Average gross beta concentrations in surface, drinking and well water[s] are presented within Table 7 at the end of this section.

Water monitoring results show no measurable effects resulting from the operation of the Clinton Power Station.

### Drinking Water

A composite water sampler is located at the Station Service Building that collects a small - fixed volume - sample at hourly intervals. The sampler discharges each sample into a common sample collection bottle. Therefore, the monthly sample analyzed by our contracted laboratory service represents a composite of the individual samples that are collected throughout the month. This monthly composite sample is then analyzed for gross alpha, gross beta and gamma isotopic activities. A portion of each of these monthly samples is further mixed with the other monthly samples collected during each calendar quarter. This quarterly composite sample is then analyzed for $H^3$ [Tritium].

Gross beta activity ranged from 0.8 to 2.0 pCi/l. These levels are attributed to very fine particles of sediment containing $K^{40}$ that are not removed during the chlorination and filtration process.

The results from the $H^3$ and gamma-emitting radioisotope analysis were all less than the Lower Limit of Detection (LLD).

### Surface Water

Composite Water Samplers are installed at three (3) locations sampling surface water from Clinton Lake. These Composite Water Samplers collect a small volume of surface water at regular intervals and discharge the sample into a large sample collection bottle. Monthly, this water is then collected.

Two (2) of the Composite Water Samplers are located upstream from Clinton Power Station and are therefore unaffected by any plant liquid releases occurring downstream. The third Composite Water Sampler is positioned to sample water being released from the plant at the start of the plant discharge flume. Grab samples are also collected from one (1) Indicator Location on Clinton Lake.

Surface water samples are analyzed for gross beta, gamma isotopic, and $H^3$ [Tritium] activities. Additional analyses for gross alpha activity are performed on the upstream water samples as required. Additional analyses for gross alpha activity and $I^{131}$ activity are performed on water samples taken from the discharge flume. Tritium analyses are performed quarterly from all of the monthly composites from all Water Composite Sample locations.

Results of all gross beta analyses ranged from 1.4 to 9.3 pCi/l for the composite water samples and 2.2 to 3.1 pCi/l for the grab samples. Pre-Operational gross beta activity ranged from 1.1 to 7.6 pCi/l. These results are attributed to naturally occurring $K^{40}$ suspended as fine sediment particles in the water. Other types of samples – such as Shoreline Sediments - have further validated the presence of $K^{40}$ in Clinton Lake

All samples analyzed for $H^3$ [Tritium] were all less than the Minimum Detectable Activity (MDA). Pre-Operational $H^3$ [Tritium] concentrations ranged from 220 to 330 pCi/l. As noted in Reference E187, previous nuclear weapons testing have increased the pre-1960 levels of Tritium (6 - 24 pCi/l) by a factor of approximately 50 to 300-1,200 pCi/l.

Gamma-emitting radioisotopes were all below the Lower Limits of Detection (LLD) and there wasn't any $I^{131}$ detected from any surface water sample collected.

**Well Water**

Every quarter - both treated and untreated well water samples - are collected from the well serving the Village of DeWitt and from a well serving the Illinois Department of Conservation at the Mascoutin State Recreational Area. Samples are analyzed for $I^{131}$, gross alpha, gross beta, $H^3$ [Tritium] and gamma isotopic activities as required.

Results of the gross beta analyses ranged from 1.2 to 3.4 pCi/l. Pre-Operational gross beta activity ranged from 1.1 to 5.1 pCi/l. The gross beta activity was attributed to naturally occurring $K^{40}$ suspended as fine sediment particles in water.

Gamma-emitting radioisotopes were all below the lower limits of detection (LLD) and there wasn't any $I^{131}$ or $H^3$ detected from any well water sample collected.

## TABLE 7

AVERAGE GROSS BETA CONCENTRATIONS IN DRINKING, SURFACE AND WELL WATER

Average ±2σ (pCi/l)

| STATION | DESCRIPTION | 2001 | 2002 |
|---|---|---|---|
| | **Drinking Water** | | |
| CL-14 | Station Service Building | 1.4 ± 0.6 | 1.2 ± 0.7 |
| | **Surface Water** | | |
| CL-13 | Salt Creek Bridge on Route 10 | 2.9 ± 0.8 | 2.6 ± 0.7 |
| CL-90 | Start of Discharge Flume | 2.9 ± 1.5 | 4.1 ± 5.7 |
| CL-91 | Parnell Boat Access | 2.7 ± 0.9 | 2.0 ± 0.8 |
| CL-99 | North Fork Canoe Access Area | 3.4 ± 4.2 | 2.4 ± 1.7 |
| | **Well Water** | | |
| CL-7D | Mascoutin Recreation Area | 2.3 ± 0.8 | 2.2 ± 2.8 |
| CL-12(**T**) | DeWitt Pumphouse | 2.4 ± 0.0 | 2.4 ± 0.1 |
| CL-12(**U**) | DeWitt Pumphouse | 1.9 ± 1.3 | 2.7 ± 2.0 |

(**U**) Untreated (**T**) Treated

Fluctuations observed in the gross beta activity over the year can be attributed to changes in the environment, specifically during seasonal changes.

## G. Quality Assurance Program

To establish confidence and credibility that both the data collected and reported are accurate and precise, REMP activities are incorporated into the Quality Assurance (QA) program, which includes assessments, audits, and surveillances. The Quality Assurance program requires the following:

- Participation in inter-comparison programs, such as the Environmental Resource Associates (ERA) crosscheck program.
- Audits of analysis laboratory functions and their facilities.
- Periodic review of the Clinton Power Station procedures specifying sampling techniques.
- Duplicate analysis of all samples received (excluding TLDs). This requirement is to validate laboratory precision.
- The routine counting of quality control samples.

The analytical results provided by the laboratory were reviewed monthly to ensure the required minimum sensitivities have been achieved and the proper analyses have been performed.

Our Vendor - Environmental Inc., Mid-West Laboratory - has participated in interlaboratory comparison (crosscheck) programs since the formulation of their quality control program in December 1971. These programs are operated by agencies that supply environmental type samples – such as milk and water - containing concentrations of radionuclides that are only known to the issuing agency and not the participating laboratory. The purpose of such a program is to provide an independent check on the laboratory's analytical procedures and alert them to any possible problems.

Results from their 2002 Environmental Inc., Mid-West Laboratory cross-check program are shown in Appendix A of this report.

## H. Changes to the REMP During 2002

On occasion, revisions to the Radiological Environmental Monitoring Program are necessary so as to improve the monitoring of the environmental exposure pathways. Changes may result from items identified during the performance of the Annual Land Use Census, incorporation of any revised or new regulatory requirement[s] or from Quality Assurance Audits.

During the course of 2002, there were no changes to the REMP program as delineated within the Off-Site Dose Calculation Manual.

# 2002 ANNUAL LAND USE CENSUS

# IV. 2002 ANNUAL LAND USE CENSUS

Each year an Annual Land Use Census is conducted to ensure that changes in the use of areas - at and beyond the site boundary - are identified and that any necessary modifications to the Radiological Environmental Monitoring Program [REMP] are made. The information gathered during the Annual Land Use Census is used for Radioactive Effluent Technical Specifications [RETS] dose assessments that feeds into the REMP ensuring that these programs accurately reflect the environment surrounding CPS.

The Annual Land Use Census is conducted during the growing season satisfying the CPS Offsite Dose Calculation Manual (ODCM) requirements. The Annual Land Use Census is conducted to identify the *nearest* milk animals, the *nearest* residence and the *nearest* garden of greater than 538 square feet that produce broadleaf vegetation – all within a distance of five (5) miles - in each of the 16 meteorological sectors.

The Annual Land Use Census shall also identify - within a distance of three (3) miles - the location in each of the 16 meteorological sectors *all* milk animals and *all* gardens of greater than 538 square feet that produce broadleaf vegetation. A detailed summary of the Annual Land Use Census is provided in a separate document that is permanently archived at CPS.

In order to assemble as much information as possible, the location of area residences, their critical age groups, milking animals, the size and vegetable content of gardens and along with livestock, were all recorded from each sector within five (5) miles, as stated above.

These land use parameters are then used in the assessment of potential radiological doses to individuals for the stated sectors. This information provides the most restrictive parameters used for dose assessments that will result in the highest calculated dose within each sector. Additional information regarding dose assessments to members of the public is provided within the 2002 CPS Annual Radioactive Effluent Release Report.

Area residents were surveyed who reside within a five (5) mile radius of the station by either direct contact, via a mail-in questionnaire, a telephone interview or direct observation within the 16 geographical sectors surrounding CPS. The information provided within this section of the report is a summary of the 2002 results from that census. The nearest residence, garden, and milk animal in for each meteorological sector - out to a distance of five (5) miles - are illustrated in Table 8.

Data from the 2002 Annual Land Use Census was obtained using the following means:

- When mail-in response[s] were ineffective, door-to-door solicitation of residences / land owners identified from the 2001 Annual Land Use Census was performed with a DeWitt County plat book available if needed.
- Telephone solicitation of persons who were unavailable during the 'door-to-door' survey and who did not mail back their questionnaire.

- By direct observation of land when the aforementioned methods proved to be unsuccessful. If an individual was unable to be contacted, data from the previous year was used.

- Contacted several state and local agencies.

## TABLE 8

ANNUAL LAND USE CENSUS SUMMARY RESULTS

| Sector | Nearest Residence [miles] | Nearest Garden [miles] | Nearest Milk Animal [miles]- (see Note) |
|---|---|---|---|
| N | 0.9 | 0.9 | 0.9 |
| NNE | 1.0 | 2.9 | 1.3 |
| NE | 1.3 | 2.1 | 3.4 |
| ENE | 1.8 | 1.8 | N/A |
| E | 1.0 | 1.0 | 1.0 |
| ESE | 3.2 | 3.3 | N/A |
| SE | 2.8 | 4.4 | 4.4 |
| SSE | 2.4 | 2.7 | N/A |
| S | 3.0 | 4.1 | N/A |
| SSW | 2.9 | N/A | 3.4 |
| SW | 0.7 | N/A | 3.6 |
| WSW | 1.6 | 2.3 | 3.4 |
| W | 1.6 | 2.0 | 2.1 |
| WNW | 1.6 | 1.6 | N/A |
| NW | 1.6 | N/A | N/A |
| NNW | 1.7 | 1.3 | 1.3 |

N/A None identified within five (5) miles of CPS within this meteorological sector.

Note – Not used for human consumption

The Annual Land Use Census results were validated to ensure that the REMP will provide representative measurements of radiation and radioactive materials from exposure pathways and for radionuclides that lead to the highest potential radiation exposure to the general public resulting from station operations.

After carefully reviewing the Annual Land Use Census results - coupled with station effluent release data provided by the CPS Chemistry Department - an evaluation is conducted to ensure current ODCM sampling location requirements are adequate. As a result of that evaluation, no changes in REMP sampling locations were required.

## Summary of Changes Identified in 2002 Annual Land Use Census

### Nearest Residence

Changes in census locations for the nearest resident were identified in one (1) of the sixteen (16) geographical sectors and is indicated below:

| 2001 Census Location | 2002 Census Location |
|---|---|
| 1.8 miles SSE | 2.4 miles SSE |

There were no changes or additions to the REMP as a result of the Nearest Resident Census.

### Garden Census

Changes in census locations for the nearest garden were identified in seven (7) of the sixteen (16) geographical sectors and are indicated below:

| 2001 Census Location | 2002 Census Location |
|---|---|
| 2.6 miles ENE | 1.8 miles ENE |
| 2.8 miles SSE | 2.7 miles SSE |
| 3.0 miles S | 4.1 miles S |
| 3.6 miles SW | > 5.0 miles SW |
| 2.2 miles WSW | 2.3 miles WSW |
| 2.9 miles NW | > 5.0 miles NW |
| > 5.0 miles NNW | 1.3 miles NNW |

There were no changes or additions to the REMP garden sampling locations as a result of the Garden Census.

### Milk Animal Census

Milk animals within five (5) miles were located in the sixteen (16) geographical sectors surrounding CPS. Ten (10) locations were identified within this five (5) mile radius. Only milk animals were specifically identified for this report. Of the livestock identified, milk animals were being raised primarily for nursing [nursing of their calves] and were being used for meat production [for both their own use and sold commercially]. There were no residents that milked their animals for any human consumption. Other livestock raised in the area were identified, but will not be addressed within this report.

Changes in the census locations for the nearest livestock / dairy were identified in two (2) of the sixteen (16) geographical sectors and are indicated below:

| 2001 Census Location | 2002 Census Location |
|---|---|
| 4.8 miles ENE | > 5 miles ENE |
| 2.4 miles NW | > 5 miles NW |

No changes or additions to REMP milk sampling locations were made as a result of the Milk Animal Census.

# LIST OF REFERENCES

# V. LIST OF REFERENCES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- United States Nuclear Regulatory Commission , Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Norm Operations) - Effluent Streams and the Environment," Revision 1, February 1979.
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# APPENDIX A

# INTERLABORATORY COMPARISON PROGRAM RESULTS

NOTE: Environmental Inc., Midwest Laboratory participates in intercomparison studies administered by Environmental Resources Associates, and serves as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada. Results are reported in Appendix A. TLD Intercomparison results, in-house spikes, blanks, duplicates and mixed analyte performance evaluation program results are also reported. Appendix A is updated four times a year; the complete Appendix is included in March, June, September and December monthly progress reports only.

January, 2002 through December, 2002

## Appendix A

## Interlaboratory Comparison Program Results

Environmental, Inc., Midwest Laboratory, formerly Teledyne Brown Engineering Environmental Services Midwest Laboratory has participated in interlaboratory comparison (crosscheck) programs since the formulation of it's quality control program in December 1971. These programs are operated by agencies which supply environmental type samples (e.g., milk or water) containing concentrations of radionuclides known to the issuing agency but not to participant laboratories. The purpose of such a program is to provide an independent check on a laboratory's analytical procedures and to alert it of any possible problems.

Participant laboratories measure the concentration of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

Results in Table A-1 were obtained through participation in the environmental sample crosscheck program administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

The results in Table A-2 were obtained for Thermoluminescent Dosimeters (TLDs), via International Intercomparison of Environmental Dosimeters under the sponsorships listed in Table A-2. Results of internal laboratory testing is also listed.

Table A-3 lists results of the analyses on in-house "spiked" samples for the past twelve months. All samples are prepared using NIST traceable sources. Data for previous years available upon request.

Table A-4 lists results of the analyses on in-house "blank" samples for the past twelve months. Data for previous years available upon request. request.

Table A-5 list results of the in-house "duplicate" program for the past twelve months. Acceptance is based on the difference of the results being less than the sum of the errors. Data for previous years available upon request.

The results in Table A-6 were obtained through participation in the Mixed Analyte Performance Evaluation Program.

The results in Table A-7 were obtained through participation in the Environmental Measurement Laboratory Quality Assessment Program.

Attachment A lists acceptance criteria for "spiked" samples.

Out-of-limit results are explained directly below the result.

## Attachment A

### ACCEPTANCE CRITERIA FOR "SPIKED" SAMPLES

LABORATORY PRECISION: ONE STANDARD DEVIATION VALUES FOR VARIOUS ANALYSES[a]

| Analysis | Level | One standard deviation for single determination |
| --- | --- | --- |
| Gamma Emitters | 5 to 100 pCi/liter or kg<br>> 100 pCi/liter or kg | 5.0 pCi/liter<br>5% of known value |
| Strontium-89[b] | 5 to 50 pCi/liter or kg<br>> 50 pCi/liter or kg | 5.0 pCi/liter<br>10% of known value |
| Strontium-90[b] | 2 to 30 pCi/liter or kg<br>> 30 pCi/liter or kg | 5.0 pCi/liter<br>10% of known value |
| Potassium-40 | > 0.1 g/liter or kg | 5% of known value |
| Gross alpha | 20 pCi/liter<br>> 20 pCi/liter | 5.0 pCi/liter<br>25% of known value |
| Gross beta | 100 pCi/liter<br>> 100 pCi/liter | 5.0 pCi/liter<br>5% of known value |
| Tritium | 4,000 pCi/liter<br>> 4,000 pCi/liter | 1s = (pCi/liter) = $169.85 \times (\text{known})^{0.0933}$<br>10% of known value |
| Radium-226,-228 | 0.1 pCi/liter | 15% of known value |
| Plutonium | 0.1 pCi/liter, gram, or sample | 10% of known value |
| Iodine-131,<br>Iodine-129[b] | 55 pCi/liter<br>> 55 pCi/liter | 6.0 pCi/liter<br>10% of known value |
| Uranium-238,<br>Nickel-63[b]<br>Technetium-99[b] | 35 pCi/liter<br>> 35 pCi/liter | 6.0 pCi/liter<br>15% of known value |
| Iron-55[b] | 50 to 100 pCi/liter<br>> 100 pCi/liter | 10 pCi/liter<br>10% of known value |
| Others[b] | --- | 20% of known value |

[a] From EPA publication, "Environmental Radioactivity Laboratory Intercomparison Studies Program, Fiscal Year, 1981-1982, EPA-600/4-81-004.

[b] Laboratory limit.

TABLE A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

| Lab Code | Date | Analysis | Concentration (pCi/L) Laboratory Result[b] | ERA Result[c] | Control Limits |
|---|---|---|---|---|---|
| STW-940 | 02/20/02 | Sr-89 | 53.0 ± 2.5 | 55.3 ± 5.0 | 46.6 - 64.0 |
| STW-940 | 02/20/02 | Sr-90 | 16.6 ± 0.5 | 15.9 ± 5.0 | 7.2 - 24.6 |
| STW-942 | 02/20/02 | Gr. Alpha | 6.5 ± 0.6 | 8.0 ± 5.0 | 0.0 - 16.7 |
| STW-942 | 02/20/02 | Gr. Beta | 45.7 ± 3.1 | 48.3 ± 5.0 | 39.6 - 57.0 |
| STW-944 | 02/20/02 | Ba-133 | 25.8 ± 1.5 | 28.9 ± 5.0 | 20.2 - 37.6 |
| STW-944 | 02/20/02 | Co-60 | 76.9 ± 2.7 | 73.4 ± 5.0 | 64.7 - 82.1 |
| STW-944 | 02/20/02 | Cs-134 | 38.7 ± 1.6 | 42.1 ± 5.0 | 33.4 - 50.8 |
| STW-944 | 02/20/02 | Cs-137 | 92.9 ± 2.7 | 88.8 ± 5.0 | 80.1 - 97.5 |
| STW-944 | 02/20/02 | Ra-226 | 15.3 ± 0.7 | 14.3 ± 2.2 | 10.6 - 18.0 |
| STW-944 | 02/20/02 | Ra-228 | 17.5 ± 0.4 | 16.9 ± 4.2 | 9.6 - 24.2 |
| STW-944 | 02/20/02 | Uranium | 23.8 ± 1.1 | 28.3 ± 3.0 | 23.1 - 33.5 |
| STW-944 | 02/20/02 | Zn-65 | 361.0 ± 9.2 | 359.0 ± 35.9 | 298.0 - 420.0 |
| STW-951 | 05/22/02 | Gr. Alpha | 23.9 ± 2.5 | 22.8 ± 5.7 | 13.0 - 32.6 |
| STW-951 | 05/22/02 | Ra-226 | 5.9 ± 0.5 | 6.1 ± 0.9 | 4.5 - 7.7 |
| STW-951 | 05/22/02 | Ra-228 | 5.6 ± 0.9 | 4.5 ± 1.1 | 2.6 - 6.5 |
| STW-951 | 05/22/02 | Uranium | 7.6 ± 0.2 | 9.3 ± 3.0 | 4.1 - 14.5 |
| STW-952 | 05/22/02 | Co-60 | 37.9 ± 0.7 | 39.1 ± 5.0 | 30.4 - 47.8 |
| STW-952 | 05/22/02 | Cs-134 | 14.5 ± 0.8 | 17.1 ± 5.0 | 8.4 - 25.8 |
| STW-952 | 05/22/02 | Cs-137 | 50.0 ± 2.0 | 52.1 ± 5.0 | 43.4 - 60.8 |
| STW-952 | 05/22/02 | Gr. Beta | 171.0 ± 2.5 | 189.0 ± 28.4 | 140.0 - 238.0 |
| STW-952 | 05/22/02 | Sr-89 | 28.4 ± 4.8 | 31.7 ± 5.0 | 23.0 - 40.4 |
| STW-952 | 05/22/02 | Sr-90 | 32.4 ± 3.1 | 28.3 ± 5.0 | 19.6 - 37.0 |
| STW-953 [d] | 05/22/02 | H-3 | 13900.0 ± 100.0 | 17400.0 ± 1740.0 | 14400.0 - 20400.0 |
| STW-954 | 05/22/02 | I-131 | 14.6 ± 0.3 | 14.7 ± 2.0 | 11.2 - 18.2 |
| STW-965 | 08/21/02 | Ba-133 | 71.9 ± 2.1 | 80.0 ± 8.0 | 66.4 - 93.6 |
| STW-965 | 08/21/02 | Co-60 | 23.8 ± 1.0 | 23.3 ± 5.0 | 14.6 - 32.0 |
| STW-965 | 08/21/02 | Cs-134[e] | 62.9 ± 1.2 | 71.7 ± 5.0 | 63.0 - 80.4 |
| STW-965 | 08/21/02 | Cs-137 | 219.3 ± 10.7 | 214.0 ± 10.7 | 195.0 - 233.0 |
| STW-965 | 08/21/02 | Gr. Alpha | 74.4 ± 0.6 | 58.8 ± 14.7 | 33.5 - 84.1 |
| STW-965 | 08/21/02 | Gr. Beta | 26.7 ± 0.4 | 21.9 ± 2.2 | 13.2 - 30.6 |
| STW-965 | 08/21/02 | Ra-226 | 5.0 ± 0.5 | 5.0 ± 0.8 | 3.7 - 6.3 |
| STW-965 | 08/21/02 | Ra-228 | 6.0 ± 0.7 | 4.7 ± 1.2 | 2.7 - 6.7 |
| STW-965 | 08/21/02 | Sr-89 | 28.4 ± 1.5 | 29.0 ± 5.0 | 20.3 - 37.7 |
| STW-965 | 08/21/02 | Sr-90 | 36.5 ± 1.1 | 36.4 ± 5.0 | 27.7 - 45.1 |
| STW-965 | 08/21/02 | Uranium | 4.1 ± 0.1 | 5.0 ± 3.0 | 0.0 - 10.2 |
| STW-965 | 08/21/02 | Zn-65 | 92.4 ± 2.2 | 95.7 ± 9.6 | 79.4 - 112.0 |
| STW-966 | 11/20/02 | Gr. Alpha | 9.3 ± 0.4 | 12.2 ± 5.0 | 3.5 - 20.9 |
| STW-966 | 11/20/02 | Gr. Beta | 44.7 ± 1.0 | 47.0 ± 5.0 | 38.3 - 55.7 |
| STW-967 | 11/20/02 | H-3 | 10100.0 ± 38.7 | 10200.0 ± 1020.0 | 8440.0 - 12000.0 |
| STW-968 | 11/20/02 | Ra-226 | 11.6 ± 0.1 | 12.1 ± 1.8 | 9.0 - 15.2 |
| STW-968 | 11/20/02 | Ra-228 | 16.0 ± 1.4 | 15.1 ± 3.8 | 8.6 - 21.6 |
| STW-968 | 11/20/02 | Uranium | 15.5 ± 0.5 | 19.2 ± 3.0 | 14.0 - 24.4 |
| STW-969 | 11/20/02 | I-131 | 6.0 ± 0.4 | 6.8 ± 2.0 | 3.3 - 10.2 |

TABLE A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)[a].

| Lab Code | Date | Analysis | Concentration (pCi/L) Laboratory Result[b] | ERA Result[c] | Control Limits |
|---|---|---|---|---|---|
| STW-970 | 11/20/02 | Co-60 | 104.0 ± 7.1 | 104.0 ± 5.2 | 95.0 - 113.0 |
| STW-970 | 11/20/02 | Cs-134 | 48.2 ± 2.3 | 55.5 ± 5.0 | 46.8 - 64.2 |
| STW-970 | 11/20/02 | Cs-137 | 109.0 ± 12.6 | 117.0 ± 5.9 | 107.0 - 127.0 |
| STW-970 | 11/20/02 | Gr. Beta | 252.0 ± 26.8 | 288.0 ± 49.5 | 244.0 - 416.0 |
| STW-970 | 11/20/02 | Sr-89 | 43.2 ± 0.7 | 47.6 ± 5.0 | 38.9 - 56.3 |
| STW-970 | 11/20/02 | Sr-90 | 7.5 ± 0.2 | 7.6 ± 5.0 | 0.0 - 16.2 |
| STW-971 | 11/20/02 | Gr. Alpha | 74.9 ± 1.5 | 103.0 ± 25.8 | 58.4 - 148.0 |
| STW-971 | 11/20/02 | Ra-226 | 8.9 ± 0.0 | 9.1 ± 1.4 | 6.7 - 11.5 |
| STW-971 | 11/20/02 | Ra-228 | 15.3 ± 0.1 | 17.8 ± 4.5 | 10.1 - 25.5 |
| STW-971 | 11/20/02 | Uranium | 51.7 ± 1.6 | 61.7 ± 6.2 | 51.0 - 72.4 |

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the environmental samples crosscheck program operated by Environmental Resources Associates (ERA).

[b] Unless otherwise indicated, the laboratory result is given as the mean ± standard deviation for three determinations.

[c] Results are presented as the known values, expected laboratory precision (1 sigma, 1 determination) and control limits as provided by ERA.

[d] Analysis was repeated; result of reanalysis: 16114±487 pCi/L.

[e] ERA acknowledged an unacceptably high percentage of failure for Cs-134 and questioned its own control limits. No problems were identified in the analysis.

TABLE A-2. Crosscheck program results; Thermoluminescent Dosimetry, (TLDs).

| Lab Code | TLD Type | Date | Measurement | mR<br>Known Value | Lab Result ± 2 sigma | Control Limits |
|---|---|---|---|---|---|---|
| Environmental, Inc. | | | | | | |
| 2001-1 | CaSO4: Dy Cards | 24-12-01 | Reader 1, #1 | 3.98 | 3.71 ± 0.12 | 2.79 - 5.17 |
| 2001-1 | CaSO4: Dy Cards | 24-12-01 | Reader 1, #1 | 3.98 | 3.38 ± 0.09 | 2.79 - 5.17 |
| 2001-1 | CaSO4: Dy Cards | 24-12-01 | Reader 1, #2 | 7.07 | 7.89 ± 0.18 | 4.95 - 9.19 |
| 2001-1 | CaSO4: Dy Cards | 24-12-01 | Reader 1, #2 | 7.07 | 7.64 ± 0.25 | 4.95 - 9.19 |
| 2001-1 | CaSO4: Dy Cards | 24-12-01 | Reader 1, #3 | 15.9 | 18.62 ± 0.40 | 11.13 - 20.67 |
| 2001-1 | CaSO4: Dy Cards | 24-12-01 | Reader 1, #3 | 15.9 | 19.58 ± 0.12 | 11.13 - 20.67 |
| 2001-1 | CaSO4: Dy Cards | 24-12-01 | Reader 1, #4 | 63.61 | 78.24 ± 1.23 | 44.53 - 82.69 |
| 2001-1 | CaSO4: Dy Cards | 24-12-01 | Reader 1, #4 | 63.61 | 79.89 ± 2.47 | 44.53 - 82.69 |
| Environmental, Inc. | | | | | | |
| 2002-1 | CaSO4: Dy Cards | 28-05-02 | Reader 1, #1 | 4.84 | 4.44 ± 0.16 | 3.39 - 6.29 |
| 2002-1 | CaSO4: Dy Cards | 28-05-02 | Reader 1, #1 | 4.84 | 4.37 ± 0.20 | 3.39 - 6.29 |
| 2002-1 | CaSO4: Dy Cards | 28-05-02 | Reader 1, #2 | 8.60 | 9.08 ± 0.14 | 6.02 - 11.18 |
| 2002-1 | CaSO4: Dy Cards | 28-05-02 | Reader 1, #2 | 8.60 | 8.76 ± 0.16 | 6.02 - 11.18 |
| 2002-1 | CaSO4: Dy Cards | 28-05-02 | Reader 1, #3 | 19.34 | 22.14 ± 0.27 | 13.54 - 25.14 |
| 2002-1 | CaSO4: Dy Cards | 28-05-02 | Reader 1, #3 | 19.34 | 24.03 ± 0.30 | 13.54 - 25.14 |
| 2002-1 | CaSO4: Dy Cards | 28-05-02 | Reader 1, #4 | 77.36 | 92.77 ± 0.58 | 54.15 - 100.57 |
| 2002-1 | CaSO4: Dy Cards | 28-05-02 | Reader 1, #4 | 77.36 | 85.25 ± 0.37 | 54.15 - 100.57 |
| Environmental, Inc. | | | | | | |
| 2002-2 | CaSO4: Dy Cards | 13-12-02 | Reader 1, 30 | 56.73 | 71.61 ± 1.79 | 39.71 - 73.75 |
| 2002-2 | CaSO4: Dy Cards | 13-12-02 | Reader 1, 45[a] | 25.21 | 33.49 ± 1.38 | 17.65 - 32.77 |
| 2002-2 | CaSO4: Dy Cards | 13-12-02 | Reader 1, 60 | 14.18 | 17.37 ± 1.24 | 9.93 - 18.43 |
| 2002-2 | CaSO4: Dy Cards | 13-12-02 | Reader 1, 75 | 9.08 | 10.65 ± 1.02 | 6.36 - 11.80 |
| 2002-2 | CaSO4: Dy Cards | 13-12-02 | Reader 1, 90 | 6.30 | 6.37 ± 0.54 | 4.41 - 8.19 |
| 2002-2 | CaSO4: Dy Cards | 13-12-02 | Reader 1, 120 | 3.55 | 4.60 ± 0.41 | 2.49 - 4.62 |
| 2002-2 | CaSO4: Dy Cards | 13-12-02 | Reader 1, 135 | 2.80 | 2.51 ± 0.23 | 1.96 - 3.64 |
| 2002-2 | CaSO4: Dy Cards | 13-12-02 | Reader 1, 150 | 2.28 | 2.22 ± 0.28 | 1.60 - 2.96 |

[a] Precision of the distance (cm) measurement can significantly increase the error. The placement of the card holder on the table could account for the higher error.

