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ILLINOIS POWER

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March 24, 1992

Docket No. 50-461

Document Control Desk
Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Clinton Power Station
Annual Radiological Environmental Monitoring Program Report

Dear Sir:

Illinois Power Company is submitting the 1991 Annual Radiological Environmental Monitoring Program Report for Clinton Power Station. This submittal is provided in accordance with the requirements of Section 6.9.1.6 of Clinton Power Station Technical Specifications.

Sincerely yours,

F. A. Spangenberg, III
Manager, Licensing and Safety

WSI/alh

Attachment

cc: NRC Clinton Licensing Project Manager
NRC Resident Office
Regional Administrator, Region III, USNRC
Illinois Department of Nuclear Safety

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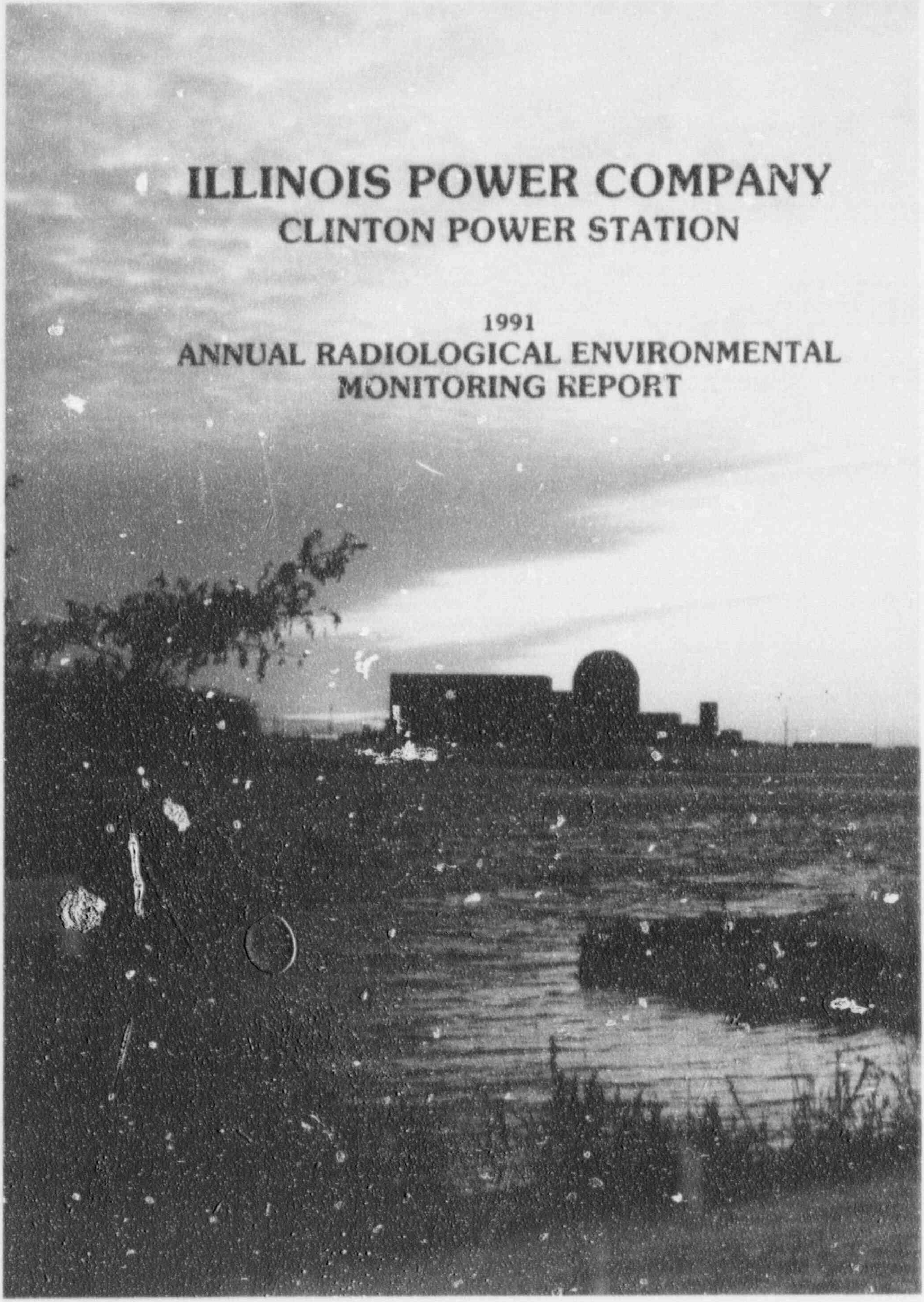
ILLINOIS POWER COMPANY
CLINTON POWER STATION

1991
ANNUAL RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT



1991

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT

FOR THE

CLINTON POWER STATION

Prepared by

Radiological Environmental Group

Radiation Protection Department

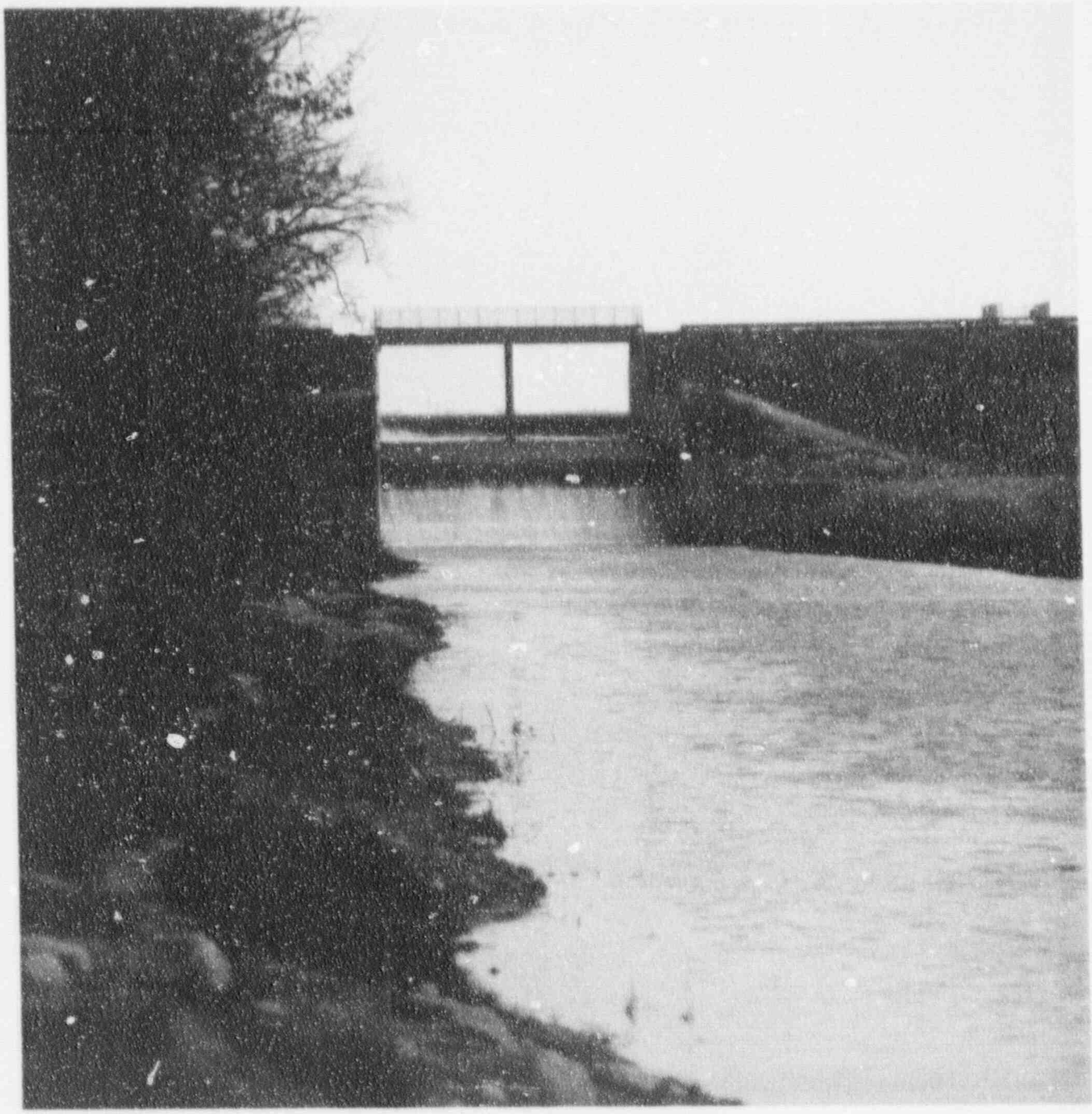
May 1, 1992

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

LIST OF TABLES

LIST OF FIGURES



EXECUTIVE SUMMARY

CLINTON POWER STATION
OPERATIONAL RADIOLOGICAL ENVIRONMENTAL
MONITORING REPORT FOR 1991

I. EXECUTIVE SUMMARY

A. Radiological Environmental Monitoring Program

This report describes the Operational Radiological Environmental Monitoring Program (REMP) conducted during 1991 in the vicinity of the Clinton Power Station (the fifth year of the Clinton Power Station Operational Radiological Environmental Monitoring Program). The REMP was performed in 1991 as required by the Clinton Power Station Operating License issued by the United States Nuclear Regulatory Commission. The purpose of the REMP is to assess any radiological impact upon the surrounding environment due to the operation of the Clinton Power Station.

Over 1760 environmental samples were collected during 1991. These samples represented direct radiation; atmospheric, terrestrial, and aquatic environments; and Clinton Lake surface water and public drinking water supplies. More than 2290 analyses were performed on these environmental samples. Results showed that radioactivity levels were similar to the preoperational levels. The Clinton Power Station Preoperational Radiological Environmental Monitoring Report documented natural background radionuclides in the environment surrounding Clinton Power Station prior to plant operations.

Direct radiation measurements were taken at 86 locations using thermoluminescent dosimeters. The average annual dose was 67 mrem. This is consistent with the annual average dose documented in the Preoperational Radiological Environmental Monitoring Report, 1980 - 1987.

Atmospheric monitoring results for 1991 were within the same range as environmental measurements made prior to the commercial operation of the Clinton Power Station (preoperational data). No radioactivity attributable to the operation of the Clinton Power Station was detected in any atmospheric samples during 1991.

Terrestrial monitoring includes analyses of vegetation samples, grass samples, milk samples, and meat samples. Results of the analyses showed natural radioactivity and radioactivity attributed to other historical nuclear events (i.e., fallout from nuclear weapons testing and the 1986 Russian reactor accident at Chernobyl). The radioactivity levels detected were consistent with the preoperational results.

Aquatic monitoring includes analyses of fish samples, lake bottom sediment samples, lake shoreline sediment samples and aquatic vegetations (periphyton) samples. All sampled media showed that radioactivity levels were consistent with the levels in the preoperational program.

Ground and surface water monitoring results were consistent with the results obtained during the preoperational program. None of the 1991 samples showed radioactive material due to the operation of the Clinton Power Station.

Releases of gaseous radioactive materials were accurately measured in plant effluents during 1991. No release exceeded or even approached the limits specified in the Clinton Power Station Offsite Dose Calculation Manual (ODCM). A total of 5.94 curies of gaseous radioactive effluents were released during 1991. This total includes 5.22 curies of tritium.

Releases of liquid radioactive materials were also accurately measured in plant effluents during 1991. As stated above for gaseous effluents, no release exceeded or approached the Clinton Power Station ODCM limits. A total of 4.49 curies of liquid radioactive effluents were released during 1991. This total includes 4.41 curies of tritium.

The highest calculated total body dose received by a member of the public due to the release of radioactive materials in gaseous and liquid effluents from Clinton Power Station was 0.00978 mRem.

Radiological environmental measurements taken during 1991 demonstrated that operational and engineered controls on the radioactive effluents released from the Clinton Power Station functioned as designed. Any radioactivity that was detected in the environment at indicator locations was appropriately compared against both the measurements at control locations (sample locations not affected by station operations) and preoperational results.

All comparisons between 1991 operational data and preoperational data showed that the operation of Clinton Power Station had no measurable effect upon the environment in 1991.

B. Non-Radiological Environmental Programs

Illinois Power's corporate environmental goal states: "Illinois Power is to become a corporate leader on environmental issues by demonstrating its commitment and encouraging a partnership with its customers and employees to improve the environment".

To achieve this goal and to comply with various permits and licenses, Illinois Power Company is involved in the following environmental projects adjacent to the Clinton Power Station (CPS) site:

- Environmental Monitoring Program
- Fish Reading Ponds
- Lake Temperature Monitoring
- Management of Settling Pond for Waterfowl Habitat and Nesting Structure Improvement
- Deer Management
- Turkey Stocking Program
- Prairie Restoration
- Water Chemistry
- Outreach Programs

Illinois Power Company designed and constructed the facilities for the recreational areas surrounding Clinton Lake. These areas were then leased to the Illinois Department of Conservation (IDOC) for recreation. Illinois Power works with the IDOC and some private enterprises in maintaining these facilities and programs, e.g., the Marina, fish cleaning stations, boat ramps, parking lots, picnic shelters, canoe access areas, bank fishing areas, etc. The cooperative agreement between Illinois Power and IDOC results in a maximum effort of environmental awareness and effective managerial decisions.

INTRODUCTION

II. INTRODUCTION

The following background information regarding basic radiation characteristics, plant operations, radioactive effluent controls and environmental monitoring is provided to assist the reader in reviewing this document.

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". X-rays and gamma 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 alpha and beta particles, or have no charge, like neutrons.

The term "half-life" refers to the time it takes 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 a million years. Radionuclides may decay directly into stable elements or may undergo a series of decays which ultimately end up reaching a stable element. Radionuclides are found in nature (e.g., radioactive uranium, thorium, carbon and potassium), and may also be produced artificially in accelerators and nuclear reactors (e.g., radioactive iodine, cesium and cobalt).

The activity of a radioactive source is the number of nuclear disintegrations (decays) of the source per unit of time. The unit of activity is the curie. A one curie radioactive source undergoes 2.2 trillion disintegrations per minute, but in the realm of nuclear power plant effluents and environmental radioactivity, this is a large unit. Therefore, two fractional units, the microcurie and the picocurie, are more commonly used. The microcurie (uCi) 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 analogy with distances. A picocurie would be the width of a pencil mark while a curie would be 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 about 462,400 grams to obtain an activity of one curie. But iodine-131 (I-131) with a half-life of 8.04 days only requires about 0.003 grams to produce 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 is 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. For example, radioiodine selectively concentrates in the thyroid gland, whereas radiocesium collects in muscle and liver tissue, and radiostrontium collects in mineralized bone. The total dose to organs by a given radionuclide is also influenced by the quantity and the duration of time that the radionuclide remains in the body. Owing to radioactive decay and human metabolism factors, some radionuclides stay in the body for very short times while others remain for years.

The amount of radiation dose which an individual receives is expressed in rem. Since human exposure to radiation usually involves very small exposures, the millirem (mrem) is the unit most commonly used. One millirem is one thousandth of a rem.

B. Sources of Radiation Exposure

Many sources of radiation exposure exist. The most common and least controllable source is background radiation from cosmic rays and terrestrial radioactivity 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 which has come from the earth including our own bodies is, therefore, naturally radioactive. Radioactive materials found in the earth's crust today consist of such radionuclides as potassium-40 (K-40), uranium-238 (U-238), thorium-232 (Th-232), radium-226 (Ra-226) and radon-222 (Rn-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 daughters". These new materials, which are solid particles, not gases, can stick to surfaces such as dust particles in the air. Concentrations of radon in air are variable and are affected by concentrations of uranium and thorium in soil, altitude, soil porosity, temperature, pressure, soil moisture, rainfall, snow cover, atmospheric conditions, and season. It can move through cracks and openings into basements of buildings and become trapped in a small air volume 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 high energy alpha radiation dose to the lung lining. Table 1 shows the average annual effective dose due to radon.

About three hundred cosmic rays originating from outer space pass through each person every second. The interaction of cosmic rays with atoms in the earth's atmosphere produces radionuclides such as Beryllium-7 (Be-7), Beryllium-10 (Be-10), Carbon-14 (C-14), tritium (H-3), and Sodium-22 (Na-22). Portions of these radionuclides become deposited on land or in water while the remainder stay suspended in the atmosphere.

Consequently, there are natural radioactive materials in the soil, water, air and building materials which contribute to radiation doses to the human body. Natural drinking water contains trace amounts of uranium and radium; milk contains measurable amounts of potassium-40. Sources of natural radiation and their average contributing radiation doses are summarized in Table 1. Figure 1 graphically shows the percent contribution from radiation exposure to the general population of the United States. Radiation exposure levels from natural radiation fluctuate with time and also can vary widely from location to location. The average individual in the United States receives approximately three hundred mrem per year from natural sources. In some areas of the country, the dose from natural radiation is significantly higher. Residents of Colorado, five thousand feet above sea level, receive additional dose due to the increase in cosmic and terrestrial radiation levels. In fact, for every one thousand feet in elevation above sea level, an individual will receive an additional one 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 comes 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 53 mrem. Smaller doses from man-made sources come from consumer products (television, smoke detectors, fertilizer), fallout from prior nuclear weapons tests, and 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 nuclear weapons. Fallout is dispersed throughout the environment but can be washed down to the earth's surface by rain or snow.

TABLE 1

COMMON SOURCES OF RADIATION

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	360

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PERCENTAGE OF CONTRIBUTION

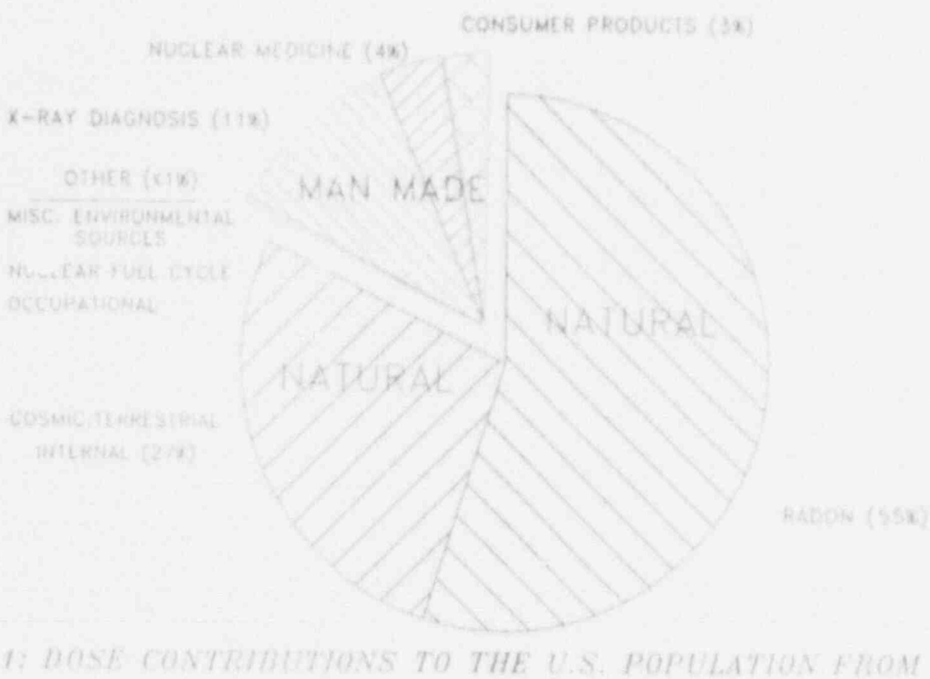

FIGURE 1: DOSE CONTRIBUTIONS TO THE U.S. POPULATION FROM PRINCIPAL SOURCES OF RADIATION EXPOSURE

There are approximately two hundred radionuclides produced in the nuclear weapon detonation process; a number of these are detected in fallout. The radionuclides found in fallout which produce most of the fallout radiation exposures to man are iodine-131 (I-131), strontium-89 (Sr-89), strontium-90 (Sr-90), and cesium-137 (Cs-137).

C. Description of the Clinton Power Station

The Clinton Power Station is located in Harp Township, DeWitt County, Illinois. It is approximately six miles east of the city of Clinton, Illinois.

The station, its V-shaped cooling lake, and the surrounding Illinois Power Company-owned land enclose 14,182 acres. This includes the 4,895 acre man-made cooling lake and about 90 acres of privately-owned property. The Clinton Power Station is sited 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 14,182 acres lie in Wilson, Rutledge, DeWitt, Creek, Nixon and Santa Anna Townships.

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

Through arrangements 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 11,460 people per day during peak usage periods. The outflow from Clinton Lake falls into Salt Creek and flows in a westerly direction for about 56 miles before joining the Sangamon River. The Sangamon River drains into the Illinois River which enters the Mississippi River near Grafton, Illinois. The nearest use of downstream water for drinking purposes is 242 river miles downstream of Clinton Lake at Alton, Illinois as verified in August 1991 by the Illinois Environmental Protection Agency Public Water Service. Although some farms in the Salt Creek drainage area downstream of Clinton Lake use irrigation, the irrigation water is drawn from wells, not from the waters of Salt Creek.

An estimated 810,000 individuals live within 50 miles of the Clinton Power Station. Over half of these are located in the major metropolitan centers of Bloomington-Normal (located about 23 miles north northwest), Champaign-Urbana (located about 31 miles east), Decatur (located about 22 miles south southwest) and Springfield (located about 48 miles west southwest). The nearest city is Clinton, the county seat of DeWitt County, located about 6 miles west of the station. The estimated population of Clinton is about 8,000 people. Outside of the urban areas, most of the land within 50 miles of the Clinton Power Station is used for farming. The principal crops 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". In fission, the uranium atom absorbs a neutron (an atomic particle found in nature and produced by the fissioning of uranium in the reactor) and splits to produce fission products, heat, radiation and free neutrons. The free neutrons travel in the core; further absorption of neutrons by uranium permits the fission process to continue. As the fission process continues, more fission products, radiation, heat and neutrons are produced and a sustained reaction occurs. The heat produced is extracted from the fuel to produce steam which drives a turbine generator to produce electricity. The fission products are predominantly radioactive; they are unstable elements which emit radiation as they change from unstable to stable elements. Neutrons which are not absorbed by the uranium fuel may be absorbed by stable atoms in the materials which make up the components and structures of the reactor. In such cases, stable atoms often become radioactive. This process is called "activation" and the radioactive atoms which result are called "activation products".

The reactor at the Clinton Power Station is a boiling water reactor (BWR). In this type of reactor the fuel is formed into small ceramic pellets which are loaded into sealed fuel rods. The fuel rods are arranged in arrays called bundles which are supported within a massive steel reactor vessel.

The spaces 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 which contains no moving parts (a jet pump), and recirculation pumps are used to force the water to circulate through the fuel bundles to assure even cooling of the fuel rods. As the water absorbs heat from the fuel rods some of it is changed to steam. The steam is used to drive a turbine which is coupled to a generator, thereby completing the conversion of the energy released during fission to electricity.

After the steam passes through the turbine it is condensed back to water and returned to the reactor vessel to repeat the process. As the water circulates through the reactor pressure vessel, corrosion allows trace quantities of the component and structure surfaces to get 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 system although small leaks from the primary system may occur. Figure 2 provides a basic plant schematic for the Clinton Power Station and shows the separation of the cooling water from plant systems.

E. Containment of Radioactivity

Under normal operating conditions, essentially all radioactivity is contained within the first of several barriers of the primary system which collectively prevent escape of radioactivity to the 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 the noble gases and other 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 seventy-foot high vessel with steel walls approximately four to seven inches thick which encase 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 steel-lined, four-foot thick reinforced concrete walls 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 operation or from radioactive materials created during reactor operations.

F. Sources of Radioactive Effluents

In a normal 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 which have been activated, also get into the primary coolant. Many soluble fission and activation products such as radioactive iodines, strontiums, cobalts and cesiums are removed by demineralizers in the purification systems. The noble gas fission products, activated atmospheric gases introduced with reactor feedwater, and some of the volatile fission products such as iodine and bromine, are carried from the reactor pressure vessel to the condenser with the steam. The steam jet air ejectors or the condenser vacuum pump remove the gases from the condenser and transfer them to the off-gas treatment system. In the off-gas treatment system the gases are held up by adsorption on specially treated charcoal beds to allow the radioactive gases to decay before they are released through the main ventilation exhaust stack.

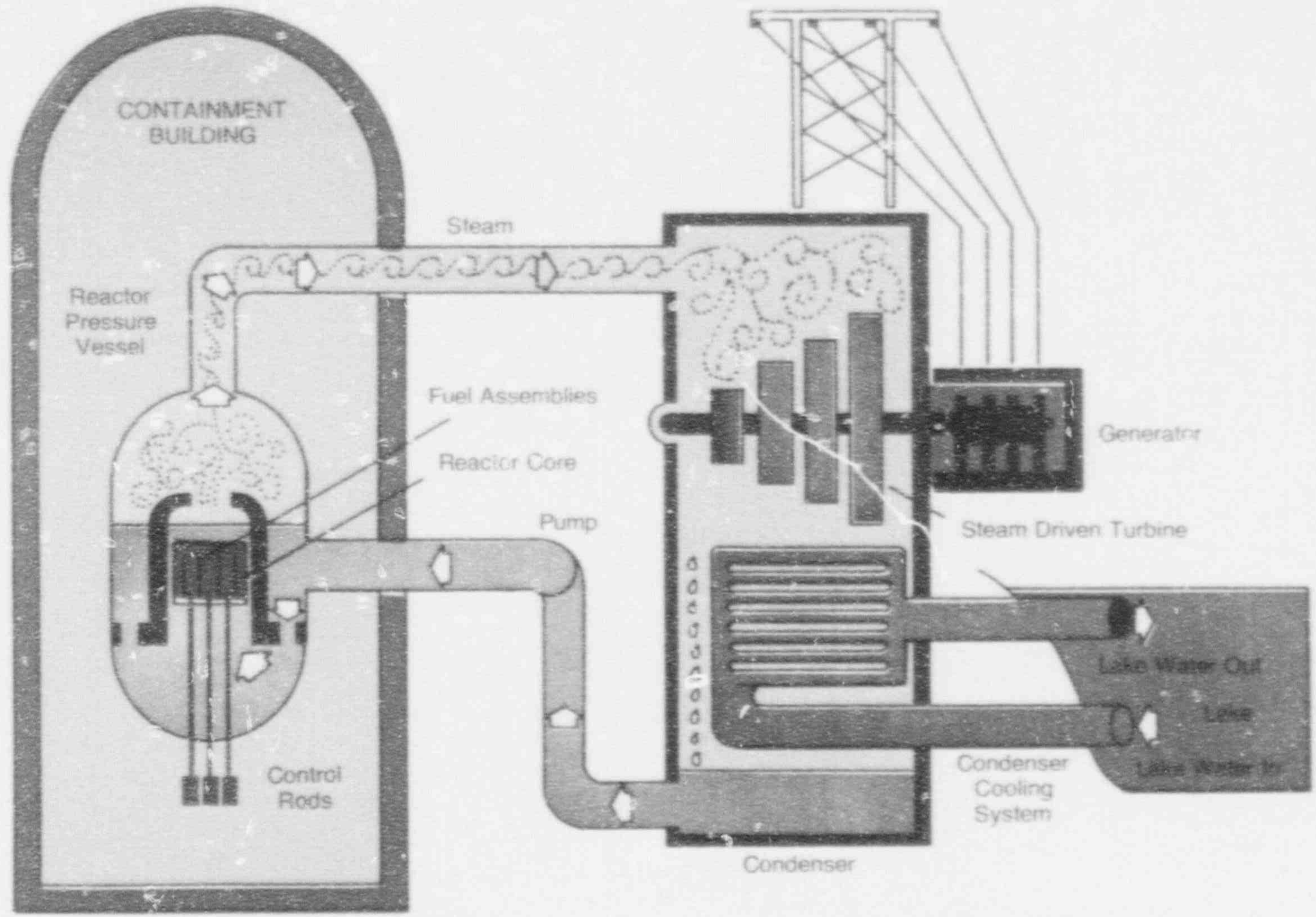

FIGURE 2: CLINTON POWER STATION BASIC PLANT SCHEMATIC

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

Table 2 summarizes the composition of radioactive effluents (gaseous and liquid) released from the Clinton Power Station during 1991. The highest calculated total body dose received by a member of the public due to the release of these radioactive materials was 0.00978 mRem. This is compared to the 93 mrem per year received in Central Illinois due to natural background radiation.

TABLE 2

1991 RADIONUCLIDE COMPOSITION OF CPS EFFLUENTS

Radionuclide	Half-life	Gaseous Effluents(Ci)	Liquid Effluents(Ci)
Gross Alpha	NA	0.0000015	*
Tritium (H-3)	12.3y	5.22	4.41
Sodium-24	14.97h	0.000208	*
Chromium-51	27.7d	0.00874	0.0113
Manganese-54	312.7d	0.0000548	0.0052
Iron-55	2.7y	*	0.0488
Cobalt-58	70.8d	0.0000314	0.0030
Iron-59	44.5d	*	0.00115
Cobalt-60	5.3y	0.000230	0.0128
Strontium-89	50.6d	0.00000434	*
Technetium-99m	6.01h	0.000745	*
Silver-110m	249.8d	*	0.0000143
Iodine-131	8.0d	0.0000292	*
Iodine-133	20.8h	0.0000318	*
Xenon-135	9.1h	0.708	*
Total		5.94	4.49

* Isotopes not detected at the 95% confidence level in effluents released from the Clinton Power Station.

G. Radioactive Waste Processing

In a normal operating nuclear power plant, radioactive liquid and gaseous wastes are collected, stored and processed through treatment systems to remove or reduce most of the radioactivity (excluding tritium) prior to reuse within the plant or discharge to the environment. These processing systems are required by the Clinton Power Station Offsite Dose Calculation Manual to be installed and operable to help ensure all releases of radioactive liquid and gaseous effluents are As Low As Reasonably Achievable (ALARA).

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 are discharged into the plant cooling water stream which varies from approximately 5,000 gallons per minute, when the plant is in shutdown, to 567,000 gallons per minute, when the plant is at full power. The liquid effluents are thoroughly mixed with and diluted by the plant cooling water as it travels the 3.4 miles of the discharge canal before it enters Clinton Lake east of DeWitt County Road 14. The Clinton Power Station Offsite Dose Calculation Manual requires that liquid effluents shall not contain a higher concentration of any radioisotope than that set for continuous exposure to the general public. This condition is satisfied at the point the liquid effluent is first introduced into the cooling water flow. The additional dilution which occurs in the cooling water canal reduces the concentrations of radioisotopes to between 1/73 (minimum flow) and 1/1890 of their original value before the water enters Clinton Lake.