TABLE A-3. In-House "Spike" Samples

| Lab Code | Sample Type | Date | Concentration (pCi/L)[a] Analysis | Laboratory results 2s, n=1[b] | Known Activity | Control Limits[c] |
|---|---|---|---|---|---|---|
| SPW-11552 | Water | 1/7/2002 | Gr. Alpha | 35.33 ± 1.83 | 34.57 | 17.29 - 51.86 |
| SPW-11552 | Water | 1/7/2002 | Gr. Beta | 112.62 ± 2.44 | 107.70 | 96.93 - 118.47 |
| SPMI-595 | Milk | 1/31/2002 | Cs-134 | 29.63 ± 4.98 | 27.10 | 17.10 - 37.10 |
| SPMI-595 | Milk | 1/31/2002 | Cs-137 | 51.31 ± 7.55 | 50.89 | 40.89 - 60.89 |
| SPMI-597 | Milk | 1/31/2002 | Co-60 | 44.18 ± 7.76 | 41.36 | 31.36 - 51.36 |
| SPMI-597 | Milk | 1/31/2002 | Cs-134 | 20.15 ± 5.08 | 22.59 | 12.59 - 32.59 |
| SPMI-597 | Milk | 1/31/2002 | Cs-137 | 54.88 ± 8.32 | 50.89 | 40.89 - 60.89 |
| SPAP-594 | Air Filter | 2/6/2002 | Gr. Beta | 1.58 ± 0.02 | 1.55 | 0.00 - 11.55 |
| SPW-599 | Water | 2/19/2002 | H-3 | 47607 ± 595 | 50189 | 40151 ± 60227 |
| SPMI-1446 | Milk | 3/8/2002 | I-131(G) | 87.84 ± 11.47 | 85.20 | 75.20 - 95.20 |
| SPW-1446 | Water | 3/8/2002 | I-131 | 82.98 ± 1.20 | 85.20 | 68.16 - 102.24 |
| SPW-1446 | Water | 3/8/2002 | I-131(G) | 92.75 ± 12.87 | 85.20 | 75.20 - 95.20 |
| SPMI-1448 | Milk | 3/8/2002 | I-131 | 88.00 ± 1.13 | 85.20 | 68.16 - 102.24 |
| SPVE-1444 | Vegetation | 3/11/2002 | I-131(G) | 0.39 ± 0.04 | 0.42 | 0.25 - 0.58 |
| SPAP-2078 | Air Filter | 4/8/2002 | Gr. Beta | 1.43 ± 0.01 | 1.55 | 0.00 - 11.55 |
| SPW-2080 | Water | 4/5/2002 | H-3 | 49121 ± 608 | 46912 | 37530 ± 56294 |
| SPF-2082 | Fish | 4/5/2002 | Cs-134 | 0.83 ± 0.04 | 0.83 | 0.50 - 1.16 |
| SPF-2082 | Fish | 4/5/2002 | Cs-137 | 1.29 ± 0.07 | 1.35 | 0.81 - 1.89 |
| SPMI-2084 | Milk | 4/8/2002 | Cs-134 | 20.93 ± 5.82 | 24.69 | 14.69 - 34.69 |
| SPMI-2084 | Milk | 4/8/2002 | Cs-137 | 51.83 ± 10.23 | 50.56 | 40.56 - 60.56 |
| SPMI-2084 | Milk | 4/8/2002 | I-131 | 87.72 ± 1.28 | 88.37 | 70.70 - 106.04 |
| SPMI-2084 | Milk | 4/8/2002 | I-131(G) | 84.08 ± 10.75 | 88.37 | 78.37 - 98.37 |
| SPMI-2084 | Milk | 4/8/2002 | Sr-90 | 62.81 ± 1.99 | 66.85 | 53.48 - 80.22 |
| SPW-2115 | Water | 4/8/2002 | I-131 | 82.42 ± 1.27 | 88.37 | 70.70 - 106.04 |
| SPW-2116 | Water | 4/8/2002 | Co-60 | 32.47 ± 5.78 | 33.09 | 23.09 - 43.09 |
| SPW-2116 | Water | 4/8/2002 | Cs-134 | 30.80 ± 3.60 | 28.80 | 18.80 - 38.80 |
| SPW-2116 | Water | 4/8/2002 | Cs-137 | 53.85 ± 7.07 | 50.56 | 40.56 - 60.56 |
| SPW-2116 | Water | 4/8/2002 | I-131(G) | 79.09 ± 7.58 | 88.37 | 78.37 - 98.37 |
| SPW-2116 | Water | 4/8/2002 | Sr-90 | 70.35 ± 2.32 | 66.85 | 53.48 - 80.22 |
| SPW-2019 | Water | 5/3/2002 | Gr. Alpha | 25.89 ± 1.71 | 34.57 | 17.29 - 51.86 |
| SPW-2019 | Water | 5/3/2002 | Gr. Beta | 101.19 ± 2.37 | 107.70 | 96.93 - 118.47 |
| SPCH-3064 | Charcoal | 5/11/2002 | I-131(G) | 0.74 ± 0.04 | 0.85 | 0.51 - 1.18 |
| SPW-4682 | Water | 7/17/2002 | H-3 | 40856 ± 548 | 46179 | 36943 ± 55415 |
| SPAP-4685 | Air Filter | 7/17/2002 | Gr. Beta | 1.58 ± 0.02 | 1.55 | 0.00 - 11.55 |
| W-71702S | Water | 7/17/2002 | Fe-55 | 10463.00 ± 126.00 | 12200.60 | 9760.48 - 14640.72 |
| W-71702S | Water | 07/17/02 | H-3 | 45779 ± 583 | 46179 | 36943 ± 55415 |
| W-71702S | Water | 07/17/02 | Ni-63 | 17.02 ± 1.50 | 17.10 | 10.26 - 23.94 |
| SPVE-4910 | Vegetation | 07/22/02 | Sr-90 | 10.22 ± 0.80 | 9.04 | 0.00 - 19.04 |
| W-72302S | Water | 07/23/02 | Sr-90 | 21.43 ± 0.97 | 26.55 | 16.55 - 36.55 |
| W-80102S | Water | 08/01/02 | Gr. Alpha | 41.25 ± 4.58 | 34.45 | 17.23 - 51.68 |
| W-80102S | Water | 08/01/02 | Gr. Beta | 113.66 ± 5.30 | 107.70 | 96.93 - 118.47 |
| W-80202S | Water | 08/02/02 | Tc-99 | 16.39 ± 0.72 | 14.13 | 2.13 - 26.13 |
| SPW-7188 | Water | 10/25/02 | Fe-55 | 20396 ± 265 | 22778 | 18222 - 27334 |
| SPW-7190 | Water | 10/25/02 | Ni-63 | 227.18 ± 11.60 | 170.80 | 102.48 - 239.12 |

TABLE A-3. In-House "Spike" Samples

| Lab Code | Sample Type | Date | Concentration (pCi/L) Analysis | Laboratory results 2s, n=1[b] | Known Activity | Control Limits[c] |
|---|---|---|---|---|---|---|
| SPW-7192 | Water | 10/25/02 | H-3 | 96310 ± 871 | 90963 | 72770 - 109156 |
| SPW-7194 | Water | 10/25/02 | C-14 | 42938 ± 167 | 49661 | 29796 - 69525 |
| SPAP-7198 | Air Filter | 10/25/02 | Gr. Beta | 1.65 ± 0.02 | 1.53 | 0.00 - 11.53 |
| SPW-7335 | Water | 10/30/02 | Co-60 | 39.67 ± 7.38 | 37.05 | 27.05 - 47.05 |
| SPW-7335 | Water | 10/30/02 | Cs-134 | 33.09 ± 5.96 | 34.11 | 24.11 - 44.11 |
| SPW-7335 | Water | 10/30/02 | Cs-137 | 46.80 ± 10.39 | 49.90 | 39.90 - 59.90 |
| SPMI-7336 | Milk | 10/30/02 | Cs-134 | 34.40 ± 4.99 | 34.11 | 24.11 - 44.11 |
| SPMI-7336 | Milk | 10/30/02 | Cs-137 | 46.52 ± 8.52 | 49.91 | 39.91 - 59.91 |
| SPF-7340 | Fish | 10/30/02 | Cs-134 | 0.66 ± 0.03 | 0.68 | 0.41 - 0.95 |
| SPF-7340 | Fish | 10/30/02 | Cs-137 | 1.35 ± 0.05 | 1.33 | 0.80 - 1.86 |
| SPS-8102 | Sediment | 11/01/02 | Sr-90 | 14.69 ± 0.67 | 13.45 | 3.45 - 23.45 |

[a] Results are reported in units of pCi/L, except for air filters (pCi/Filter), food products, vegetation, soil, sediment (pCi/g).
[b] Results are based on single determinations.
[c] Control limits are based on Attachment A, Page A2 of this report.

NOTE: For fish, Jello is used for the Spike matrix. For Vegetation, cabbage is used for the Spike matrix.

TABLE A-4. In-House "Blank" Samples

| Lab Code | Sample Type | Date | Analysis | Concentration (pCi/L)[a] Laboratory results (4.66σ) LLD | Activity[b] | Acceptance Criteria (4.66 σ) |
|---|---|---|---|---|---|---|
| SPW-11551 | water | 1/7/2002 | Gr. Alpha | 0.47 | 0.45 ± 0.39 | 1 |
| SPW-11551 | water | 1/7/2002 | Gr. Beta | 1.37 | 0.55 ± 1.03 | 3.2 |
| SPAP-590 | Air Filter | 1/31/2002 | Co-60 | 1.78 | | 100 |
| SPAP-590 | Air Filter | 1/31/2002 | Cs-134 | 3.42 | | 100 |
| SPAP-590 | Air Filter | 1/31/2002 | Cs-137 | 2.33 | | 100 |
| SPAP-590 | Air Filter | 1/31/2002 | Gr. Beta | 0.74 | -0.096 ± 0.38 | 3.2 |
| SPMI-596 | Milk | 1/31/2002 | Co-60 | 3.54 | | 10 |
| SPMI-596 | Milk | 1/31/2002 | Cs-134 | 3.24 | | 10 |
| SPMI-596 | Milk | 1/31/2002 | Cs-137 | 3.89 | | 10 |
| SPMI-596 | Milk | 1/31/2002 | K-40 | | 1472.1 ± 101.50 | 0 |
| SPW-598 | water | 1/31/2002 | Co-60 | 2.30 | | 10 |
| SPW-598 | water | 1/31/2002 | Cs-134 | 3.74 | | 10 |
| SPW-598 | water | 1/31/2002 | Cs-137 | 3.23 | | 10 |
| SPW-600 | water | 1/31/2002 | H-3 | 138.80 | -96.5 ± 63.40 | 200 |
| SPMI-1447 | Milk | 3/7/2002 | I-131(G) | 7.63 | | 20 |
| SPVE-1443 | Vegetation | 3/8/2002 | I-131(G) | 0.02 | | 20 |
| SPW-1445 | water | 3/8/2002 | Co-60 | 2.76 | | 10 |
| SPW-1445 | water | 3/8/2002 | Cs-134 | 2.87 | | 10 |
| SPW-1445 | water | 3/8/2002 | Cs-137 | 4.34 | | 10 |
| SPW-1445 | water | 3/8/2002 | I-131 | 0.45 | 0.17 ± 0.31 | 0.5 |
| SPW-1445 | water | 3/8/2002 | I-131(G) | 6.50 | | 20 |
| SPMI-1447 | Milk | 3/8/2002 | I-131 | 0.31 | 0.15 ± 0.22 | 0.5 |
| SPAP-2077 | Air Filter | 4/8/2002 | Gr. Beta | 0.32 | -0.055 ± 0.19 | 3.2 |
| SPW-2079 | water | 4/5/2002 | H-3 | 134.17 | 16.13 ± 67.39 | 200 |
| SPF-2081 | Fish | 4/5/2002 | Cs-134 | 7.67 | | 100 |
| SPF-2081 | Fish | 4/5/2002 | Cs-137 | 9.54 | | 100 |
| SPMI-2083 | Milk | 4/8/2002 | Cs-134 | 2.90 | | 10 |
| SPMI-2083 | Milk | 4/8/2002 | Cs-137 | 3.03 | | 10 |
| SPMI-2083 | Milk | 4/8/2002 | I-131 | 0.52 | -0.38 ± 0.34 | 0.5 |
| SPMI-2083 | Milk[c] | 4/8/2002 | Sr-90 | 0.48 | 1.29 ± 0.36 | 1 |
| SPW-2115 | water | 4/8/2002 | Co-60 | 1.49 | | 10 |
| SPW-2115 | water | 4/8/2002 | Cs-134 | 2.09 | | 10 |
| SPW-2115 | water | 4/8/2002 | Cs-137 | 3.78 | | 10 |
| SPW-2115 | water | 4/8/2002 | I-131 | 0.50 | -0.16 ± 0.33 | 0.5 |
| SPW-2115 | water | 4/8/2002 | I-131(G) | 3.30 | | 20 |
| SPW-2115 | water | 4/8/2002 | Sr-90 | 0.66 | 0.10 ± 0.32 | 1 |
| SPW-2018 | water | 4/22/2002 | Gr. Alpha | 0.56 | -0.24 ± 0.38 | 1 |
| SPW-2018 | water | 4/22/2002 | Gr. Beta | 1.38 | 3.19 ± 1.03 | 3.2 |
| SPch-3063 | Charcoal | 5/11/2002 | I-131(G) | 8.27 | | 9.6 |
| SPW-4683 | water | 7/17/2002 | H-3 | 129.00 | -62.8 ± 60.30 | 200 |
| W-71702 | water | 7/17/2002 | Fe-55 | 33.61 | -1.72 ± 15.63 | 1000 |
| W-71702 | water | 7/17/2002 | Ni-63 | 2.56 | 0.71 ± 1.37 | 20 |
| W-71802B | water | 7/18/2002 | Gr. Alpha | 0.48 | 0.31 ± 0.36 | 1 |
| W-71802B | water | 7/18/2002 | Gr. Beta | 1.33 | 0.9 ± 0.95 | 3.2 |

TABLE A-4. In-House "Blank" Samples

| Lab Code | Sample Type | Date | Analysis | Concentration (pCi/L)[a] Laboratory results (4.66σ) LLD | Activity[b] | Acceptance Criteria (4.66 σ) |
|---|---|---|---|---|---|---|
| W-72302 | water | 7/23/2002 | Sr-90 | 0.27 | 0.027 ± 0.13 | 1 |
| W-80202 | water | 8/2/2002 | Tc-99 | 0.34 | -0.051 ± 0.16 | 10 |
| SPW-7189 | water | 10/25/2002 | Fe-55 | 978.21 | 21.77 ± 595.33 | 1000 |
| SPW-7191 | water | 10/25/2002 | Ni-63 | 11.74 | 4.47 ± 7.24 | 20 |
| SPW-7193 | water | 10/25/2002 | H-3 | 146.00 | -92 ± 65.00 | 200 |
| SPAP-7199 | Air Filter | 10/25/2002 | Gr. Beta | 0.00 | -0.0024 ± 0.00 | 3.2 |
| SPMI-7333 | Milk | 10/30/2002 | Cs-134 | 5.30 | | 10 |
| SPMI-7333 | Milk | 10/30/2002 | Cs-137 | 4.80 | | 10 |
| SPW-7334 | water | 10/30/2002 | Co-60 | 3.69 | | 10 |
| SPW-7334 | water | 10/30/2002 | Cs-134 | 5.37 | | 10 |
| SPW-7334 | water | 10/30/2002 | Cs-137 | 3.90 | | 10 |
| SPF-7339 | Fish | 10/30/2002 | Cs-134 | 4.69 | | 100 |
| SPF-7339 | Fish | 10/30/2002 | Cs-137 | 11.18 | | 100 |

[a] *Liquid sample results are reported in pCi/Liter, air filters( pCi/filter), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).*

[b] The activity reported is the net activity result.

[c] Low levels of Sr-90 are still detected in the environment. A concentration of (1-5 pCi/L) in milk is not unusual.

TABLE A-5. In-House "Duplicate" Samples

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result |
|---|---|---|---|---|---|
| CF-20, 21 | 1/2/2002 | Be-7 | 0.47 ± 0.25 | 0.37 ± 0.12 | 0.42 ± 0.14 |
| CF-20, 21 | 1/2/2002 | Gr. Beta | 7.82 ± 0.20 | 7.95 ± 0.21 | 7.89 ± 0.14 |
| CF-20, 21 | 1/2/2002 | K-40 | 6.65 ± 0.55 | 6.53 ± 0.36 | 6.59 ± 0.33 |
| CF-20, 21 | 1/2/2002 | Sr-90 | 0.01 ± 0.01 | 0.01 ± 0.01 | 0.01 ± 0.00 |
| AP-11804, 11805 | 1/2/2002 | Be-7 | 0.054 ± 0.011 | 0.049 ± 0.019 | 0.052 ± 0.011 |
| AP-11825, 11826 | 1/2/2002 | Be-7 | 0.053 ± 0.013 | 0.043 ± 0.013 | 0.048 ± 0.009 |
| AP-11846, 11847 | 1/2/2002 | Be-7 | 0.054 ± 0.018 | 0.048 ± 0.016 | 0.051 ± 0.012 |
| WW-150, 151 | 1/7/2002 | Gr. Beta | 1.26 ± 0.50 | 1.04 ± 0.46 | 1.15 ± 0.34 |
| MI-124, 125 | 1/8/2002 | K-40 | 1332.30 ± 158.90 | 1271.70 ± 151.50 | 1302.00 ± 109.77 |
| W-172, 173 | 1/8/2002 | H-3 | 153.00 ± 68.00 | 148.00 ± 68.00 | 150.50 ± 48.08 |
| SW-11698, 11699 | 1/8/2002 | Gr. Alpha | 2.51 ± 1.36 | 3.71 ± 1.80 | 3.11 ± 1.13 |
| SW-11698, 11699 | 1/8/2002 | Gr. Beta | 7.68 ± 1.33 | 8.49 ± 1.43 | 8.09 ± 0.98 |
| U-275, 276 | 1/10/2002 | Gr. Alpha | 1.40 ± 1.00 | 1.10 ± 1.20 | 1.25 ± 0.78 |
| LW-356, 357 | 1/16/2002 | Gr. Beta | 3.47 ± 0.65 | 2.94 ± 0.61 | 3.21 ± 0.45 |
| LW-377, 378 | 1/16/2002 | Gr. Beta | 2.75 ± 0.68 | 2.84 ± 0.61 | 2.79 ± 0.46 |
| SW-525, 526 | 1/30/2002 | Gr. Alpha | 0.56 ± 0.35 | 0.24 ± 0.35 | 0.40 ± 0.25 |
| SW-525, 526 | 1/30/2002 | Gr. Beta | 2.29 ± 0.41 | 2.58 ± 0.39 | 2.43 ± 0.28 |
| DW-504, 505 | 1/31/2002 | Gr. Alpha | 2.30 ± 1.70 | 3.90 ± 1.40 | 3.10 ± 1.10 |
| MI-649, 650 | 2/5/2002 | K-40 | 1319.40 ± 176.70 | 1210.80 ± 118.20 | 1265.10 ± 106.29 |
| DW-697, 698 | 2/6/2002 | Gr. Beta | 5.10 ± 1.20 | 4.70 ± 1.20 | 4.90 ± 0.85 |
| DW-927, 928 | 2/8/2002 | Sr-90 | 0.69 ± 0.29 | 0.71 ± 0.29 | 0.70 ± 0.21 |
| W-973, 974 | 2/18/2002 | Fe-55 | 7.29 ± 0.97 | 6.86 ± 0.94 | 7.08 ± 0.68 |
| W-1673, 1674 | 2/25/2002 | H-3 | 2640.00 ± 155.00 | 2908.00 ± 161.00 | 2774.00 ± 111.74 |
| SWT-1395, 1396 | 2/26/2002 | Gr. Beta | 2.96 ± 0.59 | 2.29 ± 0.53 | 2.63 ± 0.40 |
| MI-1268, 1269 | 2/27/2002 | K-40 | 1460.50 ± 162.50 | 1573.00 ± 168.00 | 1516.75 ± 116.87 |
| MI-1268, 1269 | 2/27/2002 | Sr-90 | 0.77 ± 0.36 | 0.95 ± 0.40 | 0.86 ± 0.27 |
| MI-1332, 1333 | 3/5/2002 | K-40 | 1503.00 ± 164.00 | 1305.00 ± 168.00 | 1404.00 ± 117.39 |
| MI-1332, 1333 | 3/5/2002 | Sr-90 | 1.35 ± 0.38 | 1.07 ± 0.40 | 1.21 ± 0.28 |
| MI-1458, 1459 | 3/6/2002 | K-40 | 1411.70 ± 166.70 | 1390.00 ± 172.30 | 1400.85 ± 119.87 |
| DW-10100, 10101 | 3/9/2002 | Gr. Alpha | 4.10 ± 1.70 | 1.80 ± 1.60 | 2.95 ± 1.17 |
| DW-10111, 10112 | 3/9/2002 | Gr. Alpha | 7.10 ± 2.00 | 8.30 ± 2.30 | 7.70 ± 1.52 |
| MI-1521, 1522 | 3/11/2002 | K-40 | 1270.80 ± 103.30 | 1369.10 ± 121.60 | 1319.95 ± 79.78 |
| MI-1521, 1522 | 3/11/2002 | Sr-90 | 1.69 ± 0.46 | 2.46 ± 0.49 | 2.07 ± 0.34 |
| MI-1541, 1542 | 3/11/2002 | K-40 | 1562.20 ± 122.80 | 1529.30 ± 126.10 | 1545.75 ± 88.01 |
| MI-1541, 1542 | 3/11/2002 | Sr-90 | 0.85 ± 0.57 | 1.48 ± 0.43 | 1.16 ± 0.36 |
| LW-1651, 1652 | 3/14/2002 | Gr. Beta | 2.90 ± 0.57 | 2.57 ± 0.56 | 2.74 ± 0.40 |
| DW-10134, 10135 | 3/16/2002 | Gr. Alpha | 5.60 ± 1.90 | 5.40 ± 1.60 | 5.50 ± 1.24 |
| WW-1694, 1695 | 3/18/2002 | Gr. Beta | 1.79 ± 0.59 | 1.53 ± 0.50 | 1.66 ± 0.39 |
| SO-1715, 1716 | 3/19/2002 | Cs-137 | 0.03 ± 0.01 | 0.02 ± 0.01 | 0.03 ± 0.01 |
| SO-1715, 1716 | 3/19/2002 | Gr. Beta | 18.50 ± 1.70 | 19.10 ± 1.70 | 18.80 ± 1.20 |
| DW-10302, 10303 | 3/20/2002 | Gr. Alpha | 2.30 ± 1.40 | 3.30 ± 1.60 | 2.80 ± 1.06 |
| W-1758, 1759 | 3/25/2002 | Gr. Alpha | 2.50 ± 0.70 | 2.30 ± 0.60 | 2.40 ± 0.46 |
| W-1758, 1759 | 3/25/2002 | Gr. Beta | 4.10 ± 1.20 | 2.50 ± 1.10 | 3.30 ± 0.81 |

TABLE A-5. In-House "Duplicate" Samples

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result |
|---|---|---|---|---|---|
| MI-1926, 1927 | 3/26/2002 | K-40 | 1414.00 ± 115.00 | 1316.00 ± 128.00 | 1365.00 ± 86.04 |
| MI-1926, 1927 | 3/26/2002 | Sr-90 | 2.30 ± 0.70 | 2.40 ± 0.70 | 2.35 ± 0.49 |
| SWU-2010, 2011 | 3/26/2002 | Gr. Beta | 2.90 ± 0.60 | 2.20 ± 0.50 | 2.55 ± 0.39 |
| DW-10376, 10377 | 3/27/2002 | Gr. Beta | 10.50 ± 1.30 | 10.10 ± 1.50 | 10.30 ± 0.99 |
| AP-2479, 2480 | 3/28/2002 | Be-7 | 0.064 ± 0.023 | 0.068 ± 0.014 | 0.066 ± 0.013 |
| DW-10395, 10396 | 3/29/2002 | Gr. Alpha | 10.20 ± 2.10 | 14.60 ± 2.40 | 12.40 ± 1.59 |
| LW-2181, 2182 | 3/31/2002 | Gr. Beta | 2.98 ± 0.68 | 1.99 ± 0.70 | 2.48 ± 0.49 |
| LW-2181, 2182 | 3/31/2002 | H-3 | 2694.43 ± 156.53 | 2688.84 ± 156.40 | 2691.64 ± 110.64 |
| CW-2437, 2438 | 3/31/2002 | Gr. Beta | 1.09 ± 0.61 | 1.14 ± 0.58 | 1.11 ± 0.42 |
| CW-2437, 2438 | 3/31/2002 | H-3 | 6456.70 ± 229.20 | 6292.80 ± 226.52 | 6374.75 ± 161.12 |
| MI-1947, 1948 | 4/1/2002 | K-40 | 1421.40 ± 130.90 | 1256.80 ± 104.20 | 1339.10 ± 83.65 |
| AP-2458, 2459 | 4/1/2002 | Be-7 | 0.077 ± 0.011 | 0.081 ± 0.010 | 0.079 ± 0.008 |
| DW-10409, 10410 | 4/1/2002 | Gr. Alpha | 39.30 ± 4.00 | 35.30 ± 3.60 | 37.30 ± 2.69 |
| MI-2052, 2053 | 4/3/2002 | K-40 | 1283.70 ± 103.20 | 1434.80 ± 147.90 | 1359.25 ± 90.17 |
| MI-2052, 2053 | 4/3/2002 | Sr-90 | 0.81 ± 0.36 | 0.75 ± 0.35 | 0.78 ± 0.25 |
| AP-2711, 2712 | 4/3/2002 | Be-7 | 0.071 ± 0.01 | 0.07 ± 0.01 | 0.07 ± 0.01 |
| W-938, 939 | 4/9/2002 | Ni-63 | 1.73 ± 0.10 | 1.82 ± 0.10 | 1.78 ± 0.07 |
| SS-2202, 2203 | 4/9/2002 | Gr. Beta | 5.83 ± 1.16 | 5.52 ± 1.19 | 5.67 ± 0.83 |
| SS-2202, 2203 | 4/9/2002 | K-40 | 5.75 ± 0.48 | 6.11 ± 0.51 | 5.93 ± 0.35 |
| F-2307, 2308 | 4/10/2002 | K-40 | 2.75 ± 0.27 | 2.49 ± 0.32 | 2.62 ± 0.21 |
| DW-10476, 10477 | 4/12/2002 | Gr. Alpha | 5.10 ± 1.30 | 3.90 ± 1.60 | 4.50 ± 1.03 |
| W-2244, 2245 | 4/15/2002 | Gr. Beta | 1.70 ± 1.10 | 1.60 ± 1.00 | 1.65 ± 0.74 |
| DW-10509, 10510 | 4/17/2002 | Gr. Alpha | 6.00 ± 2.00 | 7.30 ± 1.80 | 6.65 ± 1.35 |
| SW-2690, 2691 | 4/24/2002 | Gr. Beta | 2.25 ± 0.68 | 2.15 ± 0.59 | 2.20 ± 0.45 |
| SO-2903, 2904 | 4/24/2002 | Be-7 | 1.22 ± 0.57 | 0.78 ± 0.43 | 1.00 ± 0.36 |
| SO-2903, 2904 | 4/24/2002 | Cs-137 | 0.13 ± 0.05 | 0.09 ± 0.05 | 0.11 ± 0.04 |
| SO-2903, 2904 | 4/24/2002 | K-40 | 21.06 ± 1.48 | 19.91 ± 1.16 | 20.48 ± 0.94 |
| DW-10562, 10563 | 4/24/2002 | Gr. Alpha | 2.17 ± 1.13 | 3.25 ± 1.54 | 2.71 ± 0.96 |
| DW-10578, 10579 | 4/29/2002 | Gr. Alpha | 8.20 ± 2.20 | 7.40 ± 2.00 | 7.80 ± 1.49 |
| SO-2861, 2862 | 4/30/2002 | Cs-137 | 236.40 ± 46.00 | 200.70 ± 52.60 | 218.55 ± 34.94 |
| SO-2861, 2862 | 4/30/2002 | K-40 | 10191.00 ± 784.60 | 11025.00 ± 941.30 | 10608.00 ± 612.71 |
| SL-2819, 2820 | 5/1/2002 | Be-7 | 805.70 ± 301.50 | 860.73 ± 164.80 | 833.22 ± 171.80 |
| SL-2819, 2820 | 5/1/2002 | Gr. Beta | 5566.00 ± 124.00 | 5359.00 ± 122.00 | 5462.50 ± 86.98 |
| SL-2819, 2820 | 5/1/2002 | K-40 | 5524.00 ± 632.90 | 5277.50 ± 431.40 | 5400.75 ± 382.97 |
| SL-2840, 2841 | 5/1/2002 | Be-7 | 1010.00 ± 352.10 | 872.95 ± 181.70 | 941.48 ± 198.11 |
| SL-2840, 2841 | 5/1/2002 | Gr. Beta | 4399.00 ± 221.80 | 4593.00 ± 276.00 | 4496.00 ± 177.04 |
| SL-2840, 2841 | 5/1/2002 | K-40 | 2422.80 ± 352.10 | 2254.10 ± 371.40 | 2338.45 ± 255.89 |
| MI-2971, 2972 | 5/5/2002 | K-40 | 1338.90 ± 83.44 | 1345.80 ± 100.90 | 1342.35 ± 65.47 |
| MI-2971, 2972 | 5/5/2002 | Sr-90 | 0.83 ± 0.47 | 1.65 ± 0.46 | 1.24 ± 0.33 |
| DW-10603, 10604 | 5/6/2002 | Gr. Alpha | 6.30 ± 1.70 | 5.50 ± 1.60 | 5.90 ± 1.17 |
| SS-3037, 3038 | 5/9/2002 | K-40 | 11585.00 ± 749.00 | 11612.00 ± 787.00 | 11598.50 ± 543.22 |
| MI-3124, 3125 | 5/13/2002 | K-40 | 1329.50 ± 103.80 | 1373.00 ± 107.40 | 1351.25 ± 74.68 |
| MI-3208, 3209 | 5/14/2002 | K-40 | 1494.60 ± 158.40 | 1462.60 ± 182.50 | 1478.60 ± 120.83 |
| LW-3250, 3251 | 5/15/2002 | Gr. Beta | 3.14 ± 0.55 | 3.28 ± 0.63 | 3.21 ± 0.42 |

TABLE A-5. In-House "Duplicate" Samples

| | | | Concentration (pCi/L)[a] | | |
|---|---|---|---|---|---|
| Lab Code | Date | Analysis | First Result | Second Result | Averaged Result |
| CF-3292, 3293 | 5/20/2002 | K-40 | 1.33 ± 0.99 | 1.14 ± 0.91 | 1.23 ± 0.67 |
| MI-3376, 3377 | 5/26/2002 | K-40 | 1333.30 ± 159.40 | 1090.70 ± 143.40 | 1212.00 ± 107.21 |
| MI-3418, 3419 | 5/28/2002 | K-40 | 1423.70 ± 121.30 | 1443.30 ± 164.30 | 1433.50 ± 102.11 |
| SWT-3461, 3462 | 5/28/2002 | Gr. Beta | 2.65 ± 0.54 | 3.28 ± 0.60 | 2.97 ± 0.40 |
| SO-3503, 3504 | 5/29/2002 | Cs-137 | 0.17 ± 0.04 | 0.18 ± 0.05 | 0.18 ± 0.03 |
| SO-3503, 3504 | 5/29/2002 | Gr. Beta | 27.72 ± 2.26 | 25.45 ± 2.03 | 26.58 ± 1.52 |
| SO-3503, 3504 | 5/29/2002 | K-40 | 20.24 ± 1.19 | 20.54 ± 1.24 | 20.39 ± 0.86 |
| SL-3545, 3546 | 6/3/2002 | Gr. Beta | 4436.00 ± 90.00 | 4281.00 ± 89.00 | 4358.50 ± 63.29 |
| SL-3545, 3546 | 6/3/2002 | K-40 | 4684.20 ± 734.40 | 5242.50 ± 884.50 | 4963.35 ± 574.82 |
| DW-10754, 10755 | 6/6/2002 | Sr-90 | 0.50 ± 0.30 | 0.60 ± 0.30 | 0.55 ± 0.21 |
| SW-3777, 3778 | 6/11/2002 | Gr. Alpha | 4.42 ± 1.50 | 2.97 ± 1.40 | 3.70 ± 1.02 |
| SW-3777, 3778 | 6/11/2002 | Gr. Beta | 7.57 ± 1.22 | 6.83 ± 1.16 | 7.20 ± 0.84 |
| MI-3798, 3799 | 6/11/2002 | K-40 | 1433.40 ± 124.20 | 1401.20 ± 96.96 | 1417.30 ± 78.78 |
| LW-3924, 3925 | 6/13/2002 | Gr. Beta | 3.05 ± 0.59 | 3.38 ± 0.72 | 3.21 ± 0.46 |
| MI-3966, 3967 | 6/18/2002 | K-40 | 1245.20 ± 109.20 | 1340.20 ± 121.90 | 1292.70 ± 81.83 |
| MI-3966, 3967 | 6/18/2002 | Sr-90 | 2.38 ± 0.51 | 2.63 ± 0.52 | 2.51 ± 0.36 |
| MI-3987, 3988 | 6/19/2002 | Sr-90 | 0.98 ± 0.35 | 0.97 ± 0.35 | 0.98 ± 0.25 |
| MI-4095, 4096 | 6/25/2002 | K-40 | 1256.10 ± 138.20 | 1199.00 ± 128.30 | 1227.55 ± 94.29 |
| SWU-4221, 4222 | 6/25/2002 | Gr. Beta | 6.89 ± 1.97 | 5.38 ± 1.93 | 6.13 ± 1.38 |
| LW-4179, 4180 | 6/27/2002 | Gr. Beta | 2.37 ± 0.58 | 2.00 ± 0.62 | 2.19 ± 0.42 |
| G-4329, 4330 | 7/1/2002 | Be-7 | 1394.80 ± 538.40 | 1098.10 ± 437.40 | 1246.45 ± 346.84 |
| G-4329, 4330 | 7/1/2002 | Gr. Beta | 8.10 ± 0.27 | 8.00 ± 0.25 | 8.05 ± 0.18 |
| G-4329, 4330 | 7/1/2002 | K-40 | 7758.20 ± 1100.00 | 8399.80 ± 929.30 | 8079.00 ± 720.00 |
| SL-4337, 4338 | 7/1/2002 | Be-7 | 1480.90 ± 223.80 | 1726.40 ± 552.60 | 1603.65 ± 298.10 |
| SL-4337, 4338 | 7/1/2002 | Cs-137 | 32.30 ± 14.70 | 50.97 ± 27.10 | 41.64 ± 15.42 |
| SL-4337, 4338 | 7/1/2002 | Gr. Beta | 5262.40 ± 522.10 | 5432.40 ± 540.00 | 5347.40 ± 375.56 |
| SL-4337, 4338 | 7/1/2002 | K-40 | 2249.00 ± 381.90 | 2989.90 ± 509.60 | 2619.45 ± 318.41 |
| AP-4864, 4865 | 7/1/2002 | Be-7 | 0.085 ± 0.009 | 0.085 ± 0.006 | 0.085 ± 0.006 |
| MI-4359, 4360 | 7/2/2002 | K-40 | 1390.10 ± 168.30 | 1567.40 ± 194.30 | 1478.75 ± 128.53 |
| AP-4569, 4570 | 7/2/2002 | Be-7 | 0.068 ± 0.016 | 0.086 ± 0.018 | 0.077 ± 0.012 |
| AP-4843, 4844 | 7/2/2002 | Be-7 | 0.077 ± 0.016 | 0.090 ± 0.020 | 0.084 ± 0.013 |
| AP-4789, 4790 | 7/3/2002 | Be-7 | 0.080 ± 0.013 | 0.078 ± 0.015 | 0.079 ± 0.010 |
| SWU-4810, 4811 | 7/3/2002 | Gr. Beta | 2.40 ± 0.84 | 2.47 ± 0.88 | 2.43 ± 0.61 |
| MI-4548, 4549 | 7/9/2002 | K-40 | 1511.80 ± 127.00 | 1446.80 ± 101.80 | 1479.30 ± 81.38 |
| DW-4737, 4738 | 7/12/2002 | I-131 | 0.52 ± 0.20 | 0.49 ± 0.29 | 0.51 ± 0.18 |
| MI-4632, 4633 | 7/15/2002 | K-40 | 1198.40 ± 114.10 | 1371.30 ± 146.90 | 1284.85 ± 93.00 |
| MI-5054, 5055 | 7/30/2002 | K-40 | 1428.80 ± 105.60 | 1344.30 ± 106.40 | 1386.55 ± 74.95 |
| G-5075, 5076 | 7/30/2002 | Gr. Beta | 7.11 ± 0.07 | 6.99 ± 0.07 | 7.05 ± 0.05 |
| SWU-5124, 5125 | 7/30/2002 | Gr. Beta | 1.75 ± 0.84 | 1.90 ± 0.78 | 1.82 ± 0.57 |
| G-5151, 5152 | 7/31/2002 | Be-7 | 1.82 ± 0.30 | 2.05 ± 0.32 | 1.93 ± 0.22 |
| G-5151, 5152 | 7/31/2002 | K-40 | 5.13 ± 0.66 | 5.72 ± 0.70 | 5.42 ± 0.48 |
| MI-5103, 5104 | 8/2/2002 | K-40 | 1415.90 ± 70.57 | 1423.80 ± 129.20 | 1419.85 ± 73.61 |
| LW-5434, 5435 | 8/5/2002 | Gr. Beta | 2.77 ± 0.35 | 2.26 ± 0.35 | 2.52 ± 0.25 |
| MI-5215, 5216 | 8/7/2002 | K-40 | 1361.10 ± 111.90 | 1358.30 ± 115.80 | 1359.70 ± 80.52 |

TABLE A-5. In-House "Duplicate" Samples

| Lab Code | Date | Analysis | Concentration (pCi/L)[a] First Result | Second Result | Averaged Result |
|---|---|---|---|---|---|
| MI-5355, 5356 | 8/13/2002 | K-40 | 1405.00 ± 165.80 | 1549.30 ± 114.40 | 1477.15 ± 100.72 |
| F-5413, 5414 | 8/15/2002 | Gr. Beta | 2.37 ± 0.10 | 2.55 ± 0.10 | 2.46 ± 0.07 |
| F-5413, 5414 | 8/15/2002 | K-40 | 1.47 ± 0.32 | 1.73 ± 0.43 | 1.60 ± 0.27 |
| MI-5603, 5604 | 8/26/2002 | I-131 | 0.64 ± 0.34 | 0.52 ± 0.36 | 0.58 ± 0.25 |
| MI-5603, 5604 | 8/26/2002 | K-40 | 1353.60 ± 83.13 | 1261.40 ± 117.80 | 1307.50 ± 72.09 |
| MI-5578, 5579 | 8/27/2002 | K-40 | 1301.50 ± 161.70 | 1381.60 ± 111.20 | 1341.55 ± 98.12 |
| VE-5682, 5683 | 8/28/2002 | Be-7 | 0.29 ± 0.10 | 0.25 ± 0.11 | 0.27 ± 0.08 |
| VE-5682, 5683 | 8/28/2002 | Gr. Beta | 3.79 ± 0.08 | 3.80 ± 0.08 | 3.79 ± 0.06 |
| VE-5682, 5683 | 8/28/2002 | K-40 | 3.06 ± 0.29 | 3.31 ± 0.42 | 3.18 ± 0.25 |
| WW-6188, 6189 | 8/31/2002 | Gr. Beta | 2.70 ± 0.57 | 2.30 ± 0.57 | 2.50 ± 0.41 |
| SL-5724, 5725 | 9/3/2002 | Be-7 | 0.92 ± 0.19 | 1.04 ± 0.23 | 0.98 ± 0.15 |
| SL-5724, 5725 | 9/3/2002 | Cs-137 | 0.05 ± 0.02 | 0.05 ± 0.02 | 0.05 ± 0.01 |
| SL-5724, 5725 | 9/3/2002 | K-40 | 2.09 ± 0.31 | 2.28 ± 0.48 | 2.19 ± 0.29 |
| MI-5877, 5878 | 9/9/2002 | K-40 | 1340.70 ± 165.00 | 1168.50 ± 172.50 | 1254.60 ± 119.35 |
| MI-6157, 6158 | 9/19/2002 | K-40 | 1372.10 ± 115.10 | 1136.50 ± 222.70 | 1254.30 ± 125.34 |
| MI-6258, 6259 | 9/24/2002 | K-40 | 1328.60 ± 201.00 | 1312.60 ± 118.60 | 1320.60 ± 116.69 |
| LW-6278, 6279 | 9/30/2002 | Gr. Beta | 2.15 ± 0.51 | 1.70 ± 0.50 | 1.93 ± 0.36 |
| MI-6385, 6386 | 10/1/2002 | K-40 | 1297.10 ± 168.90 | 1310.10 ± 128.30 | 1303.60 ± 106.05 |
| BS-6453, 6454 | 10/1/2002 | Cs-137 | 0.43 ± 0.03 | 0.44 ± 0.03 | 0.44 ± 0.02 |
| BS-6453, 6454 | 10/1/2002 | K-40 | 16.50 ± 0.51 | 16.80 ± 0.61 | 16.65 ± 0.40 |
| SO-6478, 6479 | 10/1/2002 | Cs-137 | 0.074 ± 0.016 | 0.070 ± 0.016 | 0.072 ± 0.011 |
| SO-6478, 6479 | 10/1/2002 | Gr. Alpha | 8.01 ± 4.36 | 7.55 ± 4.57 | 7.78 ± 3.16 |
| SO-6478, 6479 | 10/1/2002 | Gr. Beta | 30.41 ± 4.07 | 33.04 ± 4.28 | 31.73 ± 2.95 |
| SO-6478, 6479 | 10/1/2002 | K-40 | 19.82 ± 0.53 | 20.39 ± 0.58 | 20.10 ± 0.39 |
| SO-6478, 6479 | 10/1/2002 | Sr-90 | 0.087 ± 0.017 | 0.094 ± 0.020 | 0.091 ± 0.013 |
| AP-6641, 6642 | 10/1/2002 | Be-7 | 0.070 ± 0.016 | 0.080 ± 0.015 | 0.075 ± 0.011 |
| MI-6544, 6545 | 10/2/2002 | K-40 | 1331.60 ± 125.20 | 1326.50 ± 171.60 | 1329.05 ± 106.21 |
| AP-6857, 6858 | 10/3/2002 | Be-7 | 0.062 ± 0.015 | 0.071 ± 0.015 | 0.066 ± 0.010 |
| AP-6857, 6858 | 10/3/2002 | Be-7 | 0.062 ± 0.015 | 0.071 ± 0.015 | 0.066 ± 0.010 |
| AP-6857, 6858 | 10/3/2002 | Be-7 | 0.062 ± 0.015 | 0.071 ± 0.015 | 0.066 ± 0.010 |
| BS-6620, 6621 | 10/7/2002 | Co-60 | 0.090 ± 0.020 | 0.11 ± 0.02 | 0.10 ± 0.01 |
| BS-6620, 6621 | 10/7/2002 | Cs-137 | 0.62 ± 0.04 | 0.63 ± 0.03 | 0.62 ± 0.02 |
| BS-6620, 6621 | 10/7/2002 | K-40 | 11.38 ± 0.48 | 10.78 ± 0.52 | 11.08 ± 0.35 |
| MI-6651, 6652 | 10/8/2002 | K-40 | 1565.50 ± 141.00 | 1640.60 ± 189.20 | 1603.05 ± 117.98 |
| G-6760, 6761 | 10/9/2002 | Be-7 | 2.17 ± 0.49 | 2.31 ± 0.34 | 2.24 ± 0.30 |
| G-6760, 6761 | 10/9/2002 | K-40 | 6.24 ± 1.00 | 6.61 ± 0.60 | 6.42 ± 0.58 |
| SWU-7054, 7055 | 10/10/2002 | Gr. Beta | 3.09 ± 0.57 | 2.06 ± 0.52 | 2.57 ± 0.39 |
| U-7126, 7127 | 10/11/2002 | Gr. Beta | 2.61 ± 1.24 | 2.61 ± 1.08 | 2.61 ± 0.82 |
| XW-7768, 7769 | 10/14/2002 | Cs-137 | 2.25 ± 0.25 | 2.09 ± 0.18 | 2.17 ± 0.15 |
| XW-7768, 7769 | 10/14/2002 | H-3 | 2.63 ± 0.10 | 2.64 ± 0.10 | 2.64 ± 0.07 |
| F-7148, 7149 | 10/15/2002 | K-40 | 2.57 ± 0.28 | 2.98 ± 0.44 | 2.77 ± 0.26 |
| BS-7337, 7338 | 10/23/2002 | Co-60 | 0.083 ± 0.025 | 0.073 ± 0.031 | 0.078 ± 0.020 |
| BS-7337, 7338 | 10/23/2002 | Cs-137 | 0.082 ± 0.019 | 0.11 ± 0.04 | 0.10 ± 0.02 |
| BS-7337, 7338 | 10/23/2002 | Gr. Beta | 12.54 ± 2.34 | 12.99 ± 2.22 | 12.77 ± 1.61 |
| SO-7407, 7408 | 10/29/2002 | Cs-137 | 0.14 ± 0.03 | 0.15 ± 0.03 | 0.15 ± 0.02 |
| SO-7407, 7408 | 10/29/2002 | Gr. Beta | 16.73 ± 2.21 | 16.62 ± 2.27 | 16.67 ± 1.58 |
| SO-7407, 7408 | 10/29/2002 | K-40 | 12.05 ± 0.61 | 12.27 ± 0.81 | 12.16 ± 0.51 |

TABLE A-5. In-House "Duplicate" Samples

| | | | Concentration (pCi/L)[a] | | |
|---|---|---|---|---|---|
| Lab Code | Date | Analysis | First Result | Second Result | Averaged Result |
| MI-7428, 7429 | 10/29/2002 | K-40 | 1542.60 ± 213.00 | 1355.80 ± 185.70 | 1449.20 ± 141.29 |
| pw-7621, 7622 | 10/30/2002 | Gr. Beta | 2.22 ± 0.92 | 2.08 ± 0.83 | 2.15 ± 0.62 |
| TD-7653, 7654 | 10/31/2002 | H-3 | 11122.00 ± 387.00 | 11259.00 ± 390.00 | 11190.50 ± 274.71 |
| SW-7569, 7570 | 11/5/2002 | Gr. Beta | 15.90 ± 1.25 | 16.24 ± 1.27 | 16.07 ± 0.89 |
| SW-7569, 7570 | 11/5/2002 | K-40 | 14.79 ± 1.48 | 14.79 ± 1.48 | 14.79 ± 1.05 |
| SO-8010, 8011 | 11/7/2002 | Cs-137 | 0.11 ± 0.02 | 0.11 ± 0.03 | 0.11 ± 0.02 |
| SO-8010, 8011 | 11/7/2002 | K-40 | 6.91 ± 0.54 | 7.21 ± 0.54 | 7.06 ± 0.38 |
| VE-7747, 7748 | 11/11/2002 | Gr. Beta | 3.59 ± 0.05 | 3.25 ± 0.05 | 3.42 ± 0.03 |
| VE-7747, 7748 | 11/11/2002 | K-40 | 3.17 ± 0.36 | 3.26 ± 0.46 | 3.22 ± 0.29 |
| MI-7789, 7790 | 11/13/2002 | K-40 | 1319.30 ± 167.60 | 1301.20 ± 140.70 | 1310.25 ± 109.41 |
| DW-8082, 8083 | 11/29/2002 | I-131 | 0.83 ± 0.24 | 0.98 ± 0.22 | 0.90 ± 0.16 |
| SW-8054, 8055 | 12/2/2002 | Gr. Beta | 2.60 ± 0.46 | 2.21 ± 0.39 | 2.41 ± 0.30 |
| SW-8054, 8055 | 12/2/2002 | K-40 | 1.44 ± 0.14 | 1.43 ± 0.14 | 1.44 ± 0.10 |
| MI-8105, 8106 | 12/4/2002 | K-40 | 1300.60 ± 111.30 | 1315.40 ± 108.90 | 1308.00 ± 77.86 |
| TD-8298, 8299 | 12/5/2002 | H-3 | 355.00 ± 94.00 | 469.00 ± 99.00 | 412.00 ± 68.26 |
| MI-8396, 8397 | 12/17/2002 | K-40 | 1409.20 ± 117.30 | 1449.60 ± 108.60 | 1429.40 ± 79.93 |
| SWT-8654, 8655 | 12/30/2002 | Gr. Beta | 1.63 ± 0.50 | 1.40 ± 0.47 | 1.51 ± 0.34 |
| AP-8783, 8784 | 12/31/2002 | Be-7 | 0.044 ± 0.009 | 0.042 ± 0.008 | 0.043 ± 0.006 |

Note: Duplicate analyses are performed on every twentieth sample received in-house. Results are not listed for those analyses with activities that measure below the LLD.

[a] Results are reported in units of pCi/L, except for air filters (pCi/Filter), food products, vegetation, soil, sediment (pCi/g).

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP)[a].

| | | | Concentration[b] | | | |
|---|---|---|---|---|---|---|
| Lab Code | Type | Date | Analysis | Laboratory result | Known Activity | Control Limits[c] |
| STW-939 | water | 12/01/01 | Am-241 | 1.25 ± 0.0 | 1.19 ± 0.0 | 0.83 - 1.6 |
| STW-939 | water | 12/01/01 | Co-57 | 138.9 ± 0.5 | 143 ± 14.3 | 100.1 - 185.9 |
| STW-939 | water | 12/01/01 | Co-60 | 139.1 ± 0.5 | 141 ± 14.1 | 98.7 - 183.3 |
| STW-939 | water | 12/01/01 | Cs-134 | 25.16 ± 0.2 | 28.5 ± 0.3 | 19.95 - 37.1 |
| STW-939 | water | 12/01/01 | Cs-137 | 279.96 ± 0.9 | 286 ± 28.6 | 200.2 - 371.8 |
| STW-939[d] | water | 12/01/01 | Fe-55 | 19.68 ± 23.2 | 9.2 ± 0.9 | 6.44 - 12.0 |
| STW-939 | water | 12/01/01 | Mn-54 | 253.64 ± 0.9 | 246 ± 0.2 | 172.2 - 319.8 |
| STW-939 | water | 12/01/01 | Ni-63 | 65.88 ± 1.9 | 88.3 ± 8.8 | 61.81 - 114.8 |
| STW-939[e] | water | 12/01/01 | Pu-238 | 0.060 ± 0.01 | 0.0 ± 0.0 | - |
| STW-939 | water | 12/01/01 | Pu-239/40 | 2.79 ± 0.0 | 2.99 ± 0.3 | 2.09 - 3.9 |
| STW-939 | water | 12/01/01 | Sr-90 | 4.88 ± 0.3 | 4.8 ± 0.5 | 3.36 - 6.2 |
| STW-939 | water | 12/01/01 | U-233/4 | 0.89 ± 0.0 | 0.98 ± 0.1 | 0.69 - 1.3 |
| STW-939 | water | 12/01/01 | U-238 | 6.75 ± 0.0 | 7.8 ± 0.8 | 5.46 - 10.1 |
| STW-939 | water | 12/01/01 | Zn-65 | 70.6 ± 1.1 | 67.3 ± 6.7 | 47.11 - 87.5 |
| STSO-955 | soil | 10/16/02 | Am-241 | 40.54 ± 2.7 | 43.5 ± 4.4 | 30.45 - 56.6 |
| STSO-955 | soil | 10/16/02 | Co-57 | 210.58 ± 2.0 | 246 ± 24.6 | 172.2 - 319.8 |
| STSO-955 | soil | 10/16/02 | Co-60 | 84.38 ± 0.9 | 87.5 ± 8.8 | 61.25 - 113.8 |
| STSO-955 | soil | 10/16/02 | Cs-134 | 692.6 ± 2.1 | 862 ± 86.0 | 603.4 - 1120.6 |
| STSO-955 | soil | 10/16/02 | Cs-137 | 96.98 ± 1.7 | 111 ± 11.1 | 77.7 - 144.3 |
| STSO-955 | soil | 10/16/02 | Fe-55 | 1714.6 ± 299.6 | 1870 ± 187.0 | 1309 - 2431.0 |
| STSO-955 | soil | 10/16/02 | Mn-54 | 509.74 ± 3.4 | 546 ± 54.6 | 382.2 - 709.8 |
| STSO-955 | soil | 10/16/02 | Ni-63 | 890.6 ± 22.4 | 1180 ± 118.0 | 826 - 1534.0 |
| STSO-955 | soil | 10/16/02 | Pu-238 | 34.04 ± 6.0 | 33.3 ± 3.3 | 23.31 - 43.3 |
| STSO-955 | soil | 10/16/02 | Pu-239/40 | 68.7 ± 3.7 | 72.9 ± 7.3 | 51.03 - 94.8 |
| STSO-955[e] | soil | 10/16/02 | Sr-90 | 1.5 ± 3.0 | 0.0 ± 0.0 | - |
| STSO-955 | soil | 10/16/02 | U-233/4 | 166.33 ± 3.8 | 229 ± 22.9 | 160.3 - 297.7 |
| STSO-955 | soil | 10/16/02 | U-238 | 169.76 ± 3.8 | 220 ± 22.0 | 154 - 286.0 |
| STSO-955 | soil | 10/16/02 | Zn-65 | 783.59 ± 6.4 | 809 ± 80.9 | 566.3 - 1051.7 |

[a] Results obtained by Environmental, Inc. ,Midwest Laboratory as a participant in the Department of Energy's Mixed Analyte Performance Evaluation Program, Idaho Operations office, Idaho Falls, Idaho

[b] All results are in Bq/kg or Bq/L as requested by the Department of Energy.

[c] MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP.

[d] Known activity below the laboratory LLD. The sample was recounted for 2000 minutes; result : 11.52 ± 5.55 Bq /L

[e] Included in the testing series as a "false positive". No activity expected.

TABLE A-7. Environmental Measurements Laboratory Quality Assessment Program (EML)

| | | | Concentration[a] | | | |
|---|---|---|---|---|---|---|
| Lab Code | Type | Date | Analysis | Laboratory results | EML Result[b] | Control Limits[c] |
| STW-945 | Water | 03/01/02 | Am-241 | 1.68 ± 0.14 | 1.47 | 0.79 - 1.41 |
| STW-945 | Water | 03/01/02 | Co-60 | 349.20 ± 2.60 | 347.33 | 0.80 - 1.20 |
| STW-945 | Water | 03/01/02 | Cs-134 | 3.40 ± 0.60 | 3.36 | 0.80 - 1.30 |
| STW-945 | Water | 03/01/02 | Cs-137 | 57.20 ± 1.70 | 56.07 | 0.80 - 1.22 |
| STW-945 | Water | 03/01/02 | Pu-238 | 0.45 ± 0.11 | 0.49 | 0.74 - 1.20 |
| STW-945 | Water | 03/01/02 | Pu-239/40 | 4.47 ± 0.28 | 4.22 | 0.79 - 1.20 |
| STW-945 | Water | 03/01/02 | Sr-90 | 7.40 ± 1.30 | 7.58 | 0.69 - 1.34 |
| STW-945 | Water | 03/01/02 | Uranium | 3.27 ± 0.43 | 2.84 | 0.75 - 1.33 |
| STW-946 | Water | 03/01/02 | Gr. Alpha | 265.40 ± 7.70 | 375.00 | 0.58 - 1.29 |
| STW-946 | Water | 03/01/02 | Gr. Beta | 930.60 ± 12.00 | 1030.00 | 0.61 - 1.43 |
| STW-946 | Water | 03/01/02 | H-3 | 226.30 ± 32.70 | 283.70 | 0.78 - 2.45 |
| STSO-947 | Soil | 03/01/02 | Ac-228 | 55.00 ± 5.50 | 51.17 | 0.80 - 1.38 |
| STSO-947 | Soil | 03/01/02 | Am-241 | 8.30 ± 3.30 | 10.93 | 0.65 - 2.28 |
| STSO-947 | Soil | 03/01/02 | Bi-212 | 49.20 ± 12.40 | 53.43 | 0.50 - 1.34 |
| STSO-947 | Soil | 03/01/02 | Bi-214 | 46.60 ± 3.10 | 53.93 | 0.78 - 1.42 |
| STSO-947 | Soil | 03/01/02 | Cs-137 | 1401.60 ± 9.10 | 1326.67 | 0.80 - 1.25 |
| STSO-947 | Soil | 03/01/02 | K-40 | 613.10 ± 28.10 | 621.67 | 0.80 - 1.32 |
| STSO-947 | Soil | 03/01/02 | Pb-212 | 51.60 ± 2.60 | 51.10 | 0.78 - 1.32 |
| STSO-947 | Soil | 03/01/02 | Pb-214 | 52.00 ± 3.60 | 54.37 | 0.76 - 1.46 |
| STSO-947 | Soil | 03/01/02 | Pu-239/40 | 14.70 ± 3.50 | 19.10 | 0.71 - 1.30 |
| STSO-947 | Soil | 03/01/02 | Sr-90 | 52.10 ± 6.30 | 53.76 | 0.67 - 2.90 |
| STSO-947 | Soil | 03/01/02 | Th-234 | 122.40 ± 6.30 | 89.30 | 0.63 - 2.35 |
| STSO-947 | Soil | 03/01/02 | Uranium | 143.40 ± 9.40 | 194.77 | 0.71 - 1.32 |
| STVE-948 | Vegetation | 03/01/02 | Am-241 | 3.10 ± 2.20 | 2.23 | 0.73 - 2.02 |
| STVE-948 | Vegetation | 03/01/02 | Cm-244 | 0.90 ± 0.80 | 1.32 | 0.61 - 1.59 |
| STVE-948 | Vegetation | 03/01/02 | Co-60 | 13.50 ± 2.10 | 11.23 | 0.80 - 1.44 |
| STVE-948 | Vegetation | 03/01/02 | Cs-137 | 350.40 ± 6.30 | 313.67 | 0.80 - 1.31 |
| STVE-948 | Vegetation | 03/01/02 | K-40 | 940.80 ± 45.60 | 864.33 | 0.79 - 1.39 |
| STVE-948[d] | Vegetation | 03/01/02 | Pu-239/40 | 16.90 ± 0.70 | 3.54 | 0.69 - 1.31 |
| STVE-948 | Vegetation | 03/01/02 | Sr-90 | 543.40 ± 24.90 | 586.28 | 0.55 - 1.21 |
| STAP-949 | Air Filter | 03/01/02 | Am-241 | 0.09 ± 0.05 | 0.09 | 0.70 - 2.34 |
| STAP-949 | Air Filter | 03/01/02 | Co-60 | 30.10 ± 0.30 | 30.52 | 0.80 - 1.26 |
| STAP-949 | Air Filter | 03/01/02 | Cs-137 | 29.90 ± 0.30 | 28.23 | 0.80 - 1.32 |
| STAP-949 | Air Filter | 03/01/02 | Mn-54 | 40.40 ± 0.40 | 38.53 | 0.80 - 1.35 |
| STAP-949 | Air Filter | 03/01/02 | Pu-238 | 0.05 ± 0.02 | 0.06 | 0.67 - 1.33 |
| STAP-949 | Air Filter | 03/01/02 | Pu-239/40 | 0.15 ± 0.02 | 0.19 | 0.73 - 1.26 |
| STAP-949 | Air Filter | 03/01/02 | Sr-90 | 3.40 ± 0.40 | 4.83 | 0.53 - 1.84 |
| STAP-949 | Air Filter | 03/01/02 | Uranium | 0.80 ± 0.20 | 0.61 | 0.79 - 2.10 |
| STAP-950 | Air Filter | 03/01/02 | Gr. Alpha | 0.43 ± 0.04 | 0.53 | 0.73 - 1.43 |
| STAP-950 | Air Filter | 03/01/02 | Gr. Beta | 1.34 ± 0.05 | 1.30 | 0.76 - 1.36 |
| STW-959 | Water | 09/01/02 | Am-241 | 3.00 ± 0.10 | 3.04 | 0.79 - 1.41 |
| STW-959 | Water | 09/01/02 | Co-60 | 258.40 ± 2.30 | 268.67 | 0.80 - 1.20 |
| STW-959 | Water | 09/01/02 | Cs-134 | 50.80 ± 3.30 | 60.20 | 0.80 - 1.30 |
| STW-959 | Water | 09/01/02 | Cs-137 | 80.10 ± 0.30 | 81.43 | 0.80 - 1.22 |
| STW-959 | Water | 09/01/02 | Cs-137 | 80.10 ± 0.30 | 81.43 | 0.80 - 1.22 |
| STW-959 | Water | 09/01/02 | Am-241 | 3.00 ± 0.10 | 3.04 | 0.79 - 1.41 |

TABLE A-7. Environmental Measurements Laboratory Quality Assessment Program (EML)[a].

| Lab Code | Type | Date | Concentration[b] Analysis | Laboratory results | EML Result[c] | Control Limits[d] |
|---|---|---|---|---|---|---|
| STW-959 | Water | 09/01/02 | Am-241 | 3.00 ± 0.10 | 3.04 | 0.79 - 1.41 |
| STW-959 | Water | 09/01/02 | Co-60 | 258.40 ± 2.30 | 268.67 | 0.80 - 1.20 |
| STW-959 | Water | 09/01/02 | Cs-134 | 50.80 ± 3.30 | 60.20 | 0.80 - 1.30 |
| STW-959 | Water | 09/01/02 | Cs-137 | 80.10 ± 0.30 | 81.43 | 0.80 - 1.22 |
| STW-959 | Water | 09/01/02 | H-3 | 271.90 ± 20.90 | 227.30 | 0.78 - 2.45 |
| STW-959 | Water | 09/01/02 | Pu-238 | 4.40 ± 0.20 | 4.33 | 0.74 - 1.20 |
| STW-959 | Water | 09/01/02 | Pu-239/40 | 2.10 ± 0.10 | 2.07 | 0.79 - 1.20 |
| STW-959 | Water | 09/01/02 | Sr-90 | 9.70 ± 0.20 | 8.69 | 0.69 - 1.34 |
| STW-959 | Water | 09/01/02 | Uranium | 5.60 ± 0.10 | 6.84 | 0.75 - 1.33 |
| STW-960 | Water | 09/01/02 | Gr. Alpha | 204.90 ± 3.20 | 210.00 | 0.58 - 1.29 |
| STW-960 | Water | 09/01/02 | Gr. Beta | 852.00 ± 26.50 | 900.00 | 0.61 - 1.43 |
| STSO-961 | Soil | 09/01/02 | Ac-228 | 47.60 ± 1.90 | 42.30 | 0.80 - 1.38 |
| STSO-961 | Soil | 09/01/02 | Am-241 | 7.80 ± 1.40 | 6.77 | 0.65 - 2.28 |
| STSO-961 | Soil | 09/01/02 | Bi-212 | 45.60 ± 1.70 | 45.93 | 0.50 - 1.34 |
| STSO-961[e] | Soil | 09/01/02 | Bi-214 | 48.80 ± 4.90 | 33.63 | 0.78 - 1.42 |
| STSO-961 | Soil | 09/01/02 | Cs-137 | 819.60 ± 16.60 | 829.33 | 0.80 - 1.25 |
| STSO-961 | Soil | 09/01/02 | K-40 | 705.30 ± 31.40 | 637.67 | 0.80 - 1.32 |
| STSO-961 | Soil | 09/01/02 | Pb-212 | 48.60 ± 3.40 | 43.43 | 0.78 - 1.32 |
| STSO-961 | Soil | 09/01/02 | Pb-214 | 51.10 ± 5.10 | 35.20 | 0.76 - 1.46 |
| STSO-961[f] | Soil | 09/01/02 | Pu-239/40 | 20.20 ± 0.80 | 12.90 | 0.71 - 1.30 |
| STSO-961 | Soil | 09/01/02 | Sr-90 | 38.50 ± 0.10 | 41.16 | 0.67 - 2.90 |
| STSO-961 | Soil | 09/01/02 | Uranium | 58.90 ± 0.70 | 87.21 | 0.71 - 1.32 |
| STVE-962 | Vegetation | 09/01/02 | Am-241 | 2.10 ± 0.30 | 2.25 | 0.73 - 2.02 |
| STVE-962 | Vegetation | 09/01/02 | Cm-244 | 1.00 ± 0.30 | 1.25 | 0.61 - 1.59 |
| STVE-962 | Vegetation | 09/01/02 | Co-60 | 11.80 ± 1.50 | 9.66 | 0.80 - 1.44 |
| STVE-962 | Vegetation | 09/01/02 | Cs-137 | 340.30 ± 16.80 | 300.67 | 0.80 - 1.31 |
| STVE-962 | Vegetation | 09/01/02 | K-40 | 1646.00 ± 74.40 | 1480.00 | 0.79 - 1.39 |
| STVE-962 | Vegetation | 09/01/02 | Pu-239/40 | 3.00 ± 0.30 | 3.43 | 0.69 - 1.31 |
| STVE-962 | Vegetation | 09/01/02 | Sr-90 | 345.60 ± 97.80 | 476.26 | 0.55 - 1.21 |
| STAP-963[g] | Air Filter | 09/01/02 | Am-241 | 0.20 ± 0.01 | 0.19 | 0.70 - 2.34 |
| STAP-963 | Air Filter | 09/01/02 | Co-60 | 24.90 ± 0.60 | 23.00 | 0.80 - 1.26 |
| STAP-963 | Air Filter | 09/01/02 | Cs-137 | 38.00 ± 1.30 | 32.50 | 0.80 - 1.32 |
| STAP-963 | Air Filter | 09/01/02 | Mn-54 | 60.80 ± 1.90 | 52.20 | 0.80 - 1.35 |
| STAP-963[g] | Air Filter | 09/01/02 | Pu-238 | 0.11 ± 0.02 | 0.12 | 0.67 - 1.33 |
| STAP-963[g] | Air Filter | 09/01/02 | Pu-239/40 | 0.21 ± 0.01 | 0.21 | 0.73 - 1.26 |
| STAP-963 | Air Filter | 09/01/02 | Sr-90 | 5.20 ± 0.20 | 5.56 | 0.53 - 1.84 |
| STAP-963[g] | Air Filter | 09/01/02 | Uranium | 0.41 ± 0.04 | 0.47 | 0.79 - 2.10 |
| STAP-964 | Air Filter | 09/01/02 | Gr. Alpha | 0.40 ± 0.10 | 0.29 | 0.73 - 1.43 |
| STAP-964 | Air Filter | 09/01/02 | Gr. Beta | 0.80 ± 0.10 | 0.87 | 0.76 - 1.36 |

[a] *Results are reported in Bq/L with the following exceptions: Air Filters (Bq/Filter), Soil and Vegetation (Bq/kg).*

[b] The EML result listed is the mean of replicate determinations for each nuclide ± the standard error of the mean.