The concentrated radioactive solids captured in the liquid waste treatment system are solidified and shipped off-site for disposal at licensed low-level waste disposal facilities.

The gaseous effluents from the main condenser are held up in the off-gas charcoal beds for at least 46 hours. This provides time for the decay of most of the radionuclides present since most have a half-life of less than 8 hours. If gaseous effluents in the ventilation exhaust system for the Containment Building and for the Secondary Containment structure exceed conservatively set levels, they are processed through charcoal beds and high efficiency particulate air filters in the Standby Gas Treatment System before being discharged to the environment. This combination of filters and charcoal beds is rated to be 95% efficient for removing iodines and greater than 99% efficient for removing particulate material larger than one micron (one millionth of an inch) in diameter.

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

III. RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)

A. Program Description

The Clinton Power Station is required to maintain a radiological environmental monitoring program in accordance with the Code of Federal Regulations (CFR) Title 10, Section 20.201 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 Radiological Environmental Monitoring Program is an extensive program of sampling, measuring and analyzing that was instituted to monitor the radiological impact of reactor operation on the environment. Objectives of the program include:

- identification, measurement and evaluation of existing radionuclides in the environs of the Clinton Power Station and fluctuations in radioactivity levels which may occur

- evaluation of the measurements to determine the impact of the Clinton Power Station operations on 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 phases, preoperational and operational. The preoperational portion of the program (the program was initiated in May, 1980 and was completed on February 27, 1987) established 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. The operational phase implements confirmatory measurements to verify the in-station controls for the release of radioactive material are functioning as designed. Figure 3 shows the basic pathways of gaseous and liquid radioactive effluents to man.

Illinois Power Company maintains a contract with Teledyne Isotopes Midwest Laboratory (TIML) for analysis of all radiological environmental samples. TIML is located in Northbrook, Illinois. Samples are collected by Illinois Power Company personnel and shipped to TIML for analysis. After analysis, environmental samples are saved at TIML for a specified period of time in case additional analysis is required. Analytical results are reported monthly to the Clinton Power Station and reviewed by company radiation protection personnel.

Current regulatory guidance recommends evaluating direct pathways, or the highest trophic level in a dietary pathway, that contribute to an individual's dose. The "important pathways" are selected based primarily on how radionuclides move through the environment and eventually expose individuals, as well as on man's use of the environment. The scope of the program includes the monitoring of five environmental compartments:

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

Each pathway is monitored at "indicator" and "control" locations. Indicator locations are generally within the 10-mile radius of the station. Control locations are located at least ten miles from the plant, far enough to be unaffected by plant operations. An increase in dose rate or radioactive material concentration at an indicator location may be due to plant operations.

Locations of sampling stations are shown on maps in Figures 4 through 7. Table 3 provides a list of the sample codes for each sample medium and Table 4 provides information on sample location, media sampled at each location, and a brief description of each location where samples are taken. The location is listed according to distance (in miles) and the compass sector relative to the Station Heating, Ventilation and Air Conditioning (HVAC) stack.

An on-site meteorological tower collects information such as wind speed, wind direction and air temperature at various levels. Meteorological monitoring is further discussed in Section V of this report.

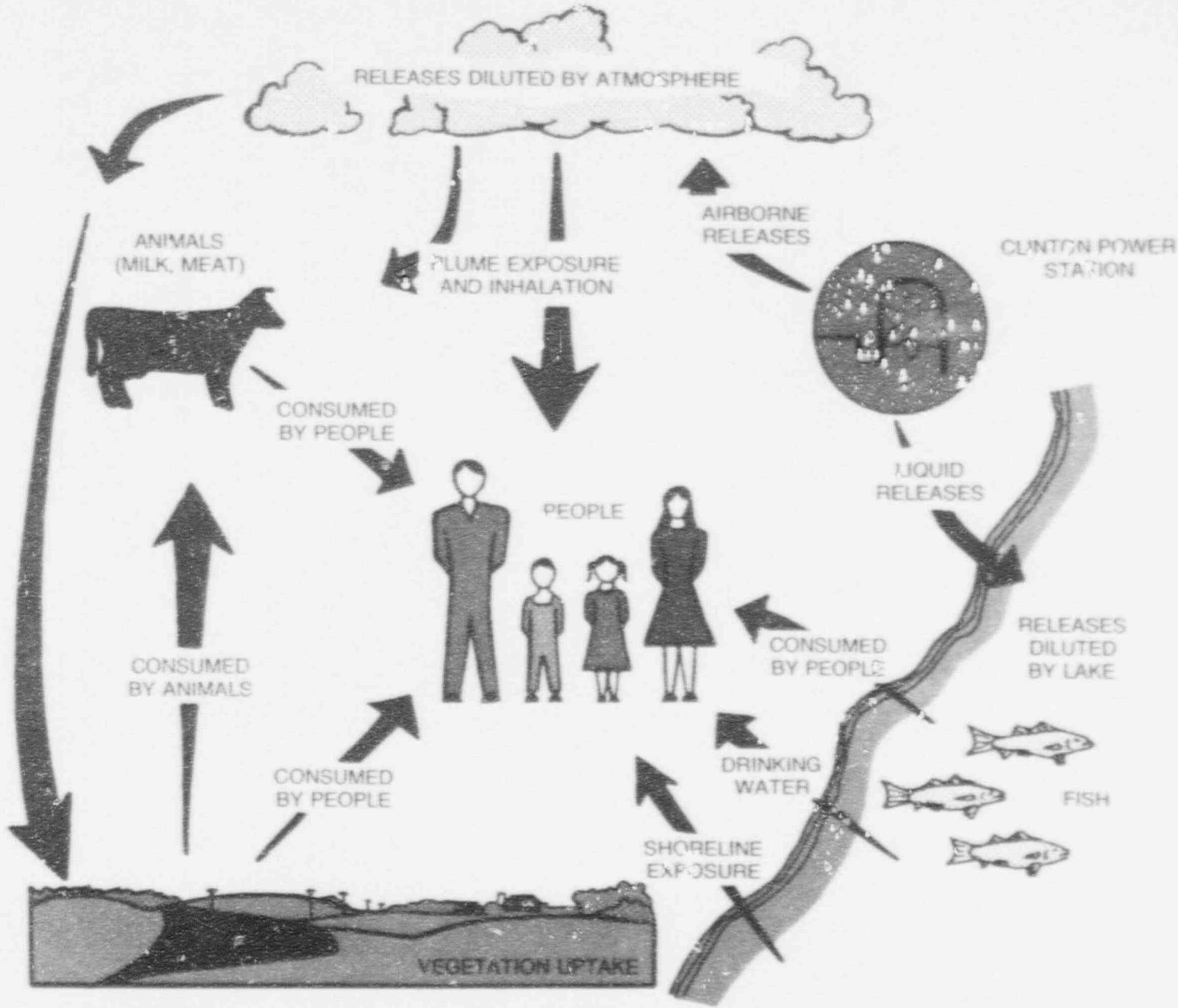

FIGURE 3: POTENTIAL EXPOSURE PATHWAYS OF MAN DUE TO RELEASES OF RADIOACTIVE MATERIAL TO THE ENVIRONMENT

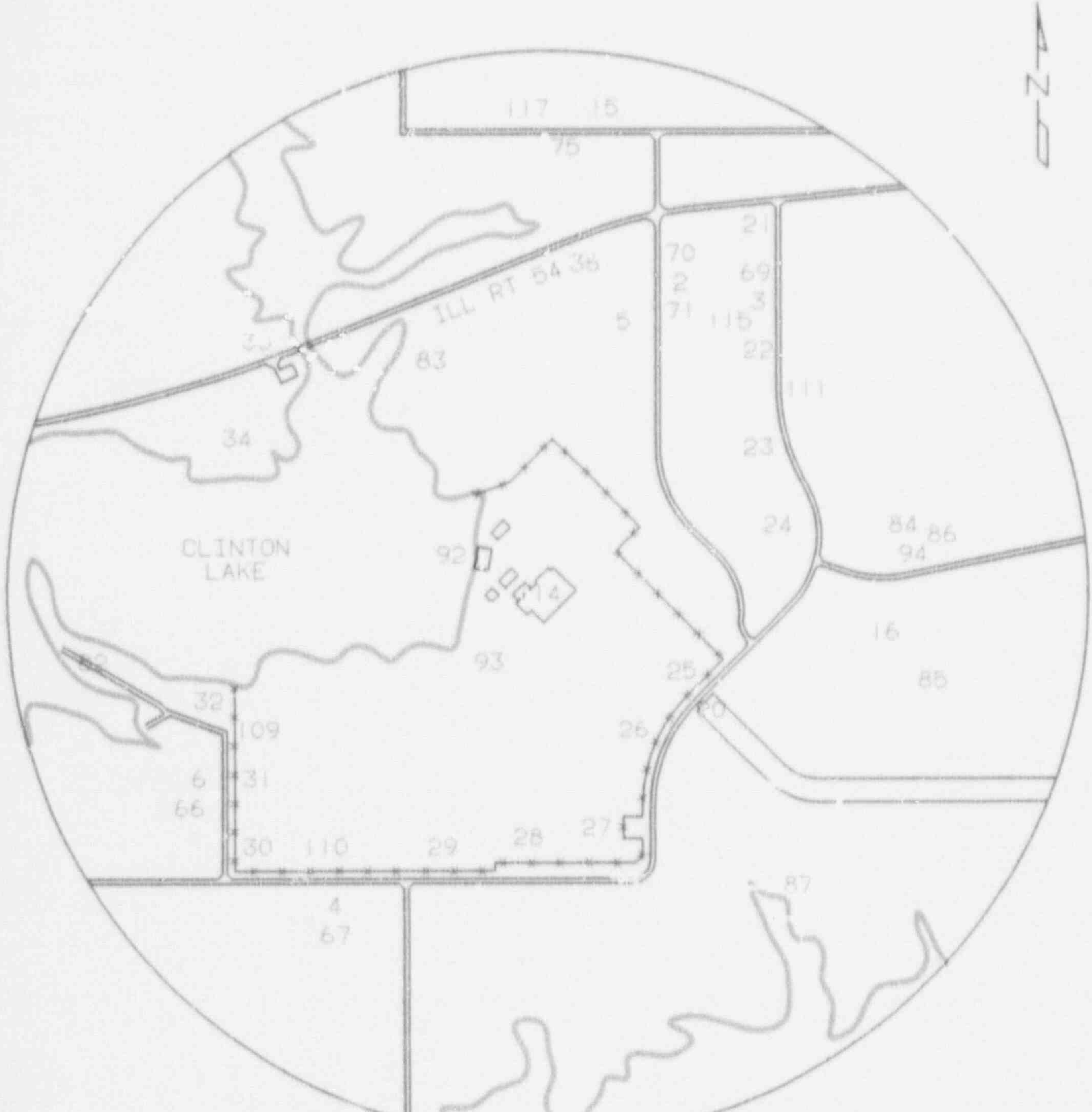

FIGURE 4: REMP SAMPLE LOCATIONS WITHIN 1 MILE

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FIGURE 5: REMP SAMPLE LOCATIONS FROM 1 - 2 MILES

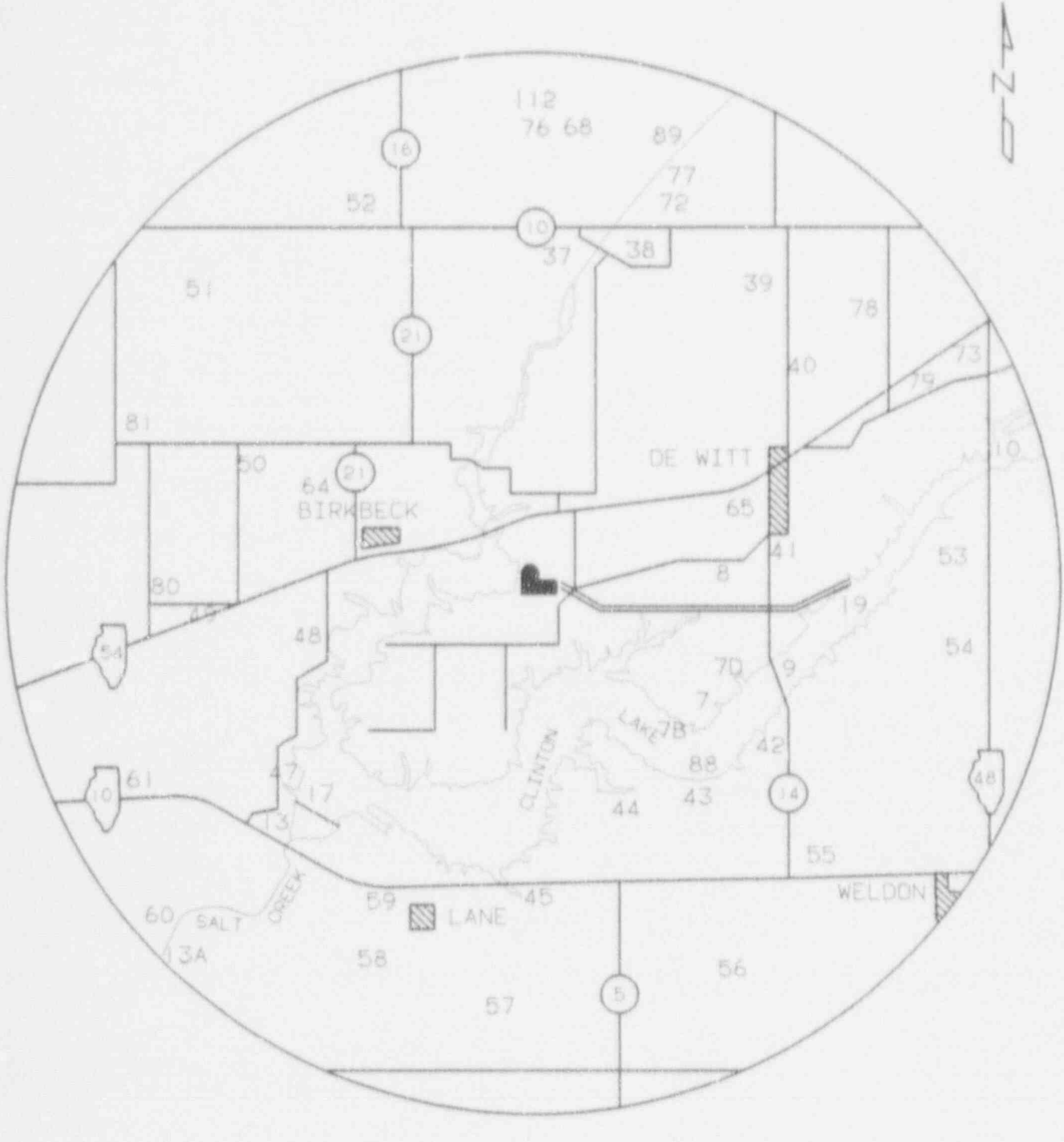

FIGURE 6: REMP SAMPLE LOCATIONS FROM 2 - 5 MILES

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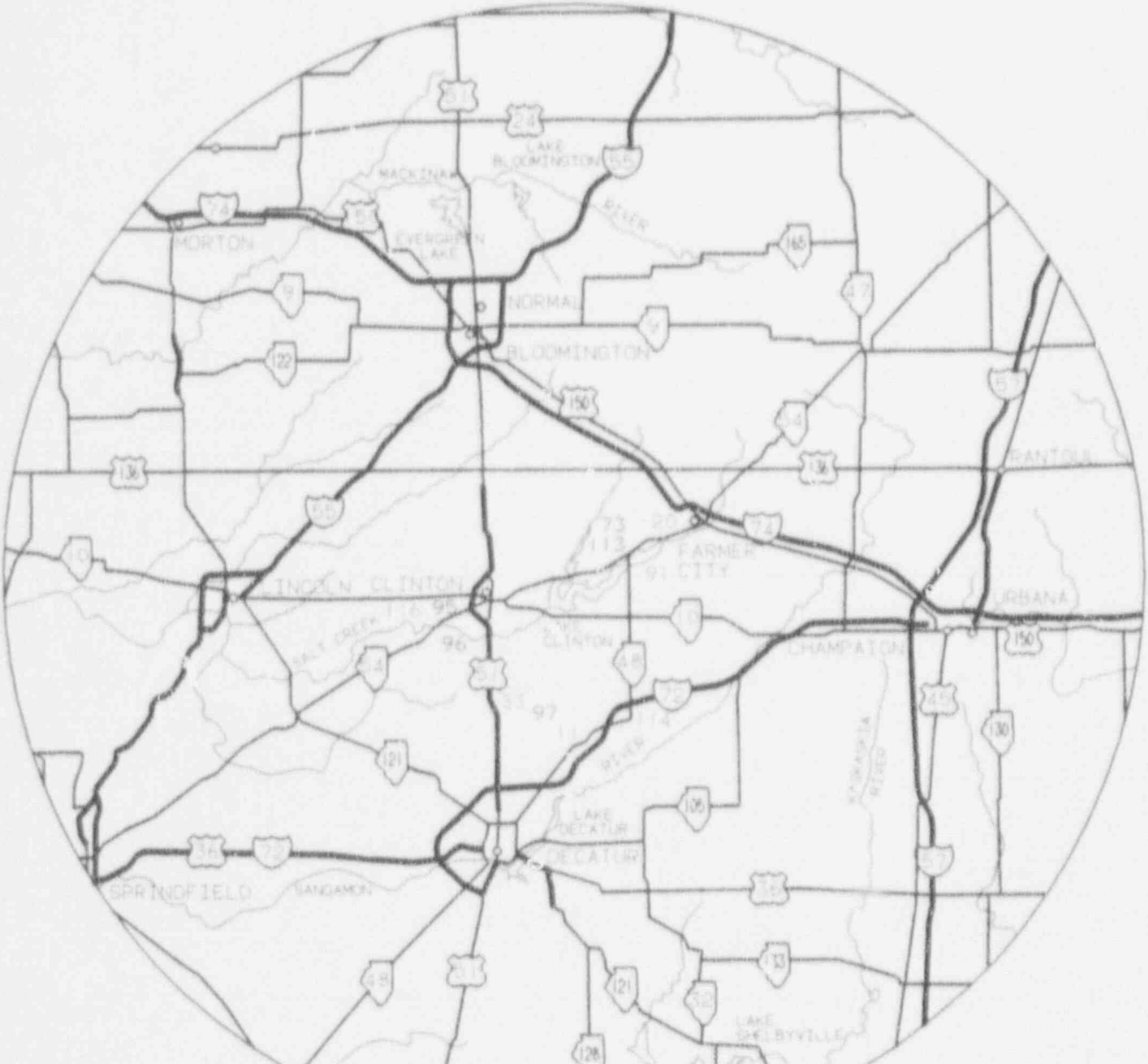


FIGURE 7: REMP SAMPLE LOCATIONS
GREATER THAN 5 MILES

M.02349E
1-27-92

TABLE 3

CLINTON POWER STATION SAMPLE CODES

Code	Sample Medium
AP	Airborne Particulate
AI	Airborne Iodine
TLD	Direct Radiation (Thermoluminescent Dosimeter)
M	Milk
DW	Drinking Water
SW	Surface Water
WW	Well Water
VE	Green Leafy Vegetables
F	Fish
SL	Periphyton, Slime, Bottom Organisms and Aquatic Vegetation
BS	Bottom Sediments
SS	Shoreline Sediments
SO	Soil
ME	Meat

TABLE 4

REMP SAMPLE LOCATIONS*

Station Code	Sample Medium	Location	Description
CL-1	AP,AI,TLD,SO,G	1.8 miles W	Near the gate to Camp Quest, S of Birkbeck
CL-2	AP,AI,TLD,SO,G	0.7 miles NNE	Located on site's main access road. Collocated with CL-70 and CL-71.
CL-3	AP,AI,TLD,SO	0.7 miles NE	Located on site's secondary access road. Collocated with CL-69.
CL-4	AP,AI,TLD,SO	0.8 miles SW	Located on farm SE of Illinois Power Recreation Area. Collocated with CL-67.
CL-5	TLD	0.7 miles NNE	Located on site's main access road
CL-6	AP,AI,TLD,SO	0.8 miles WSW	Located near the Illinois Power Recreation Area softball field. Collocated with CL-66.
CL-7	AP,AI,TLD,SO	2.3 miles SE	Located in the Mascoutin State Recreation Area
CL-7B	SS,SL	2.1 miles SE	SE of site on Clinton Lake
CL-7C	BS,SL,SS	1.3 miles SE	SE of site on Clinton Lake
CL-7D	WW	2.3 miles ESE	Located in Illinois Power Department of Conservation office at the Mascoutin State Recreation Area
CL-8	AP,AI,TLD,SO,G	2.2 miles E	Located at DeWitt Cemetery
CL-9	SW,SL	2.7 miles ESE	Located on NE side of DeWitt County Route 14 bridge
CL-10c	SW,BS,SS,SL(1)	5.0 miles ENE	Located on SE side of Illinois Route 48 bridge
CL-11c	AP,AI,TLD,SO,G	16 miles S	Located SW of Argenta at the Illinois Power Substation
CL-12	WW	1.6 miles E	Located at the DeWitt pumphouse
CL-13	SW	3.6 miles SW	Located near the Salt Creek bridge on Illinois Route 10
CL-13A	BS	5.0 miles SW	Located on Salt Creek at the Route 1300E bridge
CL-14	DW	Plant Service Building	Located in the Plant Service Building

TABLE 4 (Cont'd)

Station Code	Sample Medium	Location	Description
CL-15	AP,AI,TLD	0.9 miles N	Located north of CPS on Route 900N (added to program in Jan 1990)
CL-16	SO	0.5 miles ESE	Located ESE of CPS just north of discharge flume (added to program in Oct 1990)
CL-17	BS	3.5 miles SW	Located on the lake side of Clinton Lake dam (added to program in Oct 1990)
CL-19	F,BS,SS,SL	3.4 miles E	Located E of site at the end of the discharge flume
CL-20	TLD	9.1 miles ENE	Located at the Campground Cemetery W of Farmer City
CL-21	TLD	0.9 miles NNE	Located at the intersection of Illinois Route 54 and the site's secondary access road
CL-22	TLD	0.6 miles NE	Located on the site's secondary access road
CL-23	TLD	0.5 miles ENE	Located on the site's secondary access road
CL-24	TLD	0.5 miles E	Located on the site's secondary access road
CL-25	TLD	0.4 miles ESE	Located on the Owner Controlled Area fence
CL-26	TLD	0.3 miles SE	Located on the Owner Controlled Area fence
CL-27	TLD	0.6 miles SSE	Located on the Owner Controlled Area fence near the Meteorological Tower
CL-28	TLD	0.5 miles S	Located on the Owner Controlled Area fence
CL-29	TLD	0.6 miles SSW	Located on the Owner Controlled Area fence
CL-30	TLD	0.7 miles SW	Located on the Owner Controlled Area fence at the entrance to Illinois Power Recreation Area
CL-31	TLD	0.8 miles WSW	Located on the Owner Controlled Area fence near the Illinois Power Recreation Area softball field
CL-32	TLD	0.7 miles WSW	Located on the Owner Controlled Area fence near Clinton Lake
CL-33c	TLD	11.7 miles SW	Located in Maroa at family residence

TABLE 4 (Cont'd)

Station Code	Sample Medium	Location	Description
CL-34	TLD	0.8 miles WNW	Loc. d near CPS Visitors Center
CL-35	TLD	0.7 miles NW	Located near CPS Visitors Center near Illinois Route 54 bridge
CL-36	TLD	0.6 miles N	Located on Illinois Route 54 near intersection with site's main access road
CL-37	TLD	3.4 miles N	Located N of site
CL-38	TLD	3.6 miles NNE	Located near microwave tower N of site
CL-39	TLD	3.8 miles NE	Located 2 mile of DeWitt
CL-40	TLD	3.5 miles NE	Located 0.6 miles N of DeWitt
CL-41	TLD	2.4 miles E	Located at S DeWitt city limit
CL-42	TLD	2.8 miles ESE	Located S of DeWitt County Route 14 bridge
CL-43	TLD	2.8 miles SE	Located on Clinton Marina access road
CL-44	TLD	2.3 miles SSE	Located near Clinton Marine Boat Sales
CL-45	TLD	2.8 miles S	Located at Lane Day Use Area
CL-46	TLD	2.8 miles SSW	Located at Peninsula Day Use Area
CL-47	TLD	3.3 miles SW	Located near Clinton Lake Dam Access Road
CL-48	TLD	2.3 miles WSW	Located at residence on West Side Access Road
CL-49	TLD	3.5 miles W	Located W of site along Illinois Route 54
CL-50	TLD	3.7 miles WNW	Located WNW of site
CL-51	TLD	4.4 miles NW	Located NW of site
CL-52	TLD	4.3 miles NNW	Located NNW of site
CL-53	TLD	4.3 miles E	Located E of site
CL-54	TLD	4.6 miles ESE	Located 2 miles N of Weldon
CL-55	TLD	4.1 miles SE	Located 1.5 miles W of Weldon
CL-56	TLD	4.1 miles SSE	Located SSE of site

TABLE 4 (Cont'd)

Station Code	Sample Medium	Location	Description
CL-57	TLD	4.6 miles S	Located S of site
CL-58	TLD	4.3 miles SSW	Located in rural Lane
CL-59	TLD	3.3 miles SSW	Located near Lane city limit
CL-60	TLD	4.5 miles SW	Located SW of Clinton Lake Dam near Salt Creek
CL-61	TLD	4.5 miles WSW	Located WSW of site
CL-62	TLD	1.9 miles NW	Located NW of site
CL-63	TLD	1.3 miles NNW	Located at North Fork Boat Access
CL-64	TLD	2.1 miles WNW	Located 0.5 miles N of Birkbeck
CL-65	TLD	2.6 miles ENE	Located at residence in DeWitt
CL-66	TLD	0.8 miles WSW	Located near the Illinois Power Recreation Area softball field. Collocated with CL-6.
CL-67	TLD	0.8 miles SW	Located on farm SE of Illinois Power Recreation Area. Collocated with CL-4.
CL-68	TLD	4.6 miles N	Located N of site. Collocated with CL-[illegible].
CL-69	TLD	0.7 miles NE	Located on site's secondary access road. Collocated with CL-3.
CL-70	TLD	0.7 miles NNE	Located on site's secondary access road. Collocated with CL-2 and CL-71.
CL-71	TLD	0.7 miles NNE	Located on site's secondary access road. Collocated with CL-2 and CL-70.
CL-72	TLD	4.5 miles NNE	Located NNE of site. Collocated with CL-77
CL-73	TLD	5.1 miles ENE	Located near the MidAmerica Commodities plant on Illinois Route 48. Collocated with CL-113.
CL-74	TLD	1.9 miles W	Located at Camp Quest
CL-75	TLD	0.9 miles N	Located N of site
CL-76	TLD	4.6 miles N	Located N of site
CL-77	TLD	4.5 miles NNE	Located NNE of site. Collocated with CL-72.

TABLE 4 (Cont'd)

Station Code	Sample Medium	Location	Description
CL-78	TLD	4.8 miles NE	Located NE of site
CL-79	TLD	4.5 miles ENE	Located ENE of site
CL-80	TLD	4.1 miles W	Located W of site
CL-81	TLD	4.5 miles WNW	Located WNW of site
CL-82	TLD	0.9 miles W	Located at Illinois Power Recreation Area
CL-83	TLD	0.5 miles NNW	Located near Illinois Route 54 E of the bridge
CL-84	TLD	0.6 miles E	Located on Old Clinton Road between DeWitt and site. Collocated with CL-94 and CL-86.
CL-85	TLD	0.6 miles ESE	Located ESE of site
CL-86	TLD	0.6 miles E	Located on Old Clinton Road between DeWitt and site. Collocated with CL-84 and CL-94.
CL-87	TLD	0.6 miles ESE	Located near discharge flume road
CL-88	TLD	2.4 miles SE	Located SE of site
CL-89	BS,SS	3.6 miles NNE	Located NNE of site
CL-90	SW	0.4 miles SE	Located at start of discharge flume
CL-91	SW	6.1 miles ENE	Located at Parnell Boat Access
CL-92	SW	0.1 miles NW	Located at CPS Intake Screenhouse
CL-93	SW,SS	0.4 miles SW	Located at CPS Settling Pond
CL-94	AP,AI,SO	0.6 miles E	Located on Old Clinton Road between DeWitt and site. Collocated with CL-84 and CL-86.
CL-95c	TLD	10.5 miles W	Located at a family residence west of Clinton
CL-96c	TLD	10.9 miles WSW	Located at a family residence SW of Clinton
CL-97c	TLD	10.3 miles SSW	Located on Macon County Road 1400E SE of Maroa
CL-105c	F,SS,BS,SL	50 miles S	Located at Lake Shelbyville
CL-106	ME	2.0 miles NNE	Located NNE of site

TABLE 4 (Cont'd)

Station Code	Sample Medium	Location	Description
CL-109	TLD	0.7 miles WSW	Located on the Owner Controlled Area fence near Shooting Range
CL-110	TLD	0.8 miles SW	Located on the Owner Controlled Area fence
CL-111	TLD	0.6 miles NE	Located near site's secondary access road
CL-112	TLD	4.6 miles N	Located N of site. Collocated with CL-68.
CL-113	TLD	5.1 miles ENE	Located near the MidAmerica Commodities plant on Illinois Route 48. Collocated with CL-73.
CL-114c	VE	12.5 miles SSE	Located S of Cisco
CL-115	VE	0.7 miles NE	Located on site's secondary access road
CL-116c	M,G	14 miles WSW	Located in rural Kenney
CL-117	VE	0.9 miles N	Located N of site

* Sample location is listed by station code, location and number. Station Code is Clinton (CL) - Number (site's number designator). Location is listed by distance in miles and directional sector from the Station HVAC stack.

c Control location; all other locations are indicators.

(1) Control location for surface water only.