[c] Control limits are reported by EML as the ratio of Reported Value / EML value.

[d] An error was found in the conversion from pCi/g to Bq/g. Corrected result : 2.84 ± 0.59 Bq/g.

[e] Naturally-occurring radium daughters are present in the shield background, and a probable cause of the higher bias seen for isotopes of lead and bismuth.

[f] Reporting error.The average result of the triplicate analyses was 14.1± 5.7 Bq/kg.

[g] STAP-963, Calculations for the transuranics analyses (Am-241, Uranium, Pu-238, -239/40) were not converted to Bq/total filter. The data listed is the result of recalculation.

# APPENDIX B

# REMP ANNUAL SUMMARY

# TABLE B-1

## SAMPLING AND ANALYSIS FREQUENCY SUMMARY

| Sample Type | Number of Sampling Locations | Collection Frequency | Number of Samples Collected | Type of Analysis | Analysis Frequency | Number of Samples Analyzed* |
|---|---|---|---|---|---|---|
| Air Particulate | 10 | Weekly | 520 | Gross Beta | Weekly | 520 |
| | | | | Gamma Isotopic | Quarterly Composite | 40 |
| Air Iodine | 10 | Weekly | 520 | Iodine$^{131}$ | Weekly | 520 |
| Direct Radiation (TLD) | 54 | Quarterly (continuous) | 216 | Gamma Exposure | Quarterly | 216 |
| Surface Water (Grab) | 1 | Monthly | 12 | Gamma Isotopic | Monthly | 12 |
| | | | | Tritium | Quarterly Composite | 4 |
| | | | | Gross Beta | Monthly | 6[g] |
| Surface Water (Effluent Composite) | 1 | Monthly | 12 | Gamma Isotopic | Monthly | 12 |
| | | | | Gross Beta | Monthly | 6[g] |
| | | | | Gross Alpha | Monthly | 6[j] |
| | | | | Tritium | Quarterly Composite | 4 |
| | | | | Iodine$^{131}$ | Monthly | 12 |

* Number of samples analyzed does not include duplicate analysis, recounts, or reanalysis.

g Analysis for Gross Beta are not required REMP Samples and were suspended in July 2002.

j Analysis for Gross Alpha are not required REMP Samples and were suspended in July 2002.

## TABLE B-1 (continued)

| Sample Type | Number of Sampling Locations | Collection Frequency | Number of Samples Collected | Type of Analysis | Analysis Frequency | Number of Samples Analyzed* |
|---|---|---|---|---|---|---|
| Surface Water (Upstream Composite) | 2 | Monthly | 24 | Gamma Isotopic | Monthly | 24 |
| | | | | Gross Beta | Monthly | 12[g] |
| | | | | Gross Alpha | Monthly | 12[j] |
| | | | | Tritium | Quarterly Composite | 8 |
| Well Water | 2[h] | Quarterly | 12 | Iodine$^{131}$ | Quarterly | 6[i] |
| | | | | Gross Alpha | Quarterly | 6[j] |
| | | | | Gross Beta | Quarterly | 6[g] |
| | | | | Gamma Isotopic | Quarterly | 12 |
| | | | | Tritium | Quarterly | 12 |
| Drinking Water | 1 | Monthly | 12 | Gross Alpha | Monthly | 6[j] |
| | | | | Gross Beta | Monthly | 12 |
| | | | | Gamma Isotopic | Monthly | 12 |
| | | | | Tritium | Quarterly Composite | 4 |

* Number of samples analyzed does not include duplicate analysis, recounts, or reanalysis.

g Analysis for Gross Beta are not required REMP Samples and were suspended in July 2002.

h Samples collected at CL-12 are taken prior to water treatment and after water treatment.

i Analysis for Iodine$^{131}$ is not a required REMP Sample and was suspended in July 2002.

j Analysis for Gross Alpha is not a required REMP Sample and was suspended in July 2002.

## TABLE B-1 (continued)

| Sample Type | Number of Sampling Locations | Collection Frequency | Number of Samples Collected | Type of Analysis | Analysis Frequency | Number of Samples Analyzed* |
|---|---|---|---|---|---|---|
| Shoreline Sediment | 1 | Semi-Annually | 2 | Gross Alpha | Semi-Annually | 2 |
| | | | | Gross Beta | Semi-Annually | 2 |
| | | | | Gamma Isotopic | Semi-Annually | 2 |
| | | | | $Sr^{90}$ | Semi-Annually | 2 |
| Grass | 4 | Monthly / Semi-Monthly[k] | 56 | Gamma Isotopic (including $I^{131}$) | Monthly / Semi-Monthly | 56 |
| Vegetables | 4 | Monthly (during growing season) | 40 | Gross Beta | Monthly | 40 |
| | | | | Gamma Isotopic (including $I^{131}$) | Monthly | 40 |
| Fish | 2 | Semi-Annually | 16 | Gamma Isotopic | Semi-Annually | 16 |
| Milk | 1 | Monthly / Semi-Monthly[k] | 19 | Gamma Isotopic | Monthly / Semi-Monthly | 19 |
| | | | | $Iodine^{131}$ | Monthly / Semi-Monthly | 19 |
| | | | | $Sr^{90}$ | Monthly / Semi-Monthly | 10[l] |

* Number of samples analyzed does not include duplicate analysis, recounts, or reanalysis.

k Samples are collected Monthly from November through April (as delineated within the Station ODCM) and Semi-Monthly May through October.

l Analysis for $Strontium^{90}$ is not a required REMP Sample and was suspended in July 2002.

# TABLE B-2

## RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

**Name of Facility: Clinton Power Station** **Docket No. 50-461**

Location of Facility: **DeWitt, Illinois** Reporting Period: **01 January – 31 December 2002**
(county, state)

| Medium or Pathway Sampled<br>---<br>(Unit of Measurement) | Type of Analysis<br>---<br>Total Number Performed | Lower Limit of Detection (LLD) | All Indicator Locations:<br>---<br>Mean (f)<br>(Range) | Location with Highest Annual Mean<br><br>Name<br>Distance – Direction<br>---<br>Mean (f) - (Range) | Control Locations:<br><br>Mean (f)<br>---<br>(Range) | Number of Non-routine Reported Measurements |
|---|---|---|---|---|---|---|
| Direct Radiation<br>---<br>(mRem/qtr) | Gamma dose<br>---<br>216 | - | 21.3<br>(150/150)<br>---<br>(17.7 – 23.6) | CL-57<br>4.6 miles S<br>---<br>23.6 (3/3)<br>(19.8 – 25.8) | 20.8<br>(12/12)<br>---<br>(19.6 – 21.9) | 0 |

| Medium or Pathway Sampled | Type of Analysis / Total Number Performed | LLD | All Indicator Locations | Location with Highest Annual Mean | Control Locations | Number of Non-routine Reported Measurements |
|---|---|---|---|---|---|---|
| Air Particulates<br>---<br>(pCi/m$^3$) | Gross Beta<br>---<br>520 | - | 0.025<br>(468/468)<br>(.015 - .035)<br>--- | CL-8<br>2.2 miles E<br>---<br>.026 (52/52)<br>(.017 - .033) | 0.026<br>(52/52)<br><br>(0.018 – 0.034)<br>--- | 0 |
| | Gamma Spec<br>---<br>40 | | | | | |
| | $Cs^{134}$ | 0.05 | <0.0009 | - | LLD | 0 |
| | $Cs^{137}$ | 0.06 | <0.0011 | - | LLD | 0 |

| Medium or Pathway Sampled | Type of Analysis / Total Number Performed | LLD | All Indicator Locations | Location with Highest Annual Mean | Control Locations | Number of Non-routine Reported Measurements |
|---|---|---|---|---|---|---|
| Air Iodine<br>---<br>(pCi/m$^3$) | $I^{131}$<br>---<br>520 | 0.07 | <MDA | - | LLD | 0 |

Note: Column explanations are at the end of Table B-2.

## TABLE B-2 (continued)

| Medium or Pathway Sampled<br>------------------<br>(Unit of Measurement) | Type of Analysis<br>---------------<br>Total Number Performed | Lower Limit of Detection (LLD) | All Indicator Locations:<br>-------------<br>Mean (f)<br>(Range) | Location with Highest Annual Mean<br><br>Name<br>Distance – Direction<br>---------------<br>Mean (f) -<br>(Range) | Control Locations:<br><br>Mean (f) -<br>-------------<br>(Range) | Number of Non-routine Reported Measurements |
|---|---|---|---|---|---|---|
| Surface Water Grab (pCi/l) | Gross Beta<br>6 | 4 | 2.6 (0/6)<br>(2.2 – 3.1) | CL-13 3.6 miles SW<br>---------------<br>2.6 (0/6)<br>(2.2 – 3.1) | NA | 0 |
| | Tritium<br>4 | 3,000 | <169 | - | NA | 0 |
| | Gamma Spec<br>12 | | | | | |
| | $Mn^{54}$ | 15.0 | <4.8 | - | NA | 0 |
| | $Fe^{59}$ | 30.0 | <11.6 | - | NA | 0 |
| | $Co^{58}$ | 15.0 | <5.6 | - | NA | 0 |
| | $Co^{60}$ | 15.0 | <5.8 | - | NA | 0 |
| | $Zn^{65}$ | 30.0 | <6.3 | - | NA | 0 |
| | $Nb^{95}$ | 15.0 | <7.1 | - | NA | 0 |
| | $Zr^{95}$ | 30.0 | <12.8 | - | NA | 0 |
| | $Cs^{134}$ | 15.0 | <5.0 | - | NA | 0 |
| | $Cs^{137}$ | 18.0 | <7.1 | - | NA | 0 |
| | $Ba^{140}$ | 60.0 | <47.1 | - | NA | 0 |
| | $La^{140}$ | 15.0 | <9.5 | - | NA | 0 |

Note: Column explanations are at the end of Table B-2.

## TABLE B-2 (continued)

| Medium or Pathway Sampled<br>---<br>(Unit of Measurement) | Type of Analysis<br>---<br>Total Number Performed | Lower Limit of Detection (LLD) | All Indicator Locations:<br>---<br>Mean (f)<br>(Range) | Location with Highest Annual Mean<br><br>Name<br>Distance – Direction<br>---<br>Mean (f) -<br>(Range) | Control Locations:<br><br>Mean (f) -<br>---<br>(Range) | Number of Non-routine Reported Measurements |
|---|---|---|---|---|---|---|
| Surface Water Composite (pCi/l) | Gross Beta<br>18 | 4 | 2.8 (2/18)<br>(1.4 – 9.3) | CL-90 0.4 Miles ESE<br>---<br>4.1 (2/6)<br>(1.8 – 9.3) | NA | 0 |
| | Tritium<br>12 | 3,000 | <169 | - | NA | 0 |
| | $I^{131}$<br>12 | 15.0 | <0.5 | - | NA | 0 |
| | Gamma Spec<br>36 | | | | | |
| | $Mn^{54}$ | 15.0 | <5.2 | - | NA | 0 |
| | $Fe^{59}$ | 30.0 | <10.6 | - | NA | 0 |
| | $Co^{58}$ | 15.0 | <6.0 | - | NA | 0 |
| | $Co^{60}$ | 15.0 | <6.1 | - | NA | 0 |
| | $Zn^{65}$ | 30.0 | <9.9 | - | NA | 0 |
| | $Nb^{95}$ | 15.0 | <6.9 | - | NA | 0 |
| | $Zr^{95}$ | 30.0 | <12.6 | - | NA | 0 |
| | $Cs^{134}$ | 15.0 | <6.2 | - | NA | 0 |
| | $Cs^{137}$ | 18.0 | <6.0 | - | NA | 0 |
| | $Ba^{140}$ | 60.0 | <46.9 | - | NA | 0 |
| | $La^{140}$ | 15.0 | <13.0 | - | NA | 0 |

Note: Column explanations are at the end of Table B-2.

**TABLE B-2 (continued)**

| Medium or Pathway Sampled<br>---<br>(Unit of Measurement) | Type of Analysis<br>---<br>Total Number Performed | Lower Limit of Detection (LLD) | All Indicator Locations:<br>---<br>Mean (f)<br>(Range) | Location with Highest Annual Mean<br>Name<br>Distance – Direction<br>---<br>Mean (f) -<br>(Range) | Control Locations:<br>Mean (f) -<br>---<br>(Range) | Number of Non-routine Reported Measurements |
|---|---|---|---|---|---|---|
| Drinking Water (pCi/l) | Gross Beta<br>12 | 4 | 1.2 (0/12)<br>(0.8 – 2.0) | CL-14<br>0 Miles<br>---<br>1.2 (0/12)<br>(0.8 – 2.0) | NA | 0 |
| | Tritium<br>4 | 3,000 | <169 | - | NA | 0 |
| | Gamma Spec<br>12 | | | | | |
| | $Mn^{54}$ | 15.0 | <6.8 | - | NA | 0 |
| | $Fe^{59}$ | 30.0 | <8.2 | - | NA | 0 |
| | $Co^{58}$ | 15.0 | <6.1 | - | NA | 0 |
| | $Co^{60}$ | 15.0 | <6.4 | - | NA | 0 |
| | $Zn^{65}$ | 30.0 | <5.8 | - | NA | 0 |
| | $Nb^{95}$ | 15.0 | <6.2 | - | NA | 0 |
| | $Zr^{95}$ | 30.0 | <14.0 | - | NA | 0 |
| | $Cs^{134}$ | 15.0 | <6.8 | - | NA | 0 |
| | $Cs^{137}$ | 18.0 | <6.7 | - | NA | 0 |
| | $Ba^{140}$ | 60.0 | <44.6 | - | NA | 0 |
| | $La^{140}$ | 15.0 | <11.6 | - | NA | 0 |

Note: Column explanations are at the end of Table B-2.

## TABLE B-2 (continued)

| Medium or Pathway Sampled<br>---<br>(Unit of Measurement) | Type of Analysis<br>---<br>Total Number Performed | Lower Limit of Detection (LLD) | All Indicator Locations:<br>---<br>Mean (f)<br>(Range) | Location with Highest Annual Mean<br><br>Name<br>Distance – Direction<br>---<br>Mean (f) -<br>(Range) | Control Locations:<br><br>Mean (f) -<br>---<br>(Range) | Number of Non-routine Reported Measurements |
|---|---|---|---|---|---|---|
| Well Water (pCi/l) | Gross Beta<br>6 | 3.4 | 2.4 (0/6)<br>(1.2 – 3.4) | CL-12(U)<br>1.6 Miles E<br>---<br>2.7 (0/2)<br>(2.0 – 3.4) | NA | 0 |
| | $I^{131}$<br>6 | 15.0 | <0.5 | - | NA | 0 |
| | Tritium<br>12 | 3,000 | <162 | - | NA | 0 |
| | Gamma Spec<br>12 | | | | | |
| | $Mn^{54}$ | 15.0 | <5.2 | - | NA | 0 |
| | $Fe^{59}$ | 30.0 | <13.4 | - | NA | 0 |
| | $Co^{58}$ | 15.0 | <5.4 | - | NA | 0 |
| | $Co^{60}$ | 15.0 | <5.8 | - | NA | 0 |
| | $Zn^{65}$ | 30.0 | <5.1 | - | NA | 0 |
| | $Nb^{95}$ | 15.0 | <4.5 | - | NA | 0 |
| | $Zr^{95}$ | 30.0 | <14.8 | - | NA | 0 |
| | $Cs^{134}$ | 15.0 | <4.4 | - | NA | 0 |
| | $Cs^{137}$ | 18.0 | <4.1 | - | NA | 0 |
| | $Ba^{140}$ | 60.0 | <53.1 | - | NA | 0 |
| | $La^{140}$ | 15.0 | <11.7 | - | NA | 0 |

(U) Untreated well water sample

Note: Column explanations are at the end of Table B-2.

## TABLE B-2 (continued)

| Medium or Pathway Sampled<br>(Unit of Measurement) | Type of Analysis<br>Total Number Performed | Lower Limit of Detection (LLD) | All Indicator Locations:<br>Mean (f)<br>(Range) | Location with Highest Annual Mean<br>Name<br>Distance – Direction<br>Mean (f) -<br>(Range) | Control Locations:<br>Mean (f) -<br>(Range) | Number of Non-routine Reported Measurements |
|---|---|---|---|---|---|---|
| Milk (pCi/l) | $I^{131}$<br>19 | 1.0 | <0.5 | - | NA | 0 |
| | Gamma Spec<br>19 | | | | | |
| | $Cs^{134}$ | 15.0 | <7.8 | - | NA | 0 |
| | $Cs^{137}$ | 18.0 | <7.8 | - | NA | 0 |
| | $Ba^{140}$ | 60.0 | <31.5 | - | NA | 0 |
| | $La^{140}$ | 15.0 | <6.2 | - | NA | 0 |
| Fish (pCi/g wet) | Gamma Spec<br>16 | | | | | |
| | $Mn^{54}$ | 130 | <0.014 | - | NA | 0 |
| | $Fe^{59}$ | 260 | <0.036 | - | NA | 0 |
| | $Co^{58}$ | 130 | <0.012 | - | NA | 0 |
| | $Co^{60}$ | 130 | <0.015 | - | NA | 0 |
| | $Zn^{65}$ | 260 | <0.033 | - | NA | 0 |
| | $Cs^{134}$ | 130 | <0.019 | - | NA | 0 |
| | $Cs^{137}$ | 150 | <0.014 | - | NA | 0 |
| Shoreline Sediments (pCi/g dry) | Gamma Spec<br>2 | | | | | |
| | $Cs^{134}$ | 150 | <0.017 | - | NA | 0 |
| | $Cs^{137}$ | 180 | <0.013 | - | NA | 0 |

Note: Column explanations at the end of Table B-2.

## TABLE B-2 (continued)

| Medium or Pathway Sampled<br>---<br>(Unit of Measurement) | Type of Analysis<br>---<br>Total Number Performed | Lower Limit of Detection (LLD) | All Indicator Locations:<br>---<br>Mean (f) (Range) | Location with Highest Annual Mean<br>Name Distance – Direction<br>---<br>Mean (f) - (Range) | Control Locations:<br>Mean (f) -<br>---<br>(Range) | Number of Non-routine Reported Measurements |
|---|---|---|---|---|---|---|
| Vegetables (pCi/g wet) | Gamma Spec 40 | | | | | |
| | $I^{131}$ | 60.0 | <0.048 | - | NA | 0 |
| | $Cs^{134}$ | 60.0 | <0.025 | - | NA | 0 |
| | $Cs^{137}$ | 80.0 | <0.029 | - | NA | 0 |
| Grass (pCi/g wet) | Gamma Spec 56 | | | | | |
| | $I^{131}$ | 60.0 | 0.055 | - | NA | 0 |
| | $Cs^{134}$ | 60.0 | 0.044 | - | NA | 0 |
| | $Cs^{137}$ | 80.0 | 0.008 | - | NA | 0 |

Note: Column explanations at the end of Table B-2.

## TABLE B-2 (continued)

| Medium or Pathway Sampled<br>------------------<br>(Unit of Measurement) | Type of Analysis<br>-------------<br>Total Number Performed | Lower Limit of Detection (LLD) | All Indicator Locations:<br>-------------<br>Mean (f)<br>(Range) | Location with Highest Annual Mean<br><br>Name<br>Distance – Direction<br>-------------<br>Mean (f) -<br>(Range) | Control Locations:<br><br>Mean (f) -<br>-----------<br>(Range) | Number of Non-routine Reported Measurements |
|---|---|---|---|---|---|---|
| Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 |

## TABLE EXPLANATIONS:

**Column 1:** The Unit of Measurement describes all the numerical values for LLD, Mean and Range reported for a particular sample medium. For example: the Gross Beta LLD in AIR PARTICULATES is 0.010 pCi/$m^3$. Abbreviations used are: pCi/$m^3$ = pico-curie per cubic meter of sampled air; mRem/quarter = exposure measured for calendar quarter period; pCi/l = pico-curie per liter of sample; pCi/g = pico-curie per gram of sample.

**Column 2:** The Types of Analyses are described as follows: Gamma Spec = measurement of each radioisotope in a sample using Gamma Spectroscopy; Gross Betas and Gross Alphas = measurement of the radioactivity in a sample by measurement of emitted betas and alphas - no determination of individual radioisotopes is possible; Tritium = measurement of tritium ($H^3$) in sample by liquid scintillation counting method; TLD = direct measurement of gamma exposure using thermoluminescent dosimeters. Total number of analyses does not include duplicate analyses, recounts, or reanalysis. Only ODCM required LLDs and detectable activity (excluding some naturally occurring activity such as $Bi^{212}$) results are reported in this table. All sample results can be found in Appendix E of this report.

**Column 3:** The ODCM required LLD is given when applicable. LLD reported is the highest of those reported for each of the analyses during the year; if all analyses reported positive values, no LLD is reported. It should be noted that - in most cases - the CPS REMP uses lower detection limits than required.

## TABLE B-2 (continued)

| Medium or Pathway Sampled<br>------------------<br>(Unit of Measurement) | Type of Analysis<br>-------------<br>Total Number Performed | Lower Limit of Detection (LLD) | All Indicator Locations:<br>-------------<br>Mean (f)<br>(Range) | Location with Highest Annual Mean<br><br>Name<br>Distance – Direction<br>---------------<br>Mean (f) -<br>(Range) | Control Locations:<br><br>Mean (f) -<br>-------------<br>(Range) | Number of Non-routine Reported Measurements |
|---|---|---|---|---|---|---|
| Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 | Column 7 |

### TABLE EXPLANATIONS (continued):

**Column 4:** Samples taken at Indicator Locations during an operational Radiological Environmental Monitoring Program (REMP) reliably measure the quantities of any radioisotopes cycling through the pathways to man from a nuclear station. The reported values are the mean or average for the year of all samples of that type which had values greater than the LLD. (f) is the fraction of all the samples taken at all indicator locations for the medium, which reported values greater than the LLD. Example: Seven (7) results greater than LLD out of fifteen (15) samples taken would be reported as 7/15. The Range is the values of the lowest to highest sample results greater than LLD reported at all the indictor locations for that medium.

**Column 5:** The Mean, f-fraction and Range along with the name of the location, distance from the CPS gaseous effluent stack in miles, and the letter name corresponding to the compass sector in the direction of the sample location from the CPS HVAC gaseous effluent stack. The location with the highest annual mean is compared to both Indicator and Control Locations of the medium samples.

**Column 6:** Control locations are sited in areas with low relative deposition and / or dispersion factors. Sample results are used as reference for the control location.

**Column 7:** NRC Regulations [Branch Technical Position, Revision. 1, November 1979] include a table of radioisotope concentrations that, if exceeded by confirmed sample measurements, indicate that a Non-routine Reported Measurement exists. Such measurements require further investigation to validate the source.

# APPENDIX C

## Glossary

**Activation** - the process in which stable atoms become radioactive atoms by absorbing neutrons.

**ALARA** - acronym for "As Low As Reasonably Achievable" which applies to many facets of nuclear power (i.e., radiation exposure for personnel kept low, minimizes number / activity of effluent releases).

**Alpha particle** - a charged particle emitted from the nucleus of an atom having a mass and charge equal in magnitude to a helium nucleus which has two protons and two neutrons.

**Atom** - the smallest component of an element having all the properties of that element. Comprised of protons, neutrons and electrons such that the number of protons determines the element.

**Background radiation** - source of radiation that mankind has no control over, such as cosmic (from the sun) and terrestrial (naturally occurring radioactive elements).

**Beta particle** - a charged particle equivalent to an electron if negative or a positron if positive, originating near the nucleus of an atom during radioactive decay or fission.

**Control Location** - a sample collection location considered to be far enough away from the Clinton Power Station so as not to be influenced by station operations.

**Cosmic radiation** - penetrating ionizing radiation originating from the sun and from outer space varying from altitude and latitude.

**Curie (Ci)** - the unit of radioactivity equal to 2.2 trillion disintegrations per minute.

**Dead water** - water that contains no tritium.

**Dose** - a quantity (total or accumulated) of ionizing radiation received.

**Dose equivalent** - a quantity used in radiation protection that expresses all radiations on a common scale for calculating the effective absorbed dose (the unit of dose equivalent is the rem).

**Ecology** - a branch of biology dealing with the relations between organisms and their environment.

**Electromagnetic radiation** - a traveling wave motion resulting from changing electric or magnetic fields. Familiar sources of electromagnetic radiation range from x-rays (and gamma rays) of short wavelength, through the ultraviolet, visible and infrared regions, to radar and radio waves of relatively long wavelength. All electromagnetic radiation travels in a vacuum at the speed of light.

**Element** - one of 103 known chemical substances that cannot be broken down further without changing its chemical properties.

**Environment** - the aggregate of surrounding things, conditions, or influences.

**Exposure** - a measure of the ionization produced in air by x-ray or gamma radiation. Acute exposure is generally accepted to be a large exposure received over a short period of time. Chronic exposure is exposure received over a long period of time.

**Fission** - process by which an atomic nucleus splits into two smaller nuclei and releases neutrons and energy.

**Fission products** - the nuclei formed as part of the fissioning of an atomic nucleus.

**Gamma rays** - high energy, short wavelength electromagnetic radiation emitted from the nucleus.

**Half-life** - the time required for half of a given amount of a radionuclide to decay.

**Indicator Location** - a sample collection strategically placed to monitor dose rate or radioactive material that may be the result of Clinton Power Station operations.

**Ionization** - the process by which a neutral atom or molecule acquires a positive or negative charge.

**Irradiation** - exposure to radiation.

**Lower Limit of Detection (LLD)** - the smallest amount of sample activity that will give a net count for which there is a confidence at a predetermined level that the activity is actually present.

**Microcurie (μCi)** - one millionth of a curie and represents 2.2 million decays per minute.

**Neutron** - one of the three basic parts of an atom, which has no charge and is normally, found in the nucleus (center) of an atom.

**Nucleus** - the center of an atom containing protons and neutrons; determines the atomic weight and contributes to the net positive charge of an atom. Nuclei (plural).

**Nuclides** - atoms which all have the same atomic number and mass number.

**Periphyton** - water plant life (i.e., algae).

**Radiation** - the process by which energy is emitted from a nucleus as particles (alpha, beta, and neutron) or waves (gamma).

**Radionuclide** - a radioactive species of an atom characterized by the constitution of its nucleus. The number of protons, number of neutrons, and energy content specify the nuclear constitution.

**Rem** - the unit of dose of any ionizing radiation that produces the same biological effects as a unit of absorbed dose of ordinary x-rays. Acronym for Roentgen Equivalent Man.

**Roentgen** - a measure of ionization produced in air by x-ray or gamma radiation.

**Site boundary** - the site boundary is the line beyond which the land is neither owned, nor leased, nor otherwise controlled by the licensee.

**Statistics** - the science that deals with the collection, classification, analysis and interpretation of numerical data by use of mathematical theories of probabilities.

**Target tissue** - any tissue or organ of the body in which radiation is absorbed.

**Terrestrial radiation** - source of radiation pertaining to the ground (Earth's crust).

**X-rays** - high energy, short wavelength electromagnetic radiation, emitted from the electron shells of an atom.

## APPENDIX D

### Exceptions to the REMP During 2002

Data from the radiological analysis of environmental samples are routinely reviewed and evaluated by the ODCM Program Owner at the Clinton Power Station (CPS). This data is checked for LLD compliance, anomalous values, quality control sample agreement, and any positive results which are inconsistent with expected results - or - which exceed any Offsite Dose Calculation Manual (ODCM) reporting levels. Reporting levels for radioactivity concentrations from environmental samples are required by the Station's ODCM and are listed in Table 3-A of this report.