B. <u>Direct Radiation Monitoring</u>

Radionuclides present in the air, and those deposited in or on the ground cause human exposure by immersion in the atmosphere or by deposition on the ground. TLDs (thermoluminescent dosimeters) are used to measure the ambient gamma radiation field at many locations around the Clinton Power Station. TLDs are crystalline devices that store energy when they are exposed to radiation. They can be processed months after exposure with minimal loss of information. This makes them well suited for quarterly environmental radiation measurements. During processing, the stored energy is released as light and measured by a TLD reader. The light intensity is proportional to the radiation dose the TLD received. The TLDs used in monitoring around the Clinton Power Station are easily capable of measuring environmental levels of radiation, approximately 20 mrem per quarter.

Monitoring stations are placed near the site boundary and approximately five miles from the reactor, in locations representing the sixteen compass sectors. Other locations are chosen to measure the radiation field at places of special interest such as nearby residences, meeting places and population centers. Control sites are located farther than ten miles from the site, in areas that should not be affected by plant operations.

TLD measurements register the gamma ray exposure in milliRoentgen (mR). For reporting purposes mR is numerically equivalent to mrem. Consequently the terms are used interchangeably.

Results of the annualized TLD dose measurements are summarized by location in Table 5. Figure 8 compares operational program control and indicator location average quarterly gamma dose rates to preoperational program measurements. A total of 338 TLD measurements were made in 1991. The average quarterly dose at indicator locations was 16.8 ± 2.0 mrem. The quarterly measurements ranged from 10.3 to 24.7 mrem. At control locations the average quarterly dose was 16.2 ± 2.8 mrem. The quarterly control measurements ranged from 9.6 to 21.4 mrem.

TABLE 5

1991 ANNUAL TLD RESULTS

Station Code (a)	Annual Total (± 2 s.d.), mR(b)
CL-1	65.1 ± 2.6
CL-2	67.4 ± 1.6
CL-3	66.4 ± 3.1
CL-4	67.2 ± 1.7
CL-5	69.9 ± 1.3
CL-6	58.6 ± 2.5
CL-7	68.5 ± 4.1
CL-8	69.3 ± 2.3
CL-11(c)	62.6 ± 1.9
CL-15	50.2 ± 1.6
CL-20	67.3 ± 3.2
CL-21	69.6 ± 2.8
CL-22	68.7 ± 2.6
CL-23	52.3 ± 1.7
CL-24	69.2 ± 2.2
CL-25	50.3 ± 2.8
CL-26	59.6 ± 2.0
CL-27	64.1 ± 2.2
CL-28	69.5 ± 2.4
CL-29	68.9 ± 4.0
CL-30	74.9 ± 5.4
CL-31	62.4 ± 3.2
CL-32	66.3 ± 3.5
CL-33(c)	75.7 ± 5.1
CL-34	85.3 ± 6.3
CL-35	65.7 ± 1.7
CL-36	65.9 ± 3.4
CL-37	66.8 ± 3.9
CL-38	72.0 ± 3.0
CL-39	60.6 ± 2.8
CL-40	65.7 ± 2.2
CL-41	67.1 ± 2.8
CL-42	60.6 ± 2.9
CL-43	67.4 ± 3.3
CL-44	73.1 ± 2.8
CL-45	71.9 ± 4.2
CL-46	65.6 ± 3.8
CL-47	73.1 ± 3.2
CL-48	67.9 ± 4.4
CL-49	73.4 ± 3.8
CL-50	72.0 ± 4.6
CL-51	74.0 ± 3.3
CL-52	72.6 ± 2.8
CL-53	63.5 ± 4.1
CL-54	67.6 ± 3.2
CL-55	64.7 ± 2.1
CL-56	67.1 ± 3.0

TABLE 5 (Cont'd)

Station Code(a)	Annual Total (± 2 s.d.), mR(b)
CL-57	66.7 ± 2.6
CL-58	64.3 ± 2.8
CL-59	65.3 ± 1.4
CL-60	70.4 ± 2.8
CL-61	70.6 ± 2.9
CL-62	71.6 ± 3.4
CL-63	77.8 ± 3.6
CL-64	74.9 ± 2.9
CL-65	77.0 ± 3.8
CL-66	61.3 ± 4.0
CL-67	64.3 ± 2.1
CL-68	70.2 ± 3.4
CL-69	67.8 ± 2.3
CL-70	59.5 ± 5.2
CL-71	67.3 ± 1.8
CL-72	61.3 ± 2.5
CL-73	74.3 ± 3.4
CL-74	64.9 ± 3.0
CL-75	70.1 ± 2.3
CL-76	66.5 ± 2.5
CL-77	63.2 ± 2.4
CL-78	64.6 ± 3.3
CL-79	69.3 ± 3.5
CL-80	68.7 ± 2.4
CL-81	75.5 ± 3.7
CL-82	68.6 ± 3.9
CL-83	73.9 ± 2.7
CL-84	66.6 ± 2.2
CL-85	69.9 ± 2.7
CL-86	69.0 ± 1.9
CL-87	74.8 ± 2.6
CL-95(c)	67.4 ± 0.1
CL-96(c)	59. ± 0.4
CL-97(c)	50.8 ± 2.5
CL-109	61.7 ± 2.8
CL-110	66.5 ± 2.1
CL-111	53.5 ± 6.9
CL-112	67.3 ± 2.2
CL-113	69.3 ± 3.2

(a) For station location description refer to Table 4
(b) Annual TLD results are the total of the quarterly doses at the location
(c) Control Station

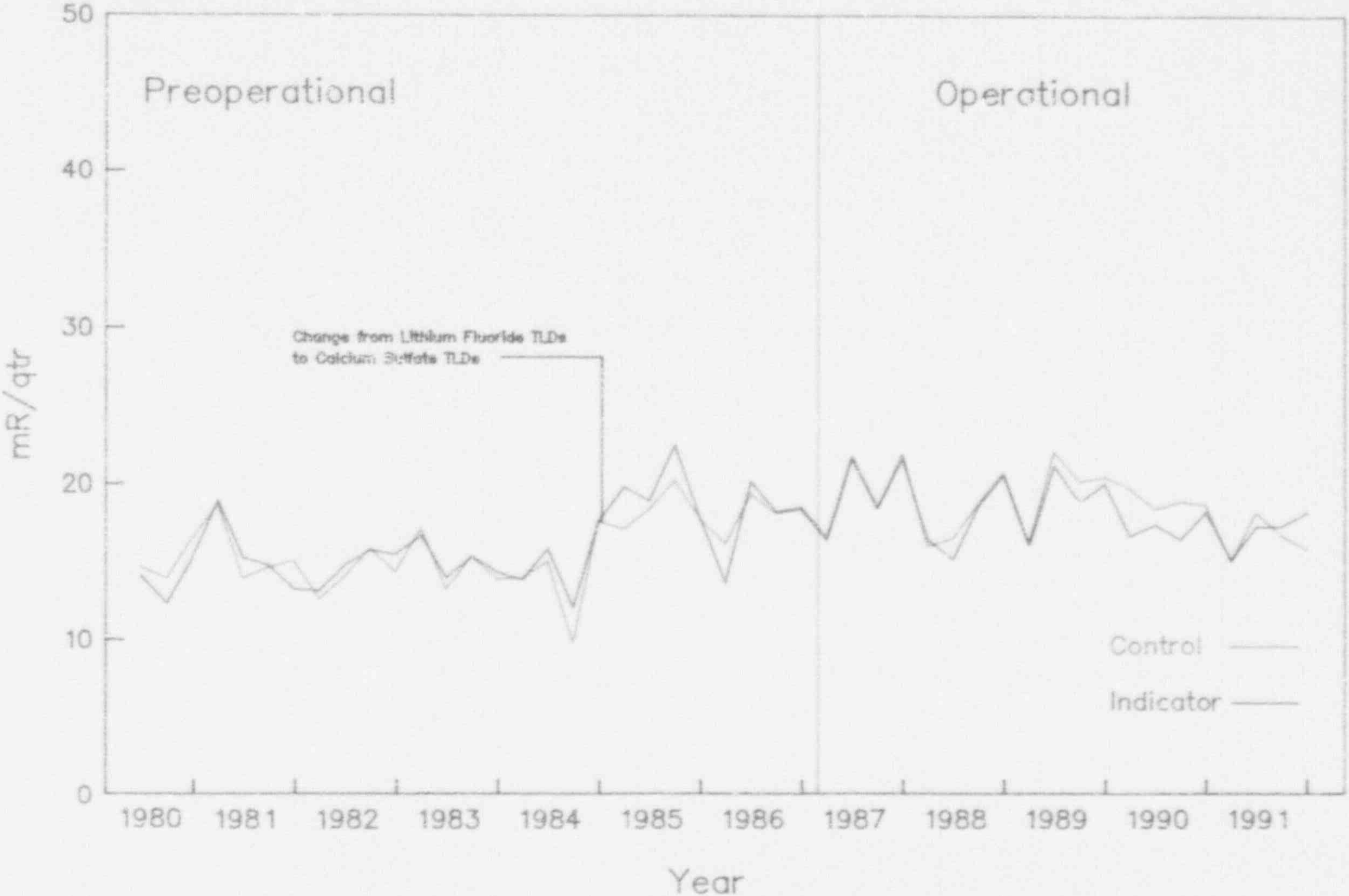


FIGURE 8: DIRECT RADIATION COMPARISON

Average doses (±2 standard deviations (s.d.)), broken down by calendar quarter, are shown in Table 6 for both indicator and control locations.

TABLE 6

QUARTERLY AVERAGE TLD RESULTS

	Indicator	Control
First Quarter	15.0 ± 2.6	14.9 ± 2.0
Second Quarter	17.2 ± 3.7	18.1 ± 5.1
Third Quarter	17.2 ± 3.2	16.6 ± 2.9
Fourth Quarter	18.1 ± 3.7	15.7 ± 8.5

Site CL-34, located 0.8 miles WNW of the station, registered the highest annualized dose: 85.3 mrem during 1991. The elevated measurements are attributed to the proximity of CL-34 to a tile field constructed of ceramic pipe tile. This material is known to be rich in naturally occurring radionuclides. Preoperational data indicated that the dose at this location had been among the highest measured. Between 1980 and 1984 CL-34 registered, on the average, the highest annual dose. In 1985 and 1986 its dose was in the top 20% of all locations monitored.

From these observations, no increase in environmental gamma radiation levels resulted from operation of the Clinton Power Station during 1991.

C. Atmospheric Monitoring

The inhalation and ingestion of radionuclides present in the atmosphere is a direct exposure pathway to man. A network of ten active air samplers around the Clinton Power Station monitors this pathway. Nine of the air sampling stations are strategically located in areas which are most likely to indicate effects due to the release of radioactive effluents from the Clinton Power Station. The control location is located approximately 16 miles south of the plant in an area which is likely to be independent of the effects of station operations. Historical meteorological data indicates this control location is normally upwind from the plant.

No contribution to the general level of airborne particulate radioactivity could be identified as a result of station operations during 1991. The radioactivity that was detected is normally found in the environment and is consistent with expected concentrations of natural radioactivity and fallout from prior atmospheric nuclear weapons testing.

Mechanical air samplers are used to draw a continuous volume of air through two filters designed to collect particulates and radioiodines present in the atmosphere. The samplers are equipped with a pressure-sensing flow regulator to maintain a constant sampling flow rate of about one cubic foot per minute. The total volume is calculated based on the amount of time the air sampler ran and its flow rate. The air sampling equipment is maintained and calibrated by the Clinton Power Station personnel using reference standards traceable to the National Institute of Standards and Technology.

Air samples are collected weekly and analyzed for gross beta and I-131 activities. Quarterly all air particulate filters collected during that period are combined and counted for gamma isotopic activity. Since the intent of particulate sampling is to measure airborne radioactivity released from the plant, the counting of short-lived daughters produced by the decay of natural radon and thoron may mask plant contributions. Therefore, the filters are not analyzed for at least five days after their collection to allow for the decay of the short-lived daughters, thereby reducing their contribution to the gross beta activity.

Results of the gross beta airborne particulate analyses provided comparisons between indicator and control locations for the year, as well as comparisons between locations in relation to spatial and temporal differences. The calculated annual average was 0.021 pCi/m^3 for all indicator locations and 0.022 pCi/m^3 for the control location. These results are consistent with the preoperational averages for both indicator and control locations which were 0.027 pCi/m^3. The location with the highest annual average was indicator station CL-3 located 0.7 miles northeast of the Clinton Power Station. This location had an average concentration of 0.023 pCi/m^3. Individual location averages for the year are presented in Table 7.

Minor fluctuations in the gross beta concentrations were noted throughout the year. The general trend for average weekly gross beta concentrations in the indicator locations correlated to the trend for control locations throughout the monitoring period. This correlation is evidenced by the similarity of the trends in the average monthly gross beta concentrations displayed in Figure 9. No significant difference was indicated between individual locations. Monthly averages for indicator and control locations for the year are presented in Table 8.

All gross beta concentrations for 1991 were within normal background levels and no increases were noted as a result of the operation of the Clinton Power Station.

Naturally occurring Be-7 was the only gamma-emitting radionuclide detected in analyses of particulate filters.

TABLE 7

1991 AVERAGE GROSS BETA CONCENTRATIONS

IN AIR PARTICULATES

Station	Description	Average ± 2 s.d. (pCi/m^3)
CL-1 (I)	Camp Quest (Birkbeck)	0.021 ± 0.012
CL-2 (I)	CPS Main Access Road	0.022 ± 0.012
CL-3 (I)	CPS Secondary Access Road	0.023 ± 0.011
CL-4 (I)	0.8 Miles SW	0.022 ± 0.012
CL-6 (I)	IP Recreation Area	0.020 ± 0.012
CL-7 (I)	Mascoutin State Recreation Area	0.020 ± 0.012
CL-8 (I)	DeWitt Cemetery	0.022 ± 0.012
CL-11 (C)	IP Substation (Argenta)	0.022 ± 0.012
CL-15 (I)	0.9 Miles N	0.022 ± 0.011
CL-94 (I)	Old Clinton Road (0.6 miles E)	0.022 ± 0.013

(I) Indicator Station

(C) Control Station

TABLE 8

1991 AVERAGE MONTHLY GROSS BETA

CONCENTRATIONS IN AIR PARTICULATES

Month	Indicator, pCi/m^3 (Average ± 2 s.d.)	Control, pCi/m^3 (Average ± 2 s.d.)
January	0.028 ± 0.011	0.028 ± 0.012
February	0.023 ± 0.008	0.023 ± 0.007
March	0.021 ± 0.009	0.021 ± 0.011
April	0.015 ± 0.006	0.016 ± 0.006
May	0.015 ± 0.006	0.017 ± 0.006
June	0.018 ± 0.007	0.019 ± 0.007
July	0.021 ± 0.009	0.023 ± 0.009
August	0.025 ± 0.010	0.026 ± 0.012
September	0.020 ± 0.007	0.020 ± 0.007
October	0.019 ± 0.010	0.020 ± 0.011
November	0.026 ± 0.014	0.027 ± 0.020
December	0.025 ± 0.009	0.026 ± 0.009

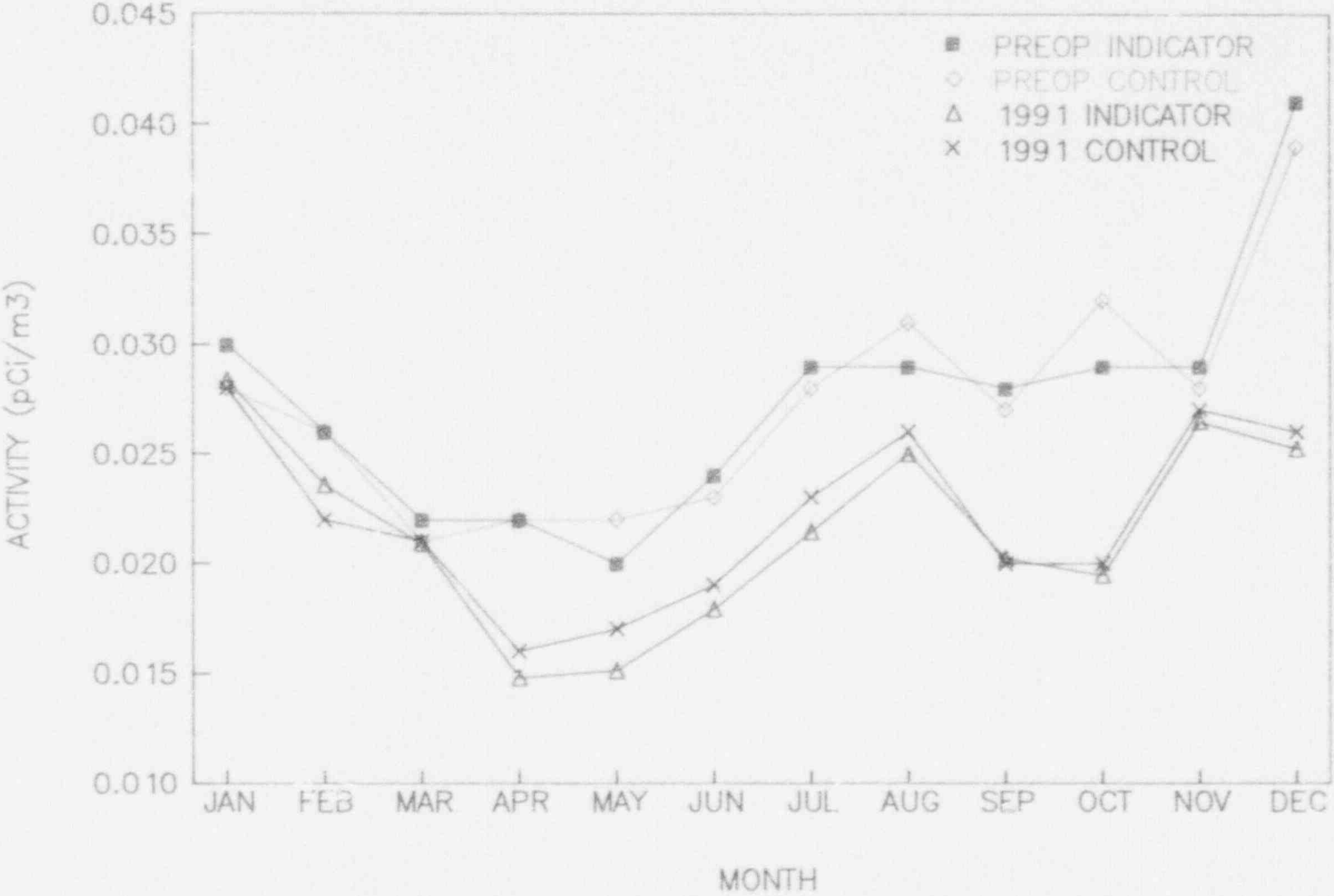


FIGURE 9: AIR PARTICULATE GROSS BETA ACTIVITY COMPARISON

D. <u>Aquatic Monitoring</u>

The Clinton Power Station utilizes an artificial lake as the source of cooling water and returns the used cooling water to the same lake while most nuclear power stations use once-through flow from a river, the ocean or a body of water much larger than Clinton Lake. When radioactive liquid effluents are discharged from the Clinton Power Station into the cooling water outfall, radioisotopes with long half-lives could build up as the same water is reused on successive trips through the plant. This water travels from the plant, into the eastern arm of the lake, then into the northern arm of the lake and back into the plant. Although the only user of Clinton Lake as a source of drinking water is the Clinton Power Station, the 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 in liquid effluents. Aquatic monitoring provides for the collection of fish, shoreline and bottom sediments, and periphyton samples to detect the presence of any radioisotopes related to operation of the Clinton Power Station. These samples are analyzed for naturally occurring and man-made radioactive materials. Both indicator and control locations were sampled during 1991. Indicator samples were taken from various locations on Clinton Lake and the control samples were taken at Lake Shelbyville which is approximately 50 miles south of Clinton Power Station.

Aquatic monitoring samples are collected by the personnel from the Field Biology Laboratory of the Environmental Affairs Department of Illinois Power Company.

<u>Fish</u>

Samples of fish are collected from Clinton Lake and Lake Shelbyville. In both lakes the samples include largemouth bass, crappie, carp and bluegill. These species are the fish most commonly harvested from the lakes by sportsfishermen. Fish ingest sediments during bottom feeding, or prey on other organisms which ingest sediments or otherwise retain radionuclides. Radiological analyses of these fish samples provide information on the potential ingestion of radionuclides by humans via the aquatic pathway. These samples are collected semiannually and analyzed by gamma spectroscopy.

The results of gamma isotopic analysis on the fish samples showed the presence of naturally occurring K-40 in all 1991 samples ranging from 2.22 to 3.02 pCi/g (wet). Preoperational K-40 concentrations ranged from 1.71 to 4.61 pCi/g (wet). All other analytical results were less than the lower limit of detection (LLD) for each radionuclide.

Shoreline Sediments

Samples of shoreline sediments are collected at six locations from Clinton Lake, at one location from the Clinton Power Station lower settling pond and at one location from Lake Shelbyville. Radiological analyses of shoreline sediments provide information on the potential shoreline exposure to humans and for determining long term trends and accumulation of long-lived radionuclides in the environment. Samples are collected semiannually and 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 dry weight. Naturally occurring radioisotopes, such as K-40, Ra-226 and Pb-212, were present in samples taken at both indicator and control locations. Two fission products, Sr-90 and Cs-137, were detected in samples from indicator locations. Sr-90 was detected in 2 samples and Cs-137 was detected in 5 samples. No fission products were detected at the control location. The activity detected was not substantially different from that measured during the preoperational program.

	Preoperational Range (pCi/g dry)	1991 Range (pCi/g dry)
Sr-90	0.009 to 0.087	0.007 to 0.043
Cs-137	0.015 to 0.045	0.016 to 0.048

The presence of these fission products is attributed to previous nuclear weapons testing and atmospheric fallout from the accident at Chernobyl.

Gross alpha activity in samples of shoreline sediments collected from all locations ranged from 2.9 to 8.5 pCi/g (dry) during 1991. This activity was attributed to naturally occurring radium isotopes and decay products present in soil. These values compare closely with the activity detected in the preoperational program which ranged from 3.8 to 8.0 pCi/g (dry).

Gross beta activity in samples of shoreline sediments collected from all locations ranged from 5.9 to 9.6 pCi/g (dry) during 1991. The majority of this activity was attributed to naturally occurring K-40. These values are comparable with the activity detected in the preoperational program which ranged from 7.0 to 17.2 pCi/g (dry).

Bottom Sediments

Samples of bottom sediments are collected from Clinton Lake at six locations and Lake Shelbyville at one location. Radiological analyses of bottom sediments primarily provide information about the amount of radionuclides available to predators who feed on the organisms found in bottom sediments. Samples are collected semiannually and analyzed for gross beta, gross alpha, Sr-90 and gamma isotopic activities.

Bottom sediment samples are dried prior to analysis and the results are reported in pCi/g dry weight. Naturally occurring radioisotopes, such as K-40 and Pb-212, were present in all 1991 control and indicator sample locations.

Fission products, Cs-137 and Sr-90 were detected in samples from indicator and control locations.

	Preoperational Range (pCi/g dry)	1991 Range (pCi/g dry)
Sr-90	0.011 to 0.056	0.007 to 0.025
Cs-137	0.008 to 1.39	0.017 to 0.590

The presence of these fission products is attributed to previous nuclear weapons testing and atmospheric fallout from the accident at Chernobyl.

Gross alpha activity in samples of bottom sediments collected from both lakes ranged from 5.0 to 14.7 pCi/g (dry) during 1991. This activity was attributed to naturally occurring radium isotopes and decay products present in soil. The preoperational gross alpha activity ranged from 4.4 to 14.7 pCi/g (dry).

Gross beta activity in samples of bottom sediments collected from both lakes ranged from 8.4 to 30.1 pCi/g (dry) during 1991. The majority of this activity was attributed to naturally occurring K-40. The preoperational gross beta activity ranged from 8.3 to 27.7 pCi/g (dry).

Aquatic Vegetation (Periphyton)

Samples of periphyton are collected from five locations in Clinton Lake and one location in Lake Shelbyville. Periphyton (attached algae) are collected from the submerged surface of the permanently anchored buoys. Periphyton absorb trace elements and radionuclides directly from water, often concentrating them to levels much higher than the dilute concentrations that occur in the aquatic environment. This is because most algae are coated with a carbohydrate jelly and have a large surface to volume ratio. Cell division usually occurs once every one or two days and, as a result, half of the cell wall is a new surface for sorption. Periphyton represent one of the earliest links in the food chain and provide information about the amounts of radionuclides available to predators further up the food chain. Samples of periphyton are collected every two months between April and October (during the colder months growth is limited) at the indicator locations and semiannually at the control location and analyzed by gamma spectroscopy.

The results of the gamma isotopic analyses on periphyton samples showed the following concentrations of naturally occurring radioisotopes:

	Preoperational Range (pCi/g wet)	1991 Range (pCi/g wet)
Be-7	0.38 to 1.07	0.21 to 1.62
K-40	0.74 to 6.82	0.69 to 3.12

One fission product, Cs-137, was detected in several periphyton samples. Concentrations for Cs-137 in 1991 ranged from 0.022 to 0.079 pCi/g (wet). Preoperational results for Cs-137 showed concentrations ranging from 0.042 to 0.15 pCi/g (wet). The presence of Cs-137 is attributed to previous nuclear weapons testing and atmospheric fallout from the accident at Chernobyl.

Periphyton analyses are included in the Clinton Power Station Environmental Monitoring Program because of their sensitivity to the presence of radionuclides in the aquatic environment due to bio magnification. Periphyton provides good qualitative information, however, there are quantitative limitations. Using periphyton as biomonitors for radionuclides in aquatic systems can be a highly sensitive and qualitatively effective means of environmental monitoring around nuclear power plants that release radioactive effluents to aquatic systems. It enables the Radiological Environmental Monitoring Program to determine the relative presence of radioactivity before it becomes a problem.

E. Terrestrial Monitoring

In addition to the direct radiation, radionuclides present in the atmosphere expose individuals when these radionuclides deposit on surfaces (such as plants and soil) and are subsequently ingested directly by man or indirectly by consumption of animal products such as meat and milk. To monitor this food pathway, control and indicator samples of green leafy vegetables, grass, milk (control only) and meat (indicator only) are analyzed. Surface soil samples are collected and analyzed at three-year intervals (triennially) to monitor the potential buildup of atmospherically deposited radionuclides.

Surface vegetation samples are collected from a number of locations for the purpose of monitoring the potential buildup of atmospherically deposited radionuclides. Because the radionuclides of interest, with respect to the Clinton Power Station operations, are also present in the environment as a result of several decades of worldwide fallout or because they are naturally occurring, the presence of these radionuclides is expected in all of the samples collected.

The possible contributions of radionuclides from the operation of the Clinton Power Station are assessed by comparing the results of samples collected in prevalent downwind locations (north to northeast of the plant) with control samples and samples collected in locations generally upwind of the plant. In addition, the results of samples collected during 1991 were compared with the results of samples collected during the preoperational program.

In addition to naturally occurring radioisotopes, Sr-90 and Cs-137 were found in a number of 1991 samples. However, the concentrations of radionuclides in samples collected near the Clinton Power Station were comparable to the concentrations in samples collected at locations remote from the station. The presence of these fission products is attributable to previous nuclear weapons testing and fallout from the accident at Chernobyl. 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-mile radius of the Clinton Power Station. Milk samples are collected from a dairy located about 14 miles west southwest of the station (twice a month during May through October and once a month during November through April). These samples are analyzed for I-131, Sr-90 and gamma isotopic activities.

The results of the analyses showed positive concentrations of K-40 and Sr-90 in all 1991 samples with a range of 1070 to 1440 pCi/l for K-40 and 1.0 to 4.8 pCi/l for Sr-90. Preoperational activity of K-40 in milk ranged from 706 to 1375 pCi/l. Strontium-90 (Sr-90) analysis in milk was added to the REMP in October of 1987. These results ranged from 2.3 to 2.5 pCi/l. I-131 was not detected in any milk sample obtained during 1991. Figure 10 presents the Sr-90 results graphically.