If an inconsistent result occurs, an investigation is initiated which may consist of one, some, or all of the following actions:

- Examine the collection data sheets for any indication of collection or delivery errors, tampering, vandalism, equipment calibration or any malfunction[s] as a result of electrical power failure[s], weather conditions, blown fuses, etc.
- Perform statistical tests
- Examine previous data for trends
- Review other results from same sample media and different sample media
- Review control station data
- Review quality control or duplicate sample data
- Review CPS Radiological Effluent Release Reports
- If possible, recount and / or reanalyze the sample
- Collect additional follow-up samples as warranted

During 2002, no investigations were performed as a result of reaching any ODCM reporting levels. All sample analysis required by the ODCM achieved the LLDs specified by the Station's ODCM (refer to Table 3-B of this report). Sampling and analysis exceptions are listed in this appendix.

## SAMPLING AND ANALYSIS EXCEPTIONS FOR 2002

The exceptions described below are those that are considered 'deviations' from the Radiological Environmental Monitoring Program as required by the Station's ODCM. By definition, 'deviations' *are* permitted as delineated within NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," October 1978, and within Radiological Assessment Brach Technical Position, Revision 1, November 1979 which states.... "Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons".... The below section addresses the reporting requirements found within Section 7.1 of the Station's ODCM.

[1] 21 June 2002

- As a result of an unusual and excessively wet spring [17.1 inches of rain vice a typical area average of 12.4 inches of rain], the planting and subsequent growing of our Broadleaf Vegetables had not yet matured for our first harvest occurring in June. As such, Broadleaf Vegetables were not sampled from ODCM Gardens CL-115 and CL-118.

[2] 24 September 2002

- During the last 'end of the year' harvesting of Broadleaf Vegetables, of the three (3) different varieties that are required, we were unable to collect a minimum of two (2) pounds from this third type; lettuce. As previously illustrated in [1] above regarding the unusually wet spring that challenged our planting, any remaining lettuce was found to be either rotten or consumed by wildlife. As such, the remaining lettuce that was collected, did not satisfy the minimum two (2) pound criteria limitation from Gardens CL-115 and CL-118.

[3] 11 November 2002

- Although our 3rd Quarter Environmental ODCM REMP TLDs were properly installed and removed after the required monitoring period for processing, our vendor reported 'abnormally high readings'. Subsequent investigations revealed that prior to placing ODCM REMP TLDs out into the environment, Clinton's 3rd Quarter ODCM REMP, Occupational and Area TLDs were irradiated from an adjacent source during air transportation from California to Illinois. As such, Clinton's 3rd Quarter ODCM REMP TLD results were influenced from an external source – in addition to their quarterly environmental exposure – thus resulting in inconsistent readings.

## APPENDIX E

## CPS Radiological Environmental Monitoring Results

## During 2002

## GROSS BETA ACTIVITY IN AIR PARTICULATES FOR 2002

(pCi/m$^3$)

| DATE COLLECTED | CL-1 | CL-2 | CL-3 | CL-4 | CL-6 |
|---|---|---|---|---|---|
| 09-Jan-02 | 0.040 ± 0.005 | 0.044 ± 0.005 | 0.040 ± 0.004 | 0.044 ± 0.005 | 0.042 ± 0.005 |
| 16-Jan-02 | 0.030 ± 0.004 | 0.026 ± 0.004 | 0.021 ± 0.004 | 0.027 ± 0.004 | 0.026 ± 0.004 |
| 23-Jan-02 | 0.029 ± 0.004 | 0.032 ± 0.004 | 0.034 ± 0.004 | 0.030 ± 0.004 | 0.029 ± 0.004 |
| 30-Jan-02 | 0.028 ± 0.004 | 0.037 ± 0.003 | 0.034 ± 0.004 | 0.035 ± 0.004 | 0.030 ± 0.004 |
| 06-Feb-02 | 0.027 ± 0.004 | 0.028 ± 0.004 | 0.026 ± 0.003 | 0.025 ± 0.004 | 0.026 ± 0.003 |
| 13-Feb-02 | 0.026 ± 0.003 | 0.027 ± 0.003 | 0.028 ± 0.004 | 0.028 ± 0.003 | 0.023 ± 0.003 |
| 20-Feb-02 | 0.019 ± 0.004 | 0.020 ± 0.004 | 0.020 ± 0.004 | 0.015 ± 0.003 | 0.019 ± 0.004 |
| 27-Feb-02 | 0.018 ± 0.003 | 0.018 ± 0.003 | 0.016 ± 0.003 | 0.018 ± 0.003 | 0.018 ± 0.003 |
| 06-Mar-02 | 0.029 ± 0.004 | 0.031 ± 0.004 | 0.026 ± 0.004 | 0.027 ± 0.004 | 0.028 ± 0.004 |
| 13-Mar-02 | 0.025 ± 0.004 | 0.030 ± 0.004 | 0.027 ± 0.004 | 0.031 ± 0.004 | 0.030 ± 0.004 |
| 20-Mar-02 | 0.015 ± 0.004 | 0.015 ± 0.004 | 0.013 ± 0.004 | 0.014 ± 0.004 | 0.015 ± 0.004 |
| 27-Mar-02 | 0.024 ± 0.003 | 0.027 ± 0.004 | 0.022 ± 0.003 | 0.025 ± 0.004 | 0.025 ± 0.004 |
| 03-Apr-02 | 0.023 ± 0.004 | 0.018 ± 0.003 | 0.019 ± 0.004 | 0.020 ± 0.003 | 0.021 ± 0.004 |
| 10-Apr-02 | 0.023 ± 0.004 | 0.025 ± 0.004 | 0.023 ± 0.004 | 0.023 ± 0.004 | 0.023 ± 0.004 |
| 17-Apr-02 | 0.022 ± 0.003 | 0.026 ± 0.004 | 0.023 ± 0.004 | 0.026 ± 0.004 | 0.022 ± 0.003 |
| 24-Apr-02 | 0.013 ± 0.003 | 0.017 ± 0.003 | 0.020 ± 0.003 | 0.018 ± 0.003 | 0.015 ± 0.003 |
| 01-May-02 | 0.015 ± 0.003 | 0.018 ± 0.003 | 0.017 ± 0.003 | 0.015 ± 0.003 | 0.015 ± 0.003 |
| 08-May-02 | 0.019 ± 0.003 | 0.019 ± 0.003 | 0.020 ± 0.003 | 0.020 ± 0.003 | 0.021 ± 0.003 |
| 15-May-02 | 0.016 ± 0.003 | 0.023 ± 0.004 | 0.017 ± 0.003 | 0.015 ± 0.003 | 0.018 ± 0.003 |
| 22-May-02 | 0.014 ± 0.003 | 0.012 ± 0.003 | 0.014 ± 0.003 | 0.013 ± 0.003 | 0.013 ± 0.003 |
| 29-May-02 | 0.018 ± 0.003 | 0.017 ± 0.003 | 0.017 ± 0.003 | 0.016 ± 0.003 | 0.017 ± 0.003 |
| 05-Jun-02 | 0.027 ± 0.003 | 0.022 ± 0.003 | 0.026 ± 0.003 | 0.026 ± 0.003 | 0.024 ± 0.004 |
| 12-Jun-02 | 0.015 ± 0.003 | 0.018 ± 0.004 | 0.017 ± 0.004 | 0.014 ± 0.003 | 0.015 ± 0.003 |
| 19-Jun-02 | 0.019 ± 0.004 | 0.020 ± 0.004 | 0.017 ± 0.004 | 0.018 ± 0.003 | 0.015 ± 0.003 |
| 26-Jun-02 | 0.026 ± 0.003 | 0.024 ± 0.003 | 0.023 ± 0.003 | 0.028 ± 0.004 | 0.022 ± 0.003 |
| 02-Jul-02 | 0.019 ± 0.004 | 0.025 ± 0.004 | 0.023 ± 0.004 | 0.025 ± 0.004 | 0.023 ± 0.004 |
| 10-Jul-02 | 0.029 ± 0.003 | 0.029 ± 0.003 | 0.033 ± 0.003 | 0.030 ± 0.003 | 0.032 ± 0.003 |
| 17-Jul-02 | 0.030 ± 0.004 | 0.028 ± 0.004 | 0.034 ± 0.004 | 0.024 ± 0.004 | 0.030 ± 0.004 |
| 24-Jul-02 | 0.024 ± 0.003 | 0.022 ± 0.003 | 0.025 ± 0.003 | 0.021 ± 0.003 | 0.025 ± 0.003 |
| 31-Jul-02 | 0.019 ± 0.004 | 0.022 ± 0.004 | 0.022 ± 0.004 | 0.023 ± 0.004 | 0.025 ± 0.004 |
| 07-Aug-02 | 0.023 ± 0.004 | 0.026 ± 0.004 | 0.027 ± 0.004 | 0.026 ± 0.004 | 0.029 ± 0.004 |
| 14-Aug-02 | 0.020 ± 0.003 | 0.023 ± 0.003 | 0.025 ± 0.003 | 0.022 ± 0.003 | 0.023 ± 0.003 |
| 21-Aug-02 | 0.016 ± 0.003 | 0.015 ± 0.003 | 0.014 ± 0.003 | 0.017 ± 0.003 | 0.015 ± 0.003 |
| 28-Aug-02 | 0.022 ± 0.004 | 0.024 + 0.004 | 0.027 ± 0.004 | 0.020 ± 0.004 | 0.024 ± 0.004 |
| 04-Sep-02 | 0.028 ± 0.004 | 0.026 ± 0.004 | 0.027 ± 0.004 | 0.024 ± 0.004 | 0.026 ± 0.004 |
| 11-Sep-02 | 0.033 ± 0.004 | 0.038 + 0.004 | 0.035 ± 0.004 | 0.032 ± 0.004 | 0.037 ± 0.004 |
| 18-Sep-02 | 0.032 ± 0.004 | 0.031 + 0.004 | 0.026 ± 0.004 | 0.026 ± 0.004 | 0.035 ± 0.004 |
| 25-Sep-02 | 0.017 ± 0.003 | 0.013 ± 0.003 | 0.018 ± 0.003 | 0.016 ± 0.003 | 0.017 ± 0.003 |
| 02-Oct-02 | 0.041 ± 0.005 | 0.041 ± 0.005 | 0.044 ± 0.005 | 0.034 ± 0.004 | 0.041 ± 0.005 |
| 09-Oct-02 | 0.023 ± 0.003 | 0.022 ± 0.003 | 0.025 ± 0.004 | 0.023 ± 0.003 | 0.023 ± 0.003 |
| 16-Oct-02 | 0.034 ± 0.004 | 0.033 ± 0.004 | 0.039 ± 0.004 | 0.030 ± 0.004 | 0.033 ± 0.004 |
| 23-Oct-02 | 0.026 ± 0.003 | 0.025 ± 0.003 | 0.027 ± 0.003 | 0.024 ± 0.003 | 0.026 ± 0.003 |
| 30-Oct-02 | 0.026 ± 0.004 | 0.026 + 0.004 | 0.021 ± 0.004 | 0.023 ± 0.004 | 0.026 ± 0.004 |
| 06-Nov-02 | 0.028 ± 0.004 | 0.035 ± 0.004 | 0.034 ± 0.004 | 0.033 ± 0.004 | 0.032 ± 0.004 |
| 13-Nov-02 | 0.042 ± 0.004 | 0.042 ± 0.004 | 0.050 ± 0.004 | 0.049 ± 0.005 | 0.045 ± 0.004 |
| 20-Nov-02 | 0.021 ± 0.004 | 0.023 + 0.004 | 0.023 ± 0.004 | 0.022 ± 0.004 | 0.022 ± 0.004 |
| 26-Nov-02 | 0.018 ± 0.004 | 0.016 + 0.004 | 0.020 ± 0.004 | 0.019 ± 0.004 | 0.017 ± 0.004 |
| 04-Dec-02 | 0.024 ± 0.003 | 0.025 ± 0.003 | 0.027 ± 0.003 | 0.024 ± 0.003 | 0.025 ± 0.003 |
| 11-Dec-02 | 0.037 ± 0.005 | 0.037 ± 0.005 | 0.036 ± 0.005 | 0.035 ± 0.004 | 0.033 ± 0.004 |
| 18-Dec-02 | 0.039 ± 0.004 | 0.041 ± 0.004 | 0.040 ± 0.004 | 0.042 ± 0.004 | 0.037 ± 0.004 |
| 26-Dec-02 | 0.020 ± 0.003 | 0.025 ± 0.004 | 0.025 ± 0.004 | 0.019 ± 0.003 | 0.022 ± 0.003 |
| 02-Jan-03 | 0.036 ± 0.004 | 0.039 ± 0.004 | 0.037 ± 0.004 | 0.033 ± 0.004 | 0.035 ± 0.004 |

## GROSS BETA ACTIVITY IN AIR PARTICULATES FOR 2002 (continued)

| DATE COLLECTED | CL-7 | CL-8 | CL-11* | CL-15 | CL-94 |
|---|---|---|---|---|---|
| 09-Jan-02 | 0.046 ± 0.005 | 0.039 ± 0.004 | 0.040 ± 0.005 | 0.039 ± 0.004 | 0.035 ± 0.004 |
| 16-Jan-02 | 0.021 ± 0.004 | 0.024 ± 0.004 | 0.024 ± 0.004 | 0.025 ± 0.004 | 0.021 ± 0.004 |
| 23-Jan-02 | 0.033 ± 0.004 | 0.027 ± 0.004 | 0.032 ± 0.004 | 0.032 ± 0.004 | 0.031 ± 0.004 |
| 30-Jan-02 | 0.034 ± 0.004 | 0.034 ± 0.004 | 0.032 ± 0.004 | 0.033 ± 0.004 | 0.032 ± 0.004 |
| 06-Feb-02 | 0.030 ± 0.004 | 0.027 ± 0.003 | 0.029 ± 0.004 | 0.024 ± 0.003 | 0.026 ± 0.003 |
| 13-Feb-02 | 0.027 ± 0.003 | 0.028 ± 0.004 | 0.026 ± 0.003 | 0.028 ± 0.003 | 0.028 ± 0.004 |
| 20-Feb-02 | 0.017 ± 0.004 | 0.017 ± 0.003 | 0.015 ± 0.004 | 0.019 ± 0.004 | 0.017 ± 0.004 |
| 27-Feb-02 | 0.019 ± 0.003 | 0.018 ± 0.003 | 0.016 ± 0.003 | 0.013 ± 0.003 | 0.019 ± 0.003 |
| 06-Mar-02 | 0.029 ± 0.004 | 0.029 ± 0.004 | 0.023 ± 0.004 | 0.025 ± 0.004 | 0.026 ± 0.004 |
| 13-Mar-02 | 0.030 ± 0.004 | 0.028 ± 0.004 | 0.028 ± 0.004 | 0.026 ± 0.004 | 0.026 ± 0.004 |
| 20-Mar-02 | 0.018 ± 0.004 | 0.020 ± 0.004 | 0.012 ± 0.004 | 0.015 ± 0.004 | 0.017 ± 0.004 |
| 27-Mar-02 | 0.029 ± 0.004 | 0.028 ± 0.004 | 0.027 ± 0.003 | 0.024 ± 0.004 | 0.025 ± 0.004 |
| 03-Apr-02 | 0.022 ± 0.003 | 0.022 ± 0.004 | 0.022 ± 0.004 | 0.018 ± 0.003 | 0.023 ± 0.004 |
| 10-Apr-02 | 0.024 ± 0.004 | 0.021 ± 0.004 | 0.020 ± 0.004 | 0.018 ± 0.004 | 0.024 ± 0.004 |
| 17-Apr-02 | 0.023 ± 0.003 | 0.021 ± 0.003 | 0.023 ± 0.004 | 0.024 ± 0.004 | 0.027 ± 0.004 |
| 24-Apr-02 | 0.014 ± 0.003 | 0.017 ± 0.003 | 0.013 ± 0.003 | 0.018 ± 0.003 | 0.017 ± 0.003 |
| 01-May-02 | 0.017 ± 0.003 | 0.019 ± 0.003 | 0.017 ± 0.003 | 0.018 ± 0.003 | 0.017 ± 0.003 |
| 08-May-02 | 0.020 ± 0.003 | 0.019 ± 0.003 | 0.022 ± 0.003 | 0.016 ± 0.003 | 0.019 ± 0.003 |
| 15-May-02 | 0.019 ± 0.003 | 0.018 ± 0.004 | 0.018 ± 0.003 | 0.019 ± 0.004 | 0.017 ± 0.003 |
| 22-May-02 | 0.013 ± 0.003 | 0.014 ± 0.003 | 0.014 ± 0.003 | 0.011 ± 0.003 | 0.012 ± 0.003 |
| 29-May-02 | 0.017 ± 0.003 | 0.015 ± 0.003 | 0.019 ± 0.003 | 0.015 ± 0.003 | 0.016 ± 0.003 |
| 05-Jun-02 | 0.027 ± 0.004 | 0.025 ± 0.003 | 0.024 ± 0.003 | 0.024 ± 0.004 | 0.024 ± 0.003 |
| 12-Jun-02 | 0.015 ± 0.003 | 0.019 ± 0.004 | 0.017 ± 0.004 | 0.018 ± 0.003 | 0.018 ± 0.004 |
| 19-Jun-02 | 0.015 ± 0.003 | 0.015 ± 0.003 | 0.018 ± 0.003 | 0.016 ± 0.003 | 0.016 ± 0.003 |
| 26-Jun-02 | 0.023 ± 0.003 | 0.026 ± 0.003 | 0.026 ± 0.003 | 0.023 ± 0.003 | 0.023 ± 0.003 |
| 02-Jul-02 | 0.021 ± 0.004 | 0.024 ± 0.004 | 0.029 ± 0.004 | 0.024 ± 0.004 | 0.026 ± 0.004 |
| 10-Jul-02 | 0.030 ± 0.003 | 0.034 ± 0.003 | 0.031 ± 0.003 | 0.030 ± 0.003 | 0.030 ± 0.003 |
| 17-Jul-02 | 0.021 ± 0.004 | 0.037 ± 0.004 | 0.041 ± 0.005 | 0.028 ± 0.004 | 0.035 ± 0.004 |
| 24-Jul-02 | 0.021 ± 0.003 | 0.025 ± 0.003 | 0.026 ± 0.003 | 0.024 ± 0.003 | 0.024 ± 0.003 |
| 31-Jul-02 | 0.022 ± 0.004 | 0.023 ± 0.004 | 0.022 ± 0.004 | 0.024 ± 0.004 | 0.023 ± 0.004 |
| 07-Aug-02 | 0.028 ± 0.004 | 0.028 ± 0.004 | 0.028 ± 0.004 | 0.024 ± 0.004 | 0.027 ± 0.004 |
| 14-Aug-02 | 0.024 ± 0.003 | 0.025 ± 0.003 | 0.025 ± 0.003 | 0.023 ± 0.003 | 0.024 ± 0.003 |
| 21-Aug-02 | 0.018 ± 0.003 | 0.012 ± 0.003 | 0.013 ± 0.003 | 0.014 ± 0.003 | 0.015 ± 0.003 |
| 28-Aug-02 | 0.020 ± 0.004 | 0.020 ± 0.004 | 0.023 ± 0.004 | 0.018 ± 0.004 | 0.023 ± 0.004 |
| 04-Sep-02 | 0.022 ± 0.004 | 0.029 ± 0.004 | 0.028 ± 0.004 | 0.024 ± 0.004 | 0.027 ± 0.004 |
| 11-Sep-02 | 0.028 ± 0.004 | 0.035 ± 0.004 | 0.032 ± 0.004 | 0.034 ± 0.004 | 0.034 ± 0.004 |
| 18-Sep-02 | 0.026 ± 0.004 | 0.033 ± 0.004 | 0.033 ± 0.004 | 0.033 ± 0.004 | 0.029 ± 0.004 |
| 25-Sep-02 | 0.013 ± 0.003 | 0.016 ± 0.003 | 0.020 ± 0.003 | 0.016 ± 0.003 | 0.015 ± 0.003 |
| 02-Oct-02 | 0.034 ± 0.004 | 0.042 ± 0.005 | 0.043 ± 0.005 | 0.040 ± 0.004 | 0.036 ± 0.004 |
| 09-Oct-02 | 0.024 ± 0.003 | 0.025 ± 0.003 | 0.028 ± 0.004 | 0.024 ± 0.003 | 0.024 ± 0.003 |
| 16-Oct-02 | 0.028 ± 0.004 | 0.036 ± 0.004 | 0.041 ± 0.004 | 0.034 ± 0.004 | 0.033 ± 0.004 |
| 23-Oct-02 | 0.024 ± 0.003 | 0.029 ± 0.003 | 0.026 ± 0.003 | 0.023 ± 0.003 | 0.025 ± 0.003 |
| 30-Oct-02 | 0.025 ± 0.004 | 0.027 ± 0.004 | 0.025 ± 0.004 | 0.024 ± 0.004 | 0.027 ± 0.004 |
| 06-Nov-02 | 0.034 ± 0.004 | 0.036 ± 0.004 | 0.036 ± 0.004 | 0.034 ± 0.004 | 0.034 ± 0.004 |
| 13-Nov-02 | 0.045 ± 0.004 | 0.048 ± 0.004 | 0.044 ± 0.004 | 0.047 ± 0.004 | 0.049 ± 0.004 |
| 20-Nov-02 | 0.020 ± 0.004 | 0.021 ± 0.004 | 0.022 ± 0.004 | 0.019 ± 0.004 | 0.022 ± 0.004 |
| 26-Nov-02 | 0.016 ± 0.004 | 0.017 ± 0.004 | 0.020 ± 0.004 | 0.017 ± 0.004 | 0.018 ± 0.004 |
| 04-Dec-02 | 0.024 ± 0.003 | 0.023 ± 0.003 | 0.026 ± 0.003 | 0.023 ± 0.003 | 0.024 ± 0.003 |
| 11-Dec-02 | 0.039 ± 0.005 | 0.038 ± 0.005 | 0.040 ± 0.005 | 0.044 ± 0.005 | 0.035 ± 0.005 |
| 18-Dec-02 | 0.039 ± 0.005 | 0.041 ± 0.005 | 0.040 ± 0.004 | 0.037 ± 0.004 | 0.041 ± 0.005 |
| 26-Dec-02 | 0.023 ± 0.003 | 0.024 ± 0.003 | 0.023 ± 0.003 | 0.022 ± 0.003 | 0.023 ± 0.003 |
| 02-Jan-03 | 0.037 ± 0.004 | 0.039 ± 0.004 | 0.041 ± 0.004 | 0.042 ± 0.005 | 0.039 ± 0.004 |

* Control Location, all other locations are Indicator Locations.

## GAMMA ISOTOPIC ACTIVITY IN AIR PARTICULATES FOR 2002[m]

($pCi/m^3$)

| SITE | ISOTOPE | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR |
|---|---|---|---|---|---|
| CL-1 | $Be^7$ | 0.067 ± 0.017 | 0.070 ± 0.020 | 0.081 ± 0.016 | 0.053 ± 0.011 |
| | $K^{40}$ | < 0.0250 | < 0.0260 | < 0.0240 | < 0.0250 |
| | $Co^{60}$ | < 0.0010 | < 0.0012 | < 0.0007 | < 0.0005 |
| | $Nb^{95}$ | < 0.0005 | < 0.0019 | < 0.0010 | < 0.0006 |
| | $Zr^{95}$ | < 0.0011 | < 0.0009 | < 0.0023 | < 0.0009 |
| | $Ru^{103}$ | < 0.0015 | < 0.0008 | < 0.0008 | < 0.0009 |
| | $Ru^{106}$ | < 0.0050 | < 0.0053 | < 0.0061 | < 0.0040 |
| | $Cs^{134}$ | < 0.0008 | < 0.0008 | < 0.0006 | < 0.0007 |
| | $Cs^{137}$ | < 0.0006 | < 0.0009 | < 0.0006 | < 0.0004 |
| | $Ce^{141}$ | < 0.0027 | < 0.0017 | < 0.0019 | < 0.0011 |
| | $Ce^{144}$ | < 0.0038 | < 0.0024 | < 0.0041 | < 0.0043 |
| CL-2 | $Be^7$ | 0.081 ± 0.016 | 0.064 ± 0.015 | 0.066 ± 0.017 | 0.053 ± 0.020 |
| | $K^{40}$ | < 0.0250 | < 0.0410 | < 0.0260 | < 0.0250 |
| | $Co^{60}$ | < 0.0009 | < 0.0013 | < 0.0007 | < 0.0005 |
| | $Nb^{95}$ | < 0.0015 | < 0.0005 | < 0.0011 | < 0.0008 |
| | $Zr^{95}$ | < 0.0020 | < 0.0017 | < 0.0015 | < 0.0017 |
| | $Ru^{103}$ | < 0.0009 | < 0.0006 | < 0.0006 | < 0.0014 |
| | $Ru^{106}$ | < 0.0027 | < 0.0062 | < 0.0045 | < 0.0055 |
| | $Cs^{134}$ | < 0.0007 | < 0.0008 | < 0.0006 | < 0.0004 |
| | $Cs^{137}$ | < 0.0005 | < 0.0008 | < 0.0006 | < 0.0004 |
| | $Ce^{141}$ | < 0.0011 | < 0.0012 | < 0.0021 | < 0.0019 |
| | $Ce^{144}$ | < 0.0067 | < 0.0036 | < 0.0038 | < 0.0064 |
| CL-3 | $Be^7$ | 0.071 ± 0.015 | 0.091 ± 0.019 | 0.072 ± 0.019 | 0.058 ± 0.018 |
| | $K^{40}$ | < 0.0250 | < 0.0270 | < 0.0240 | < 0.0340 |
| | $Co^{60}$ | < 0.0008 | < 0.0013 | < 0.0007 | < 0.0005 |
| | $Nb^{95}$ | < 0.0008 | < 0.0008 | < 0.0008 | < 0.0011 |
| | $Zr^{95}$ | < 0.0022 | < 0.0019 | < 0.0022 | < 0.0019 |
| | $Ru^{103}$ | < 0.0008 | < 0.0007 | < 0.0010 | < 0.0010 |
| | $Ru^{106}$ | < 0.0039 | < 0.0097 | < 0.0045 | < 0.0071 |
| | $Cs^{134}$ | < 0.0007 | < 0.0008 | < 0.0005 | < 0.0006 |
| | $Cs^{137}$ | < 0.0005 | < 0.0007 | < 0.0003 | < 0.0003 |
| | $Ce^{141}$ | < 0.0020 | < 0.0013 | < 0.0018 | < 0.0023 |
| | $Ce^{144}$ | < 0.0056 | < 0.0039 | < 0.0045 | < 0.0048 |

m All $I^{131}$ results were < 0.07 $pCi/m^3$

## GAMMA ISOTOPIC ACTIVITY IN AIR PARTICULATES FOR 2002[m] (continued)

| SITE | ISOTOPE | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR |
|---|---|---|---|---|---|
| **CL-11*** | $Be^7$ | 0.084 ± 0.019 | 0.075 ± 0.016 | 0.068 ± 0.021 | 0.047 ± 0.014 |
| | $K^{40}$ | < 0.0250 | < 0.0260 | < 0.0240 | < 0.0250 |
| | $Co^{60}$ | < 0.0008 | < 0.0013 | < 0.0008 | < 0.0005 |
| | $Nb^{95}$ | < 0.0014 | < 0.0005 | < 0.0008 | < 0.0013 |
| | $Zr^{95}$ | < 0.0009 | < 0.0009 | < 0.0019 | < 0.0008 |
| | $Ru^{103}$ | < 0.0009 | < 0.0009 | < 0.0007 | < 0.0009 |
| | $Ru^{106}$ | < 0.0049 | < 0.0080 | < 0.0032 | < 0.0045 |
| | $Cs^{134}$ | < 0.0008 | < 0.0008 | < 0.0004 | < 0.0004 |
| | $Cs^{137}$ | < 0.0008 | < 0.0006 | < 0.0005 | < 0.0011 |
| | $Ce^{141}$ | < 0.0022 | < 0.0018 | < 0.0021 | < 0.0017 |
| | $Ce^{144}$ | < 0.0035 | < 0.0062 | < 0.0042 | < 0.0045 |
| **CL-15** | $Be^7$ | 0.064 ± 0.018 | 0.062 ± 0.017 | 0.074 ± 0.018 | 0.045 ± 0.015 |
| | $K^{40}$ | < 0.0230 | < 0.0260 | < 0.0240 | < 0.0250 |
| | $Co^{60}$ | < 0.0005 | < 0.0013 | < 0.0007 | < 0.0005 |
| | $Nb^{95}$ | < 0.0013 | < 0.0005 | < 0.0013 | < 0.0007 |
| | $Zr^{95}$ | < 0.0016 | < 0.0009 | < 0.0015 | < 0.0008 |
| | $Ru^{103}$ | < 0.0014 | < 0.0009 | < 0.0009 | < 0.0014 |
| | $Ru^{106}$ | < 0.0046 | < 0.0053 | < 0.0072 | < 0.0057 |
| | $Cs^{134}$ | < 0.0008 | < 0.0006 | < 0.0006 | < 0.0008 |
| | $Cs^{137}$ | < 0.0007 | < 0.0005 | < 0.0005 | < 0.0005 |
| | $Ce^{141}$ | < 0.0014 | < 0.0027 | < 0.0019 | < 0.0016 |
| | $Ce^{144}$ | < 0.0053 | < 0.0024 | < 0.0048 | < 0.0029 |
| **CL-94** | $Be^7$ | 0.037 ± 0.015 | 0.081 ± 0.020 | 0.070 ± 021 | 0.057 ± 0.013 |
| | $K^{40}$ | < 0.0250 | < 0.0260 | < 0.0240 | < 0.0250 |
| | $Co^{60}$ | < 0.0009 | < 0.0013 | < 0.0008 | < 0.0005 |
| | $Nb^{95}$ | < 0.0009 | < 0.0008 | < 0.0008 | < 0.0011 |
| | $Zr^{95}$ | < 0.0031 | < 0.0018 | < 0.0015 | < 0.0008 |
| | $Ru^{103}$ | < 0.0008 | < 0.0009 | < 0.0008 | < 0.0010 |
| | $Ru^{106}$ | < 0.0038 | < 0.0066 | < 0.0041 | < 0.0081 |
| | $Cs^{134}$ | < 0.0007 | < 0.0009 | < 0.0005 | < 0.0005 |
| | $Cs^{137}$ | < 0.0003 | < 0.0005 | < 0.0006 | < 0.0006 |
| | $Ce^{141}$ | < 0.0015 | < 0.0022 | < 0.0020 | < 0.0021 |
| | $Ce^{144}$ | < 0.0041 | < 0.0030 | < 0.0045 | < 0.0068 |

* Control Location, all other locations are Indicator Locations.