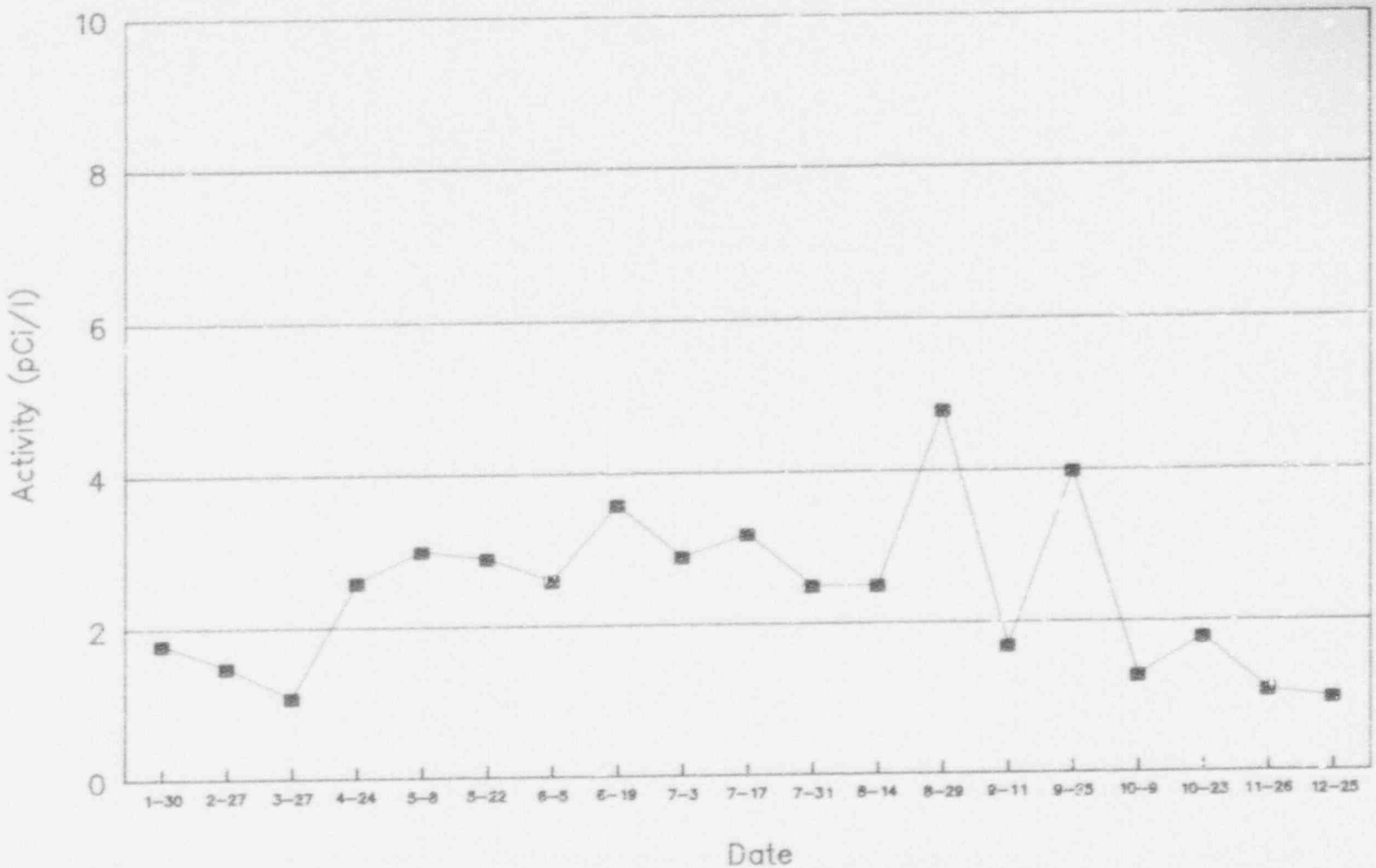


FIGURE 10: STRONTIUM-90 ACTIVITY IN MILK

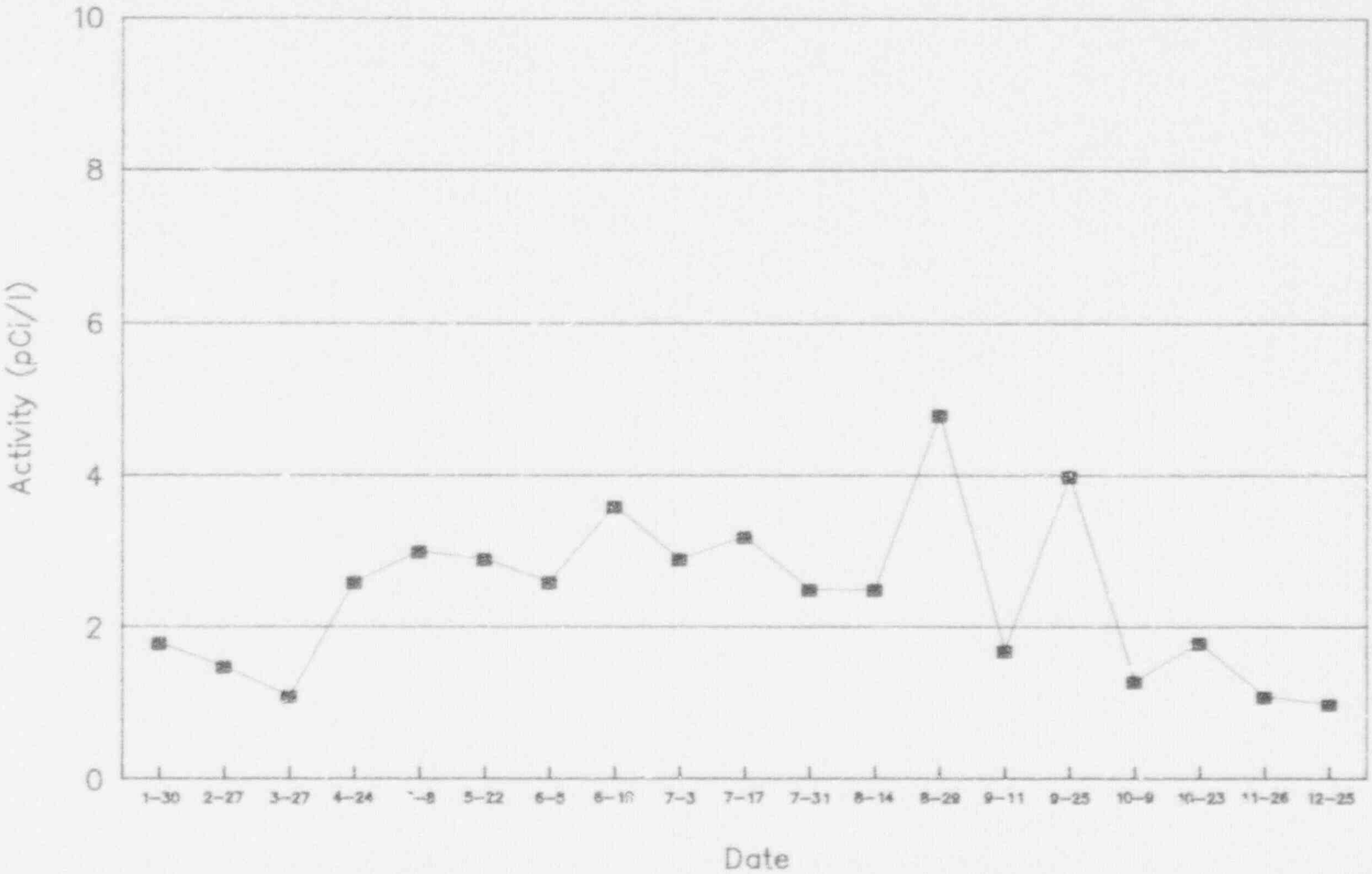


FIGURE 10: STRONTIUM-90 ACTIVITY IN MILK

Grass

In addition to milk samples, grass samples are collected at four indicator locations and at one control location. These samples are collected twice a month during May through October and once a month during November through April. These samples are analyzed for gamma isotopic activity including I-131.

The results of the analyses showed naturally occurring Be-7 and K-40 in all 1991 samples. Two indicator samples showed the presence of Cs-137 in 1991.

	Preoperational Range (pCi/g wet)	1991 Range (pCi/g wet)
Be-7	0.22 to 14.0	0.12 to 9.81
K-40	0.22 to 14.5	0.84 to 9.52
Cs-137	0.017 to 0.085	0.023 to 0.029

The presence of fission product Cs-137 is attributed to fallout from nuclear weapons testing and the Chernobyl accident.

I-131 was not detected in any grass sample obtained during 1991.

Vegetables

The Clinton Power Station obtains samples of cabbage, lettuce and swiss chard from two indicator locations and at one control location. The indicator locations are located in the sectors with the highest potential for surface deposition and the control location is in a sector and at a distance which is considered to be unaffected by plant operations. Samples are collected once a month during the growing season (June through September) and analyzed for gross beta and gamma isotopic activities including I-131.

Fourteen out of thirty-six vegetable samples were not available for collection in 1991 due to consumption by wildlife and hot, dry weather during the growing season. The swiss chard potting plants which were planted at indicator location CL-115 were eaten by deer from the deer population which inhabits the areas around Clinton Lake. Attempts to grow swiss chard from seed to replace the swiss chard that was eaten were unsuccessful. Lettuce and cabbage were not available for sampling in the late summer period due to insufficient plant growth to accommodate sampling throughout the growing season. The lack of growth was attributed to hot, dry weather during key portions of the growing season.

The results of the gamma isotopic analysis showed naturally occurring K-40 and Be-7. K-40 was found in all 1991 samples and Be-7 was found in eight samples. One indicator sampled showed the presence of Cs-137 in 1991.

	Preoperational Range (pCi/g wet)	1991 Range (pCi/g wet)
Be-7	0.082 to 0.69	0.080 to 0.24
K-40	1.45 to 7.00	1.91 to 5.60
Gross Beta	0.87 to 8.80	2.1 to 7.1
Cs-137	0.006*	0.007*

* Cs-137 was detected in only one preoperational sample and in only one sample in 1991.

The presence of fission product Cs-137 is attributed to fallout from nuclear weapons testing and the Chernobyl accident.

I-131 was not detected in any vegetation sample during 1991.

Meat

As an additional check on the presence of radioactive materials in terrestrial exposure pathways, the Clinton Power Station environmental group collects annual samples of beef liver, beef thyroid and ground beef from an animal raised near the Clinton Power Station. These samples are analyzed for gamma isotopic activity including I-131.

The results of the gamma isotopic analysis showed only naturally occurring K-40 in the ground beef, liver and thyroid at 2.02, 2.49 and 1.67 pCi/g (wet) respectively. Preoperational activity ranged from 1.95 to 2.78 pCi/g (wet). I-131 was not detected in the meat samples during 1991.

Soil

Soil samples adjacent to air sample stations are collected triennially from eight indicator locations and one control location. The samples are collected to monitor the potential buildup of atmospherically deposited radionuclides. One soil sample is collected annually from the area where Clinton Power Station land applies processed sewage sludge from the Clinton Power Station Sewage Treatment Plant. This sample is collected to ensure radionuclides attributed to the operation of Clinton Power Station are not being land applied with the processed sewage sludge. All soil samples are analyzed for gross beta, gross alpha and gamma isotopic activities.

Soil samples are sifted to remove any stones or debris and then dried. The results of the gross beta activity ranged from 19.8 to 26.6 pCi/g (dry). Gross alpha activity ranged from 7.8 to 16.8 pCi/g (dry). Gamma isotopic activity indicated several naturally occurring isotopes, such as K-40, Ra-226, Pb-212 and one fission product, Cs-137. Cs-137 concentrations ranged from 0.015 to 1.030 pCi/g (dry).

	Preoperational Range (pCi/g dry)	1991 Range (pCi/g dry)
Gross Beta	17.7 to 24.7	19.8 to 26.6
Gross Alpha	6.2 to 10.4	7.8 to 16.8
Cs-137	0.14 to 0.40	0.015 to 1.030

The presence of Cs-137 is attributed to previous nuclear weapons testing and atmospheric fallout from the accident at Chernobyl.

F. Water Monitoring

Section 2.4 of the Updated Safety Analysis Report (USAR) for the Clinton Power Station provides a technical description of the geologic and hydrologic conditions in the vicinity of the Clinton Power Station, and the locations of public and private wells. Each year during the performance of the Annual Land Use Census, the Illinois State Water Survey office is contacted to determine if any new wells have been drilled within 5.0 miles of the Clinton Power Station which are not referenced in Section 2.4 of the USAR. The most rapid vertical diffusion of surface water into the sub-surface aquifer supplying local wells is about 10.5 feet per year. The only identified user of water from Clinton Lake for domestic purposes is the Clinton Power Station; all others potentially exposed to any radioisotopes released into surface or ground water would not be affected for several years.

Water monitoring provides for the collection of drinking water, surface water and ground water (well water), samples to detect the presence of any radioisotopes related to the operation of the Clinton Power Station. Both indicator and control locations were sampled during 1991. These samples were analyzed for naturally occurring and man-made radioactive isotopes. Average tritium and gross beta concentrations in surface, drinking and well water are presented in Table 9 and Table 10.

Drinking Water

The Clinton Power Station domestic water system is the only known direct user of water from Clinton Lake for human consumption. A composite water sampler located in the Service Building 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 the contracted laboratory service is a composite of the individual samples collected throughout the month. The monthly composite sample is analyzed for gross alpha, gross beta and gamma isotopic activities. A portion of each monthly sample is mixed with the other monthly samples collected during each calendar quarter. The quarterly composite sample is analyzed for tritium.

Gross alpha activity was detected in two samples and ranged from 0.3 to 0.4 pCi/l. This activity is attributed to naturally occurring radioisotopes, such as U-238 and Ra-226, suspended as fine sediment particles in water.

Gross beta activity ranged from 1.3 to 2.6 pCi/l. These levels are attributed to very fine particles of sediment containing K-40 which are not removed during the chlorination and filtration process. Monthly drinking water gross beta concentrations are presented in Figure 11.

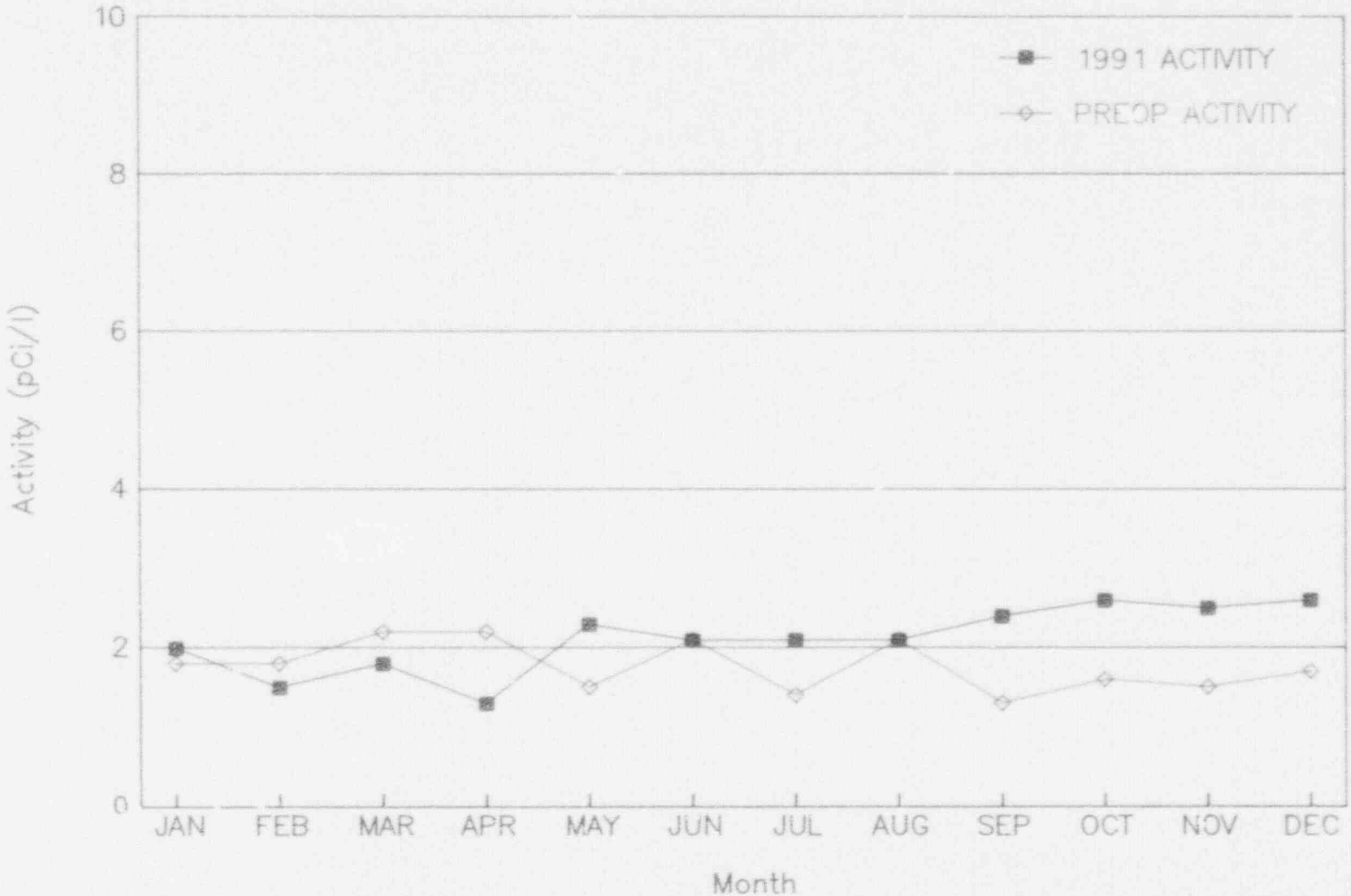


FIGURE 11: DRINKING WATER GROSS BETA ACTIVITY COMPARISON

Specific gamma-emitting radioisotopes were all below the lower limits of detection. Specific searches were made for activated corrosion products (manganese-54, iron-59, cobalt-58, cobalt-60 and zinc-65) and fission products (niobium-95, zirconium-95, cesium-134, cesium-137, barium-140 and lanthanum-140).

The results of all analyses for tritium were less than the lower limit of detection.

These results show no measurable effects on drinking water resulting from operation of the Clinton Power Station during 1991.

Surface Water

Composite water samplers are installed in three locations to sample surface water from Clinton Lake. These samplers collect a small volume of water at regular intervals and discharge it to a large sample collection bottle. These bottles are collected monthly. One of the composite samplers is located upstream from Clinton Power Station and is unaffected by plant liquid releases downstream. The two other composite samplers are positioned at the locations most likely to be affected by plant operations (one samples the intake water to the Circulating Water Intake Structure and the other samples the water at the start of the plant discharge flume). Monthly grab samples are collected from two indicator locations and one control location on Clinton Lake. One additional indicator sample is obtained from the Clinton Power Station lower settling pond.

Surface water samples are analyzed for gross beta, gamma isotopic and tritium activities. Additional analyses for gross alpha activity are performed on the upstream water samples. Additional analyses for gross alpha activity and I-131 activity are performed on water samples taken from the discharge flume. Tritium analyses are performed monthly on samples from the lower settling pond, the intake structure water samples and the upstream composite water samples, and quarterly from composites of monthly samples at the other locations.

The 1991 results of the gross beta analyses ranged from 1.0 to 6.0 pCi/l at the indicator locations and 1.3 to 3.9 pCi/l at the control location. Preoperational 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 water. Other types of samples have confirmed the presence of K-40 in Clinton Lake sh...ine and bottom sediments. Monthly surface water gross beta activity for the control and indicator locations are presented graphically in Figure 12.

Tritium analyses performed on samples indicated one sample with a concentration of 216 pCi/l. All other concentrations were less than the lower limit of detection. The preoperational tritium concentrations ranged from 220 to 330 pCi/l. As noted in reference (EI87), previous nuclear weapons testing increased the pre-1960 levels of tritium (6-24 pCi/l) by a factor of approximately fifty (300-1200 pCi/l). Since the level of tritium reported in the one positive sample fell in the low end of the existing, non-reactor-related, natural inventory of tritium, it is considered this positive result is not associated with operation of the Clinton Power Station.

Specific gamma-emitting radioisotopes were all below the lower limits of detection. Specific searches were made for activated corrosion products (manganese-54, iron-59, cobalt-58, cobalt-60 and zinc-65) and fission products (niobium-95, zirconium-95, cesium-134, cesium-137, barium-140 and lanthanum-140). No I-131 was detected in any surface water sample during 1991.

Gross alpha activity was detected in approximately half the surface water samples analyzed for gross alpha. The 1991 results ranged from 0.6 to 1.8 pCi/l. Preoperational gross alpha activity ranged from 1.3 to 1.9 pCi/l. These results were attributed to naturally occurring radioisotopes, such as U-238 and Ra-226, suspended as fine sediment particles in water.

These results show no measurable change in radioactive material concentration in surface water due to operation of the Clinton Power Station during 1991.

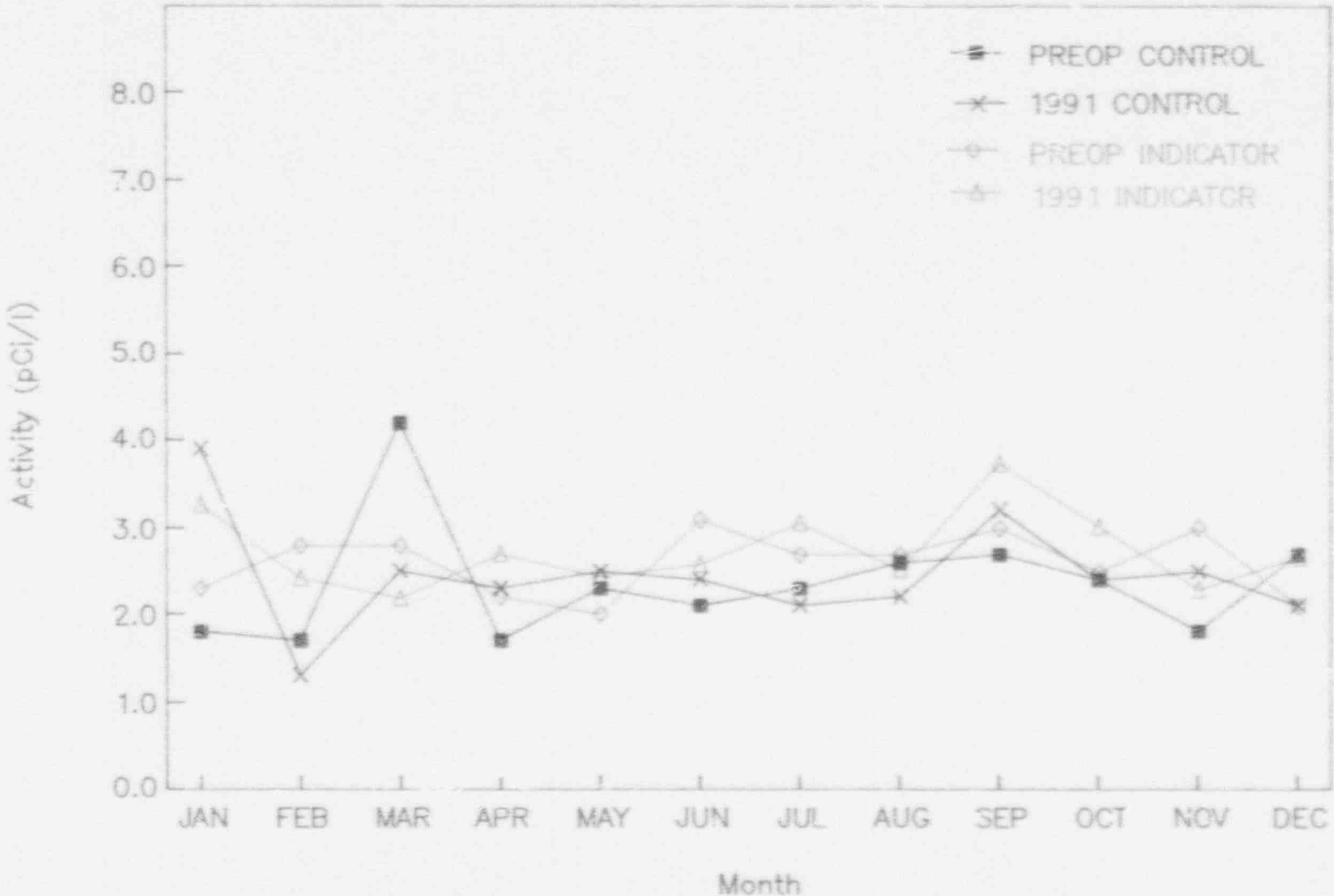


FIGURE 12: SURFACE WATER GROSS BETA ACTIVITY COMPARISON

Well Water

Every two weeks samples are collected from the well serving the Village of DeWitt (both treated and untreated samples are obtained) and from a well serving the Illinois Department of Conservation at the Mascoutin State Recreational Area. Each sample is analyzed for I-131. All samples drawn from the same well during a particular month are combined and analyzed for gross alpha, gross beta and gamma isotopic activities. In addition, a portion of each monthly composite is added to the quarterly composite sample and is analyzed for tritium.

The 1991 results of the gross beta analyses ranged from 0.9 to 4.0 pCi/l. Preoperational 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. Monthly well water gross beta activity is presented graphically in Figure 13.

Gross alpha activity was detected in two well water samples in 1991 and ranged from 0.3 to 0.9 pCi/l. Preoperational gross alpha activity ranged from 0.9 to 1.8 pCi/l. These results were attributed to naturally occurring radioisotopes, such as U-238 and Ra-226, suspended as fine sediment particles in water.

Specific gamma-emitting radioisotopes were all below the lower limits of detection. Specific searches were made for activated corrosion products (manganese-54, iron-59, cobalt-58, cobalt-60 and zinc-65) and fission products (niobium-95, zirconium-95, cesium-134, cesium-137, barium-140 and lanthanum-140). Tritium and I-131 were not detected in any well water samples taken during 1991.

These results show no measurable change in radioactive material concentration in well water resulting from operation of the Clinton Power Station during 1991.

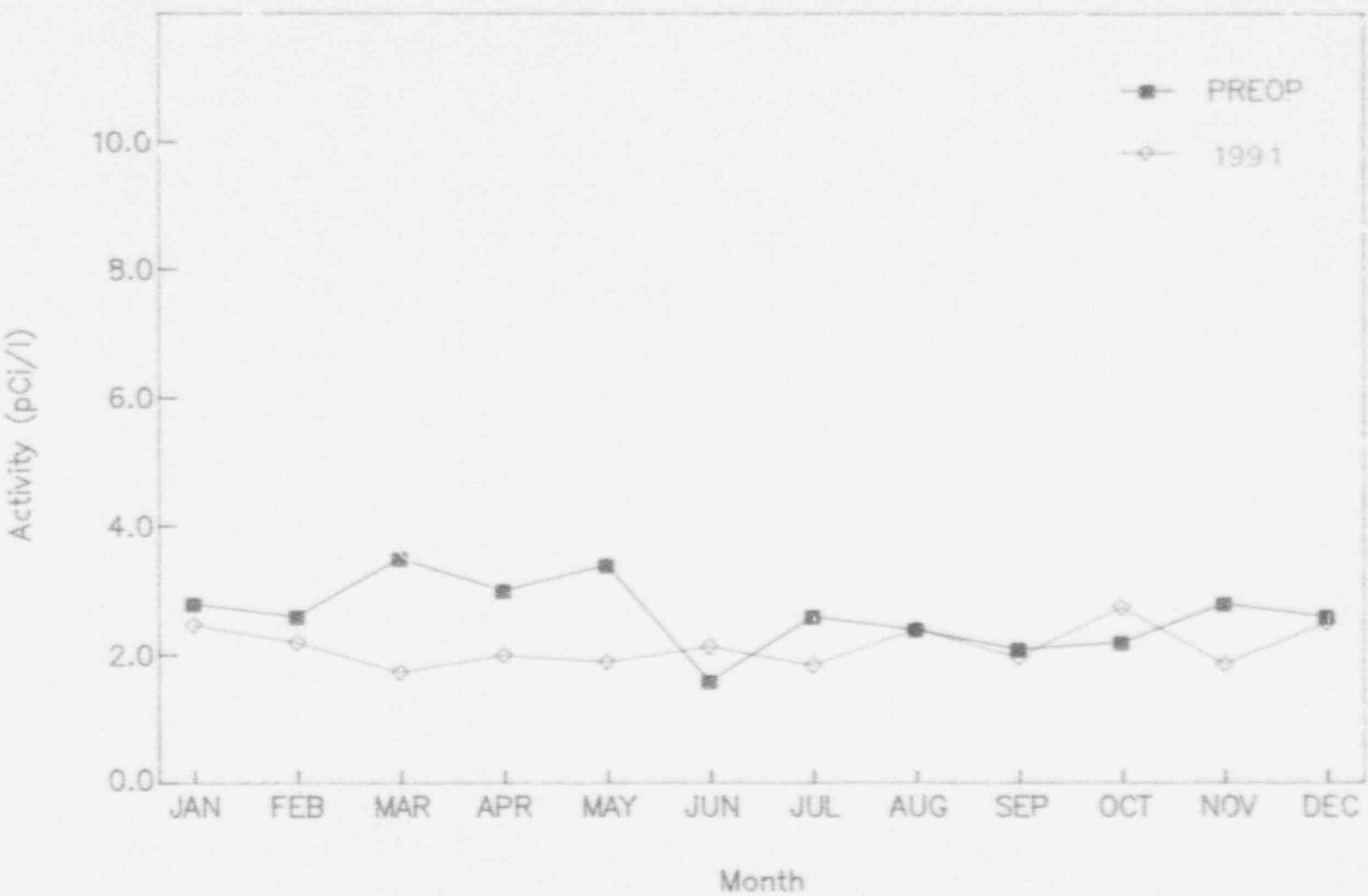


FIGURE 13: WELL WATER GROSS BETA ACTIVITY COMPARISON

TABLE 9

1991 TRITIUM CONCENTRATIONS IN DRINKING, SURFACE AND WELL WATER

Station	Description	(pCi/l)*
	Drinking Water	
CL-14 (I)	CPS Service Building	<LLD
	Surface Water	
CL-9 (I)	DeWitt Road Bridge	<LLD
CL-10 (C)	Ill. 48 Bridge	<LLD
CL-13 (I)	Salt Creek (below dam)	<LLD
CL-90 (I)	CPS Discharge Flume	216[a]
CL-91 (I)	Parnell Boat Access	<LLD
CL-92 (I)	CPS Intake Screenhouse	<LLD
CL-93 (I)	CPS Settling Ponds	<LLD
	Well Water	
CL-7D (I)	Mascoutin State Recreation Area	<LLD
CL-12 (I) Treated	DeWitt Pump Station	<LLD
CL-12 (I) Untreated	DeWitt Pump Station	<LLD

* Based on detectable activities only

(C) Control

(I) Indicator

a Composite Sample

TABLE 10

1991 AVERAGE GROSS BETA CONCENTRATIONS IN DRINKING, SURFACE AND WELL WATER

Station	Description	Average ± 2 s.d. (pCi/l)*
	Drinking Water	
CL-14 (I)	CPS (Service Building)	2.1 ± 0.8
	Surface Water	
CL-9 (I)	DeWitt Road Bridge	2.6 ± 1.4
CL-10 (C)	Ill. 48 Bridge	2.5 ± 1.3
CL-13 (I)	Salt Creek (below dam)	2.6 ± 1.1
CL-90 (I)	CPS Discharge Flume	2.8 ± 0.8
CL-91 (I)	Parnell Boat Access	2.6 ± 2.4
CL-92 (I)	CPS Intake Screenhouse	2.8 ± 2.1
CL-93 (I)	CPS Settling Ponds	3.0 ± 1.9
	Well Water	
CL-7D (I)	Mascoutin State Recreation Area	1.3 ± 0.8
CL-12 (I) Treated	DeWitt Pump Station	2.8 ± 1.2
CL-12 (I) Untreated	DeWitt Pump Station	2.3 ± 1.4

* Based on detectable activities only

(C) Control

(I) Indicator

G. Quality Assurance Program

To establish confidence that data developed and reported are accurate and precise, all REMP activities are incorporated into the Illinois Power Company Quality Assurance (QA) program of audits and surveillances. The Quality Assurance program requires:

- Participation in intercomparison programs, such as the EPA crosscheck program.
- An annual audit of the analysis laboratory functions and facilities.
- Biennial review of the Clinton Power Station procedures specifying sampling techniques.
- Duplicate analysis of every tenth sample assayed (not including TLDs). This requirement is to check laboratory precision.
- The routine counting of quality control samples. Approximately ten percent of the total number of counts performed are to be quality control counts.