**m** All $I^{131}$ results were < 0.07 pCi/$m^3$

## GAMMA ISOTOPIC ACTIVITY IN AIR PARTICULATES FOR 2002[m] (continued)

| SITE | ISOTOPE | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR |
|---|---|---|---|---|---|
| **CL-11*** | $Be^{7}$ | 0.084 ± 0.019 | 0.075 ± 0.016 | 0.068 ± 0.021 | 0.047 ± 0.014 |
| | $K^{40}$ | < 0.0250 | < 0.0260 | < 0.0240 | < 0.0250 |
| | $Co^{60}$ | < 0.0008 | < 0.0013 | < 0.0008 | < 0.0005 |
| | $Nb^{95}$ | < 0.0014 | < 0.0005 | < 0.0008 | < 0.0013 |
| | $Zr^{95}$ | < 0.0009 | < 0.0009 | < 0.0019 | < 0.0008 |
| | $Ru^{103}$ | < 0.0009 | < 0.0009 | < 0.0007 | < 0.0009 |
| | $Ru^{106}$ | < 0.0049 | < 0.0080 | < 0.0032 | < 0.0045 |
| | $Cs^{134}$ | < 0.0008 | < 0.0008 | < 0.0004 | < 0.0004 |
| | $Cs^{137}$ | < 0.0008 | < 0.0006 | < 0.0005 | < 0.0011 |
| | $Ce^{141}$ | < 0.0022 | < 0.0018 | < 0.0021 | < 0.0017 |
| | $Ce^{144}$ | < 0.0035 | < 0.0062 | < 0.0042 | < 0.0045 |
| **CL-15** | $Be^{7}$ | 0.064 ± 0.018 | 0.062 ± 0.017 | 0.074 ± 0.018 | 0.045 ± 0.015 |
| | $K^{40}$ | < 0.0230 | < 0.0260 | < 0.0240 | < 0.0250 |
| | $Co^{60}$ | < 0.0005 | < 0.0013 | < 0.0007 | < 0.0005 |
| | $Nb^{95}$ | < 0.0013 | < 0.0005 | < 0.0013 | < 0.0007 |
| | $Zr^{95}$ | < 0.0016 | < 0.0009 | < 0.0015 | < 0.0008 |
| | $Ru^{103}$ | < 0.0014 | < 0.0009 | < 0.0009 | < 0.0014 |
| | $Ru^{106}$ | < 0.0046 | < 0.0053 | < 0.0072 | < 0.0057 |
| | $Cs^{134}$ | < 0.0008 | < 0.0006 | < 0.0006 | < 0.0008 |
| | $Cs^{137}$ | < 0.0007 | < 0.0005 | < 0.0005 | < 0.0005 |
| | $Ce^{141}$ | < 0.0014 | < 0.0027 | < 0.0019 | < 0.0016 |
| | $Ce^{144}$ | < 0.0053 | < 0.0024 | < 0.0048 | < 0.0029 |
| **CL-94** | $Be^{7}$ | 0.037 ± 0.015 | 0.081 ± 0.020 | 0.070 ± 021 | 0.057 ± 0.013 |
| | $K^{40}$ | < 0.0250 | < 0.0260 | < 0.0240 | < 0.0250 |
| | $Co^{60}$ | < 0.0009 | < 0.0013 | < 0.0008 | < 0.0005 |
| | $Nb^{95}$ | < 0.0009 | < 0.0008 | < 0.0008 | < 0.0011 |
| | $Zr^{95}$ | < 0.0031 | < 0.0018 | < 0.0015 | < 0.0008 |
| | $Ru^{103}$ | < 0.0008 | < 0.0009 | < 0.0008 | < 0.0010 |
| | $Ru^{106}$ | < 0.0038 | < 0.0066 | < 0.0041 | < 0.0081 |
| | $Cs^{134}$ | < 0.0007 | < 0.0009 | < 0.0005 | < 0.0005 |
| | $Cs^{137}$ | < 0.0003 | < 0.0005 | < 0.0006 | < 0.0006 |
| | $Ce^{141}$ | < 0.0015 | < 0.0022 | < 0.0020 | < 0.0021 |
| | $Ce^{144}$ | < 0.0041 | < 0.0030 | < 0.0045 | < 0.0068 |

* Control Location, all other locations are Indicator Locations.

**m** All $I^{131}$ results were < 0.07 $pCi/m^3$

## 2002 QUARTERLY TLD RESULTS
**(mRem / quarter net exposure)**

| Location | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR |
|---|---|---|---|---|
| CL-1 | 16.8 ± 0.2 | 22.5 ± 0.1 | ▲ | 22.5 ± 0.5 |
| CL-2 | 18.6 ± 0.3 | 21.3 ± 2.3 | ▲ | 24.9 ± 0.6 |
| CL-3 | 18.0 ± 0.2 | 20.4 ± 2.2 | ▲ | 23.6 ± 0.6 |
| CL-4 | 17.9 ± 0.3 | 20.2 ± 0.0 | ▲ | 23.5 ± 1.2 |
| CL-5 | 18.4 ± 0.4 | 21.8 ± 2.4 | ▲ | 24.4 ± 2.1 |
| CL-6 | 15.1 ± 0.2 | 20.4 ± 0.4 | ▲ | 20.9 ± 1.7 |
| CL-7 | 17.0 ± 0.2 | 22.2 ± 2.7 | ▲ | 23.2 ± 1.6 |
| CL-8 | 16.8 ± 0.2 | 22.3 ± 1.8 | ▲ | 22.4 ± 1.3 |
| CL-11* | 16.0 ± 0.2 | 19.4 ± 0.8 | ▲ | 23.5 ± 1.6 |
| CL-15 | 14.8 ± 0.3 | 19.7 ± 1.2 | ▲ | 20.7 ± 0.8 |
| CL-22 | 15.0 ± 0.4 | 20.1 ± 1.0 | ▲ | 26.0 ± 2.1 |
| CL-23 | 15.0 ± 0.3 | 24.0 ± 1.5 | ▲ | 24.6 ± 1.9 |
| CL-24 | 16.2 ± 0.2 | 21.0 ± 1.1 | ▲ | 25.1 ± 1.7 |
| CL-33n | 16.9 ± 0.2 | 20.7 ± 2.2 | ▲ | 25.8 ± 2.0 |
| CL-34 | 18.7 ± 0.4 | 21.3 ± 1.0 | ▲ | 25.4 ± 1.4 |
| CL-35 | 16.5 ± 0.2 | 20.9 ± 1.4 | ▲ | 24.9 ± 2.1 |
| CL-36 | 18.3 ± 0.4 | 23.3 ± 0.1 | ▲ | 25.6 ± 1.5 |
| CL-37 | 18.6 ± 0.3 | 20.4 ± 0.7 | ▲ | 24.1 ± 0.6 |
| CL-41 | 19.4 ± 0.2 | 24.4 ± 2.8 | ▲ | 25.5 ± 0.3 |
| CL-42 | 18.0 ± 0.2 | 20.1 ± 0.3 | ▲ | 25.0 ± 0.1 |
| CL-43 | 19.0 ± 0.3 | 23.5 ± 2.2 | ▲ | 26.6 ± 1.6 |
| CL-44 | 18.7 ± 0.4 | 23.8 ± 0.0 | ▲ | 25.0 ± 1.8 |
| CL-45 | 19.9 ± 0.2 | 21.2 ± 0.8 | ▲ | 24.8 ± 0.6 |
| CL-46 | 17.5 ± 0.2 | 20.4 ± 1.6 | ▲ | 23.1 ± 0.1 |
| CL-47 | 18.5 ± 0.4 | 24.7 ± 0.5 | ▲ | 23.7 ± 0.0 |
| CL-48 | 17.2 ± 0.2 | 19.7 ± 1.8 | ▲ | 23.7 ± 0.8 |
| CL-49 | 18.0 ± 0.3 | 22.8 ± 3.5 | ▲ | 25.5 ± 1.1 |
| CL-51 | 17.9 ± 0.3 | 25.5 ± 2.3 | ▲ | 25.2 ± 1.4 |
| CL-52 | 18.5 ± 0.3 | 25.6 ± 1.7 | ▲ | 24.5 ± 2.3 |
| CL-53 | 16.2 ± 0.2 | 19.3 ± 0.0 | ▲ | 23.7 ± 2.8 |
| CL-54 | 18.6 ± 0.3 | 20.7 ± 0.0 | ▲ | 25.7 ± 0.9 |
| CL-55 | 19.0 ± 0.3 | 20.9 ± 0.5 | ▲ | 27.9 ± 5.3 |
| CL-56 | 19.4 ± 0.2 | 23.8 ± 1.2 | ▲ | 24.3 ± 0.2 |
| CL-57 | 19.8 ± 0.2 | 25.2 ± 2.3 | ▲ | 25.8 ± 0.7 |
| CL-58 | 20.2 ± 0.2 | 24.6 ± 2.3 | ▲ | 25.7 ± 1.4 |
| CL-60 | 18.7 ± 0.3 | 21.5 ± 2.0 | ▲ | 26.4 ± 1.6 |
| CL-61 | 18.9 ± 0.3 | 21.2 ± 1.8 | ▲ | 24.7 ± 0.9 |
| CL-63 | 19.1 ± 0.3 | 21.3 ± 3.0 | ▲ | 23.4 ± 0.6 |
| CL-64 | 18.8 ± 0.4 | 24.3 ± 0.4 | ▲ | 24.9 ± 0.5 |
| CL-65 | 18.9 ± 0.2 | 21.8 ± 0.5 | ▲ | 24.1 ± 0.7 |
| CL-74 | 16.1 ± 0.2 | 19.9 ± 0.1 | ▲ | 21.7 ± 0.3 |
| CL-75 | 17.2 ± 0.2 | 24.1 ± 2.0 | ▲ | 24.6 ± 0.5 |
| CL-76 | 17.3 ± 0.2 | 21.8 ± 2.6 | ▲ | 24.9 ± 0.7 |
| CL-77 | 16.6 ± 0.2 | 22.3 ± 1.5 | ▲ | 23.2 ± 0.6 |
| CL-78 | 18.1 ± 0.2 | 24.4 ± 1.1 | ▲ | 24.2 ± 0.9 |

* *ODCM Control Location*

n Supplemental Control Locations

▲ Clinton's 3rd Quarter ODCM REMP TLD results – both Indicator and Control - were determined to be inaccurate from our Vendor. ODCM REMP TLD results were irradiated from an unknown external source of radiation during air transportation from California to Illinois prior to placement in the environment. This resulted in inconsistent readings after adding this unknown exposure to their quarterly environmental exposure.

## 2002 QUARTERLY TLD RESULTS (continued)

(mRem / quarter net exposure

| Location | 1ST QTR | 2ND QTR | 3RD QTR | 4TH QTR |
|---|---|---|---|---|
| CL-79 | 18.0 ± 0.2 | 23.7 ± 2.0 | ▲ | 24.6 ± 1.0 |
| CL-80 | 18.8 ± 0.3 | 20.5 ± 2.6 | ▲ | 26.4 ± 2.0 |
| CL-81 | 18.6 ± 0.3 | 20.7 ± 0.4 | ▲ | 24.6 ± 3.4 |
| CL-84 | 18.4 ± 0.4 | 23.6 ± 2.6 | ▲ | 25.5 ± 1.0 |
| CL-90 | 13.7 ± 0.2 | 17.7 ± 0.7 | ▲ | 21.6 ± 1.3 |
| CL-91 | 16.2 ± 0.2 | 20.0 ± 1.4 | ▲ | 24.1 ± 1.4 |
| CL-97[n] | 18.6 ± 0.4 | 22.5 ± 0.0 | ▲ | 27.1 ± 0.8 |
| CL-99 | 14.8 ± 0.3 | 19.8 ± 1.6 | ▲ | 19.9 ± 0.7 |
| CL-114[n] | 14.8 ± 0.5 | 22.4 ± 1.5 | ▲ | 22.1 ± 0.8 |

**n** Supplemental Control Locations

▲ Clinton's 3rd Quarter ODCM REMP TLD results – both Indicator and Control - were determined to be inaccurate from our Vendor. ODCM REMP TLD results were irradiated from an unknown external source of radiation during air transportation from California to Illinois prior to placement in the environment. This resulted in inconsistent readings after adding this unknown exposure to their quarterly environmental exposure.

## CL-13 SURFACE WATER ACTIVITY
(pCi/l)

| Date Collected | 30 Jan 02 | 27 Feb 02 | 27 Mar 02 | 24 Apr 02 | 29 May 02 | 26 Jun 02 |
|---|---|---|---|---|---|---|
| Gross Beta | 3.1 ± 0.7 | 2.2 ± 0.5 | 2.5 ± 0.6 | 2.2 ± 0.5 | 2.9 ± 0.6 | 2.4 ± 0.6 |
| $Be^{7}$ | < 36.5 | < 51.0 | < 22.3 | < 32.9 | < 23.5 | < 23.0 |
| $K^{40}$ | < 79.5 | < 104.8 | < 57.2 | < 54.2 | < 71.1 | < 51.1 |
| $Mn^{54}$ | < 4.7 | < 3.8 | < 2.8 | < 2.3 | < 2.7 | < 2.2 |
| $Fe^{59}$ | < 3.4 | < 9.0 | < 4.1 | < 4.3 | < 3.7 | < 6.5 |
| $Co^{58}$ | < 2.5 | < 5.6 | < 3.2 | < 2.9 | < 2.0 | < 1.7 |
| $Co^{60}$ | < 5.8 | < 3.3 | < 3.7 | < 2.3 | < 2.8 | < 2.6 |
| $Zn^{65}$ | < 3.6 | < 3.8 | < 2.4 | < 3.9 | < 3.6 | < 5.6 |
| $Nb^{95}$ | < 2.5 | < 4.3 | < 2.5 | < 1.4 | < 3.5 | < 3.1 |
| $Zr^{95}$ | < 10.9 | < 7.9 | < 4.7 | < 2.6 | < 4.4 | < 5.3 |
| $Cs^{134}$ | < 2.5 | < 4.4 | < 2.9 | < 1.6 | < 3.3 | < 2.6 |
| $Cs^{137}$ | < 3.2 | < 4.8 | < 3.2 | < 2.4 | < 2.4 | < 2.0 |
| $Ba^{140}$ | < 14.8 | < 26.3 | < 14.8 | < 22.0 | < 33.0 | < 42.0 |
| $La^{140}$ | < 3.4 | < 8.7 | < 5.0 | < 3.2 | < 3.9 | < 4.6 |
| $Ce^{144}$ | < 38.6 | < 50.8 | < 25.3 | < 22.0 | < 27.9 | < 19.9 |

| Date Collected | 31 Jul 02 | 28 Aug 02 | 24 Sep 02 | 30 Oct 02 | 26 Nov 02 | 02 Jan 03 |
|---|---|---|---|---|---|---|
| Gross Beta | (g) | (g) | (g) | (g) | (g) | (g) |
| $Be^{7}$ | < 25.5 | < 28.6 | < 42.2 | < 26.1 | < 38.5 | < 47.5 |
| $K^{40}$ | < 58.9 | < 81.9 | < 87.2 | < 97.0 | < 99.9 | < 113.4 |
| $Mn^{54}$ | < 2.4 | < 3.0 | < 3.7 | < 3.9 | < 3.8 | < 4.8 |
| $Fe^{59}$ | < 6.6 | < 7.8 | < 7.8 | < 8.8 | < 6.1 | < 11.6 |
| $Co^{58}$ | < 1.9 | < 2.8 | < 2.9 | < 4.4 | < 3.3 | < 5.5 |
| $Co^{60}$ | < 2.4 | < 3.7 | < 4.0 | < 3.3 | < 4.7 | < 5.7 |
| $Zn^{65}$ | < 4.6 | < 4.0 | < 6.3 | < 5.0 | < 5.8 | < 5.7 |
| $Nb^{95}$ | < 4.2 | < 4.9 | < 2.3 | < 3.5 | < 3.7 | < 7.1 |
| $Zr^{95}$ | < 5.0 | < 8.3 | < 7.6 | < 12.8 | < 5.5 | < 11.0 |
| $Cs^{134}$ | < 2.9 | < 4.1 | < 4.4 | < 2.9 | < 5.0 | < 3.7 |
| $Cs^{137}$ | < 2.4 | < 4.3 | < 3.8 | < 5.2 | < 7.1 | < 6.9 |
| $Ba^{140}$ | < 47.1 | < 15.4 | < 17.7 | < 21.4 | < 20.4 | < 32.2 |
| $La^{140}$ | < 6.1 | < 2.2 | < 5.1 | < 7.9 | < 5.3 | < 9.5 |
| $Ce^{144}$ | < 25.8 | < 40.8 | < 22.7 | < 34.2 | < 33.8 | < 46.7 |

(g) Analysis for Gross Beta is not a required REMP analysis and was suspended in July 2002

## CL-90 SURFACE WATER ACTIVITY (pCi/l)

| Date Collected | 30 Jan 02 | 27 Feb 02 | 27 Mar 02 | 24 Apr 02 | 29 May 02 | 26 Jun 02 |
|---|---|---|---|---|---|---|
| Gross Alpha | 0.4 ± 0.3 | < 1.4 | 2.4 ± 1.1 | < 1.8 | < 1.3 | < 1.3 |
| Gross Beta | 2.4 ± 0.3 | 5.7 ± 0.9 | 9.3 ± 1.0 | 1.8 ± 0.8 | 2.6 ± 0.7 | 3.0 ± 0.8 |
| $I^{131}$ | < 0.4 | < 0.4 | < 0.4 | < 0.3 | < 0.3 | < 0.4 |
| $Be^{7}$ | < 21.9 | < 44.6 | < 29.8 | < 18.6 | < 48.0 | < 23.2 |
| $K^{40}$ | < 62.3 | < 96.2 | < 91.1 | < 48.4 | < 89.6 | < 90.9 |
| $Mn^{54}$ | < 2.1 | < 5.0 | < 5.0 | < 1.8 | < 4.7 | < 3.2 |
| $Fe^{59}$ | < 3.0 | < 10.6 | < 4.4 | < 3.1 | < 6.4 | < 6.2 |
| $Co^{58}$ | < 2.6 | < 4.6 | < 3.8 | < 1.5 | < 3.7 | < 3.1 |
| $Co^{60}$ | < 2.2 | < 5.3 | < 5.2 | < 2.4 | < 3.9 | < 4.1 |
| $Zn^{65}$ | < 2.7 | < 2.6 | < 8.5 | < 2.7 | < 9.9 | < 5.9 |
| $Nb^{95}$ | < 2.7 | < 3.9 | < 4.8 | < 1.4 | < 6.9 | < 3.8 |
| $Zr^{95}$ | < 7.6 | < 7.2 | < 9.6 | < 5.1 | < 5.5 | < 8.6 |
| $Cs^{134}$ | < 2.1 | < 4.8 | < 2.4 | < 1.7 | < 5.2 | < 4.3 |
| $Cs^{137}$ | < 2.9 | < 5.0 | < 5.1 | < 1.9 | < 5.2 | < 3.7 |
| $Ba^{140}$ | < 13.6 | < 21.8 | < 15.1 | < 7.9 | < 27.3 | < 12.5 |
| $La^{140}$ | < 2.2 | < 3.5 | < 4.9 | < 2.0 | < 2.9 | < 3.4 |
| $Ce^{144}$ | < 21.1 | < 49.3 | < 36.4 | < 20.5 | < 48.6 | < 38.5 |

| Date Collected | 31 Jul 02 | 28 Aug 02 | 24 Sep 02 | 30 Oct 02 | 26 Nov 02 | 02 Jan 03 |
|---|---|---|---|---|---|---|
| Gross Alpha | (j) | (j) | (j) | (j) | (j) | (j) |
| Gross Beta | (g) | (g) | (g) | (g) | (g) | (g) |
| $I^{131}$ | < 0.5 | < 0.4 | < 0.3 | < 0.3 | < 0.5 | < 0.4 |
| $Be^{7}$ | < 24.8 | < 16.7 | < 31.5 | < 26.3 | < 28.9 | < 20.3 |
| $K^{40}$ | < 98.0 | < 66.3 | < 86.0 | < 58.3 | < 57.0 | < 79.1 |
| $Mn^{54}$ | < 3.3 | < 2.7 | < 2.4 | < 1.1 | < 2.0 | < 3.7 |
| $Fe^{59}$ | < 10.2 | < 5.4 | < 4.4 | < 4.9 | < 3.5 | < 4.0 |
| $Co^{58}$ | < 4.7 | < 3.2 | < 2.5 | < 1.7 | < 1.4 | < 2.7 |
| $Co^{60}$ | < 5.7 | < 2.8 | < 3.0 | < 2.9 | < 2.7 | < 2.0 |
| $Zn^{65}$ | < 7.3 | < 4.1 | < 2.5 | < 5.0 | < 1.8 | < 2.2 |
| $Nb^{95}$ | < 5.3 | < 2.6 | < 2.1 | < 2.4 | < 3.9 | < 2.7 |
| $Zr^{95}$ | < 12.6 | < 4.0 | < 3.1 | < 2.3 | < 6.3 | < 4.1 |
| $Cs^{134}$ | < 5.5 | < 3.2 | < 2.5 | < 2.9 | < 2.5 | < 3.1 |
| $Cs^{137}$ | < 4.4 | < 2.6 | < 3.4 | < 2.9 | < 2.3 | < 3.3 |
| $Ba^{140}$ | < 16.4 | < 12.5 | < 11.1 | < 7.8 | < 10.7 | < 17.3 |
| $La^{140}$ | < 4.4 | < 4.3 | < 3.1 | < 1.9 | < 3.3 | < 3.9 |
| $Ce^{144}$ | < 38.5 | < 32.5 | < 32.7 | < 24.3 | < 33.4 | < 23.3 |

(g) Analysis for Gross Beta is not a required REMP analysis and was suspended in July 2002
(j) Analysis for Gross Alpha is not a required REMP analysis and was suspended in July 2002

## CL-91 SURFACE WATER ACTIVITY
(pCi/l)

| Date Collected | 30 Jan 02 | 27 Feb 02 | 27 Mar 02 | 24 Apr 02 | 29 May 02 | 26 Jun 02 |
|---|---|---|---|---|---|---|
| Gross Alpha | < 1.2 | < 1.6 | < 1.7 | < 1.5 | < 1.7 | < 1.8 |
| Gross Beta | 2.2 ± 0.9 | 2.7 ± 1.1 | 1.8 ± 0.9 | < 1.6 | 1.8 ± 0.9 | < 1.9 |
| $Be^{7}$ | < 21.2 | < 43.9 | < 44.6 | < 15.5 | < 30.9 | < 13.2 |
| $K^{40}$ | < 93.5 | < 99.2 | < 88.1 | < 64.0 | < 62.8 | < 32.1 |
| $Mn^{54}$ | < 2.8 | < 3.5 | < 4.0 | < 2.4 | < 1.7 | < 1.0 |
| $Fe^{59}$ | < 3.3 | < 6.9 | < 6.5 | < 3.9 | < 4.5 | < 3.0 |
| $Co^{58}$ | < 2.3 | < 2.6 | < 3.0 | < 2.7 | < 1.6 | < 1.3 |
| $Co^{60}$ | < 4.0 | < 4.4 | < 2.5 | < 2.9 | < 2.4 | < 1.5 |
| $Zn^{65}$ | < 6.0 | < 5.3 | < 5.8 | < 4.3 | < 2.8 | < 1.8 |
| $Nb^{95}$ | < 5.1 | < 3.7 | < 4.0 | < 2.5 | < 3.6 | < 2.1 |
| $Zr^{95}$ | < 9.5 | < 8.2 | < 9.2 | < 3.4 | < 4.4 | < 3.4 |
| $Cs^{134}$ | < 4.4 | < 5.0 | < 2.5 | < 2.8 | < 2.7 | < 1.9 |
| $Cs^{137}$ | < 2.6 | < 4.3 | < 4.9 | < 2.2 | < 2.8 | < 1.9 |
| $Ba^{140}$ | < 22.8 | < 16.3 | < 23.7 | < 14.4 | < 19.4 | < 25.5 |
| $La^{140}$ | < 3.4 | < 3.1 | < 6.5 | < 2.3 | < 5.9 | < 5.2 |
| $Ce^{144}$ | < 28.9 | < 52.8 | < 25.4 | < 21.7 | < 28.1 | < 12.0 |

| Date Collected | 31 Jul 02 | 28 Aug 02 | 24 Sep 02 | 30 Oct 02 | 26 Nov 02 | 02 Jan 03 |
|---|---|---|---|---|---|---|
| Gross Alpha | (j) | (j) | (j) | (j) | (j) | (j) |
| Gross Beta | (g) | (g) | (g) | (g) | (g) | (g) |
| $Be^{7}$ | < 33.3 | < 34.3 | < 35.9 | < 29.8 | < 30.0 | < 46.8 |
| $K^{40}$ | < 69.6 | < 68.8 | < 67.7 | < 121.6 | < 92.4 | < 108.7 |
| $Mn^{54}$ | < 3.1 | < 3.4 | < 2.8 | < 4.5 | < 1.5 | < 3.1 |
| $Fe^{59}$ | < 4.7 | < 9.1 | < 4.5 | < 7.8 | < 4.5 | < 4.9 |
| $Co^{58}$ | < 2.8 | < 4.7 | < 1.8 | < 6.0 | < 2.3 | < 4.4 |
| $Co^{60}$ | < 2.9 | < 3.1 | < 3.5 | < 5.2 | < 2.1 | < 3.4 |
| $Zn^{65}$ | < 3.3 | < 7.3 | < 3.8 | < 6.8 | < 5.8 | < 5.1 |
| $Nb^{95}$ | < 2.4 | < 3.7 | < 3.4 | < 5.0 | < 2.7 | < 5.9 |
| $Zr^{95}$ | < 6.2 | < 7.1 | < 5.6 | < 10.1 | < 4.3 | < 11.5 |
| $Cs^{134}$ | < 3.4 | < 3.4 | < 3.5 | < 5.9 | < 3.1 | < 4.5 |
| $Cs^{137}$ | < 2.5 | < 4.5 | < 1.8 | < 4.7 | < 3.0 | < 5.1 |
| $Ba^{140}$ | < 44.6 | < 26.7 | < 16.4 | < 30.2 | < 18.8 | < 38.2 |
| $La^{140}$ | < 12.4 | < 5.0 | < 2.1 | < 5.5 | < 2.1 | < 8.1 |
| $Ce^{144}$ | < 29.5 | < 26.5 | < 27.9 | < 46.6 | < 32.1 | < 38.5 |

(g) Analysis for Gross Beta is not a required REMP analysis and was suspended in July 2002
(j) Analysis for Gross Alpha is not a required REMP analysis and was suspended in July 2002

## CL-99 SURFACE WATER ACTIVITY
(pCi/l)

| Date Collected | 30 Jan 02 | 27 Feb 02 | 27 Mar 02 | 24 Apr 02 | 29 May 02 | 26 Jun 02 |
|---|---|---|---|---|---|---|
| Gross Alpha | < 0.8 | < 0.7 | < 0.9 | < 1.9 | < 1.7 | < 2.0 |
| Gross Beta | 3.2 ± 1.3 | 1.4 ± 1.1 | 1.7 ± 1.1 | < 2.4 | < 2.0 | 3.6 ± 0.8 |
| $Be^{7}$ | < 53.2 | < 55.6 | < 21.5 | < 25.0 | < 37.7 | < 21.3 |
| $K^{40}$ | < 98.6 | < 87.4 | < 45.7 | < 52.3 | < 77.9 | < 38.1 |
| $Mn^{54}$ | < 4.1 | < 4.9 | < 2.4 | < 2.6 | < 2.4 | < 1.1 |
| $Fe^{59}$ | < 6.4 | < 8.8 | < 3.9 | < 3.8 | < 5.9 | < 4.3 |
| $Co^{58}$ | < 4.3 | < 5.3 | < 2.0 | < 2.6 | < 2.9 | < 1.6 |
| $Co^{60}$ | < 6.1 | < 2.8 | < 2.3 | < 1.7 | < 2.6 | < 1.4 |
| $Zn^{65}$ | < 6.5 | < 5.9 | < 3.3 | < 2.4 | < 2.7 | < 3.6 |
| $Nb^{95}$ | < 4.5 | < 4.3 | < 2.4 | < 4.0 | < 3.2 | < 2.0 |
| $Zr^{95}$ | < 11.1 | < 8.4 | < 4.0 | < 4.3 | < 7.7 | < 3.5 |
| $Cs^{134}$ | < 6.2 | < 4.6 | < 3.2 | < 1.7 | < 3.6 | < 1.4 |
| $Cs^{137}$ | < 5.7 | < 5.3 | < 2.5 | < 2.9 | < 3.9 | < 1.6 |
| $Ba^{140}$ | < 25.1 | < 34.2 | < 8.1 | < 22.2 | < 42.5 | < 19.6 |
| $La^{140}$ | < 4.9 | < 5.4 | < 2.3 | < 5.1 | < 4.5 | < 5.6 |
| $Ce^{144}$ | < 45.0 | < 35.0 | < 21.6 | < 27.0 | < 30.7 | < 19.6 |

| Date Collected | 31 Jul 02 | 28 Aug 02 | 24 Sep 02 | 30 Oct 02 | 26 Nov 02 | 02 Jan 03 |
|---|---|---|---|---|---|---|
| Gross Alpha | (j) | (j) | (j) | (j) | (j) | (j) |
| Gross Beta | (g) | (g) | (g) | (g) | (g) | (g) |
| $Be^{7}$ | < 40.3 | < 25.1 | < 32.8 | < 48.8 | < 29.4 | < 43.0 |
| $K^{40}$ | < 77.3 | < 68.6 | < 98.9 | < 96.0 | < 82.2 | < 109.7 |
| $Mn^{54}$ | < 1.8 | < 2.9 | < 5.2 | < 3.8 | < 3.6 | < 4.2 |
| $Fe^{59}$ | < 4.8 | < 2.3 | < 4.9 | < 6.0 | < 3.9 | < 9.1 |
| $Co^{58}$ | < 1.7 | < 3.1 | < 2.8 | < 3.4 | < 2.9 | < 4.2 |
| $Co^{60}$ | < 2.9 | < 3.7 | < 4.6 | < 3.9 | < 4.2 | < 4.4 |
| $Zn^{65}$ | < 3.1 | < 2.6 | < 4.0 | < 5.3 | < 4.6 | < 5.9 |
| $Nb^{95}$ | < 4.9 | < 2.1 | < 2.7 | < 3.3 | < 2.9 | < 6.3 |
| $Zr^{95}$ | < 5.3 | < 4.8 | < 6.2 | < 10.7 | < 3.6 | < 11.6 |
| $Cs^{134}$ | < 2.7 | < 3.3 | < 3.6 | < 4.3 | < 3.5 | < 3.6 |
| $Cs^{137}$ | < 1.7 | < 2.7 | < 5.5 | < 4.0 | < 4.2 | < 6.0 |
| $Ba^{140}$ | < 46.9 | < 13.4 | < 13.8 | < 24.1 | < 21.0 | < 24.2 |
| $La^{140}$ | < 10.7 | < 6.3 | < 5.1 | < 7.4 | < 5.0 | < 13.0 |
| $Ce^{144}$ | < 29.2 | < 20.7 | < 20.9 | < 24.9 | < 22.8 | < 39.5 |

(g) Analysis for Gross Beta is not a required REMP analysis and was suspended in July 2002
(j) Analysis for Gross Alpha is not a required REMP analysis and was suspended in July 2002

## SURFACE WATER and DRINKING WATER QUARTERLY TRITIUM COMPOSITE
(pCi/l)

| Quarter | CI-13 | CI-14 | CI-90 | CI-91 | CI-99 |
|---|---|---|---|---|---|
| 1st | < 169 | < 169 | < 169 | < 169 | < 169 |
| 2nd | < 131 | < 131 | < 131 | < 131 | < 131 |
| 3rd | < 146 | < 146 | < 146 | < 146 | < 146 |
| 4th | < 162 | < 162 | < 162 | < 162 | < 162 |

## CL-7D WELL WATER ACTIVITY
(pCi/l)

| Date Collected | 27 Mar 02 | 26 Jun 02 | 24 Sep 02 | 02 Jan 03 |
|---|---|---|---|---|
| Gross Alpha | < 1.0 | 2.2 ± 1.5 | (j) | (j) |
| Gross Beta | 1.2 ± 0.8 | 3.2 ± 1.3 | (g) | (g) |
| $H^3$ | < 89 | < 131 | < 146 | < 162 |
| $I^{131}$ | < 0.3 | < 0.4 | (i) | (i) |
| $Be^7$ | < 20.7 | < 21.1 | < 30.7 | < 63.2 |
| $K^{40}$ | < 41.5 | < 33.5 | < 72.8 | < 112.1 |
| $Mn^{54}$ | < 2.5 | < 1.9 | < 2.4 | < 5.2 |
| $Fe^{59}$ | < 2.3 | < 6.8 | < 3.5 | < 13.4 |
| $Co^{58}$ | < 2.0 | < 2.9 | < 3.2 | < 5.4 |
| $Co^{60}$ | < 2.6 | < 1.9 | < 2.8 | < 5.8 |
| $Zn^{65}$ | < 1.9 | < 2.7 | < 2.5 | < 5.1 |
| $Nb^{95}$ | < 2.8 | < 4.1 | < 3.4 | < 4.1 |
| $Zr^{95}$ | < 3.9 | < 5.7 | < 4.5 | < 14.8 |
| $Cs^{134}$ | < 2.4 | < 2.0 | < 4.4 | < 3.7 |
| $Cs^{137}$ | < 2.4 | < 3.4 | < 3.4 | < 2.8 |
| $Ba^{140}$ | < 10.0 | < 29.8 | < 13.0 | < 53.1 |
| $La^{140}$ | < 3.6 | < 8.5 | < 2.1 | < 11.7 |
| $Ce^{144}$ | < 15.5 | < 16.3 | < 29.1 | < 34.3 |

(g) Analysis for Gross Beta is not a required REMP analysis and was suspended in July 2002
(j) Analysis for Gross Alpha is not a required REMP analysis and was suspended in July 2002
(i) Analysis for $I^{131}$ is not a required REMP analysis and was suspended in July 2002

## CL-12 UNTREATED WELL WATER ACTIVITY
(pCi/l)

| Date Collected | 27 Mar 02 | 26 Jun 02 | 24 Sep 02 | 02 Jan 03 |
|---|---|---|---|---|
| Gross Alpha | 2.4 ± 1.5 | < 1.9 | (j) | (j) |
| Gross Beta | 3.4 ± 1.6 | 2.0 ± 1.5 | (g) | (g) |
| $H^3$ | < 89 | < 131 | < 146 | < 162 |
| $I^{131}$ | < 0.4 | < 0.5 | (i) | (i) |
| $Be^7$ | < 39.5 | < 23.3 | < 34.0 | < 33.1 |
| $K^{40}$ | < 76.1 | < 41.8 | < 76.2 | < 68.2 |
| $Mn^{54}$ | < 4.5 | < 1.9 | < 1.9 | < 3.4 |
| $Fe^{59}$ | < 4.0 | < 4.9 | < 5.2 | < 3.6 |
| $Co^{58}$ | < 1.9 | < 1.7 | < 1.6 | < 2.6 |
| $Co^{60}$ | < 4.9 | < 1.7 | < 2.4 | < 2.4 |
| $Zn^{65}$ | < 2.4 | < 3.6 | < 2.9 | < 3.9 |
| $Nb^{95}$ | < 4.5 | < 2.7 | < 3.8 | < 4.2 |
| $Zr^{95}$ | < 8.4 | < 5.2 | < 6.0 | < 5.7 |
| $Cs^{134}$ | < 3.6 | < 1.8 | < 3.3 | < 2.9 |
| $Cs^{137}$ | < 4.1 | < 1.9 | < 2.6 | < 2.6 |
| $Ba^{140}$ | < 12.0 | < 26.6 | < 14.4 | < 19.2 |
| $La^{140}$ | < 4.7 | < 5.1 | < 2.6 | < 8.7 |
| $Ce^{144}$ | < 31.1 | < 19.1 | < 26.4 | < 27.7 |

(g) Analysis for Gross Beta is not a required REMP analysis and was suspended in July 2002
(j) Analysis for Gross Alpha is not a required REMP analysis and was suspended in July 2002
(i) Analysis for $I^{131}$ is not a required REMP analysis and was suspended in July 2002

## CL-12 TREATED WELL WATER ACTIVITY
(pCi/l)

| Date Collected | 27 Mar 02 | 26 Jun 02 | 24 Sep 02 | 02 Jan 03 |
|---|---|---|---|---|
| Gross Alpha | 2.0 ± 1.4 | < 1.8 | (j) | (j) |
| Gross Beta | 2.3 ± 1.5 | 2.4 ± 1.5 | (g) | (g) |
| $H^{3}$ | < 89 | < 131 | < 146 | < 162 |
| $I^{131}$ | < 0.4 | < 0.4 | (i) | (i) |
| $Be^{7}$ | < 26.4 | < 16.7 | < 33.8 | < 27.6 |
| $K^{40}$ | < 50.6 | < 33.8 | < 87.2 | < 14.6 |
| $Mn^{54}$ | < 1.3 | < 1.5 | < 2.2 | < 2.1 |
| $Fe^{59}$ | < 2.2 | < 4.8 | < 6.9 | < 5.5 |
| $Co^{58}$ | < 1.4 | < 1.9 | < 2.5 | < 1.9 |
| $Co^{60}$ | < 2.1 | < 1.3 | < 2.9 | < 2.4 |
| $Zn^{65}$ | < 2.3 | < 3.0 | < 5.0 | < 4.1 |
| $Nb^{95}$ | < 1.9 | < 2.3 | < 2.9 | < 3.0 |
| $Zr^{95}$ | < 4.9 | < 4.9 | < 4.5 | < 4.4 |
| $Cs^{134}$ | < 2.7 | < 1.2 | < 3.0 | < 1.5 |
| $Cs^{137}$ | < 2.1 | < 1.6 | < 3.7 | < 1.9 |
| $Ba^{140}$ | < 12.8 | < 24.9 | < 16.1 | < 23.4 |
| $La^{140}$ | < 2.3 | < 5.3 | < 4.3 | < 6.3 |
| $Ce^{144}$ | < 26.8 | < 18.5 | < 20.0 | < 23.8 |

(g) Analysis for Gross Beta is not a required REMP analysis and was suspended in July 2002
(j) Analysis for Gross Alpha is not a required REMP analysis and was suspended in July 2002
(i) Analysis for $I^{131}$ is not a required REMP analysis and was suspended in July 2002

## CL-14 DRINKING WATER ACTIVITY
(pCi/l)

| Date Collected | 30 Jan 02 | 27 Feb 02 | 27 Mar 02 | 24 Apr 02 | 29 May 02 | 26 Jun 02 |
|---|---|---|---|---|---|---|
| Gross Alpha | < 0.9 | < 0.9 | 1.2 ± 0.6 | < 1.5 | < 1.2 | < 1.2 |
| Gross Beta | 1.3 ± 0.5 | 1.1 ± 0.5 | 2.0 ± 0.5 | 1.6 ± 0.6 | 1.3 ± 0.5 | 1.4 ± 0.6 |
| $Be^{7}$ | < 23.8 | < 44.1 | < 22.0 | < 24.4 | < 25.3 | < 30.8 |
| $K^{40}$ | < 105.0 | < 95.3 | < 63.3 | < 65.0 | < 63.4 | < 59.9 |
| $Mn^{54}$ | < 3.9 | < 3.5 | < 2.5 | < 2.5 | < 2.2 | < 2.6 |
| $Fe^{59}$ | < 8.0 | < 5.5 | < 4.6 | < 5.1 | < 3.1 | < 5.4 |
| $Co^{58}$ | < 2.8 | < 3.5 | < 2.0 | < 2.9 | < 2.3 | < 2.2 |
| $Co^{60}$ | < 5.4 | < 5.4 | < 1.9 | < 2.6 | < 1.4 | < 2.0 |
| $Zn^{65}$ | < 3.7 | < 5.3 | < 5.6 | < 4.5 | < 3.0 | < 5.3 |
| $Nb^{95}$ | < 3.4 | < 4.0 | < 2.1 | < 2.0 | < 2.5 | < 5.1 |
| $Zr^{95}$ | < 14.0 | < 7.2 | < 5.5 | < 6.2 | < 5.1 | < 8.3 |
| $Cs^{134}$ | < 5.9 | < 6.8 | < 3.1 | < 1.7 | < 1.8 | < 2.0 |
| $Cs^{137}$ | < 4.6 | < 6.6 | < 2.7 | < 1.9 | < 3.0 | < 2.5 |
| $Ba^{140}$ | < 19.0 | < 21.3 | < 16.2 | < 16.4 | < 27.1 | < 44.6 |
| $La^{140}$ | < 3.8 | < 3.2 | < 4.5 | < 2.7 | < 5.3 | < 11.6 |
| $Ce^{144}$ | < 32.0 | < 52.2 | < 25.2 | < 29.2 | < 29.0 | < 29.1 |

| Date Collected | 31 Jul 02 | 28 Aug 02 | 24 Sep 02 | 30 Oct 02 | 26 Nov 02 | 02 Jan 03 |
|---|---|---|---|---|---|---|
| Gross Alpha | (j) | (j) | (j) | (j) | (j) | (j) |
| Gross Beta | 1.1 ± 0.3 | 0.9 ± 0.5 | 1.0 ± 0.5 | 1.2 ± 0.5 | < 0.8 | 0.9 ± 0.5 |
| $Be^{7}$ | < 40.5 | < 24.0 | < 45.7 | < 34.2 | < 19.9 | < 34.6 |
| $K^{40}$ | < 70.1 | < 117.5 | < 112.2 | < 121.6 | < 82.5 | < 102.0 |
| $Mn^{54}$ | < 2.3 | < 3.2 | < 6.8 | < 3.9 | < 2.8 | < 3.2 |
| $Fe^{59}$ | < 4.1 | < 4.0 | < 8.2 | < 6.7 | < 6.7 | < 3.7 |
| $Co^{58}$ | < 2.9 | < 2.7 | < 6.1 | < 5.2 | < 3.1 | < 3.0 |
| $Co^{60}$ | < 2.4 | < 3.3 | < 5.1 | < 6.4 | < 2.9 | < 4.4 |
| $Zn^{65}$ | < 2.6 | < 5.8 | < 3.5 | < 3.5 | < 3.9 | < 5.3 |
| $Nb^{95}$ | < 4.1 | < 2.4 | < 3.0 | < 5.8 | < 2.4 | < 6.2 |
| $Zr^{95}$ | < 7.4 | < 8.0 | < 6.9 | < 13.2 | < 7.0 | < 6.3 |
| $Cs^{134}$ | < 3.5 | < 3.2 | < 6.4 | < 4.5 | < 2.8 | < 4.6 |
| $Cs^{137}$ | < 1.1 | < 5.1 | < 6.7 | < 4.3 | < 2.8 | < 5.9 |
| $Ba^{140}$ | < 35.9 | < 16.1 | < 24.2 | < 25.9 | < 21.7 | < 19.1 |
| $La^{140}$ | < 9.3 | < 5.3 | < 5.8 | < 4.8 | < 1.8 | < 8.6 |
| $Ce^{144}$ | < 21.7 | < 21.6 | < 49.6 | < 43.9 | < 34.3 | < 37.9 |

(j) Analysis for Gross Alpha is not a required REMP analysis and was suspended in July 2002

## CL-116 MILK ACTIVITY - (Control)
(pCi/l)

| Date Collected | 31 Jan 02 | 27 Feb 02 | 27 Mar 02 | 24 Apr 02 | 08 May 02 |
|---|---|---|---|---|---|
| $I^{131}$ | < 0.5 | < 0.4 | < 0.5 | < 0.3 | < 0.5 |
| $Sr^{90}$ | 1.7 ± 0.4 | 0.6 ± 0.3 | 1.0 ± 0.4 | 1.0 ± 0.4 | 1.7 ± 0.4 |
| $Be^{7}$ | < 68.5 | < 54.8 | < 36.1 | < 44.1 | < 36.5 |
| $K^{40}$ | 1,180 ± 162 | 1,253 ± 156 | 1,261 ± 143 | 1,528 ± 145 | 1,168 ± 157 |
| $Mn^{54}$ | < 6.5 | < 4.6 | < 5.9 | < 3.6 | < 3.8 |
| $Fe^{59}$ | < 8.9 | < 12.2 | < 10.0 | < 8.7 | < 7.6 |
| $Co^{58}$ | < 5.0 | < 3.7 | < 4.2 | < 5.1 | < 4.9 |
| $Co^{60}$ | < 3.7 | < 6.1 | < 4.9 | < 3.9 | < 5.1 |
| $Zn^{65}$ | < 13.2 | < 8.9 | < 9.8 | < 7.3 | < 8.7 |
| $Nb^{95}$ | < 5.3 | < 5.5 | < 5.2 | < 4.1 | < 3.4 |
| $Zr^{95}$ | < 10.6 | < 11.8 | < 8.3 | < 5.9 | < 6.3 |
| $Cs^{134}$ | < 5.3 | < 4.0 | < 6.5 | < 4.6 | < 5.4 |
| $Cs^{137}$ | < 7.8 | < 5.8 | < 5.5 | < 5.0 | < 5.5 |
| $Ba^{140}$ | < 24.2 | < 27.4 | < 26.6 | < 19.4 | < 22.0 |
| $La^{140}$ | < 6.2 | < 5.2 | < 5.8 | < 2.9 | < 2.9 |
| $Ce^{144}$ | < 39.0 | < 45.3 | < 50.6 | < 44.7 | < 45.2 |

| Date Collected | 22 May 02 | 05 Jun 02 | 19 Jun 02 | 02 Jul 02 | 17 Jul 02 |
|---|---|---|---|---|---|
| $I^{131}$ | < 0.4 | < 0.4 | < 0.5 | < 0.4 | < 0.4 |
| $Sr^{90}$ | 1.8 ± 0.5 | 1.1 ± 0.4 | 2.0 ± 0.5 | 1.0 ± 0.4 | 0.7 ± 0.3 |
| $Be^{7}$ | < 38.0 | < 38.4 | < 32.2 | < 29.0 | < 49.2 |
| $K^{40}$ | 1,300 ± 181 | 1,267 ± 152 | 1,269 ± 135 | 1,639 ± 177 | 1,264 ± 169 |
| $Mn^{54}$ | < 5.0 | < 5.3 | < 5.3 | < 6.3 | < 4.4 |
| $Fe^{59}$ | < 9.1 | < 11.4 | < 9.6 | < 8.3 | < 7.1 |
| $Co^{58}$ | < 3.2 | < 2.2 | < 3.9 | < 5.8 | < 5.4 |
| $Co^{60}$ | < 8.0 | < 4.7 | < 3.5 | < 5.5 | < 3.8 |
| $Zn^{65}$ | < 6.4 | < 7.7 | < 6.0 | < 11.8 | < 10.9 |
| $Nb^{95}$ | < 5.6 | < 4.1 | < 2.1 | < 6.2 | < 5.0 |
| $Zr^{95}$ | < 8.2 | < 10.4 | < 4.8 | < 12.3 | < 9.6 |
| $Cs^{134}$ | < 7.2 | < 2.6 | < 3.4 | < 7.8 | < 6.2 |
| $Cs^{137}$ | < 5.4 | < 5.5 | < 4.2 | < 4.4 | < 3.2 |
| $Ba^{140}$ | < 14.5 | < 23.3 | < 16.9 | < 26.7 | < 17.4 |
| $La^{140}$ | < 3.6 | < 2.7 | < 2.0 | < 4.0 | < 4.2 |
| $Ce^{144}$ | < 33.6 | < 23.2 | < 29.1 | < 47.6 | < 51.7 |

## CL-116 MILK ACTIVITY – (Control) (continued)

| Date Collected | 31 Jul 02 | 14 Aug 02 | 28 Aug 02 | 11 Sep 02 | 25 Sep 02 |
|---|---|---|---|---|---|
| $I^{131}$ | < 0.4 | < 0.4 | < 0.4 | < 0.3 | < 0.4 |
| $Sr^{90}$ | (I) | (I) | (I) | (I) | (I) |
| $Be^{7}$ | < 32.4 | < 16.7 | < 25.8 | < 20.5 | < 39.9 |
| $K^{40}$ | 1,330 ± 167 | 1,385 ± 108 | 1,301 ± 119 | 1,297 ± 106 | 1,297 ± 113 |
| $Mn^{54}$ | < 4.6 | < 3.2 | < 3.4 | < 4.2 | < 4.4 |
| $Fe^{59}$ | < 5.7 | < 5.1 | < 8.3 | < 6.7 | < 5.1 |
| $Co^{58}$ | < 5.0 | < 2.2 | < 2.8 | < 2.3 | < 3.4 |
| $Co^{60}$ | < 4.4 | < 2.8 | < 2.5 | < 2.9 | < 3.1 |
| $Zn^{65}$ | < 12.3 | < 8.6 | < 5.7 | < 7.1 | < 9.0 |
| $Nb^{95}$ | < 3.1 | < 2.1 | < 4.5 | < 3.1 | < 3.2 |
| $Zr^{95}$ | < 7.9 | < 4.2 | < 7.6 | < 3.4 | < 4.6 |
| $Cs^{134}$ | < 5.5 | < 3.3 | < 3.9 | < 3.1 | < 4.1 |
| $Cs^{137}$ | < 5.4 | < 2.6 | < 3.4 | < 4.1 | < 2.4 |
| $Ba^{140}$ | < 31.5 | < 11.2 | < 15.5 | < 15.4 | < 21.9 |
| $La^{140}$ | < 3.9 | < 2.5 | < 2.0 | < 1.5 | < 2.9 |
| $Ce^{144}$ | < 30.2 | < 26.8 | < 34.7 | < 38.1 | < 36.7 |

| Date Collected | 09 Oct 02 | 23 Oct 02 | 26 Nov 02 | 02 Jan 03 |
|---|---|---|---|---|
| $I^{131}$ | < 0.3 | < 0.4 | < 0.3 | < 0.4 |
| $Sr^{90}$ | (I) | (I) | (I) | (I) |
| $Be^{7}$ | < 30.1 | < 54.5 | < 30.6 | < 30. |
| $K^{40}$ | 1,302 ± 114 | 1,232 ± 162 | 1,241 ± 109 | 1,259 ± 120 |
| $Mn^{54}$ | < 2.8 | < 5.4 | < 2.0 | < 4.6 |
| $Fe^{59}$ | < 7.1 | < 14.8 | < 7.4 | < 7.2 |
| $Co^{58}$ | < 3.5 | < 5.6 | < 3.2 | < 3.1 |
| $Co^{60}$ | < 3.3 | < 4.4 | < 2.5 | < 4.0 |
| $Zn^{65}$ | < 5.6 | < 9.7 | < 5.6 | < 7.8 |
| $Nb^{95}$ | < 2.4 | < 6.2 | < 3.6 | < 2.4 |
| $Zr^{95}$ | < 6.2 | < 9.8 | < 5.1 | < 5.5 |
| $Cs^{134}$ | < 2.5 | < 7.3 | < 2.5 | < 2.7 |
| $Cs^{137}$ | < 3.1 | < 3.9 | < 4.3 | < 2.6 |
| $Ba^{140}$ | < 19.2 | < 23.4 | < 16.9 | < 15.9 |
| $La^{140}$ | < 1.3 | < 4.3 | < 2.6 | < 2.7 |
| $Ce^{144}$ | < 35.5 | < 44.6 | < 30.2 | < 33.8 |

(I) Analysis for $Sr^{90}$ is not a required REMP analysis and was suspended in July 2002

## CL-1 GRASS ACTIVITY
(pCi/g wet)

| Date Collected | 01 May 02 | 15 May 02 | 29 May 02 | 12 Jun 02 | 26 Jun 02 |
|---|---|---|---|---|---|
| $Be^{7}$ | 3.41 ± 0.37 | 1.88 ± 0.25 | 0.88 ± 0.33 | 1.29 ± 0.23 | 1.27 ± 0.33 |
| $K^{40}$ | 6.20 ± 0.63 | 4.98 ± 0.60 | 5.17 ± 0.68 | 4.97 ± 0.56 | 4.59 ± 0.71 |
| $Mn^{54}$ | < .015 | < .016 | < .019 | < .016 | < .019 |
| $Fe^{59}$ | < .048 | < .036 | < .047 | < .031 | < .024 |
| $Co^{58}$ | < .017 | < .014 | < .019 | < .011 | < .020 |
| $Co^{60}$ | < .017 | < .015 | < .009 | < .012 | < .023 |
| $Zn^{65}$ | < .049 | < .049 | < .059 | < .052 | < .049 |
| $Nb^{95}$ | < .028 | < .020 | < .021 | < .016 | < .014 |
| $Zr^{95}$ | < .023 | < .050 | < .025 | < .044 | < .029 |
| $I^{131}$ | < .031 | < .032 | < .035 | < .021 | < .035 |
| $Cs^{134}$ | < .025 | < .012 | < .026 | < .019 | < .022 |
| $Cs^{137}$ | < .020 | < .027 | < .020 | < .017 | < .028 |
| $Ba^{140}$ | < .092 | < .093 | < .099 | < .095 | < .131 |
| $La^{140}$ | < .009 | < .011 | < .013 | < .016 | < .016 |
| $Ce^{144}$ | < .128 | < .156 | < .142 | < .145 | < .098 |

| Date Collected | 10 Jul 02 | 17 Jul 02 | 31 Jul 02 | 14 Aug 02 | 28 Aug 02 |
|---|---|---|---|---|---|
| $Be^{7}$ | 1.19 ± 0.31 | 1.64 ± 0.34 | 2.09 ± 0.24 | 1.13 ± 0.26 | 3.33 ± 0.41 |
| $K^{40}$ | 6.24 ± 0.71 | 8.17 ± 0.99 | 4.89 ± 0.44 | 3.75 ± 0.58 | 5.54 ± 0.66 |
| $Mn^{54}$ | < .015 | < .025 | < .013 | < .016 | < .025 |
| $Fe^{59}$ | < .030 | < .056 | < .027 | < .038 | < .037 |
| $Co^{58}$ | < .020 | < .020 | < .013 | < .018 | < .015 |
| $Co^{60}$ | < .021 | < .036 | < .009 | < .026 | < .017 |
| $Zn^{65}$ | < .036 | < .053 | < .032 | < .042 | < .027 |
| $Nb^{95}$ | < .021 | < .023 | < .013 | < .019 | < .014 |
| $Zr^{95}$ | < .047 | < .069 | < .017 | < .027 | < .048 |
| $I^{131}$ | < .049 | < .027 | < .030 | < .026 | < .045 |
| $Cs^{134}$ | < .017 | < .044 | < .007 | < .020 | < .028 |
| $Cs^{137}$ | < .022 | < .026 | < .014 | < .031 | < .025 |
| $Ba^{140}$ | < .081 | < .123 | < .058 | < .086 | < .123 |
| $La^{140}$ | < .014 | < .021 | < .011 | < .018 | < .023 |
| $Ce^{144}$ | < .186 | < .192 | < .105 | < .145 | < .135 |

## CL-1 GRASS ACTIVITY (continued)

| Date Collected | 11 Sep 02 | 25 Sep 02 | 09 Oct 02 | 23 Oct 02 |
|---|---|---|---|---|
| $Be^{7}$ | 4.64 ± 0.39 | 3.81 ± 0.38 | 1.47 ± 0.28 | 1.89 ± 0.29 |
| $K^{40}$ | 5.44 ± 0.61 | 4.04 ± 0.59 | 5.95 ± 0.51 | 6.16 ± 0.58 |
| $Mn^{54}$ | < .022 | < .016 | < .014 | < .015 |
| $Fe^{59}$ | < .024 | < .030 | < .032 | < .037 |
| $Co^{58}$ | < .016 | < .024 | < .010 | < .014 |
| $Co^{60}$ | < .014 | < .018 | < .011 | < .019 |
| $Zn^{65}$ | < .020 | < .035 | < .036 | < .022 |
| $Nb^{95}$ | < .018 | < .027 | < .015 | < .022 |
| $Zr^{95}$ | < .027 | < .041 | < .019 | < .039 |
| $I^{131}$ | < .028 | < .040 | < .030 | < .024 |
| $Cs^{134}$ | < .020 | < .027 | < .016 | < .020 |
| $Cs^{137}$ | < .017 | < .017 | < .019 | < .017 |
| $Ba^{140}$ | < .083 | < .098 | < .061 | < .066 |
| $La^{140}$ | < .019 | < .020 | < .008 | < .013 |
| $Ce^{144}$ | < .134 | < .167 | < .088 | < .154 |

## CL-2 GRASS ACTIVITY
(pCi/g wet)

| Date Collected | 01 May 02 | 15 May 02 | 29 May 02 | 12 Jun 02 | 26 Jun 02 |
|---|---|---|---|---|---|
| $Be^{7}$ | 1.09 ± 0.23 | 1.62 ± 0.25 | 1.47 ± 0.26 | 2.16 ± 0.32 | 1.85 ± 0.39 |
| $K^{40}$ | 4.85 ± 0.60 | 5.29 ± 0.62 | 5.78 ± 0.63 | 4.81 ± 0.62 | 5.07 ± 0.74 |
| $Mn^{54}$ | < .008 | < .012 | < .026 | < .019 | < .032 |
| $Fe^{59}$ | < .038 | < .038 | < .042 | < .036 | < .037 |
| $Co^{58}$ | < .019 | < .018 | < .017 | < .017 | < .023 |
| $Co^{60}$ | < .016 | < .014 | < .018 | < .022 | < .018 |
| $Zn^{65}$ | < .044 | < .028 | < .042 | < .052 | < .054 |
| $Nb^{95}$ | < .018 | < .016 | < .016 | < .011 | < .019 |
| $Zr^{95}$ | < .031 | < .038 | < .037 | < .023 | < .047 |
| $I^{131}$ | < .015 | < .038 | < .023 | < .027 | < .049 |
| $Cs^{134}$ | < .019 | < .019 | < .025 | < .014 | < .015 |
| $Cs^{137}$ | < .018 | < .020 | < .013 | < .018 | < .038 |
| $Ba^{140}$ | < .039 | < .066 | < .080 | < .109 | < .118 |
| $La^{140}$ | < .015 | < .014 | < .016 | < .016 | < .015 |
| $Ce^{144}$ | < .082 | < .107 | < .133 | < .089 | < .213 |

| Date Collected | 10 Jul 02 | 17 Jul 02 | 31 Jul 02 | 14 Aug 02 | 28 Aug 02 |
|---|---|---|---|---|---|
| $Be^{7}$ | < 0.18 | < 0.22 | 1.75 ± 0.25 | 0.73 ± 0.19 | 5.07 ± 0.34 |
| $K^{40}$ | 4.70 ± 0.54 | 5.79 ± 0.59 | 5.13 ± 0.47 | 3.30 ± 0.33 | 3.52 ± 0.42 |
| $Mn^{54}$ | < .015 | < .019 | < .016 | < .013 | < .015 |
| $Fe^{59}$ | < .044 | < .043 | < .032 | < .019 | < .029 |
| $Co^{58}$ | < .018 | < .023 | < .016 | < .011 | < .015 |
| $Co^{60}$ | < .024 | < .020 | < .013 | < .012 | < .012 |
| $Zn^{65}$ | < .044 | < .048 | < .047 | < .015 | < .018 |
| $Nb^{95}$ | < .019 | < .016 | < .013 | < .009 | < .010 |
| $Zr^{95}$ | < .018 | < .045 | < .017 | < .029 | < .025 |
| $I^{131}$ | < .031 | < .023 | < .027 | < .013 | < .027 |
| $Cs^{134}$ | < .021 | < .018 | < .013 | < .007 | < .008 |
| $Cs^{137}$ | < .017 | < .015 | < .010 | < .011 | < .009 |
| $Ba^{140}$ | < .049 | < .063 | < .063 | < .039 | < .080 |
| $La^{140}$ | < .013 | < .009 | < .007 | < .008 | < .008 |
| $Ce^{144}$ | < .123 | < .155 | < .107 | < .107 | < .108 |

## CL-2 GRASS ACTIVITY (continued)

| Date Collected | 11 Sep 02 | 25 Sep 02 | 09 Oct 02 | 23 Oct 02 |
|---|---|---|---|---|
| $Be^{7}$ | 2.92 ± 0.39 | 0.61 ± 0.17 | 4.15 ± 0.38 | 0.64 ± 0.21 |
| $K^{40}$ | 9.25 ± 0.96 | 7.48 ± 0.55 | 8.09 ± 0.70 | 5.41 ± 0.62 |
| $Mn^{54}$ | < .022 | < .011 | < .015 | < .017 |
| $Fe^{59}$ | < .045 | < .037 | < .036 | < .060 |
| $Co^{58}$ | < .024 | < .014 | < .007 | < .016 |
| $Co^{60}$ | < .022 | < .014 | < .015 | < .022 |
| $Zn^{65}$ | < .046 | < .026 | < .034 | < .033 |
| $Nb^{95}$ | < .026 | < .015 | < .010 | < .024 |
| $Zr^{95}$ | < .050 | < .028 | < .049 | < .046 |
| $I^{131}$ | < .039 | < .023 | < .040 | < .023 |
| $Cs^{134}$ | < .031 | < .012 | < .018 | < .021 |
| $Cs^{137}$ | < .037 | < .019 | < .011 | < .020 |
| $Ba^{140}$ | < .075 | < .052 | < .062 | < .064 |
| $La^{140}$ | < .020 | < .007 | < .021 | < .014 |
| $Ce^{144}$ | < .100 | < .075 | < .101 | < .168 |

## CL-8 GRASS ACTIVITY
**(pCi/g wet)**

| Date Collected | 01 May 02 | 15 May 02 | 29 May 02 | 12 Jun 02 | 26 Jun 02 |
|---|---|---|---|---|---|
| $Be^{7}$ | 1.40 ± 0.30 | 2.26 ± 0.34 | 0.82 ± 0.25 | 1.16 ± 0.26 | 1.16 ± 0.18 |
| $K^{40}$ | 7.28 ± 0.76 | 6.48 ± 0.68 | 5.70 ± 0.62 | 5.50 ± 0.58 | 5.16 ± 0.47 |
| $Mn^{54}$ | < .015 | < .022 | < .016 | < .016 | < .012 |
| $Fe^{59}$ | < .058 | < .042 | < .023 | < .027 | < .023 |
| $Co^{58}$ | < .017 | < .022 | < .011 | < .014 | < .012 |
| $Co^{60}$ | < .025 | < .019 | < .018 | < .019 | < .012 |
| $Zn^{65}$ | < .057 | < .036 | < .024 | < .043 | < .031 |
| $Nb^{95}$ | < .016 | < .024 | < .011 | < .012 | < .009 |
| $Zr^{95}$ | < .048 | < .051 | < .033 | < .051 | < .036 |
| $I^{131}$ | < .042 | < .040 | < .030 | < .018 | < .022 |
| $Cs^{134}$ | < .021 | < .019 | < .018 | < .015 | < .011 |
| $Cs^{137}$ | < .021 | < .021 | < .023 | < .024 | < .014 |
| $Ba^{140}$ | < .137 | < .108 | < .085 | < .077 | < .064 |
| $La^{140}$ | < .014 | < .019 | < .011 | < .015 | < .007 |
| $Ce^{144}$ | < .119 | < .172 | < .094 | < .086 | < .093 |
| **Date Collected** | **10 Jul 02** | **17 Jul 02** | **31 Jul 02** | **14 Aug 02** | **28 Aug 02** |
| $Be^{7}$ | 1.63 ± 0.37 | 0.63 ± 0.31 | 1.94 ± 0.22 | 1.59 ± 0.24 | 4.80 ± 0.44 |
| $K^{40}$ | 7.61 ± 0.84 | 8.10 ± 1.02 | 5.43 ± 0.48 | 2.88 ± 0.35 | 7.53 ± 0.77 |
| $Mn^{54}$ | < .026 | < .035 | < .017 | < .014 | < .022 |
| $Fe^{59}$ | < .057 | < .042 | < .024 | < .024 | < .057 |
| $Co^{58}$ | < .030 | < .019 | < .012 | < .011 | < .023 |
| $Co^{60}$ | < .016 | < .024 | < .017 | < .012 | < .027 |
| $Zn^{65}$ | < .064 | < .058 | < .044 | < .021 | < .049 |
| $Nb^{95}$ | < .026 | < .030 | < .013 | < .009 | < .031 |
| $Zr^{95}$ | < .038 | < .061 | < .023 | < .033 | < .023 |
| $I^{131}$ | < .044 | < .039 | < .035 | < .015 | < .026 |
| $Cs^{134}$ | < .026 | < .020 | < .015 | < .013 | < .025 |
| $Cs^{137}$ | < .023 | < .031 | < .022 | < .011 | < .019 |
| $Ba^{140}$ | < .150 | < .107 | < .079 | < .061 | < .108 |
| $La^{140}$ | < .014 | < .017 | < .014 | < .011 | < .014 |
| $Ce^{144}$ | < .190 | < .195 | < .090 | < .128 | < .171 |