The analytical results provided by the laboratory were routinely reviewed by the Radiological Environmental Group of the Radiation Protection Department to ensure the required minimum sensitivities have been achieved and the proper analyses have been performed.

Teledyne Isotopes Midwest Laboratory (TIML) participates in the Environmental Protection Agency crosscheck program. The TIML participant code in the crosscheck program is CA. Participation in this program provides assurance that the laboratory is capable of meeting widely-accepted criteria for radioactivity analysis. TIML correctly analyzed 96% of the U.S. EPA crosscheck samples and 97% of in-house spiked samples. These results indicate that TIML is capable of routinely performing high quality analysis on environmental samples.

Results of the 1991 crosscheck program and other in-house quality programs are shown in Appendix E.

H. <u>Changes to the REMP During 1991</u>

Occasionally changes to the Radiological Environmental Monitoring Program are necessary to improve the monitoring of the environmental exposure pathways. These changes may result from items identified during the performance of the Annual Land Use Census, revised or new regulatory requirements, Quality Assurance audits or supplemental periodic and long-term sampling and analyses.

During 1991, the Annual Land Use Census identified goats being milked for human consumption. Efforts are being made to establish a milk sample location with the owner of the goats. This location was not established prior to the end of 1991. There were no changes due to Quality Assurance audits or regulatory requirements.

Three environmental TLD control sample locations were added as improvements by the Radiological Environmental staff in 1991.

Changes that were made and the reasons for the changes are listed in Table 11.

TABLE 11

CHANGES TO THE REMP DURING 1991

1.	June, 1991	Environmental TLD control sample locations were established at CL-95, CL-96 and CL-97. CL-95 is located 10.5 miles from CPS in the West sector. CL-96 is located 10.9 miles from CPS in the Southwest sector. CL-97 is located 10.3 miles from CPS in the South-Southwest sector. These locations were added as a program improvement to provide additional background radiation information.
2.	October, 1991	A milk sample location was identified but has not been established as yet. The sample location will be 3.4 miles from CPS in the South-Southwest sector. This sample will be established to satisfy the CPS Offsite Dose Calculation Manual requirements which requires a milk sample be taken within 8 km of CPS when an animal providing milk for human consumption is identified.

ANNUAL LAND USE CENSUS

IV. ANNUAL LAND USE CENSUS

A land use census is performed to ensure that changes in the use of areas at and beyond the site boundary are identified and that modifications to the REMP are made, if required, by evaluation of the land use census.

The land use census is performed to identify within a distance of 5 miles, the locations in each of the 16 meteorological sectors of the nearest milk animals, the nearest residence and the nearest garden of greater than 500 square feet producing broad leaf vegetation. Also, the census shall identify within a distance of 3 miles, the location in each of the 16 meteorological sectors of all milk animals and all gardens of greater than 500 square feet producing broadleaf vegetation.

The 1991 Land Use Census was conducted during the growing season from July 29, 1991, through October 3, 1991, satisfying the CPS Offsite Dose Calculation Manual requirements. Over 210 residences were surveyed by either mail survey, telephone follow-up, or direct contact. Data for this report was obtained using the following means:

- Performing door-to-door solicitation of one-half of the residences/land owners identified in the 1990 Annual Land Use Census and the 1991 plat of DeWitt County.
- Soliciting the remaining half of the residences/land owners identified in the 1990 Annual Land Use Census by mail survey and telephone follow-up.
- Driving along all roads within a five-mile radius and performing door-to-door solicitation of residences/land owners not identified by the 1990 report.
- Contacting several state and local agencies.

The results of the 1991 Annual Land Use Census were examined to ensure that the REMP will provide representative measurements of radiation and radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures to the general public resulting from the operation of the Clinton Power Station. Table 12 provides the nearest residence, garden and livestock/dairy animal in each of the 16 meteorological sectors within a 5-mile radius of the Clinton Power Station. Figure 14 graphically shows the information listed in Table 12.

Based on the examination of the results from the 1991 Annual Land Use Census, one change is required to be made to the REMP.

Goats were found being milked for human consumption by a family within 5 miles of Clinton Power Station. Continued effort is being made to obtain milk samples for the REMP from the family. As of the issuance date of this report, sampling had not been initiated.

Summary of Changes Identified in 1991 Annual Land Use Census

Nearest Residence

Three changes were identified for the nearest residence. The changes were attributed to new residence and ownership change. Changes in nearest residence are shown below:

NNE Sector - Change in residence ownership at 0.9 miles.
SSE Sector - Change in residence ownership at 1.7 miles.
WNW Sector - New residence established at 1.9 miles.

Nearest Garden

A total of 133 gardens were identified in the 16 sectors within a 5-mile radius of Clinton Power Station of which 31 produced broad leaf vegetation (spinach, lettuce, cabbage and chard) and were greater than $50m^2$. In most cases, tomatoes, sweet corn and beans were grown in gardens identified.

Changes in census locations for the nearest garden were identified in 13 of the 16 sectors and are shown below:

1990 Census Location	1991 Census Location
2.0 miles NE	3.2 miles NE
2.5 miles ENE	2.7 miles ENE
1.5 miles E	2.4 miles E
None identified	4.8 miles ESE
None identified	4.9 miles SE
None identified	2.6 miles SSE
None identified	3.8 miles S
3.2 miles SSW	3.5 miles SSW
2.7 miles SW	4.0 miles SW
3.4 miles WSW	3.3 miles WSW
0.8 miles WNW	4.8 miles WNW
2.2 miles NW	2.8 miles NW
2.3 miles NNW	4.4 miles NNW

Nearest Livestock/Dairy

Over 440 head of cattle were counted in the 16 sectors within a 5-mile radius of Clinton Power Station. The cattle were used for nursing (nursing of calves) and were being used for meat production. No milk cattle (for human consumption) were identified.

7 goats were identified during the land use census. Of these, 4 are being milked for human consumption.

Negotiations with the owner are underway to provide milk samples for environmental monitoring.

Over 31,000 other farm animals in addition to the cattle identified were counted. Of these, 30,000 are turkeys raised for commercial use. Of the remainder, the predominant species were chickens, hogs and sheep.

Changes in the census locations for the nearest livestock/dairy were identified in 9 of the 16 sectors and are shown below:

1990 Census Location	1991 Census Location
1.3 miles NNE	1.8 miles NNE
2.0 miles SSE	2.6 miles SSE
3.0 miles S(T. Shinneman)	3.0 miles S(L. Disney)
3.2 miles SSW	3.5 miles SSW
3.7 miles SW	3.3 miles SW
None identified	3.3 miles W
2.8 miles WNW	4.8 miles WNW
1.7 miles NW	None identified
2.3 miles NNW	3.9 miles NNW

TABLE 12

1991 ANNUAL LAND USE CENSUS

DIRECTION	NEAREST RESIDENCE (in miles)	NEAREST GARDEN (in miles)	NEAREST DAIRY OR LIVESTOCK (in miles)
N	0.9	0.9	0.9
NNE	0.9	2.0	1.8
NE	1.2	3.2	3.5
ENE	2.5	2.7	4.6
E	1.1	2.1	3.1
ESE	3.2	4.8	a
SE	2.9	4.9	2.9
SSE	1.7	2.6	2.6
S	3.0	3.8	3.0
SSW	3.0	3.5	3.5
SW	0.8	4.0	3.3
WSW	1.5	3.3	3.4
W	1.5	2.3	3.3
WNW	1.9	4.8	4.8
NW	1.6	2.8	a
NNW	1.6	4.4	3.9

a No dairy or livestock within 5 miles of CPS in this meteorological sector.

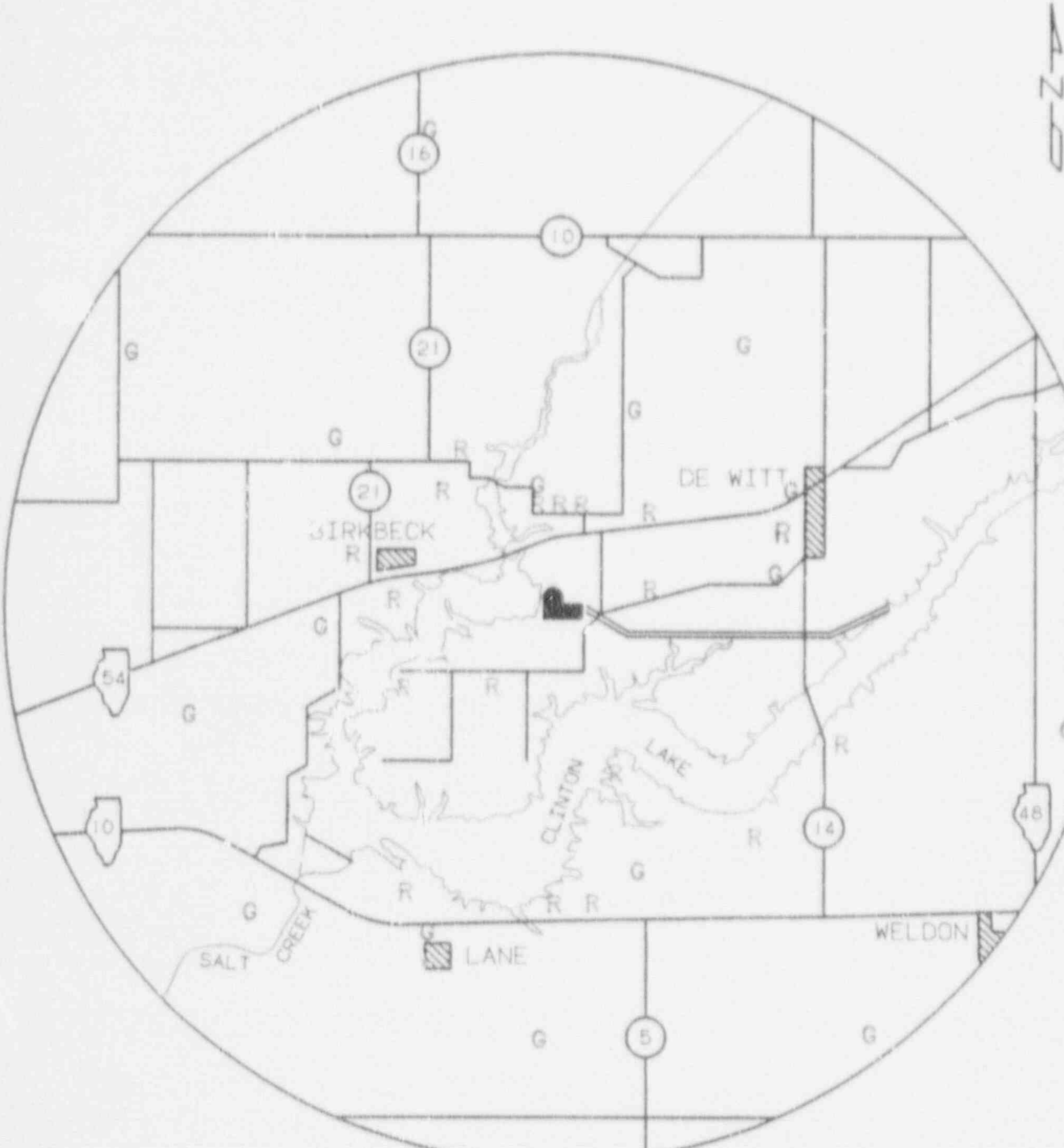


FIGURE 14: ANNUAL LAND USE CENSUS, NEAREST RESIDENCE (R), GARDEN (G), AND MILK ANIMAL (M) WITHIN 5 MILES

M.023490
3-8-91

METEOROLOGICAL MONITORING

V. METEOROLOGICAL CHARACTERISTICS

A. Description

The climate of central Illinois is typical of the Midwest, with cold winters, warm summers and frequent short-period fluctuations in temperature, humidity, cloudiness and wind direction. The variability in central Illinois climate is due to its location in a confluence zone (particularly during the cooler months) between different air masses. The specific air masses which affect central Illinois include maritime tropical air which originates in the Gulf of Mexico; continental tropical air which originates in Mexico and the southern Rockies; Pacific air which originates in the eastern North Pacific Ocean; and continental polar and continental arctic air which originates in Canada.

Monthly streamline analyses of resultant surface winds suggest that air reaching central Illinois most frequently originates over the Gulf of Mexico from April through August, over the southeastern United States from September through November, and over both the Pacific Ocean and the Gulf of Mexico from December through March.

The major factors controlling the frequency and variation of weather types are determined by the movement of storm systems which commonly follow paths along a major confluence zone between air masses. The confluence zone is usually oriented from southwest to northeast through the region and normally shifts in latitude during this period, ranging in position from the central states to the United States - Canadian border. The average frequency of passage of storm systems along this zone is about once every 5 to 8 days. These storm systems are most frequent during the winter and spring months, causing a maximum of cloudiness during these seasons. Winter is characterized by alternating periods of steady precipitation and periods of clear, crisp and cold weather. Springtime precipitation is primarily showery in nature. The frequent passage of storm systems, presence of high winds, and frequent occurrence of unstable conditions caused by the close proximity between warm, moist air masses and cold, dry air masses, result in this season's thunderstorms and on occasion, are the source of hail, damaging winds and tornados. Although storm systems also occur during the fall months, the frequency of occurrence during these months is less than that of the winter or spring months. Periods of dry weather characterize the fall season which ends rather abruptly with increasing storminess that usually begins in November.

In contrast, weather during the summer months is characterized by weaker storm systems which tend to pass to the north of Illinois. A major confluence zone is not present in this region, and the region's weather is characterized by much sunshine interspersed with thunderstorms. Showers and thunderstorms are usually of the air mass type, although occasional outbreaks of cold air bring precipitation and weather typical of that associated with the fronts and storm systems of the spring months.

When southeasterly and easterly winds are present in central Illinois, they usually bring mild and wet weather. Southerly winds are warm and showery, westerly winds are dry with moderate temperatures, and winds from the northwest and north are cool and dry.

The prevailing wind is southerly at the Clinton Power Station. The frequency of winds from other directions is relatively well distributed. The monthly average wind speed is lowest during late summer and highest during late winter and early spring.

Table 13 presents a summary of climatological data at meteorological stations surrounding the Clinton Power Station site from 1939 through 1990. The annual average temperature at the Clinton Power Station is about 52°F. Monthly average temperatures in the region range from the low to middle twenties in January to the middle seventies in July. Maximum temperatures in the Clinton Power Station region equal or exceed 90°F on an average between 20 and 30 times per year. Minimum temperatures in this region are less than or equal to 32°F on an average between 117 and 129 times per year.

Humidity varies with wind direction, lower with westerly or northwesterly winds and higher with easterly or southerly winds. The early morning relative humidity is highest during the late summer, with an average of 83% at both Peoria and

Springfield. The relative humidity is highest throughout the day during December, ranging from 83% in early morning to 71% at noon at both Peoria and Springfield. Heavy fog with visibility less than 1/4 mile occurs an average of 21 times per year at Peoria and 17 times per year at Springfield. Heavy fog occurs most frequently during the winter months.

Annual precipitation in the Clinton Power Station area averages about 34 inches per year. On the average, about 53% of the annual precipitation in the Clinton Power Station region occurs in the 5-month period from April through August. However, in this region no month averages less than 4% of the annual total. Monthly precipitation totals have ranged from 0.03 to 13.09 inches (Peoria). Snowfall commonly occurs from November through March, with an annual average of 24.7 inches at Peoria, and 22.7 inches at Springfield.

The monthly maximum snowfall at Peoria was 24.7 inches in January of 1979 while in Springfield 22.7 inches was received in December of 1973. The 24-hour maximum snowfall occurred in January of 1979 in Peoria which received 12.2 inches. In December of 1973 Springfield received its maximum 24-hour snowfall with a snowfall of 10.9 inches.

The terrain in central Illinois is relatively flat and differences in elevation have no significant impact on the general climate. However, the low hills and river valleys that exist cause a small effect upon nocturnal wind drainage patterns and fog frequency.

B. Climatological Summary - 1991

Temperatures in Springfield for the months of January, July, September, October and November averaged below normal while February, March, April, May, June, August and December averaged above normal. Over the year, the average monthly temperature ranged from 24.0°F in January to 75.6°F in June. The lowest hourly temperature of the year occurred on January 31 and November 8 when it dropped to 1°F. On August 2, 96°F was recorded, marking the year's highest hourly temperature. (IPC91)

TABLE 13

HISTORICAL CLIMATOLOGICAL DATA FROM WEATHER STATIONS SURROUNDING THE CLINTON POWER STATION

PARAMETER	STATION PEORIA	SPRINGFIELD
Temperature (°F)		
Annual average	50.4	52.6
Maximum	105 (June 1988)	112 (Jul 1954)
Minimum	-25 (Jan 1977)	-22 (Feb 1963)
Relative Humidity (%)		
Annual average at:		
6 a.m.	83	83
12 noon	61	61
Wind		
Annual average speed (mph)	10.0	11.2
Prevailing direction	S	SSW
Maximum Winds:		
Fastest Obs. 1 Min (mph)	48 (Nov 1988)	46 (Apr, Nov 1988)
Direction	SIW	WSW
Peak Gust (mph)	69 (Apr 1989)	69 (Aug 1987)
Direction	N	W
Precipitation (in.)		
Annual average	34.89	33.78
Monthly maximum	13.09 (Sep 1961)	10.76 (Jul 1981)
Monthly minimum	0.03 (Sep 1979)	Trace (Sep 1979)
24-hour maximum	5.06 (Apr 1950)	6.12 (Dec 1982)
Snowfall (in.)		
Annual average	25.1	23.9
Monthly maximum	24.7 (Jan 1979)	22.7 (Dec 1973)
24-hour maximum	12.2 (Jan 1979)	10.9 (Dec 1973)
Mean Annual (no. of days)		
Precipitation ≥ 0.01 in.	113	113
Snow, sleet, hail ≥ 1.0 in.	8	8
Thunderstorms	48	48
Heavy fog (visibility 1/4 m. or less)	21	17
Maximum temperature ≥ 90°F	20	30
Minimum temperature ≤ 32°F	129	117

TABLE 13 (Continued)

The data presented in this table are based upon references (DOC 90a) and (DOC 90b). These statistics are based on periods of record ranging from 7 to 51 years in length. The ranges span the years 1937 to 1990.

In Springfield a total of 37.91 (water equivalent) inches of precipitation fell during 1991, which amounts to approximately 4.13 inches above the annual average. Monthly precipitation totals ranged from a low of 0.71 inches in February to a high of 6.41 inches in October. The largest precipitation event came on October 4 when 3.24 inches of rain fell. 1[illegible].4 inches of snowfall was received in Springfield in 1991 with the year's heaviest snowfall occurring on January 25 when 3.2 inches fell. (IPC91)

The onsite meteorological tower obtains information that is valuable in determining plume dispersion by providing differential temperature, wind speed and direction. Table 14 summarizes the seven stability classes, with unstable conditions dispersing a plume more than stable conditions. Table 15 compiles the total hours for different wind speeds for each stability class during 1991, at 10 meters and 60 meters. Figures 15 and 16 are wind rose graphs which show predominant wind direction at 10 and 60 meters for the Clinton Power Station.

During 1991, an error was discovered in the data provided by the onsite meteorological tower. Indications were that for days when solar radiation was at a maximum, i.e., sunny, the "A" Pasquil Gifford stability class was present a higher than normal percentage of the time. Upon investigation, the cause of the problem was determined to be inadequate aspiration of the 10 meter temperature indicator. Atmospheric stability class at CPS is determined by the temperature difference between the 60 meter and the 10 meter instrumentation. This error resulted in a skewing of the data towards the "A" stability class end of the range. The problem has been corrected and the meteorological tower now yields accurate data for atmospheric stability class determination. The information provided in Table 14 has not been corrected and will be biased towards the "A" stability class.

TABLE 14

CLASSIFICATION OF ATMOSPHERIC STABILITY

Stability Classification	Pasquill Categories	Defining Conditions
Extremely unstable	A	$-0.900<\Delta T\leq-0.019$
Moderately unstable	B	$-0.019<\Delta T\leq-0.017$
Slightly unstable	C	$-0.017<\Delta T\leq-0.015$
Neutral	D	$-0.015<\Delta T\leq-0.005$
Slightly stable	E	$-0.005<\Delta T\leq0.015$
Moderately stable	F	$0.015<\Delta T\leq0.040$
Extremely stable	G	$0.040<\Delta T\leq0.900$

TABLE 15

ANNUAL JOINT FREQUENCY DISTRIBUTION OF
METEOROLOGICAL PARAMETERS DURING 1991

STABILITY CLASS A

WIND SPEED (MPH) AT 10-METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	7.00E 00	5.30E 01	5.90E 01	2.00E 01	0.00E-01	0.00E-01	1.39E 02
NNE	9.00E 00	4.80E 01	4.40E 01	1.50E 01	0.00E-01	0.00E-01	1.16E 02
NE	1.10E 01	3.70E 01	5.30E 01	2.20E 01	2.00E 00	0.00E-01	1.25E 02
ENE	1.20E 01	4.30E 01	7.80E 01	3.60E 01	1.00E 00	0.00E-01	1.70E 02
E	7.00E 00	4.90E 01	5.60E 01	4.00E 01	9.00E 00	0.00E-01	1.61E 02
ESE	9.00E 00	5.10E 01	5.00E 01	1.10E 01	0.00E-01	0.00E-01	1.21E 02
SE	1.00E 01	6.80E 01	4.90E 01	3.00E 00	1.00E 00	0.00E-01	1.31E 02
SSE	1.40E 01	7.10E 01	5.40E 01	2.20E 01	0.00E-01	0.00E-01	1.61E 02
S	1.10E 01	6.50E 01	8.70E 01	6.70E 01	1.00E 01	0.00E-01	2.40E 02
SSW	7.00E 00	6.80E 01	1.28E 02	7.30E 01	0.00E-01	0.00E-01	2.76E 02
SW	7.00E 00	6.90E 01	1.29E 02	6.10E 01	3.00E 00	5.00E 00	2.74E 02
WSW	6.00E 00	2.40E 01	7.40E 01	4.50E 01	3.20E 01	1.70E 01	1.98E 02
W	1.10E 01	1.90E 01	5.60E 01	3.80E 01	1.80E 01	8.00E 00	1.50E 02
WNW	6.00E 00	2.40E 01	3.40E 01	4.00E 01	3.40E 01	1.90E 01	1.57E 02
NW	[illegible].00E 00	3.80E 01	5.40E 01	2.30E 01	1.80E 01	3.00E 00	1.43E 02
NNW	6.00E 00	3.10E 01	5.40E 01	2.00E 01	0.00E-01	0.00E-01	1.11E 02
TOTAL	1.40E 02	7.58E 02	1.06E 03	5.36E 02	1.28E 02	5.20E 01	2.67E 03

PERIODS OF CALM (HOURS): 5.00E 00

WIND SPEED (MPH) AT 60-METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4.00E 00	3.50E 01	6.30E 01	3.60E 01	9.00E 00	0.00E-01	1.47E 02
NNE	5.00E 00	2.40E 01	4.60E 01	1.70E 01	1.10E 01	0.00E-01	1.03E 02
NE	4.00E 00	2.30E 01	3.40E 01	4.80E 01	1.80E 01	8.00E 00	1.35E 02
ENE	9.00E 00	1.80E 01	4.60E 01	3.90E 01	3.10E 01	1.40E 01	1.57E 02
E	6.00E 00	2.40E 01	3.70E 01	4.80E 01	3.10E 01	3.50E 01	1.81E [illegible]
ESE	9.00E 00	3.10E 01	3.20E 01	3.10E 01	6.00E 00	0.00E-01	1.09E [illegible]
SE	1.20E 01	5.10E 01	4.10E 01	1.40E 01	1.00E 00	1.00E 00	1.20E [illegible]
SSE	9.00E 00	4.80E 01	3.90E 01	3.60E 01	1.40E 01	2.00E 00	1.48E 02
S	1.30E 01	4.40E 01	5.60E 01	6.30E 01	2.60E 01	3.20E 01	2.34E 02
SSW	7.00E 00	4.30E 01	8.80E 01	1.15E 02	3.10E 01	3.00E 00	2.87E 02
SW	3.00E 00	4.10E 01	1.08E 02	9 40E 01	2.30E 01	1.40E 01	2.83E 02
WSW	5.00E 00	2.10E 01	6.40E 01	5.40E 01	3.30E 01	3.70E 01	2.14E 02
W	6.00E 00	1.90E 01	4.20E 01	2.10E 01	2.00E 01	1.60E 01	1.24E 02
WNW	6.00E 00	1.70E 01	2.50E 01	2.50E 01	1.60E 01	3.50E 01	1.24E 02
NW	6.00E 00	2.40E 01	4.90E 01	3.40E 01	1.60E 01	3.10E 01	1.60E 02
NNW	5.00E 00	1.80E 01	5.20E 01	3.40E 01	2.00E 00	2.00E 00	1.13E 02
TOTAL	1.09E 02	4.81E 02	8.22E 02	7.09E 02	2.88E 02	2.30E 02	2.64E 03

PERIODS OF CALM (HOURS): 5.00E 00

TABLE 15 (Cont'd)

STABILITY CLASS B

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0.00E-01	2.00E 00	4.00E 00	3.00E 00	0.00E-01	0.00E-01	9.00E 00
NNE	0.00E-01	3.00E 00	2.00E 00	3.00E 00	3.00E 00	0.00E-01	1.10E 01
NE	1.00E 00	3.00E 00	7.00E 00	3.00E 00	2.00E 00	0.00E-01	1.60E 01
ENE	0.00E-01	1.00E 00	1.20E 01	1.00E 00	0.00E-01	0.00E-01	1.40E 01
E	0.00E-01	6.00E 00	3.00E 00	0.00E-01	0.00E-01	0.00E-01	9.00E 00
ESE	0.00E-01	7.00E 00	6.00E 00	1.00E 00	0.00E-01	0.00E-01	1.40E 01
SE	1.00E 00	4.00E 00	3.00E 00	0.00E-01	0.00E-01	0.00E-01	8.00E 00
SSE	2.00E 00	4.00E 00	5.00E 00	1.00E 00	0.00E-01	0.00E-01	1.20E 01
S	1.00E 00	4.00E 00	6.00E 00	7.00E 00	1.00E 00	0.00E-01	1.90E 01
SSW	0.00E-01	2.00E 00	6.00E 00	7.00E 00	0.00E-01	2.00E 00	1.70E 01
SW	0.00E-01	2.00E 00	1.00E 00	1.00E 00	1.00E 00	1.00E 00	6.00E 00
WSW	0.00E-01	1.00E 00	3.00E 00	3.00E 00	1.00E 00	0.00E-01	8.00E 00
W	0.00E-01	0.00E-01	1.00E 01	1.00E 01	3.00E 00	4.00E 00	2.70E 01
WNW	0.00E-01	3.00E 00	1.00E 00	5.00E 00	7.00E 00	1.00E 00	1.70E 01
NW	0.00E-01	2.00E 00	6.00E 00	4.00E 00	0.00E-01	0.00E-01	1.20E 01
NNW	0.00E-01	2.00E 00	2.00E 00	8.00E 00	0.00E-01	0.00E-01	1.20E 01
TOTAL	5.00E 00	4.60E 01	7.70E 01	5.70E 01	1.80E 01	8.00E 00	2.11E 02

PERIODS OF CALM (HOURS): 0.00E-01

WIND SPEED (MPH) AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0.00E-01	1.00E 00	4.00E 00	6.00E 00	2.00E 00	0.00E-01	1.30E 01
NNE	0.00E-01	1.00E 00	1.00E 00	3.00E 00	0.00E-01	6.00E 00	1.10E 01
NE	1.00E 00	0.00E-01	2.00E 00	5.00E 00	2.00E 00	3.00E 00	1.30E 01
ENE	0.00E-01	0.00E-01	3.00E 00	1.10E 01	1.00E 00	0.00E-01	1.50E 01
E	0.00E-01	3.00E 00	4.00E 00	2.00E 00	2.00E 00	0.00E-01	1.10E 01
ESE	0.00E-01	1.00E 00	7.00E 00	3.00E 00	0.00E-01	0.00E-01	1.10E 01
SE	0.00E-01	1.00E 00	3.00E 00	2.00E 00	1.00E 00	0.00E-01	7.00E 00
SSE	0.00E-01	2.00E 00	2.00E 00	3.00E 00	1.00E 00	0.00E-01	8.00E 00
S	1.00E 00	5.00E 00	3.00E 00	5.00E 00	5.00E 00	4.00E 00	2.30E 01
SSW	0.00E-01	1.00E 00	3.00E 00	8.00E 00	5.00E 00	2.00E 00	1.90E 01
SW	0.00E-01	1.00E 00	2.00E 00	0.00E-01	1.00E 00	2.00E 00	6.00E 00
WSW	0.00E-01	2.00E 00	2.00E 00	3.00E 00	1.00E 00	1.00E 00	9.00E 00
W	0.00E-01	0.00E-01	1.00E 01	3.00E 00	6.00E 00	7.00E 00	2.60E 01
WNW	0.00E-01	1.00E 00	0.00E-01	4.00E 00	2.00E 00	7.00E 00	1.40E 01
NW	0.00E-01	1.00E 00	2.00E 00	1.00E 00	3.00E 00	0.00E-01	7.00E 00
NNW	0.00E-01	3.00E 00	5.00E 00	1.00E 00	4.00E 00	0.00E-01	1.30E 01
TOTAL	2.00E 00	2.30E 01	5.30E 01	6.00E 01	3.60E 01	3.20E 01	2.06E 02

PERIODS OF CALM (HOURS): 1.00E 00

TABLE 15 (Cont'd)