## CL-8 GRASS ACTIVITY (continued)

| Date Collected | 11 Sep 02 | 25 Sep 02 | 09 Oct 02 | 23 Oct 02 |
|---|---|---|---|---|
| $Be^{7}$ | 3.90 ± 0.53 | 2.40 ± 0.40 | 3.86 ± 0.47 | 2.70 ± 0.43 |
| $K^{40}$ | 13.73 ± 1.19 | 7.03 ± 0.85 | 6.84 ± 0.89 | 7.16 ± 0.86 |
| $Mn^{54}$ | < .036 | < .020 | < .026 | < .025 |
| $Fe^{59}$ | < .053 | < .030 | < .071 | < .044 |
| $Co^{58}$ | < .024 | < .021 | < .029 | < .024 |
| $Co^{60}$ | < .021 | < .016 | < .027 | < .021 |
| $Zn^{65}$ | < .084 | < .056 | < .059 | < .029 |
| $Nb^{95}$ | < .021 | < .014 | < .035 | < .025 |
| $Zr^{95}$ | < .040 | < .043 | < .032 | < .031 |
| $I^{131}$ | < .048 | < .045 | < .055 | < .037 |
| $Cs^{134}$ | < .024 | < .017 | < .041 | < .018 |
| $Cs^{137}$ | < .034 | < .029 | < .029 | < .035 |
| $Ba^{140}$ | < .135 | < .134 | < .150 | < .103 |
| $La^{140}$ | < .022 | < .024 | < .025 | < .030 |
| $Ce^{144}$ | < .316 | < .137 | < .193 | < .127 |

## CL-116 GRASS ACTIVITY (Control)
(pCi/g wet)

| Date Collected | 01 May 02 | 15 May 02 | 29 May 02 | 12 Jun 02 | 26 Jun 02 |
|---|---|---|---|---|---|
| $Be^{7}$ | 2.47 ± 0.30 | 2.15 ± 0.30 | 2.44 ± 0.34 | 1.54 ± 0.33 | 1.15 ± 0.36 |
| $K^{40}$ | 6.30 ± 0.66 | 4.71 ± 0.56 | 6.83 ± 0.69 | 4.68 ± 0.74 | 4.76 ± 0.69 |
| $Mn^{54}$ | < .029 | < .019 | < .027 | < .014 | < .020 |
| $Fe^{59}$ | < .057 | < .030 | < .039 | < .044 | < .055 |
| $Co^{58}$ | < .017 | < .014 | < .026 | < .015 | < .012 |
| $Co^{60}$ | < .014 | < .021 | < .018 | < .021 | < .015 |
| $Zn^{65}$ | < .047 | < .028 | < .035 | < .031 | < .055 |
| $Nb^{95}$ | < .011 | < .028 | < .022 | < .032 | < .019 |
| $Zr^{95}$ | < .043 | < .039 | < .056 | < .059 | < .039 |
| $I^{131}$ | < .035 | < .036 | < .033 | < .053 | < .038 |
| $Cs^{134}$ | < .021 | < .025 | < .028 | < .023 | < .025 |
| $Cs^{137}$ | < .028 | < .019 | < .020 | < .031 | < .022 |
| $Ba^{140}$ | < .063 | < .084 | < .090 | < .125 | < .111 |
| $La^{140}$ | < .024 | < .012 | < .017 | < .014 | < .013 |
| $Ce^{144}$ | < .177 | < .119 | < .135 | < .154 | < .164 |

| Date Collected | 10 Jul 02 | 17 Jul 02 | 31 Jul 02 | 14 Aug 02 | 28 Aug 02 |
|---|---|---|---|---|---|
| $Be^{7}$ | 0.48 ± 0.25 | 0.54 ± 0.20 | 3.44 ± 0.32 | 0.57 ± 0.14 | 2.85 ± 0.28 |
| $K^{40}$ | 5.68 ± 0.78 | 7.14 ± 0.80 | 5.43 ± 0.49 | 3.73 ± 0.35 | 4.82 ± 0.41 |
| $Mn^{54}$ | < .026 | < .023 | < .013 | < .010 | < .012 |
| $Fe^{59}$ | < .054 | < .032 | < .022 | < .016 | < .030 |
| $Co^{58}$ | < .027 | < .013 | < .013 | < .008 | < .014 |
| $Co^{60}$ | < .018 | < .024 | < .012 | < .007 | < .011 |
| $Zn^{65}$ | < .059 | < .038 | < .032 | < .021 | < .032 |
| $Nb^{95}$ | < .025 | < .017 | < .016 | < .008 | < .016 |
| $Zr^{95}$ | < .053 | < .042 | < .035 | < .018 | < .011 |
| $I^{131}$ | < .025 | < .026 | < .020 | < .015 | < .033 |
| $Cs^{134}$ | < .031 | < .014 | < .015 | < .008 | < .016 |
| $Cs^{137}$ | < .023 | < .033 | < .015 | < .010 | < .013 |
| $Ba^{140}$ | < .109 | < .103 | < .055 | < .044 | < .046 |
| $La^{140}$ | < .020 | < .017 | < .007 | < .009 | < .007 |
| $Ce^{144}$ | < .192 | < .124 | < .112 | < .053 | < .117 |

## CL-116 GRASS ACTIVITY (Control) (continued)

| Date Collected | 11 Sep 02 | 25 Sep 02 | 09 Oct 02 | 23 Oct 02 |
|---|---|---|---|---|
| $Be^7$ | 6.78 ± 0.51 | 0.49 ± 0.20 | 2.24 ± 0.30 | 1.75 ± 0.26 |
| $K^{40}$ | 15.38 ± 1.03 | 6.43 ± 0.65 | 6.42 ± 0.58 | 5.41 ± 0.47 |
| $Mn^{54}$ | < .028 | < .026 | < .018 | < .013 |
| $Fe^{59}$ | < .067 | < .045 | < .031 | < .019 |
| $Co^{58}$ | < .024 | < .022 | < .017 | < .007 |
| $Co^{60}$ | < .024 | < .016 | < .018 | < .016 |
| $Zn^{65}$ | < .042 | < .050 | < .032 | < .019 |
| $Nb^{95}$ | < .038 | < .016 | < .018 | < .013 |
| $Zr^{95}$ | < .049 | < .023 | < .033 | < .030 |
| $I^{131}$ | < .034 | < .040 | < .039 | < .024 |
| $Cs^{134}$ | < .028 | < .023 | < .018 | < .014 |
| $Cs^{137}$ | < .030 | < .019 | < .023 | < .017 |
| $Ba^{140}$ | < .097 | < .133 | < .078 | < .062 |
| $La^{140}$ | < .011 | < .020 | < .010 | < .011 |
| $Ce^{144}$ | < .210 | < .176 | < .176 | < .127 |

## CL-114 GREEN LEAFY VEGETABLE ACTIVITY (Control)

(pCi/g wet)

| Date Collected | 26 Jun 02 | 26 Jun 02 | 26 Jun 02 | 31 Jul 02 | 31 Jul 02 | 31 Jul 02 |
|---|---|---|---|---|---|---|
| Sample Type | Kale | Kohlrabi | Cabbage | Cabbage | Kohlrabi | Kale |
| Gross Beta | 5.71 ± 0.13 | 5.66 ± 0.12 | 4.63 ± 0.12 | 2.89 ± 0.08 | 3.93 ± 0.11 | 5.55 ± 0.17 |
| $Be^{7}$ | < 0.14 | < 0.19 | < 0.10 | < 0.11 | < 0.10 | < 0.21 |
| $K^{40}$ | 5.38 ± 0.43 | 4.81 ± 0.60 | 4.03 ± 0.31 | 2.99 ± 0.39 | 3.54 ± 0.30 | 4.42 ± 0.37 |
| $Mn^{54}$ | < .012 | < .015 | < .011 | < .013 | < .009 | < .010 |
| $Fe^{59}$ | < .032 | < .041 | < .019 | < .026 | < .015 | < .026 |
| $Co^{58}$ | < .014 | < .022 | < .008 | < .010 | < .007 | < .011 |
| $Co^{60}$ | < .008 | < .020 | < .006 | < .009 | < .005 | < .009 |
| $Zn^{65}$ | < .026 | < .042 | < .015 | < .022 | < .015 | < .021 |
| $Nb^{95}$ | < .009 | < .017 | < .007 | < .019 | < .011 | < .009 |
| $Zr^{95}$ | < .017 | < .033 | < .013 | < .017 | < .028 | < .011 |
| $I^{131}$ | < .021 | < .027 | < .016 | < .025 | < .021 | < .017 |
| $Cs^{134}$ | < .011 | < .022 | < .008 | < .015 | < .012 | < .009 |
| $Cs^{137}$ | < .013 | < .023 | < .008 | < .014 | < .007 | < .010 |
| $Ba^{140}$ | < .056 | < .066 | < .041 | < .039 | < .049 | < .038 |
| $La^{140}$ | < .012 | < .016 | < .004 | < .022 | < .005 | < .006 |
| $Ce^{144}$ | < .075 | < .136 | < .072 | < .050 | < .051 | < .071 |
| **Date Collected** | **28 Aug 02** | **28 Aug 02** | **28 Aug 04** | **24 Sep 02** | **24 Sep 02** | **24 Sep 02** |
| **Sample Type** | **Kale** | **Cabbage** | **Kohlrabi** | **Cabbage** | **Kohlrabi** | **Kale** |
| Gross Beta | 5.97 ± 0.15 | 3.94 ± 0.10 | 3.79+ ± 0.06 | 3.00 ± 0.06 | 4.50 ± 0.12 | 4.37 ± 0.09 |
| $Be^{7}$ | 0.39 ± 0.18 | < 0.16 | 0.27 ± 0.08 | < 0.07 | 0.48 ± 0.22 | 0.24 ± 0.13 |
| $K^{40}$ | 3.61 ± 0.51 | 2.35 ± 0.44 | 3.18 ± 0.25 | 2.20 ± 0.22 | 3.81 ± 0.57 | 4.49 ± 0.51 |
| $Mn^{54}$ | < .019 | < .016 | < .005 | < .005 | < .013 | < .018 |
| $Fe^{59}$ | < .040 | < .032 | < .012 | < .013 | < .042 | < .019 |
| $Co^{58}$ | < .014 | < .011 | < .005 | < .006 | < .011 | < .015 |
| $Co^{60}$ | < .018 | < .008 | < .006 | < .004 | < .017 | < .016 |
| $Zn^{65}$ | < .023 | < .029 | < .012 | < .012 | < .015 | < .031 |
| $Nb^{95}$ | < .012 | < .020 | < .008 | < .007 | < .009 | < .009 |
| $Zr^{95}$ | < .029 | < .037 | < .011 | < .008 | < .024 | < .023 |
| $I^{131}$ | < .034 | < .038 | < .018 | < .011 | < .036 | < .034 |
| $Cs^{134}$ | < .019 | < .013 | < .004 | < .007 | < .016 | < .012 |
| $Cs^{137}$ | < .007 | < .016 | < .005 | < .008 | < .013 | < .013 |
| $Ba^{140}$ | < .086 | < .075 | < .048 | < .031 | < .088 | < .064 |
| $La^{140}$ | < .022 | < .012 | < .011 | < .005 | < .012 | < .011 |
| $Ce^{144}$ | < .109 | < .049 | < .052 | < .043 | < .082 | < .088 |

## CL-115 GREEN LEAFY VEGETABLE ACTIVITY

**(pCi/g wet)**

| Date Collected<br>Sample Type | 31 Jul 02<br>Lettuce | 31 Jul 02<br>Cabbage | 31 Jul 02<br>Kohlrabi | 28 Aug 02<br>Lettuce |
|---|---|---|---|---|
| Gross Beta | 5.44 ± 0.17 | 2.78 ± 0.08 | 4.02 ± 0.12 | 5.71 ± 0.15 |
| $Be^{7}$ | < 0.26 | < 0.14 | < 0.14 | 1.53 ± 0.33 |
| $K^{40}$ | 6.31 ± 0.73 | 2.76 ± 0.37 | 3.58 ± 0.43 | 5.46 ± 0.66 |
| $Mn^{54}$ | < .018 | < .017 | < .010 | < .023 |
| $Fe^{59}$ | < .034 | < .018 | < .028 | < .056 |
| $Co^{58}$ | < .019 | < .012 | < .013 | < .013 |
| $Co^{60}$ | < .024 | < .006 | < .012 | < .030 |
| $Zn^{65}$ | < .037 | < .028 | < .019 | < .023 |
| $Nb^{95}$ | < .027 | < .017 | < .012 | < .024 |
| $Zr^{95}$ | < .048 | < .033 | < .019 | < .054 |
| $I^{131}$ | < .039 | < .027 | < .019 | < .037 |
| $Cs^{134}$ | < .020 | < .016 | < .013 | < .018 |
| $Cs^{137}$ | < .024 | < .012 | < .011 | < .029 |
| $Ba^{140}$ | < .108 | < .055 | < .057 | < .086 |
| $La^{140}$ | < .022 | < .015 | < .015 | < .030 |
| $Ce^{144}$ | < .199 | < .084 | < .099 | < .124 |
| **Date Collected<br>Sample Type** | **28 Aug 02<br>Cabbage** | **28 Aug 02<br>Kohlrabi** | **24 Sep 02<br>Cabbage** | **24 Sep 02<br>Kohlrabi** |
| Gross Beta | 2.80 ± 0.06 | 4.75 ± 0.12 | 3.85 ± 0.08 | 4.05 ± 0.08 |
| $Be^{7}$ | < 0.14 | 0.25 ± 0.13 | < 0.17 | < 0.13 |
| $K^{40}$ | 2.48 ± 0.33 | 4.04 ± 0.35 | 3.64 ± 0.42 | 3.96 ± 0.38 |
| $Mn^{54}$ | < .012 | < .011 | < .013 | < .012 |
| $Fe^{59}$ | < .023 | < .024 | < .034 | < .016 |
| $Co^{58}$ | < .011 | < .007 | < .013 | < .009 |
| $Co^{60}$ | < .005 | < .011 | < .009 | < .013 |
| $Zn^{65}$ | < .017 | < .017 | < .027 | < .019 |
| $Nb^{95}$ | < .010 | < .011 | < .011 | < .012 |
| $Zr^{95}$ | < .023 | < .028 | < .017 | < .010 |
| $I^{131}$ | < .022 | < .021 | < .038 | < .019 |
| $Cs^{134}$ | < .015 | < .012 | < .017 | < .014 |
| $Cs^{137}$ | < .013 | < .012 | < .017 | < .012 |
| $Ba^{140}$ | < .042 | < .045 | < .071 | < .062 |
| $La^{140}$ | < .020 | < .006 | < .020 | < .007 |
| $Ce^{144}$ | < .083 | < .073 | < .103 | < .077 |

## CL-117 GREEN LEAFY VEGETABLE ACTIVITY

**(pCi/g wet)**

| Date Collected | 26 Jun 02 | 26 Jun 02 | 26 Jun 02 | 31 Jul 02 | 31 Jul 02 | 31 Jul 02 |
|---|---|---|---|---|---|---|
| Sample Type | Lettuce | Cabbage | Kohlrabi | Kohlrabi | Lettuce | Cabbage |
| Gross Beta | 5.66 ± 0.13 | 4.09 ± 0.09 | 5.88 ± 0.13 | 3.18 ± 0.09 | 5.05 ± 0.05 | 2.57 ± 0.07 |
| $Be^7$ | < 0.08 | < 0.12 | < 0.22 | < 0.11 | < 0.23 | 0.17 ± 0.10 |
| $K^{40}$ | 4.64 ± 0.44 | 4.71 ± 0.58 | 5.19 ± 0.62 | 2.79 ± 0.34 | 7.36 ± 0.73 | 2.80 ± 0.29 |
| $Mn^{54}$ | < .009 | < .014 | < .023 | < .006 | < .022 | < .010 |
| $Fe^{59}$ | < .030 | < .027 | < .050 | < .020 | < .027 | < .027 |
| $Co^{58}$ | < .012 | < .013 | < .013 | < .009 | < .016 | < .011 |
| $Co^{60}$ | < .010 | < .020 | < .019 | < .006 | < .019 | < .007 |
| $Zn^{65}$ | < .019 | < .034 | < .028 | < .020 | < .029 | < .026 |
| $Nb^{95}$ | < .015 | < .014 | < .011 | < .014 | < .018 | < .007 |
| $Zr^{95}$ | < .034 | < .031 | < .039 | < .021 | < .052 | < .022 |
| $I^{131}$ | < .018 | < .019 | < .031 | < .021 | < .048 | < .014 |
| $Cs^{134}$ | < .013 | < .017 | < .016 | < .014 | < .025 | < .010 |
| $Cs^{137}$ | < .008 | < .012 | < .017 | < .010 | < .017 | < .006 |
| $Ba^{140}$ | < .041 | < .049 | < .103 | < .053 | < .100 | < .045 |
| $La^{140}$ | < .014 | < .030 | < .017 | < .006 | < .017 | < .007 |
| $Ce^{144}$ | < .046 | < .059 | < .170 | < .047 | < .145 | < .051 |
| **Date Collected** | **28 Aug 02** | **28 Aug 02** | **28 Aug 02** | **24 Sep 02** | **24 Sep 02** | **24 Sep 02** |
| **Sample Type** | **Kohlrabi** | **Kale** | **Cabbage** | **Cabbage** | **Kohlrabi** | **Kale** |
| Gross Beta | 2.90 ± 0.06 | 6.04 ± 0.13 | 2.73 ± 0.06 | 4.38 ± 0.09 | 4.41 ± 0.13 | 4.31 ± 0.10 |
| $Be^7$ | 0.19 ± 0.10 | 0.70 ± 0.20 | < 0.13 | 0.17 ± 0.07 | < 0.21 | 0.32 ± 0.16 |
| $K^{40}$ | 2.55 ± 0.28 | 6.04 ± 0.66 | 2.56 ± 0.28 | 2.06 ± 0.20 | 3.76 ± 0.49 | 4.06 ± 0.45 |
| $Mn^{54}$ | < .006 | < .014 | < .011 | < .004 | < .013 | < .010 |
| $Fe^{59}$ | < .022 | < .052 | < .013 | < .010 | < .011 | < .038 |
| $Co^{58}$ | < .009 | < .016 | < .006 | < .003 | < .010 | < .013 |
| $Co^{60}$ | < .008 | < .024 | < .008 | < .005 | < .009 | < .014 |
| $Zn^{65}$ | < .020 | < .029 | < .024 | < .009 | < .036 | < .026 |
| $Nb^{95}$ | < .005 | < .012 | < .010 | < .005 | < .009 | < .015 |
| $Zr^{95}$ | < .020 | < .039 | < .017 | < .010 | < .032 | < .015 |
| $I^{131}$ | < .009 | < .036 | < .022 | < .005 | < .027 | < .021 |
| $Cs^{134}$ | < .010 | < .021 | < .006 | < .003 | < .013 | < .012 |
| $Cs^{137}$ | < .010 | < .020 | < .010 | < .006 | < .013 | < .010 |
| $Ba^{140}$ | < .040 | < .099 | < .048 | < .031 | < .065 | < .063 |
| $La^{140}$ | < .004 | < .013 | < .006 | < .008 | < .011 | < .010 |
| $Ce^{144}$ | < .066 | < .056 | < .048 | < .046 | < .094 | < .097 |

## CL-118 GREEN LEAFY VEGETABLE ACTIVITY

(pCi/g wet)

| Date Collected | 31 Jul 02 | 31 Jul 02 | 31 Jul 02 | 28 Aug 02 |
|---|---|---|---|---|
| Sample Type | Lettuce | Cabbage | Kohlrabi | Lettuce |
| Gross Beta | 7.39 ± 0.23 | 5.18 ± 0.16 | 3.61 ± 0.10 | 5.58 ± 0.14 |
| $Be^{7}$ | 0.35 ± 0.16 | < 0.09 | 0.19 ± 0.08 | 0.56 ± 0.14 |
| $K^{40}$ | 8.49 ± 0.64 | 3.82 ± 0.29 | 3.42 ± 0.29 | 2.86 ± 0.30 |
| $Mn^{54}$ | < .022 | < .007 | < .010 | < .008 |
| $Fe^{59}$ | < .038 | < .014 | < .014 | < .013 |
| $Co^{58}$ | < .018 | < .008 | < .005 | < .008 |
| $Co^{60}$ | < .019 | < .010 | < .009 | < .008 |
| $Zn^{65}$ | < .035 | < .016 | < .008 | < .020 |
| $Nb^{95}$ | < .009 | < .007 | < .006 | < .010 |
| $Zr^{95}$ | < .036 | < .011 | < .014 | < .015 |
| $I^{131}$ | < .025 | < .015 | < .013 | < .020 |
| $Cs^{134}$ | < .013 | < .010 | < .007 | < .008 |
| $Cs^{137}$ | < .017 | < .009 | < .010 | < .008 |
| $Ba^{140}$ | < .088 | < .034 | < .046 | < .058 |
| $La^{140}$ | < .009 | < .011 | < .008 | < .009 |
| $Ce^{144}$ | < .134 | < .041 | < .062 | < .064 |
| **Date Collected** | **28 Aug 02** | **28 Aug 02** | **24 Sep 02** | **24 Sep 02** |
| **Sample Type** | **Kohlrabi** | **Cabbage** | **Cabbage** | **Kohlrabi** |
| Gross Beta | 3.74 ± 0.08 | 1.65 ± 0.04 | 3.73 ± 0.08 | 5.01 ± 0.13 |
| $Be^{7}$ | 0.43 ± 0.15 | 0.62 ± 0.13 | < 0.13 | 0.37 ± 0.14 |
| $K^{40}$ | 3.30 ± 0.46 | 2.16 ± 0.27 | 3.39 ± 0.39 | 4.44 ± 0.40 |
| $Mn^{54}$ | < .013 | < .009 | < .012 | < .009 |
| $Fe^{59}$ | < .035 | < .016 | < .032 | < .020 |
| $Co^{58}$ | < .011 | < .007 | < .008 | < .009 |
| $Co^{60}$ | < .010 | < .010 | < .012 | < .013 |
| $Zn^{65}$ | < .038 | < .019 | < .028 | < .014 |
| $Nb^{95}$ | < .011 | < .014 | < .016 | < .009 |
| $Zr^{95}$ | < .040 | < .009 | < .029 | < .019 |
| $I^{131}$ | < .029 | < .026 | < .033 | < .023 |
| $Cs^{134}$ | < .016 | < .012 | < .009 | < .006 |
| $Cs^{137}$ | < .011 | < .008 | < .013 | < .008 |
| $Ba^{140}$ | < .082 | < .046 | < .063 | < .043 |
| $La^{140}$ | < .011 | < .011 | < .007 | < .007 |
| $Ce^{144}$ | < .061 | < .064 | < .097 | < .092 |

## CL-19 FISH ACTIVITY
(pCi/g wet)

| Date Collected | 15 Apr 02 | 15 Apr 02 | 15 Apr 02 | 15 Apr 02 |
|---|---|---|---|---|
| Type | Bluegill | Carp | Largemouth Bass | Striped White Bass |
| $Be^{7}$ | < 0.15 | < 0.05 | < 0.10 | < 0.08 |
| $K^{40}$ | 2.81 ± 0.36 | 2.67 ± 0.26 | 2.93 ± 0.31 | 2.63 ± 0.33 |
| $Mn^{54}$ | < .009 | < .008 | < .009 | < .007 |
| $Fe^{59}$ | < .037 | < .010 | < .026 | < .029 |
| $Co^{58}$ | < .007 | < .007 | < .014 | < .007 |
| $Co^{60}$ | < .012 | < .006 | < .007 | < .005 |
| $Zn^{65}$ | < .024 | < .008 | < .018 | < .018 |
| $Nb^{95}$ | < .023 | < .010 | < .009 | < .017 |
| $Zr^{95}$ | < .017 | < .011 | < .020 | < .011 |
| $Cs^{134}$ | < .008 | < .007 | < .012 | < .012 |
| $Cs^{137}$ | < .009 | < .008 | < .009 | < .010 |
| $Ba^{140}$ | < .165 | < .040 | < .070 | < .071 |
| $La^{140}$ | < .028 | < .012 | < .041 | < .016 |
| $Ce^{144}$ | < .080 | < .035 | < .052 | < .033 |

| Date Collected | 14 Oct 02 | 14 Oct 02 | 14 Oct 02 | 14 Oct 02 |
|---|---|---|---|---|
| Type | Carp | Largemouth Bass | Bluegill | White Bass |
| $Be^{7}$ | < 0.14 | < 0.08 | < 0.15 | < 0.11 |
| $K^{40}$ | 2.90 ± 0.38 | 3.10 ± 0.38 | 2.43 ± 0.36 | 2.83 ± 0.47 |
| $Mn^{54}$ | < .011 | < .012 | < .013 | < .009 |
| $Fe^{59}$ | < .041 | < .013 | < .024 | < .047 |
| $Co^{58}$ | < .011 | < .008 | < .011 | < .016 |
| $Co^{60}$ | < .017 | < .007 | < .016 | < .008 |
| $Zn^{65}$ | < .032 | < .011 | < .026 | < .022 |
| $Nb^{95}$ | < .014 | < .008 | < .018 | < .011 |
| $Zr^{95}$ | < .028 | < .020 | < .033 | < .026 |
| $Cs^{134}$ | < .008 | < .006 | < .008 | < .011 |
| $Cs^{137}$ | < .009 | < .012 | < .015 | < .017 |
| $Ba^{140}$ | < .081 | < .104 | < .151 | < .108 |
| $La^{140}$ | < .025 | < .017 | < .022 | < .018 |
| $Ce^{144}$ | < .078 | < .040 | < .119 | < .047 |

## CL-105 FISH ACTIVITY (Control)
(pCi/g wet)

| Date Collected | 15 Apr 02 | 15 Apr 02 | 15 Apr 02 | 15 Apr 02 |
|---|---|---|---|---|
| Type | Bluegill | Bass | Carp | Crappie |
| $Be^{7}$ | < 0.22 | < 0.13 | < 0.12 | < 0.11 |
| $K^{40}$ | 3.09 ± 0.53 | 2.62 ± 0.38 | 2.89 ± 0.39 | 2.43 ± 0.37 |
| $Mn^{54}$ | < .012 | < .008 | < .013 | < .010 |
| $Fe^{59}$ | < .018 | < .026 | < .015 | < .036 |
| $Co^{58}$ | < .011 | < .011 | < .012 | < .008 |
| $Co^{60}$ | < .012 | < .006 | < .014 | < .011 |
| $Zn^{65}$ | < .026 | < .020 | < .033 | < .029 |
| $Nb^{95}$ | < .018 | < .014 | < .013 | < .011 |
| $Zr^{95}$ | < .043 | < .019 | < .027 | < .018 |
| $Cs^{134}$ | < .012 | < .014 | < .013 | < .011 |
| $Cs^{137}$ | < .014 | < .010 | < .012 | < .014 |
| $Ba^{140}$ | < .142 | < .095 | < .105 | < .110 |
| $La^{140}$ | < .074 | < .035 | < .046 | < .059 |
| $Ce^{144}$ | < .078 | < .044 | < .043 | < .057 |

| Date Collected | 10 Oct 02 | 10 Oct 02 | 10 Oct 02 | 10 Oct 02 |
|---|---|---|---|---|
| Type | Bass | Bluegill | Crappie | Carp |
| $Be^{7}$ | < 0.13 | < 0.06 | < 0.10 | < 0.12 |
| $K^{40}$ | 3.10 ± 0.46 | 2.94 ± 0.27 | 2.09 ± 0.38 | 2.86 ± 0.39 |
| $Mn^{54}$ | < .014 | < .006 | < .011 | < .007 |
| $Fe^{59}$ | < .019 | < .024 | < .026 | < .027 |
| $Co^{58}$ | < .006 | < .005 | < .010 | < .010 |
| $Co^{60}$ | < .015 | < .007 | < .006 | < .014 |
| $Zn^{65}$ | < .026 | < .009 | < .010 | < .008 |
| $Nb^{95}$ | < .016 | < .009 | < .008 | < .010 |
| $Zr^{95}$ | < .014 | < .016 | < .022 | < .015 |
| $Cs^{134}$ | < .019 | < .005 | < .011 | < .006 |
| $Cs^{137}$ | < .007 | < .007 | < .012 | < .008 |
| $Ba^{140}$ | < .078 | < .072 | < .059 | < .071 |
| $La^{140}$ | < .026 | < .008 | < .015 | < .020 |
| $Ce^{144}$ | < .068 | < .048 | < .065 | < .072 |

## CL-7B SHORELINE SEDIMENT ACTIVITY
(pCi/g dry)

| Date Collected | 15 Apr 02 | 10 Oct 02 |
|---|---|---|
| Gross Alpha | < 3.0 | < 4.8 |
| Gross Beta | 6.7 ± 1.2 | 9.4 ± 2.8 |
| $Sr^{90}$ | 0.042 ± 012 | < 0.013 |
| $Be^{7}$ | < 0.13 | < 0.10 |
| $K^{40}$ | 5.90 ± 0.45 | 5.86 ± 0.40 |
| $Mn^{54}$ | < .011 | < .009 |
| $Fe^{59}$ | < .035 | < .031 |
| $Co^{58}$ | < .016 | < .012 |
| $Co^{60}$ | < .009 | < .006 |
| $Zn^{65}$ | < .033 | < .022 |
| $Nb^{95}$ | < .012 | < .016 |
| $Zr^{95}$ | < .025 | < .027 |
| $Cs^{134}$ | < .017 | < .016 |
| $Cs^{137}$ | < .013 | < .010 |
| $Ba^{140}$ | < .070 | < .058 |
| $La^{140}$ | < .008 | < .016 |
| $Ce^{144}$ | < .050 | < .048 |