STABILITY CLASS C

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0.00E-01	4.00E 00	6.00E 00	3.00E 00	0.00E-01	0.00E-01	1.30E 01
NNE	2.00E 00	1.00E 00	3.00E 00	5.00E 00	1.00E 00	0.00E-01	1.20E 01
NE	0.00E-01	1.00E 00	7.00E 00	5.00E 00	0.00E-01	0.00E-01	1.30E 01
ENE	0.00E-01	5.00E 00	1.20E 01	2.00E 00	0.00E-01	0.00E-01	1.90E 01
E	0.00E-01	1.30E 01	3.00E 00	0.00E-01	0.00E-01	0.00E-01	1.60E 01
ESE	2.00E 00	2.00E 00	5.00E 00	2.00E 00	0.00E-01	0.00E-01	1.10E 01
SE	3.00E 00	3.00E 00	9.00E 00	1.00E 00	0.00E-01	0.00E-01	1.60E 01
SSE	0.00E-01	1.00E 00	2.00E 00	0.00E-01	0.00E-01	0.00E-01	3.00E 00
S	0.00E-01	2.00E 00	5.00E 00	6.00E 00	0.00E-01	0.00E-01	1.60E 01
SSW	0.00E-01	4.00E 00	1.00E 01	5.00E 00	0.00E-01	0.00E-01	1.90E 01
SW	1.00E 00	2.00E 00	7.00E 00	2.00E 00	0.00E-01	0.00E-01	1.20E 01
WSW	0.00E-01	2.00E 00	4.00E 00	4.00E 00	2.00E 00	0.00E 01	1.20E 01
W	0.00E-01	3.00E 00	6.00E 00	1.70E 01	5.00E 00	1.00E 00	3.20E 01
WNW	0.00E-01	1.00E 00	3.00E 00	9.00E 00	2.00E 00	3.00E 00	1.80E 01
NW	0.00E-01	4.00E 00	6.00E 00	6.00E 00	1.00E 00	0.00E-01	1.70E 01
NNW	0.00E-01	4.00E 00	6.00E 00	3.00E 00	0.00E-01	0.00E-01	1.30E 01
TOTAL	8.00E 00	5.20E 01	9.70E 01	7.00E 01	1.10E 01	4.00E 00	2.42E 02

PERIODS OF CALM (HOURS): 0.00E-01

WIND SPEED (MPH) AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0.00E-01	2.00E 00	4.00E 00	6.00E 00	4.00E 00	0.00E-01	1.60E 01
NNE	1.00E 00	3.00E 00	4.00E 00	4.00E 00	3.00E 00	1.00E 00	1.60E 01
NE	0.00E-01	0.00E-01	1.00E 00	2.00E 00	6.00E 00	3.00E 00	1.20E 01
ENE	0.00E-01	1.00E 00	2.00E 00	8.00E 00	5.00E 00	0.00E-01	1.60E 01
E	0.00E-01	2.00E 00	7.00E 00	7.00E 00	0.00E-01	0.00E-01	1.60E 01
ESE	2.00E 00	1.00E 00	2.00E 00	5.00E 00	0.00E-01	0.00E-01	1.00E 01
SE	2.00E 00	1.00E 00	5.00E 00	5.00E 00	1.00E 00	0.00E-01	1.40E 01
SSE	[illegible]E 00	1.00E 00	1.00E 00	3.00E 00	1.00E 00	0.00E-01	7.00E 00
S	0.00E-01	3.00E 00	0.00E-01	8.00E 00	4.00E 00	1.00E 00	1.60E 01
SS.	0.00E-01	1.00E 00	1.00E 00	1.00E 01	2.00E 00	1.00E 00	1.50E 01
SW	0.00E-01	2.00E 00	5.00E 00	7.00E 00	2.00E 00	0.00E-01	1.60E 01
WSW	0.00E-01	1.00E 00	2.00E 00	5.00E 00	3.00E 00	4.00E 00	1.50E 01
W	0.00E-01	1.00E 00	5.00E 00	6.00E 00	1.00E 01	2.00E 00	2.40E 01
WNW	0.00E-01	1.00E 00	1.00E 00	7.00E 00	4.00E 00	4.00E 00	1.70E 01
NW	0.00E-01	2.00E 00	6.00E 00	6.00E 00	6.00E 00	1.00E 00	2.10E 01
NNW	0.00E-01	1.00E 00	4.00E 00	3.00E 00	1.00E 00	0.00E-01	9.00E 00
TOTAL	6.00E 00	2.30E 01	5.00E 01	9.20E 01	5.20E 01	1.70E 01	2.40E 02

PERIODS OF CALM (HOURS): 0.00E-01

TABLE 15 (Cont'd)

STABILITY CLASS D

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0.00E-01	3.30E 01	1.08E 02	6.60E 01	2.00E 00	0.00E-01	2.09E 02
NNE	5.00E 00	1.40E 01	5.00E 01	2.70E 01	0.00E-01	0.00E-01	9.60E 01
NE	7.00E 00	3.00E 01	6.50E 01	8.00E 00	0.00E-01	0.00E-01	1.10E 02
ENE	7.00E 00	2.70E 01	3.00E 01	0.00E-01	0.00E-01	0.00E-01	6.40E 01
E	8.00E 00	4.70E 01	1.00E 01	0.00E-01	0.00E-01	0.00E-01	6.50E 01
ESE	6.00E 00	4.60E 01	1.70E 01	0.00E-01	0.00E-01	0.00E-01	6.90E 01
SE	3.00E 00	5.10E 01	4.90E 01	8.00E 00	0.00E-01	0.00E-01	1.11E 02
SSE	4.00E 00	3.40E 01	5.50E 01	2.60E 01	0.00E-01	0.00E-01	1.19E 02
S	3.00E 00	1.80E 01	4.70E 01	4.90E 01	1.70E 01	1.00E 00	1.35E 02
SSW	0.00E-01	4.00E 01	9.90E 01	4.10E 01	4.00E 00	0.00E-01	1.84E 02
SW	8.00E 00	1.20E 01	3.50E 01	8.00E 00	0.00E-01	1.00E 00	6.40E 01
WSW	4.00E 00	2.20E 01	3.10E 01	1.40E 01	1.00E 00	0.00E-01	7.20E 01
W	2.00E 00	1.90E 01	5.60E 01	4.60E 01	1.40E 01	2.00E 00	1.39E 02
WNW	2.00E 00	1.80E 01	5.60E 01	4.80E 01	2.00E 00	3.00E 00	1.29E 02
NW	4.00E 00	2.50E 01	5.50E 01	1.40E 01	0.00E-01	0.00E-01	9.80E 01
NNW	7.00E 00	4.00E 01	6.30E 01	1.50E 01	0.00E-01	0.00E-01	1.25E 02
TOTAL	7.00E 01	4.76E 02	8.26E 02	3.70E 02	4.00E 01	7.00E 00	1.79E 03

PERIODS OF CALM (HOURS): 8.00E 00

WIND SPEED (MPH) AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1.00E 00	2.30E 01	6.90E 01	1.15E 02	2.40E 01	1.00E 00	2.33E 02
NNE	1.00E 00	1.00E 01	2.70E 01	3.20E 01	2.10E 01	4.00E 00	9.50E 01
NE	1.00E 00	8.00E 00	1.40E 01	6.60E 01	1.70E 01	0.00E-01	1.06E 02
ENE	4.00E 00	1.30E 01	1.50E 01	2.30E 01	1.00E 00	0.00E-01	5.60E 01
E	3.00E 00	1.70E 01	2.70E 01	2.10E 01	2.00E 00	0.00E-01	7.00E 01
ESE	5.00E 00	2.50E 01	2.60E 01	7.00E 00	0.00E-01	0.00E-01	6.30E 01
SE	3.00E 00	2.60E 01	3.50E 01	1.90E 01	1.10E 01	2.00E 00	9.60E 01
SSE	3.00E 00	1.00E 01	3.40E 01	5.80E 01	2.20E 01	1.20E 01	1.39E 02
S	2.00E 00	6.00E 00	2.30E 01	3.60E 01	4.20E 01	3.50E 01	1.44E 02
SSW	1.00E 00	4.00E 00	4.80E 01	8.50E 01	2.70E 01	1.30E 01	1.78E 02
SW	1.00E 00	6.00E 00	2.70E 01	2.60E 01	5.00E 00	1.00E 00	6.60E 01
WSW	2.00E 00	1.30E 01	2.70E 01	2.50E 01	6.00E 00	1.00E 00	7.40E 01
W	0.00E-01	6.00E 00	3.30E 01	5.40E 01	2.70E 01	1.10E 01	1.31E 02
WNW	2.00E 00	6.00E 00	1.70E 01	4.40E 01	2.00E 01	5.00E 00	9.40E 01
NW	0.00E-01	1.50E 01	3.00E 01	3.80E 01	1.00E 01	0.00E-01	9.30E 01
NNW	1.00E 00	1.50E 01	4.30E 01	3.90E 01	2.00E 00	0.00E-01	1.00E 02
TOTAL	3.00E 01	2.03E 02	4.95E 02	6.88E 02	2.37E 02	8.50E 01	1.74E 03

PERIODS OF CALM (HOURS): 2.00E 01

TABLE 15 (Cont'd)

STABILITY CLASS E

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	5.00E 00	3.50E 01	2.40E 01	5.00E 00	0.00E-01	0.00E-01	6.90E 01
NNE	1.70E 01	2.70E 01	1.70E 01	6.00E 00	0.00E-01	0.00E-01	6.70E 01
NE	1.10E 01	5.10E 01	2.30E 01	1.00E 00	1.00E 00	0.00E-01	8.70E 01
ENE	8.00E 00	4.70E 01	8.00E 00	0.00E-01	0.00E-01	0.00E-01	6.30E 01
E	1.50E 01	5.50E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	7.00E 01
ESE	1.60E 01	4.50E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	6.10E 01
SE	1.40E 01	7.70E 01	2.20E 01	0.00E-01	0.00E-01	0.00E-01	1.13E 02
SSE	1.70E 01	8.90E 01	3.60E 01	6.00E 00	1.00E 00	0.00E-01	1.49E 02
S	1.30E 01	9.60E 01	1.62E 02	5.70E 01	5.00E 00	1.00E 00	3.34E 02
SSW	1.10E 01	1.24E 02	1.48E 02	3.60E 01	1.00E 00	0.00E-01	3.20E 02
SW	1.20E 01	5.30E 01	3.20E 01	9.00E 00	0.00E-01	0.00E-01	1.06E 02
WSW	7.00E 00	2.40E 01	3.60E 01	1.00E 01	0.00E-01	0.00E-01	7.70E 01
W	6.00E 00	3.90E 01	3.30E 01	6.00E 00	2.00E 00	0.00E-01	8.60E 01
WNW	6.00E 00	4.90E 01	3.20E 01	1.40E 01	0.00E-01	0.00E-01	1.01E 02
NW	7.00E 00	4.00E 01	2.70E 01	2.00E 00	0.00E-01	0.00E-01	7.60E 01
NNW	6.00E 00	2.50E 01	2.00E 01	2.00E 00	0.00E-01	0.00E-01	5.30E 01
TOTAL	1.71E 02	8.76E 02	6.20E 02	1.54E 02	1.00E 01	1.00E 00	1.83E 03

PERIODS OF CALM (HOURS): 2.00E 00

WIND SPEED (MPH) AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2.00E 00	7.00E 00	3.30E 01	2.70E 01	6.00E 00	0.00E-01	7.50E 01
NNE	2.00E 00	1.30E 01	1.80E 01	1.60E 01	4.00E 00	0.00E-01	5.30E 01
NE	2.00E 00	5.00E 00	2.10E 01	4.40E 01	3.00E 00	2.00E 00	7.70E 01
ENE	1.00E 00	3.00E 00	2.70E 01	2.70E 01	0.00E 01	0.00E-01	5.80E 01
E	2.00E 00	6.00E 00	3.60E 01	2.40E 01	0.00E-01	0.00E-01	6.80E 01
ESE	2.00E 00	2.90E 01	2.50E 01	1.00E 00	0.00E-01	0.00E-01	5.70E 01
SE	4.00E 00	1.50E 01	4.20E 01	1.10E 01	5.00E 00	0.00E-01	7.70E 01
SSE	3.00E 00	1.50E 01	6.40E 01	[illegible]	7.00E 00	6.00E 00	1.48E 02
S	3.00E 00	1.20E 01	7.80E 01	1.40E 02	7.40E 01	2.50E 01	3.32E 02
SSW	5.00E 00	[illegible]	7.90E 01	1.82E 02	5.70E 01	5.00E 00	3.41E 02
SW	2.00E 00	1.00E 01	4.80E 01	5.20E 01	1.00E 01	2.00E 00	1.24E 02
WSW	1.00E 00	3.00E 00	4.00E 01	2.90E 01	9.00E 00	1.00E 00	8.30E 01
W	2.00E 00	6.00E 00	2.40E 01	2.40E 01	7.00E 00	0.00E-01	6.30E 01
WNW	3.00E 00	8.00E 00	3.10E 01	2.60E 01	1.00E 01	0.00E-01	7.80E 01
NW	3.00E 00	1.50E 01	5.30E 01	3.20E 01	0.00E-01	0.00E-01	1.03E 02
NNW	0.00E-01	1.50E 01	3.30E 01	1.60E 01	1.00E 00	0.00E-01	6.50E 01
TOTAL	3.70E 01	1.75E 02	6.52E 02	7.04E 02	1.93E 02	4.10E 01	1.80E 03

PERIODS OF CALM (HOURS): 1.00E 00

TABLE 15 (Cont'd)

STABILITY CLASS F

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	5.00E 00	1.30E 01	1.00E 00	0.00E-01	0.00E-01	0.00E-01	1.90E 01
NNE	1.30E 01	2.50E 01	1.00E 00	0.00E-01	0.00E-01	0.00E-01	3.90E 01
NE	1.20E 01	4.90E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	6.10E 01
ENE	1.10E 01	2.30E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	3.40E 01
E	2.00E 01	8.00E 00	0.00E-01	0.00E-01	0.00E-01	0.00E-01	2.80E 01
ESE	1.30E 01	1.20E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	2.50E 01
SE	1.80E 01	2.40E 01	3.00E 00	0.00E-01	0.00E-01	0.00E-01	4.50E 01
SSE	1.40E 01	5.20E 01	4.00E 00	0.00E-01	0.00E-01	0.00E-01	7.00E 01
S	1.40E 01	3.60E 01	2.90E 01	0.00E-01	0.00E-01	0.00E-01	7.90E 01
SSW	1.10E 01	5.50E 01	2.30E 01	1.00E 00	0.00E-01	0.00E-01	9.00E 01
SW	9.00E 00	2.90E 01	6.00E 00	1.00E 00	0.00E-01	0.00E-01	4.50E 01
WSW	9.00E 00	2.40E 01	1.00E 01	4.00E 00	3.00E 00	0.00E-01	5.00E 01
W	1.00E 01	2.70E 01	5.00E 00	1.00E 00	2.00E 00	0.00E-01	4.50E 01
WNW	4.00E 00	2.10E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	2.50E 01
NW	5.00E 00	1.60E 01	1.00E 00	0.00E-01	0.00E-01	0.00E-01	2.20E 01
NNW	2.00E 00	5.00E 00	3.00E 00	0.00E-01	0.00E-01	0.00E-01	1.00E 01
TOTAL	1.70E 02	4.19E 02	8.60E 01	7.00E 00	5.00E 00	0.00E-01	6.87E 02

PERIODS OF CALM (HOURS): 1.00E 00

WIND SPEED (MPH) AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1.00E 00	1.00E 00	1.10E 01	4.00E 00	0.00E-01	0.00E-01	1.70E 01
NNE	3.00E 00	4.00E 00	1.30E 01	5.00E 00	1.00E 00	0.00E-01	2.60E 01
NE	1.00E 00	3.00E 00	1.80E 01	2.20E 01	0.00E-01	0.00E-01	4.40E 01
ENE	0.00E-01	2.00E 00	1.80E 01	1.40E 01	0.00E-01	0.00E-01	3.40E 01
E	2.00E 00	3.00E 00	2.00E 01	1.10E 01	1.00E 00	0.00E-01	3.70E 01
ESE	3.00E 00	1.30E 01	5.00E 00	0.00E-01	0.00E-01	0.00E-01	2.10E 01
SE	4.00E 00	8.00E 00	1.60E 01	6.00E 00	0.00E-01	0.00E-01	3.40E 01
SSE	2.00E 00	1.40E 01	2.30E 01	1.20E 01	2.00E 00	0.00E-01	5.30E 01
S	2.00E 00	9.00E 00	4.70E 01	2.30E 01	1.50E 01	0.00E-01	9.60E 01
SSW	1.00E 00	7.00E 00	2.70E 01	4.20E 01	1.20E 01	1.00E 00	9.00E 01
SW	2.00E 00	4.00E 00	2.80E 01	3.30E 01	2.00E 00	0.00E-01	6.90E 01
WSW	0.00E-01	6.00E 00	1.30E 01	2.50E 01	3.00E 00	6.00E 00	5.30E 01
W	2.00E 00	8.00E 00	1.00E 01	1.20E 01	1.00E 00	1.00E 00	3.40E 01
WNW	0.00E-01	5.00E 00	1.50E 01	5.00E 00	0.00E-01	0.00E-01	2.50E 01
NW	2.00E 01	7.00E 00	1.80E 01	2.00E 00	0.00E-01	0.00E-01	2.90E 01
NNW	2.00E 00	6.00E 00	8.00E 00	9.00E 00	0.00E-01	0.00E-01	2.50E 01
TOTAL	2.70E 01	1.00E 02	2.90E 02	2.25E 02	3.70E 01	8.00E 00	6.87E 02

PERIODS OF CALM (HOURS): 0.00E-01

TABLE 15 (Cont'd)

STABILITY CLASS G

WIND SPEED (MPH) AT 10 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2.10E 01	1.90E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	4.00E 01
NNE	2.60E 01	4.70E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	7.30E 01
NE	3.10E 01	3.60E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	6.70E 01
ENE	2.20E 01	7.00E 00	0.00E-01	0.00E-01	0.00E-01	0.00E-01	2.90E 01
E	2.30E 01	4.00E 00	0.00E-01	0.00E-01	0.00E-01	0.00E-01	2.70E 01
ESE	1.70E 01	4.00E 00	0.00E-01	0.00E-01	0.00E-01	0.00E-01	2.10E 01
SE	4.00E 00	1.00E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	1.40E 01
SSE	6.00E 00	9.00E 00	1.00E 00	0.00E-01	0.00E-01	0.00E-01	1.60E 01
S	7.00E 00	1.20E 01	2.00E 00	0.00E-01	0.00E-01	0.00E-01	2.10E 01
SSW	1.00E 01	9.00E 00	6.00E 00	2.00E 00	0.00E-01	0.00E-01	2.70E 01
SW	1.40E 01	1.70E 01	1.00E 00	1.00E 00	1.00E 00	0.00E-01	3.40E 01
WSW	1.40E 01	1.40E 01	2.00E 00	1.00E 00	1.00E 00	0.00E-01	3.20E 01
W	1.30E 01	4.00E 00	1.00E 00	0.00E-01	0.00E-01	0.00E-01	1.80E 01
WNW	1.10E 01	9.00E 00	0.00E-01	0.00E-01	0.00E-01	0.00E-01	2.00E 01
NW	1.40E 01	3.00E 00	0.00E-01	0.00E-01	0.00E-01	0.00E-01	1.70E 01
NNW	1.20E 01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	1.20E 01
TOTAL	2.45E 02	2.04E 02	1.30E 01	4.00E 00	2.00E 00	0.00E-01	4.68E 02

PERIODS OF CALM (HOURS): 3.00E 00

WIND SPEED AT 60 METER LEVEL

DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4.00E 00	8.00E 00	7.00E 00	3.00E 00	0.00E-01	0.00E-01	2.20E 01
NNE	6.00E 00	7.00E 00	9.00E 00	1.30E 01	0.00E-01	0.00E-01	3.50E 01
NE	2.00E 00	6.00E 00	1.30E 01	3.70E 01	0.00E-01	0.00E-01	5.80E 01
ENE	3.00E 00	8.00E 00	1.50E 01	2.50E 01	0.00E-01	0.00E-01	5.10E 01
E	5.00E 00	8.00E 00	3.00E 01	5.00E 00	0.00E-01	0.00E-01	4.80E 01
ESE	8.00E 00	1.30E 01	2.00E 00	0.00E-01	0.00E-01	0.00E-01	2.30E 01
SE	4.00E 00	1.10E 01	1.20E 01	0.00E-01	0.00E-01	0.00E-01	2.70E 01
SSE	1.00E 00	1.60E 01	6.00E 00	0.00E-01	1.00E 00	0.00E-01	2.40E 01
S	2.00E 00	[illegible]	7.00E 00	6.00E 00	1.00E 00	0.00E-01	2.30E 01
SSW	2.00E 00	[illegible]	1.00E 01	1.40E 01	4.00E 00	3.00E 00	3.40E 01
SW	1.00E 00	[illegible]	[illegible]	8.00E 00	2.00E 00	2.00E 00	2.70E 01
WSW	3.00E 00	7.00E 00	1.80E 01	1.40E 01	0.00E-01	0.00E-01	4.20E 01
W	2.00E 00	6.00E 00	[illegible]	3.00E 00	0.00E-01	0.00E-01	1.50E 01
WNW	2.00E 00	2.00E 00	6.00E 00	1.00E 00	0.00E-01	0.00E-01	1.10E 01
NW	3.00E 00	3.00E 00	9.00E 00	0.00E-01	0.00E-01	0.00E-01	1.50E 01
NNW	3.00E 00	9.00E 00	1.00E 00	2.00E 00	0.00E-01	0.00E-01	1.50E 01
TOTAL	5.10E 01	1.18E 02	1.57E 02	1.31E 02	8.00E 00	5.00E 00	4.70E 02

PERIOD OF CALM (HOURS): 1.00E 00

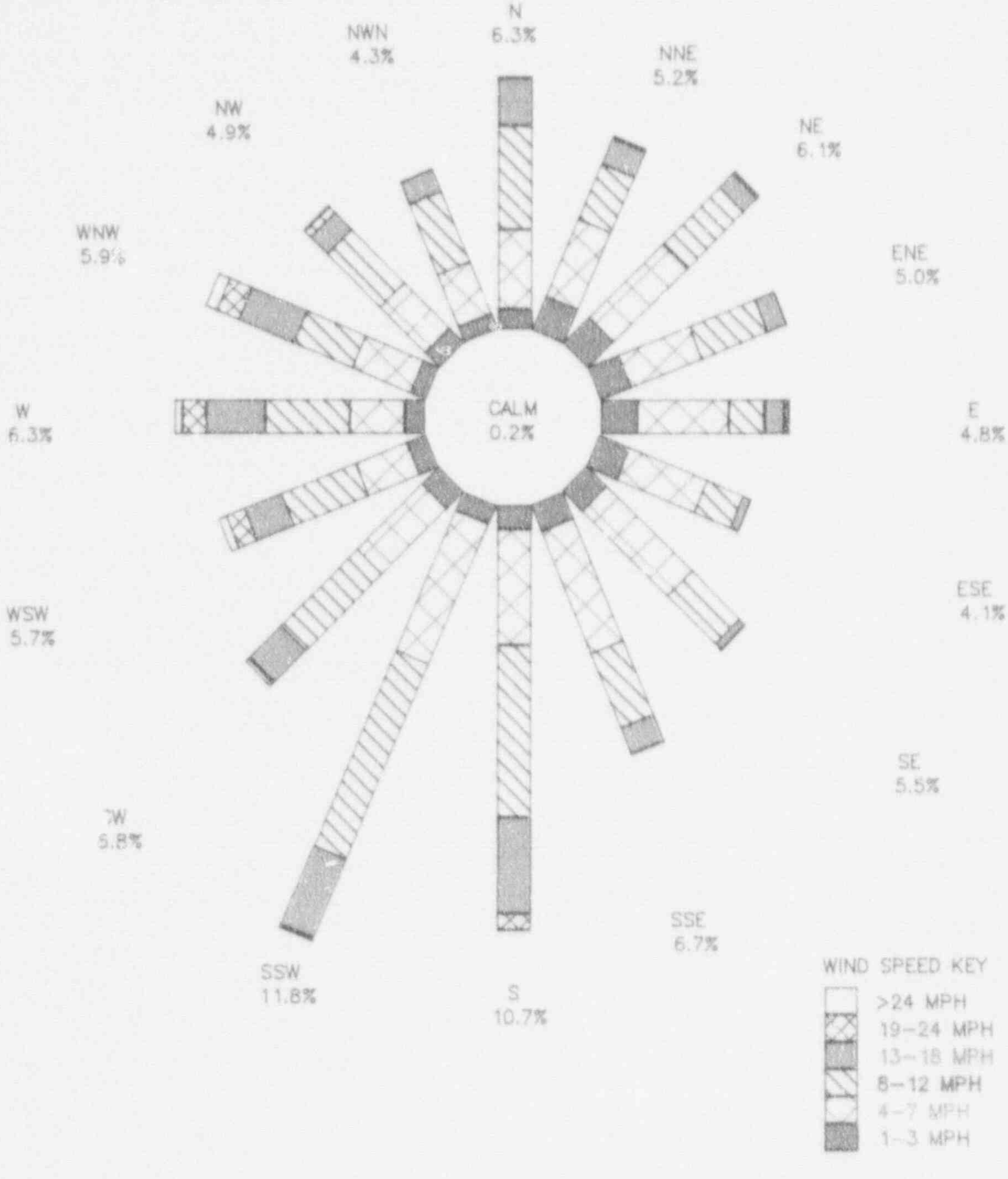


FIGURE 15: 1991 CLINTON POWER STATION
10 METER WIND ROSE

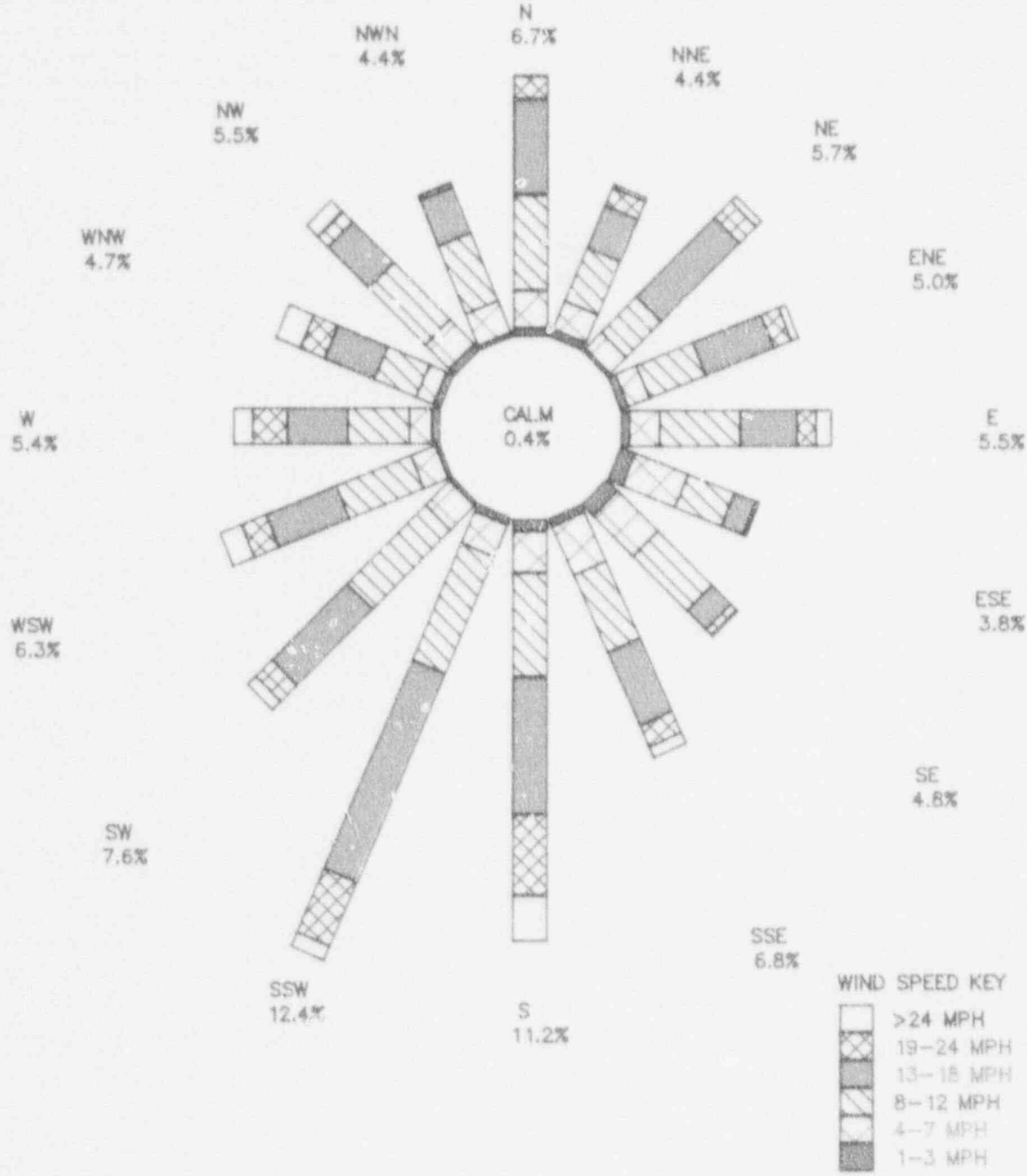


FIGURE 16: 1991 CLINTON POWER STATION
60 METER WIND ROSE

NON-RADIOLOGICAL ENVIRONMENTAL PROGRAMS

NON-RADIOLOGICAL ENVIRONMENTAL PROGRAMS

VI. NON-RADIOLOGICAL ENVIRONMENTAL PROGRAMS

The Biological Programs Section (BPS) of Environmental Affairs is in charge of the Environmental Monitoring Program. Through this program, the biological aspects of Clinton Lake are monitored on a routine basis. This is done in an effort to evaluate any changes which might take place within the lake due to the construction and operation of CPS. A number of areas are monitored, including phytoplankton (microscopic free-floating plants - algae), periphyton (microscopic attached algae), zooplankton (microscopic free-floating animals), benthos (larval insects which live in the mud at the bottom of the lake), and fish. The results of several years of monitoring indicate no detrimental effects from the operation of CPS. Several biological organisms, including fish, are attracted to, and benefit from extended growing seasons in the warm water areas of Clinton Lake.

In addition to this required sampling, BPS is also involved in several other environmental projects around the site. In addition to the fish stocking which IDOC does each year in Clinton Lake, BPS conducts supplemental fish stocking by using fish rearing ponds and the purchase of fish. There are seven rearing ponds near Clinton Lake which are annually stocked with fish fry (approximately 1/4 inch long). These fish eat insect larva and are fed minnows from May through October each year, and the resultant large size fingerlings (8-10 inches in length) are released into Clinton Lake. Stocking larger sized fish helps ensure their survival. Table 16 provides data on the numbers and species of fish released to Clinton Lake.

Illinois Power contacted IDOC during the fall of 1990 regarding the possible stocking of wild turkeys on the inner peninsula. In the winter of 1991, the IDOC successfully trapped and relocated several wild turkeys to the inner peninsula. Six more have already been stocked in 1992. These turkeys, along with a stocking at an adjacent state park (Weldon Springs) should help establish a resident population of birds in DeWitt County.

One environmental project which began while the CPS was being constructed involved the restoration of a natural prairie. An 80 acre natural prairie was planted and fertilized to help establish a prairie that has a wide variety and diversity of plants. This area had been severely degraded due to over-grazing by cattle before Illinois Power's successful prairie restoration project. It now looks and ecologically functions as a real prairie. The prairie is located on the North Fork of Clinton Lake.

Within the last two years, Illinois Power has become involved in several wildlife management projects at CPS.

One project involves management of a pond used for settling silt when the basin near the plant intake was dredged (summer and fall 1990). This pond is now being put into a secondary use for fish rearing and for waterfowl management. Numerous goose nesting structures have been placed within the pond to provide proper goose nesting habitat. Thousands of ducks also frequent the pond, and some have also nested there.

Illinois Power has also been involved in a deer management program on the inner peninsula and in the Mascoutin State park. Data was collected concerning forest and vegetation damage, and agricultural crop damage in the area. This data, along with population estimates, verified that there was a definite overpopulation of deer in the area. In an effort to reduce the number of deer in the area, a special archery only deer hunt was conducted in 1991. This hunt was conducted over an eight week period beginning November 1, 1991. Hunters were successful in reducing the herd by approximately 27%. Successive hunts will be conducted until the herd is reduced to the desired level.

(Photographer: Tom Wilson)

The Central Laboratory of the Power Generation Department monitors the water quality of Clinton Lake. This involves a quarterly assessment of various nutrients and chemical parameters which affect the biological community of Clinton Lake. Results of water quality measurements of Clinton Lake indicates the water quality of Clinton Lake is similar to several other central Illinois reservoirs. Influences of CPS operations are primarily associated with increased water temperatures and concomitant decreased dissolved oxygen concentrations. These effects are predominantly restricted to the area near the CPS cooling water discharge flume. Several areas around the lake are continually monitored for changes in water temperature. The warm water plume from the discharge canal usually only extends about one-half way around the cooling loop (the area between the warm water discharge and the CPS intake). Thermal discharges (warm water) to the lake are typically 18°F higher than plant intake temperatures. Lake temperatures are typically influenced more by meteorological conditions than by plant operations at all sites, except in the immediate area of the discharge canal.

One other area in which Environmental Affairs is involved relates to an Environmental Outreach section. To increase public environmental awareness, several of the above-mentioned programs and some new programs are currently being publicized.

TABLE 16

FISH STOCKING OF CLINTON LAKE

Year	Species	Number	Size	On-Site Pond Raised	Illinois Power Purchased
1988	Hybrid striped bass	75,000	3"		X
	Largemouth bass	1,000	8"	X	
	Walleye	5,000	7"	X	
1989	Largemouth bass	8,000	7"	X	
	Walleye	8,200	7"	X	
1990	Hybrid striped bass	50,000	3"		X
	Walleye	2,300	7"	X	
	Largemouth bass	5,900	5"	X	
1991	Striped bass	25,000	3"	X	
	Striped bass	45,000	2"		X
	Striped bass	1,400	8"	X	
	Walleye	400	8"	X	
	Largemouth bass	300	7"	X	
Totals 1988-1991	Striped bass	71,400			
	Hybrid striped bass	125,000			
	Largemouth bass	15,200			
	Walleye	15,900			
Total of all fish released		227,500			

Illinois Power has a CPS Visitor's Center, located approximately five miles east of Clinton on Route 54. The use of this facility promotes environmental awareness when the Biological Programs and Environmental Outreach sections staff make public presentations to students from grade school to college level. Partnerships have also been developed with Millikin University to provide summer workshops in lake ecology for high school students. Another environmental education program involves field trips for grade school children to one of the fish rearing pond sites. This has become very popular with local teachers and seems to be an excellent "hands on" type of field trip, during which the children are taught some basic biological principles.

(Photographer: Mike Monahan)

As an extension of this outreach philosophy, CPS volunteers constructed a wildlife viewing platform adjacent to the settling pond in the fall of 1991. This platform is very popular for the viewing of wildlife, including waterfowl, migratory birds, and deer.

It is hoped that these types of environmental programs will ensure the accomplishment of our goal of becoming a corporate leader on environmental issues by demonstrating our commitment and encouraging a partnership with our customers and employees to improve the environment.

LIST OF REFERENCES

VII. LIST OF REFERENCES

ANSI75 — American National Standards Institute, Inc., "Performance, Testing and Procedural Specifications for Thermoluminescent Dosimetry," ANSI N545-1975.

ASTM75 — American Society for Testing and Materials, "Standard Recommended Practice for Dealing with Outlying Observations," ASTM E178-75.

BR66 — "Airmass, Streamlines and the Borea Forest," A. Bryson, Technical Report No. 24, University of Wisconsin; Department of Meteorology: Madison, Wisconsin, 1966.

CFR — Code of Federal Regulations, Title 10, Part 20 (Nuclear Regulatory Commission).

CL91a — CPS Semiannual Radioactive Effluent Release Report January 1, 1991 - June 30, 1991.

CL91b — CPS Semiannual Radioactive Effluent Release Report July 1, 1991 - December 31, 1991.

DOC90a — "Local Climatological Data, Annual Summary with Comparative Data, Peoria, Illinois, 1990," U.S. Department of Commerce, NOAA, Asheville, North Carolina.

DOC90b — "Local Climatological Data, Annual Summary with Comparative Data, Springfield, Illinois, 1990," U.S. Department of Commerce, NOAA, Asheville, North Carolina.

EI87 — "Environmental Radioactivity," M. Eisenbud, 1987.

EPA72 — "Natural Radon Exposure in the United States," Donald T. Oakley, U.S. Environmental Protection Agency. ORP/SID 72-1, June 1972.

FRC60 Federal Radiation Council Report No. 1, "Background Material for the Development of Radiation Protection Standards," May 13, 1960.

ICRP77 International Commission on Radiological Protection, Publication 2, "Report of Committee II on Permissible Dose for Internal Radiation," (1959) with 1962 Supplement issued in ICRP Publication 6; Publication 9, "Recommendations on Radiation Exposure," (1965); ICRP Publication 7 (1965), amplifying specific recommendations of Publication 26 (1977).

ICRP84 International Commission on Radiation Protection, Publication No. 39 (1984), "Principles of Limiting Exposure to the Public to Natural Sources of Radiation."

IPC91 Illinois Power Company, North Decatur Dispatch Office, 1991.

KA84 "Radioactivity in the Environment: Sources, Distribution and Surveillance," Ronald L. Kathren, 1984.

NCRP59 National Council on Radiation Protection and Measurements, Report No. 22, "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and Water for Occupational Exposure," (Published as National Bureau of Standards Handbook 69, issued June 1959, superseding Handbook 52).

NCRP71 National Council on Radiation Protection and Measurements, Report No. 39, "Basic Radiation Protection Criteria," January 1971.

NCRP75 National Council on Radiation Protection and Measurements, Report No. 44, "Krypton-85 in the Atmosphere - Accumulation, Biological Significance, and Control Technology," July 1975.

NCRP87a National Council on Radiation Protection and Measurements, Report No. 91, "Recommendations on Limits for Exposure to Ionizing Radiation," June 1987.

NCRP87b National Council on Radiation Protection and Measurements, Report No. 93, "Ionizing Radiation Exposure of the Population of the United States," September 1987.

NR90 National Research Council, 1990, Committee on Biological Effects of Ionizing Radiations (BEIR V), Board on Radiation Effects Research on Life Sciences, "The Effects of Exposure to Low Levels of Ionizing Radiation".

NRC74 United States Nuclear Regulatory Commission, Regulatory Guide 5.36, "Recommended Practice for Dealing with Outlying Observations," June 1974.

NRC75 United States Nuclear Regulatory Commission, Regulatory Guide 4.1, "Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants," Revision 1, April 1975.

NRC77a United States Nuclear Regulatory Commission, Regulatory Guide 4.13, "Performance, Testing and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications," Revision 1, July 1977.

NRC77b United States Nuclear Regulatory Commission, Regulatory Guide 1.109, "Calculation of Annual Dose to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I," Revision 1, October 1977.

NRC79a United States Nuclear Regulatory Commission Branch Technical Position, "An Acceptable Radiological Environmental Monitoring Program," Revision 1, November 1979.

NRC79b — 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.

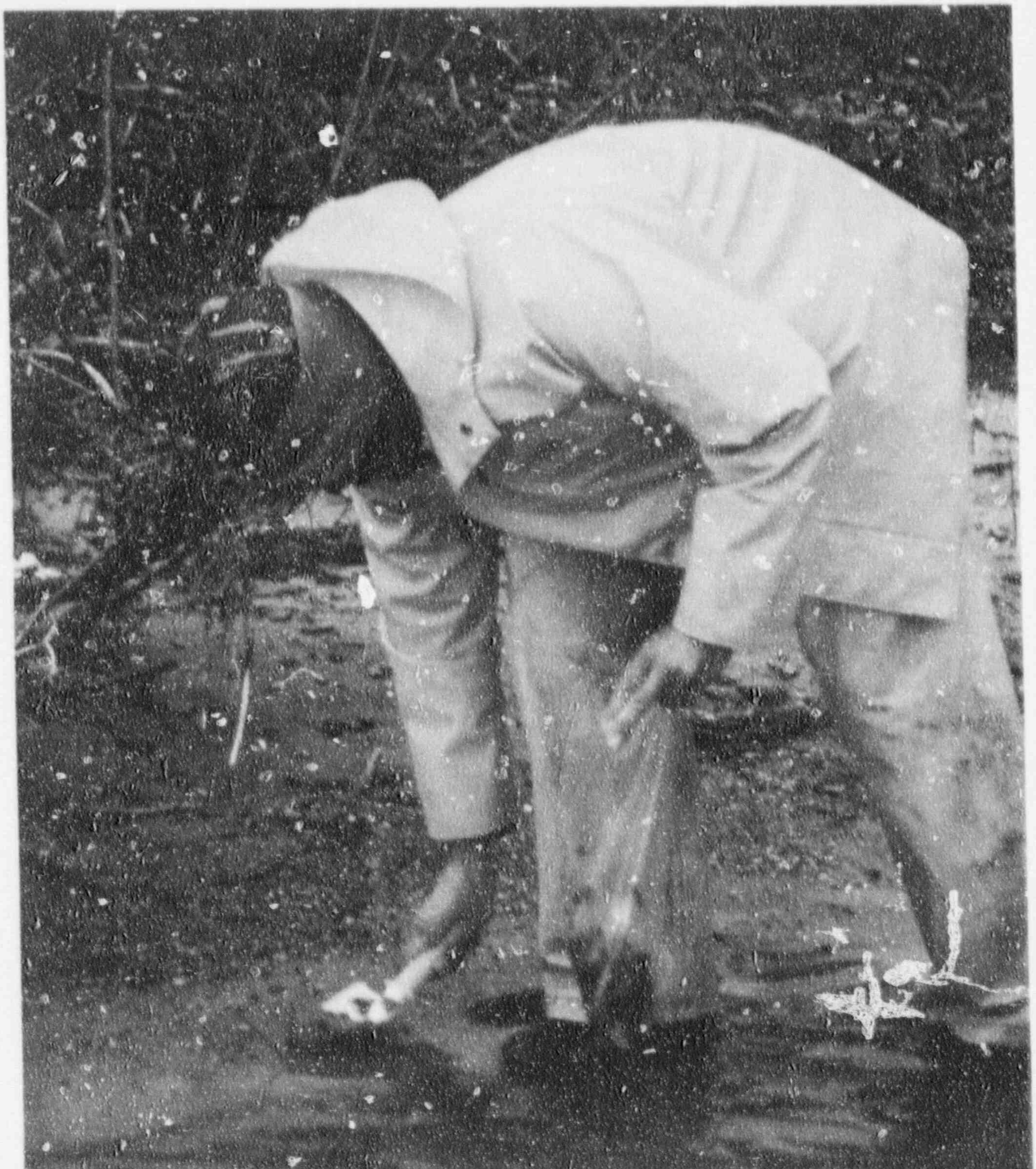
NUREG86 — Technical Specification, Clinton Power Station, Unit No. 1, Docket No. 50-461, Office of Nuclear Reactor Regulation, 1986.

NWS87 — National Weather Service, Springfield, Illinois, 1987.

PERI88 — "The Use of Diatoms (Periphyton) in Monitoring Light Water Reactor Radioactive Liquid Effluence in the Susquehanna River," Ruth Patrick and John M. Palms, 1988.

TEPM — Analytical Procedures Manual, Teledyne Isotopes Midwest Laboratory (Northbrook, Illinois). 60062-4197.

USAR — Illinois Power, Clinton Power Station, Updated Safety Analysis Report, Revision 2, September 1990.



APPENDICES

APPENDIX A

Exceptions to the REMP During 1991

Data from the radiological analysis of environmental samples are routinely reviewed and evaluated by the Clinton Power Station Radiological Environmental Group. 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 reporting levels. Table A-1 lists the reporting levels for positive radioactivity concentrations in environmental samples required by the Clinton Power Station Offsite Dose Calculation Manual.

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

- Examine the collection data sheets for any indication of collection or delivery errors, tampering, vandalism and equipment calibration or malfunctions due to electrical power failure, weather conditions, 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 effluent reports
- Recount and/or reanalyze the sample
- Collect additional samples as necessary

During 1991, no investigations were performed as a result of reaching any Offsite Dose Calculation Manual reporting level. Two LLD exceptions occurred during 1991 and are documented in Table A-2 of this appendix. Table D-19 lists the LLDs required by the Clinton Power Station Offsite Dose Calculation Manual. Other sampling and analysis exceptions are listed in Table A-3 of this appendix.

TABLE A-1

CPS REMP REPORTING LEVELS FOR POSITIVE RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES[a]

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*	---	---	---	---
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#	---	---	---	---
I-131	2**	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#	---	---	300	---

* For drinking water samples. This is the 40 CFR Part 141 value. If no drinking water pathway exists, a value of 30,000 pCi/l may be used.

** If no drinking water pathway exists, a value of 20 pCi/l may be used.

Total for parent and daughter.

a This list does not mean these nuclides are the only ones considered. Other nuclides identified are also analyzed and reported when applicable.

TABLE A-2

ANALYTICAL RESULTS WHICH FAILED TO MEET THE REQUIRED LLD DURING 1991

Date	Sample Medium	Analysis	Required LLD	Obtained LLD	Location[a]
2/20/91	AI	I-131	0.07 pCi/m^3	0.12 pCi/m^3	CL-3[b]
2/20/91	AI	I-131	0.07 pCi/m^3	0.082 pCi/m^3	CL-6[b]

a Refer to Table 4 for location description.

b LLD not reached due to low sample volume.

TABLE A-3

SAMPLING AND ANALYSIS EXCEPTIONS FOR 1991

1. **January 2, 1991, to February 13, 1991**

   Two-liter grab sample obtained on a weekly basis at CL-91. Grab sample initiated because of a) ice formation in the vicinity, b) clogged/frozen line.

2. **January 16, 1991**

   CL-1 elapsed timer was off 1.3 hours. Cause is suspected to be loss of power during an ice storm. Indicated elapsed time was used for sample volume calculation.

3. **January 30, 1991**

   Grass samples were not collected due to snow cover.

4. **February 6, 1991**

   Elapsed time at CL-6 did not function during the previous week. Apparently the timer gears did not engage. Since the air sample pump was running and the color of the particulate air filter appeared normal, a continuous run time of 163.9 hours was assumed for sample volume calculation.

5. **February 20, 1991**

   Electrical power was out to the air sample pumps at CL-3 and CL-6. Elapsed timers indicated 44.1 hours at CL-3 and 66.2 hours for CL-6. CL-6 had a blown fuse which was replaced. CL-3 had a broken electrical power wire from the breaker box. New wire was pulled to CL-3.

6. **February 27, 1991**

   CL-6 air sample pump was found deenergized with the elapsed timer showing 0.2 hours. CL-6 had a blown fuse. The suspected fuse problem was actually due to a short circuit in the electrical wiring in the conduit from the breaker box to the air sample station. Station was rewired and placed back in service.

TABLE A-3 (Cont'd)

7. **February 27, November 26 and December 25, 1991**

   Grass samples not fresh green grass.

8. **March 27, 1991**

   CL-15 air sampler elapsed timer was off by 1.5 hours. Reason is suspected to be a loss of power during thunderstorms. The indicated elapsed time was used for sample volume calculations.

9. **April 3, 1991**

   Air sampler elapsed timers for CL-4, CL-6 and CL-8 were off >0.5 hours. Times were off by 2.3, 2.4 and 2.0 hours respectively. The reason for the discrepancies is unknown. The indicated elapsed time was used for sample volume calculations.

10. **May 15, 1991**

    CL-15 air sampler elapsed timer was off by 4.5 hours. Reason is suspected to be a loss of power during thunderstorms. The indicated elapsed time was used for sample volume calculations.

11. **June 26, 1991**

    No swiss chard was collected at Cl-115 due to deer eating plants to the ground. New seeds were planted on June 20, 1991 to replace the swiss chard eaten by deer.

12. **July 3, 1991**

    The air sample pump at CL-7 was found seized. Elapsed timer was functioning properly and indicated the correct time. The total sample volume was calculated using the "as left" sample flow rate as the "as found" sample flow rate and the indicated elapsed time. The air sample pump was replaced.

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* Grass samples are normally analyzed wet. During winter months and drought conditions, the grass will dry up and die. Dry, dead grass has a moisture content much lower than that of fresh green grass. Analysis of dry dead grass may be biased.

13. **July 31, 1991**

No swiss chard collected at CL-115 and no lettuce was collected at CL-117. No lettuce remains at CL-117 for collection and swiss chard seeds planted at CL-115 on June 20, 1991 did not grow.

14. **August 6, 1991**

TLD cage at CL-62 was found to be destroyed. Damage appears to be from gunfire. The TLD suffered no apparent damage. The TLD cage was replaced and the TLD re-hung. Third quarter TLD results indicated no abnormalities for the CL-62 TLD.

15. **August 28, 1991**

No swiss chard collected at CL-115, no lettuce collected at CL-114, CL-115 or CL-117 and no cabbage collected at CL-117. Lettuce and cabbage samples not available due to being the end of the growing season. Swiss chard not available as discussed in exception #12.

16. **September 11, 1991**

CL-1 air sampler elapsed timer was off by 3.0 hours. Reason is suspected to be a loss of power during thunderstorms on September 9, 1991. The indicated elapsed time was used for sample volume calculations.

17. **September 25, 1991**

No swiss chard collected at CL-115, no lettuce collected at CL-114, CL-115 or CL-117 and no cabbage collected at CL-115 or CL-117. Lettuce and cabbage samples not available due to being the end of the growing season. Swiss chard not available as discussed in exception #12.

18. **September 26, 1991**

The TLD pole for CL-48 was broken off at the ground and was found laying on the ground. The TLD was inside the locked cage but out of its plastic bag. There was no apparent damage to the TLD and 3rd quarter TLD results for CL-48 appeared to be normal. The suspected cause of the pole being broken was a farmer accidently hitting the pole during harvesting. New pole was installed on October 10, 1991 and the 4th quarter TLD was hung on the same date.

TABLE A-3 (Cont'd)

19. October 2, 1991

Air sampler elapsed timers for CL-2 and CL-3 were off >0.5 hours. Times were off by 2.0 and 2.2 hours respectively. Reason is suspected to be a loss of electrical power. The indicated elapsed time was used for sample volume calculations.

20. November 13, 1991

Air sampler elapsed timers for CL-2 and CL-3 were off >0.5 hours. Both times were off by 3.6 hours. Reason is due to loss of electrical power while maintenance was performed on the 12 KV loop. The indicated elapsed time was used for sample volume calculations.

21. December 4, 1991

No power was found at air sampler CL-11. Power was suspected to be lost due to snow blowing inside the breaker/fuse box during snowstorm. Power was restored to CL-11 on December 6, 1991 by drying out the breaker box and replacing the fuse. The elapsed timer reading and the "as left" flow rate used for the "as found" flow rate were used for sample volume calculations.

22. December 4, 1991

Air sampler elapsed timers for CL-1, CL-15 and CL-94 were off >0.5 hours. Times were off by 2.1, 7.6 and 1.5 hours respectively. Reason is a loss of power due to ice storm. The indicated elapsed time was used for sample volume calculations.

23. December 11, 1991

Air sampler elapsed time for CL-15 reading 000.0 hours. Timer was replaced on December 12, 1991. Actual elapsed time was used for sample volume calculations.

24. January 2, 1992

CL-8 air sampler elapsed timer was off by 37.4 hours. Reason is due to a loss of electrical power for unknown reasons. The elapsed timer reading was used for sample volume calculations.

APPENDIX B

REMP Sample Collection and Analysis Methods

TABLE B-1

CLINTON POWER STATION

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SUMMARY OF SAMPLE COLLECTION AND ANALYSIS METHODS

Analysis	Sample Medium	Sampling Method	Approximate Sample Size Collected	Teledyne Procedure Number	Procedure Abstract
Gross Beta	AP	Continuous air sampling through filter media	280m^3	TIML-AP-02	Sample counted on a low level gas flow proportional counter.
	WW	Grab	7.6l	TIML-W(DS)-01	Sample evaporated on a stainless steel planchette for low-level gas flow proportional counting
	SW	Grab	3.8l	TIML-W(DS)-01	Sample evaporated on a stainless steel planchette for low-level gas flow proportional counting
	SW	Composite	3.8l	TIML-W(DS)-01	Sample evaporated on a stainless steel planchette for low-level gas flow proportional counting
	VE	Grab	2.5kg	TIML-AB-01	Sample ashed for low-level gas flow proportional counting
	BS	Grab	1.5-2.0kg	TIML-AB-01	Sample pulverized and dried for low-level gas flow proportional counting

TABLE B-1 (Cont'd)

Analysis	Sample Medium	Sampling Method	Approximate Sample Size Collected	Teledyne Procedure Number	Procedure Abstract
Gross Beta (cont'd)	SS	Grab	1.5-2.0kg	TIML-AB-01	Sample pulverized and dried for low-level gas flow proportional counting
	DW	Composite	3.8l	TIML-W(DS)-01	Sample evaporated on a stainless steel planchette for low-level gas flow proportional counting
	SO	Grab	1.0kg	TIML-AB-01	Sample pulverized and dried for low-level gas flow proportional counting
Gamma Spectroscopy	AP	Composite	$3640m^3$	TIML-GS-01	Germanium gamma isotopic analysis
	G	Grab	1.0kg	TIML-GS-01	Germanium gamma isotopic analysis
	WW	Grab	7.6l	TIML-GS-01	Germanium gamma isotopic analysis
	SW	Composite	3.8l	TIML-GS-01	Germanium gamma isotopic analysis
	VE	Grab	2.5kg	TIML-GS-01	Germanium gamma isotopic analysis
	BS	Grab	1.5-2.0kg	TIML-GS-01	Germanium gamma isotopic analysis
	SS	Grab	1.5-2.0kg	TIML-GS-01	Germanium gamma isotopic analysis

TABLE 8-1 (Cont'd)

Analysis	Sample Medium	Sampling Method	Approximate Sample Size Collected	Teledyne Procedure Number	Procedure Abstract
Gamma Spectroscopy (cont'd)	SL	Grab	0.5kg	TIML-GS-01	Germanium gamma isotopic analysis
	F	Grab	2.5kg	TIML-GS-01	Germanium gamma isotopic analysis
	ME	Grab	3.0kg	TIML-GS-01	Germanium gamma isotopic analysis
	DW	Composite	3.8l	TIML-GS-01	Germanium gamma isotopic analysis
	SW	Grab	3.8l	TIML-GS-01	Germanium gamma isotopic analysis
	SO	Grab	1.0kg	TIML-GS-01	Germanium gamma isotopic analysis
	M	Grab	3.8l	TIML-GS-01	Germanium gamma isotopic analysis
Direct Radiation	TLD	Continuous Exposure	NA	TIML-TLD-01	Integration of thermally stimulated visible photons
Gross Alpha	SW	Composite	3.8l	TIML-W(DS)-01	Sample evaporated on a stainless steel planchette for low-level gas flow proportional counting
	WW	Grab	7.6l	TIML-W(DS)-01	Sample evaporated on a stainless steel planchette for low-level gas flow proportional counting

TABLE B-1 (Cont'd)

Analysis	Sample Medium	Sampling Method	Approximate Sample Size Collected	Teledyne Procedure Number	Procedure Abstract
Gross Alpha (cont'd)	BS	Grab	1.5-2.0kg	TIML-AB-01	Sample pulverized and dried for low-level gas flow proportional counting
	DW	Composite	3.8l	TIML-W(DS)-01	Sample evaporated on stainless steel planchette for low-level gas flow proportional counting
	SO	Grab	1.0kg	TIML-AB-01	Sample pulverized and dried for low-level gas flow proportional counting
	SS	Grab	1.5-2.0kg	TIML-AB-01	Sample pulverized and dried for low-level gas flow proportional counting
Sr-90	BS	Grab	1.5-2.0kg	TIML-SR-06	Hydrochloric acid leach and low-level gas flow proportional counting
	SS	Grab	1.5-2.0kg	TIML-SR-06	Hydrochloric acid leach and low-level gas flow proportional counting
	M	Grab	3.8l	TIML-SR-07	Sample chemically separated and dried for low-level gas flow proportional counting
Tritium	SW	Composite	3.8l	TIML-T-02	Distillation followed by counting in a liquid scintillation counter

TABLE B-1 (Cont'd)

Analysis	Sample Medium	Sampling Method	Approximate Sample Size Collected	Teledyne Procedure Number	Procedure Abstract
Tritium (cont'd)	DW	Composite	3.8l	TIML-T-02	Distillation followed by counting in a liquid scintillation counter
	SW	Grab	11.4l	TIML-T-02	Distillation followed by counting in a liquid scintillation counter
	WW	Grab	22.8l	TIML-T-02	Distillation followed by counting in a liquid scintillation counter
	SW	Grab	3.8l	TIML-T-02	Distillation followed by counting in a liquid scintillation counter
I-131	ME	Grab	3kg	TIML-GS-01	Germanium gamma isotopic analysis
	AI	Continuous air sampling through filter media	$280m^3$	TIML-I-131-02	Germanium gamma isotopic analysis
	SW	Grab	3.8l	TIML-I-131-03	Ion exchange and proportional beta counting
	WW	Grab	7.6l	TIML-I-131-03	Ion exchange and proportional beta counting
	G	Grab	1.0kg	TIML-GS-01	Germanium gamma isotopic analysis
	M	Grab	3.8l	TIML-I-131-01	Ion exchange and proportional beta counting

TABLE B-2

1991 REMP 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[a]
Air Particulate	10	Weekly	519	Gross Beta	Weekly	519
				Gamma Isotopic	Quarterly Composite	40
Air Iodine	10	Weekly	519	Iodine-131	Weekly	519
Direct Radiation (TLD)	86	Quarterly	338	Gamma Exposure	Quarterly (continuous)	338
Surface Water (Grab)	4	Monthly	48	Gamma Isotopic	Monthly	48
				Tritium[a]	Quarterly Composite[a]	12
				Gross Beta	Monthly	48
				Tritium[a]	Monthly[a]	12
Surface Water (Intake Composite)	1	Monthly	12	Gamma Isotopic	Monthly	12
				Tritium	Monthly	12
				Gross Beta	Monthly	12
Surface Water (Effluent Composite)	1	Monthly	12	Gamma Isotopic	Monthly	12
				Gross Beta	Monthly	12
				Gross Alpha	Monthly	12
				Tritium	Quarterly Composite	4
				Iodine-131	Monthly	12
Surface Water (Upstream Composite)	1	Monthly	12[b]	Gamma Isotopic	Monthly	12
				Gross Beta	Monthly	12
				Gross Alpha	Monthly	12
				Tritium	Monthly	12

TABLE B-2 (Cont'd)

Sample Type	Number of Sampling Locations	Collection Frequency	Number of Samples Collected	Type of Analysis	Analysis Frequency	Number of Samples Analyzed[b]
Well Water	2[c]	Semimonthly	78	Iodine-131	Semimonthly	78
				Gross Alpha	Monthly Composite	36
				Gross Beta	Monthly Composite	36
				Gamma Isotopic	Monthly Composite	36
				Tritium	Quarterly Composite	12
Drinking Water	1	Monthly	12	Gross Alpha	Monthly	12
				Gross Beta	Monthly	12
				Gamma Isotopic	Monthly	12
				Tritium	Quarterly Composite	4
Bottom Sediments	7	Semiannually	14	Gross Alpha	Semiannually	14
				Gross Beta	Semiannually	14
				Gamma Isotopic	Semiannually	14
				Sr-90	Semiannually	14
Shoreline Sediments	8	Semiannually	16	Gross Alpha	Semiannually	16
				Gross Beta	Semiannually	16
				Gamma Isotopic	Semiannually	16
				Sr-90	Semiannually	16
Aquatic Vegetation	6	Semiannually/Bimonthly[d]	22	Gamma Isotopic	Semiannually/Bimonthly	22
Grass	5	Monthly/Semimonthly[e]	90	Gamma Isotopic (including I-131)	Monthly/Semimonthly	90
Vegetables	3	Monthly (during growing season)	22	Gross Beta	Monthly	22
				Gamma Isotopic (including I-131)	Monthly	22
Fish	2	Semiannually	16	Gamma Isotopic	Semiannually	16

TABLE B-2 (Cont'd)

Sample Type	Number of Sampling Locations	Collection Frequency	Number of Samples Collected	Type of Analysis	Analysis Frequency	Number of Samples Analyzed*
Milk	1	Monthly/Semimonthly[e]	19	Gamma Isotopic	Monthly/Semimonthly	19
				Iodine-131	Monthly/Semimonthly	19
				Sr-90	Monthly/Semimonthly	19
Meat	1	Annually (when available)	3	Gamma Isotopic (including I-131)	Annually	3
Soil	10	Triannually/Annually[f]	10	Gross Alpha	Triannually/Annually	10
				Gross Beta		10
				Gamma Isotopic		10

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

a Samples taken at CL-93 are analyzed monthly for tritium, all other surface water grab samples are composited for quarterly analysis.

b Two-liter grab sample obtained weekly from January 2 to February 13, 1992 due to clogged/frozen conditions at composite sampler.

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

d Samples are collected Semiannually at CL-105 and Bimonthly at all other locations from April to October.

e Samples are collected monthly from November through April and semimonthly May through October.

f Samples are collected annually at CL-16, triannually at all other locations.

TABLE B-3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

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

Location of Facility: DeWitt, Illi[illegible] Reporting Period January 1 - December 31, 1991
(county, [illegible]ce)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean: Name Distance and Direction	Location with Highest Annual Mean: Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Direct Radiation (mR/Qtr)	TLD 338	NA	16.8(324/324) (10.3 - 24.7)	CL-34 0.8 miles WNW	21.3(4/4)[a] (17.2 - 24.7)	16.2(14/14) (9.6 - 21.4)	0
Air Particulates (pCi/m^3)	Gross Beta 516	0.01	0.021(464/464)[b] (0.006 - 0.037)	CL-3 0.7 miles NE	0.023(51/51) (0.012 - 0.037)	0.022(52/52) (0.013 - 0.041)	0
	Gamma Spec 40						
	Be-7	0.05	0.053(36/36) (0.030 - 0.077)	CL-11 16 miles S	0.062(4/4) (0.050 - 0.070)	0.062(4/4) (0.050 - 0.070)	0
	K-40	-	LLD	-	LLD	LLD	0
	Co-60	0.014	LLD	-	LLD	LLD	0
	Nb-95	0.002	LLD	-	LLD	LLD	0
	Zr-95	0.006	LLD	-	LLD	LLD	0
	Ru-103	0.004	LLD	-	LLD	LLD	0
	Ru-106	0.015	LLD	-	LLD	LLD	0
	Cs-134	0.001	LLD	-	LLD	LLD	0
	Cs-137	0.001	LLD	-	LLD	LLD	0
	Ce-141	0.006	LLD	-	LLD	LLD	0
	Ce-144	0.005	LLD	-	LLD	LLD	0

Note: Column explanations at the end of Table B-3.

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Distance and Direction	Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Air Iodines (pCi/m^3)	I-131 516	0.07	LLD	-	LLD	LLD	0
Surface Water (pCi/l)	Gross Beta 84	2.0	2.7(70/72) (1.0 - 6.0)	CL-93 0.4 miles SW	3.0(10/12) (2.0 - 4.8)	3.9(12/12) (1.3 - 3.9)	0
	Gross Alpha 24	2.0	1.0(11/24) (0.6 - 1.8)	CL-91 6.1 miles ENE	1.1(6/12) (0.6 - 1.8)	NA	0
	Tritium 52	200	216(1/48) -	CL-90 0.4 miles SE	216(1/4) -	LLD	0
	I-131 12	0.5	LLD	-	LLD	NA	0
	Gamma Spec 84						
	Be-7	-	LLD	-	LLD	LLD	0
	K-40	-	LLD	-	LLD	LLD	0
	Mn-54	5.0	LLD	-	LLD	LLD	0
	Fe-59	12.0	LLD	-	LLD	LLD	0
	Co-58	5.0	LLD	-	LLD	LLD	0
	Co-60	5.0	LLD	-	LLD	LLD	0
	Zn-65	6.0	LLD	-	LLD	LLD	0
	Nb-95	10.0	LLD	-	LLD	LLD	0
	Zr-95	10.0	LLD	-	LLD	LLD	0

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Distance and Direction	Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Surface Water (cont'd)	Cs-134	5.0	LLD	-	LLD	LLD	0
	Cs-137	5.0	LLD	-	LLD	LLD	0
	Ba-140	-	LLD	-	LLD	LLD	0
	La-140	-	LLD	-	LLD	LLD	0
	Ce-144	30.0	LLD	-	[illegible]	LLD	0
Drinking Water (pCi/l)	Gross Beta 12	2.0	2.1(12/12) (1.3 - 2.6)	CL-14 C [illegible]	[illegible](2/12) ([illegible] - 2.6)	NA	0
	Gross Alpha 12	2.0	0.4(2/12) (0.3 - 0.4)	CL-14 0 miles	[illegible].4(2/12) ([illegible].3 - 0.4)	NA	0
	Tritium 4	200	LLD	-	LLD	NA	0
	Gamma Spec 12						
	Be-7	-	LLD	-	LLD	NA	0
	K-40	-	LLD	-	LLD	NA	0
	Mn-54	5.0	LLD	-	LLD	NA	0
	Fe-59	12.0	LLD	-	LLD	NA	0
	Co-58	5.0	LLD	-	LLD	NA	0
	Co-60	5.0	LLD	-	LLD	NA	0
	Zn-65	6.0	LLD	-	LLD	NA	0
	Nb-95	10.0	LLD	-	LLD	NA	0
	Zr-95	10.0	LLD	-	LLD	NA	0

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Distance and Direction	Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Drinking Water (cont'd)	Cs-136	5.0	LLD	-	LLD	NA	0
	Cs-137	5.0	LLD	-	LLD	NA	0
	Ba-140	-	LLD	-	LLD	NA	0
	La-140	-	LLD	-	LLD	NA	0
	Ce-144	30.0	LLD	-	LLD	NA	0
Well Water (pCi/l)	Gross Beta 36	CL-7D 3.0 CL-12 3.7	2.1(33/36) (0.9 - 4.0)	CL-12T[c] 1.6 miles E	2.8(12/12) (1.7 - 4.0)	NA	0
	Gross Alpha 36	CL-7D 3.0 CL-12 3.7	0.6(2/36) (0.3 - 0.9)	CL-7D 2.3 miles ESE	0.6(2/12) (0.3 - 0.9)	NA	0
	I-131 78	0.5	LLD	-	LLD	NA	0
	Tritium 12	200	LLD	-	LLD	NA	0
	Gamma Spec 36						
	Be-7	-	LLD	-	LLD	NA	0
	K-40	-	LLD	-	LLD	NA	0
	Mn-54	5.0	LLD	-	LLD	NA	0
	Fe-59	12.0	LLD	-	LLD	NA	0
	Co-58	5.0	LLD	-	LLD	NA	0
	Co-60	5.0	LLD	-	LLD	NA	0
	Zn-65	6.0	LLD	-	LLD	NA	0

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean: Name, Distance and Direction	Location with Highest Annual Mean: Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Well V ter (cont'd)	Nb-95	10.0	LLD	-	LLC	NA	0
	Zr-95	10.0	LLD	-	LLD	NA	0
	Cs-134	5.0	LLD	-	LLD	NA	0
	Cs-137	5.0	LLD	-	LLD	NA	0
	Ba-140	-	LLD	-	LLD	NA	0
	La-140	-	LLD	-	LLD	NA	0
	Ce-144	30.0	LLD	-	LLD	NA	0
Milk[d] (pCi/l)	I-131 19	0.5	NA	NA	NA	LLD	0
	Sr-90 19	1.0	NA	CL-116 14 miles WSW	2.4(19/19) (1.0 - 4.8)	2.4(19/19) (1.0 - 4.8)	0
	Gamma Spec 19						
	Be-7	-	NA	NA	NA	LLD	0
	K-40	-	NA	CL-116 14 miles WSW	1234(19/19) (1070-1440)	1234(19/19) (1070-1440)	0
	Mn-54	5.0	NA	NA	NA	LLD	0
	Fe-59	12.0	NA	NA	NA	LLD	0
	Co-58	5.0	NA	NA	NA	LLD	0
	Co-60	5.0	NA	NA	NA	LLD	0
	Zn-65	6.0	NA	NA	NA	LLD	0
	Nb-95	10.0	NA	NA	NA	LLD	0
	Zr-95	10.0	NA	NA	NA	LLD	0

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Distance and Direction	Location with Highest Annual Mean Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Milk (cont'd)	Cs-134	5.0	NA	NA	NA	LLD	0
	Cs-137	5.0	NA	NA	NA	LLD	0
	Ba-140	-	NA	NA	NA	LLD	0
	La-140	-	NA	NA	NA	LLD	0
	Ce-144	30.0	NA	NA	NA	LLD	0
Fish (pCi/g wet)	Gamma Spec 16						
	Be-7	-	LLD	-	LLD	LLD	0
	K-40	-	2.74(8/8) (2.24 - 3.02)	CL-19 3.4 miles E	2.74(8/8) (2.24 - 3.02)	2.59(8/8) (2.22 - 2.98)	0
	Mn-54	0.02	LLD	-	LLD	LLD	0
	Fe-59	0.04	LLD	-	LLD	LLD	0
	Co-58	0.01	LLD	-	LLD	LLD	0
	Co-60	0.01	LLD	-	LLD	LLD	0
	Zn-65	0.05	LLD	-	LLD	LLD	0
	Nb-95	0.01	LLD	-	LLD	LLD	0
	Zr-95	0.02	LLD	-	LLD	LLD	0
	Ru-103	-	LLD	-	LLD	LLD	0
	Ru-106	-	LLD	-	LLD	LLD	0
	Cs-134	0.01	LLD	-	LLD	LLD	0
	Cs-137	0.01	LLD	-	LLD	LLD	0
	Ba-140	-	LLD	-	LLD	LLD	0
	La-140	-	LLD	-	LLD	LLD	0
	Ce-141	-	LLD	-	LLD	LLD	0
	Ce-144	0.05	LLD	-	LLD	LLD	0

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Distance and Direction	Location with Highest Annual Mean Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Bottom Sediments (pCi/g dry)	Gross Beta 14	0.10	20.5(12/12) (8.4 - 27.5)	CL-7C 1.3 miles SE	27.2(2/2) (27.0 - 27.4)	26.6(2/2) (23.0 - 30.1)	0
	Gross Alpha 14	0.30	10.4(9/12) (5.0 - 14.7)	CL-10 5.0 miles ENE	14.4(2/2) (14.1 - 14.7)	11.6(2/2) (8.6 - 14.6)	0
	Sr-90 14	0.02	0.014(7/12) (0.007 - 0.022)	CL-10 5.0 miles ENE	0.022(1/2) -	0.019(2/2) (0.013 - 0.025)	0
	Gamma Spec 14						
	Be-7	-	0.36(3/12) (0.20 - 0.51)	CL-89 3.6 miles NNE	0.51(1/2) -	0.34(1/2) -	0
	K-40	-	13.07(12/12) (5.56 - 17.73)	CL-89 3.6 miles NNE	16.27(2/2) (14.80 - 17.73)	10.68(2/2) (8.20 - 13.15)	0
	Mn-54	0.05	LLD	-	LLD	LLD	0
	Fe-59	0.10	LLD	-	LLD	LLD	0
	Co-58	0.04	LLD	-	LLD	LLD	0
	Co-60	0.04	LLD	-	LLD	LLD	0
	Zn-65	0.10	LLD	-	LLD	LLD	0
	Nb-95	0.06	LLD	-	LLD	LLD	0
	Zr-95	0.07	LLD	-	LLD	LLD	0
	Cs-134	0.04	LLD	-	LLD	LLD	0
	Cs-137	0.03	0.025(11/12) (0.017 - 0.59)	CL-13A 5.0 miles SW	0.590(1/2) -	0.260(2/2) (0.220 - 0.300)	0
	Ba-140	-	LLD	-	LLD	LLD	0
	La-140	-	LLD	-	LLD	LLD	0
	Ce-144	0.30	LLD	-	LLD	LLD	0
	Ac-228	-	0.81(12/12) (0.16 - 1.28)	CL-7C 1.3 miles SE	1.19(2/2) (1.10 - 1.28)	0.83(2/2) (0.55 - 1.10)	0

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Distance and Direction	Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Bottom Sediments (cont'd)	Bi-212	-	1.25(1/12) -	CL-89 3.6 miles NNE	1.25(1/2) -	LLD	0
	Bi-214	-	0.58(12/12) (0.15 - 0.94)	CL-7C 1.3 miles SE	0.84(2/2) (0.80 - 0.87)	0.42(2/2) (0.27 - 0.56)	0
	Pb-212	-	1.03(12/12) (0.23 - 1.72)	CL-7C 1.3 miles SE	1.66(2/2) (1.59 - 1.72)	0.91(2/2) (0.62 - 1.19)	0
	Pb-214	-	0.72(12/12) (0.17 - 1.29)	CL-7C 1.3 miles SE	1.13(2/2) (0.96 - 1.29)	0.47(2/2) (0.32 - 0.62)	0
	Ra-226	-	1.77(12/12) (0.51 - 2.83)	CL-10 5.0 miles ENE	2.67(2/?) (2.51 - 2.83)	1.48(2/2) (0.94 - 2.02)	0
	Tl-208	-	0.78(12/12) (0.17 - 1.21)	CL-10 5.0 miles ENE	1.18(2/2) (1.15 - 1.21)	0.70(2/2) (0.43 - 0.97)	0
Shoreline Sediments (pCi/g dry)	Gross Beta 16	0.10	9.6(14/14) (5.9 - 16.3)	CL-89 3.6 miles NNE	13.2(2/2) (10.1 - 16.3)	9.1(2/2) (9.0 - 9.2)	3
	Gross Alpha 16	0.30	6.2(5/14) (2.9 - 8.5)	CL-93 0.4 miles SW	7.6(2/2) (6.7 - 8.5)	5.1(1/2) -	0
	Sr-90 16	0.02	0.025(2/14) (0.007 - 0.043)	CL-93 0.4 miles SW	0.043(1/2) -	LLD	0

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Distance and Direction	Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Shoreline Sediments (cont'd)	Gamma Spec 16						
	Be-7	-	0.34(6/14)	CL-93	0.66(2/2)	0.16(1/2)	0
			(0.15 - 0.94)	0.4 miles SW	(0.38 - 0.94)	-	
	K-40	-	6.95(14/14)	CL-89	9.56(2/2)	8.02(2/2)	0
			(4.51 - 9.65)	3.6 miles NNE	(9.46 - 9.65)	(5.92 - 10.12)	
	Mn-54	0.05	LLD	-	LLD	LLD	0
	Fe-59	0.10	LLD	-	LLD	LLD	0
	Co-58	0.04	LLD	-	LLD	LLD	0
	Co-60	0.04	LLD	-	LLD	LLD	0
	Zn-65	0.10	LLD	-	LLD	LLD	0
	Nb-95	0.06	LLD	-	LLD	LLD	0
	Zr-95	0.07	LLD	-	LLD	LLD	0
	Cs-134	0.04	LLD	-	LLD	LLD	0
	Cs-137	0.03	0.033(5/14)	CL-93	0.041(2/12)	LLD	0
			(0.016 - 0.048)	0.4 miles SW	(0.034 - 0.048)	-	
	Ba-140	-	LLD	-	LLD	LLD	0
	La-140	-	LLD	-	LLD	LLD	0
	Ce-144	0.30	LLD	-	LLD	LLD	0
	Ac-228	-	0.24(11/14)	CL-89	0.39(2/2)	0.18(2/2)	0
			(0.14 - 0.41)	3.6 miles NNE	(0.36 - 0.41)	(0.15 - 0.20)	
	Bi-212	-	LLD	-	LLD	LLD	0
	Bi-214	-	0.20(11/14)	CL-93	0.33(2/2)	0.13(2/2)	0
			(0.11 - 0.44)	0.4 miles SW	(0.21 - 0.44)	(0.096 - 0.16)	

TABLE 8-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Distance and Direction	Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Shoreline Sediments (cont'd)	Pb-212	-	0.25(14/14) (0.12 - 0.50)	CL-89 3.6 miles NNE	0.43(2/2) (0.36 - 0.49)	0.14(2/2) (0.11 - 0.16)	0
	Pb-214	-	0.21(14/14) (0.11 - 0.47)	CL-93 0.4 miles SW	0.39(2/2) (0.30 - 0.47)	0.16(2/2) (0.14 - 0.18)	0
	Ra-226	-	0.61(13/14) (0.22 - 2.18)	CL-93 0.4 miles SW	1.37(2/2) (0.55 - 2.18)	0.26(2/2) (0.24 - 0.28)	0
	Tl-208	-	0.21(14/14) (0.11 - 0.41)	CL-89 3.6 miles NNE	0.37(2/2) (0.32 - 0.41)	0.16(2/2) (0.12 - 0.20)	0
Aquatic Vegetation (pCi/g wet)	Gamma Spec 22						
	Be-7	-	0.57(15/20) (0.21 - 1.62)	CL-10 5.0 miles ENE	1.04(2/4) (0.45 - 1.62)	0.82(1/2) -	0
	K-40	-	1.88(20/20) (0.69 - 3.05)	CL-19 3.4 miles E	2.51(4/4) (1.82 - 3.05)	2.31(2/2) (1.50 - 3.12)	0
	Mn-54	0.02	LLD	-	LLD	LLD	0
	Fe-59	0.04	LLD	-	LLD	LLD	0
	Co-58	0.01	LLD	-	LLD	LLD	0
	Co-60	0.01	LLD	-	LLD	LLD	0

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Distance and Direction	Location with Highest Annual Mean Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Aquatic Vegetation (cont'd)	Zn-65	0.05	LLD	-	LLD	LLD	0
	Nb-95	0.01	LLD	-	LLD	LLD	0
	Zr-95	0.02	LLD	-	LLD	LLD	0
	Cs-134	0.01	LLD	-	LLD	LLD	0
	Cs-137	0.01	0.043(14/20) (0.022 - 0.079)	CL-105 50 miles S	0.078(1/2) -	0.078(1/2) -	0
	Ba-140	-	LLD	-	LLD	LLD	0
	La-140	-	LLD	-	LLD	LLD	0
	Ce-144	0.05	LLD	-	LLD	LLD	0
Vegetables (pCi/g wet)	Gross Beta 22		3.6(12/12) (2.1 - 7.1)	CL-117 0.9 miles N	3.7(7/7) (2.1 - 7.1)	3.6(10/10) (2.3 - 5.7)	0
	Gamma Spec 22						
	Be-7	-	0.144(5/12) (0.080 - 0.240)	CL-115 0.7 miles NE	0.160(2/5) (0.080 - 0.240)	0.095(3/10) (0.082 - 0.120)	0
	K-40	-	3.12(12/12) (1.92 - 4.62)	CL-114 12.5 miles SSE	3.42(10/10) (1.91 - 5.60)	3.42(10/10) (1.91 - 5.60)	0
	Mn-54	0.02	LLD	-	LLD	LLD	0
	Fe-59	0.05	LLD	-	LLD	LLD	0
	Co-58	0.025	LLD	-	LLD	LLD	0
	Co-60	0.02	LLD	-	LLD	LLD	0
	Zn-65	0.05	LLD	-	LLD	LLD	0
	Nb-95	0.02	LLD	-	LLD	LLD	0
	Zr-95	0.05	LLD	-	LLD	LLD	0

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Distance and Direction	Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Vegetables (cont'd)	I-131	0.02	LLD	-	LLD	LLD	0
	Cs-134	0.02	LLD	-	LLD	LLD	0
	Cs-137	0.02	0.007(1/12) -	CL-117 0.9 miles N	0.007(1/7) -	LLD	0
	Ba-140	-	LLD	-	LLD	LLD	0
	La-140	-	LLD	-	LLD	LLD	0
	Ce-144	0.08	LLD	-	LLD	LLD	0
Grass (pCi/g wet)	Gamma Spec 90						
	Be-7	-	2.57(72/72) (0.27 - 9.81)	CL-2 0.7 miles NNE	3.03(18/18) (0.57 - 9.21)	2.19(18/18) (0.12 - 9.52)	0
	K-40	-	5.14(72/72) (0.84 - 9.52)	CL-8 2.2 miles E	5.70(18/18) (0.96 - 8.28)	5.08(18/18) (1.46 - 7.88)	0
	Mn-54	0.015	LLD	-	LLD	LLD	0
	Fe-59	0.04	LLD	-	LLD	LLD	0
	Co-58	0.02	LLD	-	LLD	LLD	0
	Co-60	0.02	LLD	-	LLD	LLD	0
	Zn-65	0.04	LLD	-	LLD	LLD	0
	Nb-95	0.02	LLD	-	LLD	LLD	0
	Zr-95	0.03	LLD	-	LLD	LLD	0
	I-131	0.01	LLD	-	LLD	LLD	0
	Cs-134	0.014	LLD	-	LLD	LLD	0
	Cs-137	0.015	0.026(2/72) (0.023 - 0.029)	CL-2 0.7 miles NNE	0.029(1/2) -	LLD	0
	Ba-140	-	LLD	-	LLD	LLD	0
	La-140	-	LLD	-	LLD	LLD	0
	Ce-144	0.08	LLD	-	LLD	LLD	0

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Distance and Direction	Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Meat[e] (pCi/g wet)	Gamma Spec 3						
	Be-7	-	LLD	-	LLD	NA	0
	K-40	-	2.06(3/3) (1.67 - 2.49)	CL-106 2.0 miles NNE	2.06(3/3) (1.67 - 2.49)	NA	0
	Mn-54	0.02	LLD	-	LLD	NA	0
	Fe-59	0.04	LLD	-	LLD	NA	0
	Co-58	0.02	LLD	-	LLD	NA	0
	Co-60	0.02	LLD	-	LLD	NA	0
	Zn-65	0.05	LLD	-	LLD	NA	0
	Nb-95	0.01	LLD	-	LLD	NA	0
	Zr-95	0.02	LLD	-	LLD	NA	0
	Ru-103	-	LLD	-	LLD	NA	0
	Ru-106	-	LLD	-	LLD	NA	0
	I-131	0.06	LLD	-	LLD	NA	0
	Cs-134	0.01	LLD	-	LLD	NA	0
	Cs-137	0.01	LLD	-	LLD	NA	0
	Ba-140	-	LLD	-	LLD	NA	0
	La-140	-	LLD	-	LLD	NA	0
	Ce-141	-	LLD	-	LLD	NA	0
	Ce-144	0.05	LLD	-	LLD	NA	0

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean: Name Distance and Direction	Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Soil	Gross Beta	0.10	23.6(9/9)	CL-94	26.6(1/1)	24.8(1/1)	0
(pCi/g dry)	10		(19.8 - 26.6)	0.6 miles E	-		
	Gross Beta	0.30	11.7(9/9)	CL-94	16.8(1/1)	9.7(1/1)	0
	10		(7.8 - 16.8)	0.6 miles E	-	-	
	Gamma Spec 10						
	Be-7	-	LLD	-	LLD	LLD	0
	K-40	-	16.16(9/9)	CL-1	17.84(1/1)	9.79(1/1)	0
			(14.10 - 18.24)	1.8 miles W	-		
	Mn-54	0.05	LLD	-	LLD	LLD	0
	Fe-59	0.10	LLD	-	LLD	LLD	0
	Co-58	0.04	LLD	-	LLD	LLD	0
	Co-60	0.04	LLD	-	LLD	LLD	0
	Zn-65	0.10	LLD	-	LLD	LLD	0
	Nb-95	0.06	LLD	-	LLD	LLD	0
	Zr-95	0.07	LLD	-	LLD	LLD	0
	Cs-134	0.04	LLD	-	LLD	LLD	0
	Cs-137	0.03	LLD	-	LLD	LLD	0
	Ba-140	-	LLD	-	LLD	LLD	0
	La-140	-	LLD	-	LLD	LLD	0
	Ce-144	0.30	LLD	-	LLD	LLD	0
	Ac-228	-	1.02(9/9)	CL-1	1.27(1/1)	0.71(1/1)	0
			(0.67 - 1.27)	1.8 miles W	-	-	0

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Distance and Direction	Mean(f) (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine Reported Measurements
Soil (cont'd)	Bi-212	-	1.44(4/9) (1.29 - 1.64)	CL-1 1.8 miles W	1.69(1/1) -	LLD	0
	Bi-214	-	0.86(9/9) (0.51 - 1.13)	CL-1 1.8 miles W	1.13(1/1) -	0.53(1/1)	0
	Pb-212	-	1.25(9/9) (0.80 - 1.61)	CL-1 1.8 miles W	1.61(1/1) -	0.92(1/1) -	0
	Pb-214	-	1.02(9/9) (0.65 - 1.36)	CL-1 1.8 miles W	1.36(1/1) -	0.66(1/1) -	0
	Ra-226	-	2.56(9/9) (1.45 - 3.40)	CL-1 1.8 miles W	3.40(1/1) -	2.08(1/1) -	0
	TL-208	-	1.16(9/9) (0.73 - 1.53)	CL-1 1.8 miles W	1.53(1/1) -	0.86(1/1) -	0

(a) Highest quarterly mean

(b) Values excluded due to insufficient sample volume collected

(c) (T) Treated well water sample or (U) Untreated well water sample

(d) No indicator sample location exists, no milk producing animals within 10 miles of CPS

(d) No control sample location exists

TABLE B-3 (Cont'd)

Medium or Pathway Sampled (Unit of Measurement)	Type of Analysis Total Number Performed	Lower Limit of Detection (LLD)	All Indicator Locations: Mean(f) (Range)	Location with Highest Annual Mean Name Mean(f) Distance and Direction (Range)	Control Locations: Mean(f) (Range)	Number of Nonroutine 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. Example: the Gross Beta LLD in AIR PARTICULATES is 0.010 pCi/m^3. Abbreviations used are: pCi/m^3 = picocurie per cubic meter of sampled air; mR/quarter = exposure measured for calendar quarter period; pCi/l = picocurie per liter of sample; pCi/g = picocurie 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 Beta = measurement of the radioactivity in a sample by measurement of emitted betas - 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.

Column 3: LLD reported is the highest of those reported for each type of analysis during the year; if all analyses reported positive values, no LLD is reported.

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 the 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: 7 results greater than LLD out of 15 samples taken would be reported 7/15. The Range is the values of the lowest to highest sample results greater than LLD reported at all the indicator 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(s) name of the compass sector in the direction of the sample location from the CPS gaseous effluent stack. The location with the highest annual mean is compared to both indicator and control locations of the medium samples.

TABLE B-3 (Cont'd)

TABLE EXPLANATIONS (Cont'd):

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, Rev. 1, November 1979) include a table of radioisotope concentrations that, if exceeded by confirmed sample measurements, indicate that a Nonroutine Reported Measurement exists. Such measurements require further investigation to validate the source.

APPENDIX C

Glossary

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 discharges.

alpha particle - a charged particle emitted from the nucleus of an atom having a mass and charge equal in magnitude of a helium nucleus (2 proton and 2 neutrons).

atom - the smallest component of an element having all the properties of an 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 of, 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 Clinton Power Station so as not to be affected by station operations.

cosmic radiation - penetrating ionizing radiation originating in outer space.

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 which 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 travelling 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 radiowaves 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 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 present.

microcurie - 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, that 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, neutron) or waves (gamma).

radionuclide - a radioactive species of an atom characterized by the constitution of its nucleus. The nuclear constitution is specified by the number of protons, number of neutrons, and energy content.

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.

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

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

wind rose - a graphic representation indicating from which direction and speed the wind blew.

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

APPENDIX D

CPS Radiological Environmental Monitoring Results During 1991

TABLE D-1

GROSS BETA AND IODINE-131 ACTIVITY IN AIR PARTICULATES FOR 1991[a]

$(pCi/m^3 \pm 2\sigma)$

Collection Period	CL-1	CL-2	CL-3	CL-4	CL-6
01/02/91-01/09/91	0.022±0.004	0.021±0.004	0.023±0.004	0.021±0.004	0.025±0.004
01/09-01/16	0.034±0.003	0.034±0.003	0.034±0.003	0.035±0.003	0.034±0.003
01/16-01/23	0.031±0.004	0.032±0.004	0.032±0.004	0.027±0.004	0.035±0.004
01/23-01/30	0.022±0.004	0.026±0.004	0.027±0.004	0.026±0.004	0.028±0.004
01/30-02/06	0.027±0.004	0.027±0.004	0.026±0.004	0.025±0.004	0.029±0.004
02/06-02/13	0.025±0.004	0.025±0.004	0.026±0.004	0.026±0.004	0.029±0.004
02/13-02/20	0.018±0.003	0.018±0.003	0.029±0.010[b]	0.018±0.003	0.034±0.007[b]
02/20-02/27	0.023±0.004	0.023±0.004	0.019±0.004	0.020±0.004	ND[c]
02/27-03/06	0.021±0.003	0.025±0.004	0.024±0.004	0.026±0.004	0.026±0.004
03/06-03/13	0.024±0.004	0.027±0.004	0.024±0.004	0.025±0.004	0.021±0.004
03/13-03/20	0.011±0.003	0.016±0.003	0.014±0.003	0.015±0.003	0.013±0.003
03/20-03/27	0.020±0.003	0.021±0.003	0.021±0.003	0.021±0.003	0.022±0.003
03/27-04/03	0.018±0.003	0.020±0.003	0.020±0.003	0.019±0.003	0.018±0.003
04/03-04/10	0.018±0.003	0.019±0.003	0.019±0.003	0.018±0.003	0.019±0.003
04/10-04/17	0.011±0.002	0.013±0.002	0.012±0.002	0.014±0.002	0.012±0.002
04/17-04/24	0.018±0.004	0.017±0.004	0.017±0.004	0.016±0.004	0.013±0.003
04/24-05/01	0.014±0.003	0.015±0.004	0.013±0.003	0.012±0.003	0.012±0.003
05/01-05/08	0.014±0.003	0.018±0.003	0.016±0.003	0.016±0.003	0.012±0.003
05/08-05/15	0.017±0.003	0.019±0.004	0.020±0.004	0.020±0.004	0.016±0.003
05/15-05/22	0.016±0.002	0.017±0.002	0.018±0.002	0.016±0.002	0.014±0.002
05/22-05/29	0.012±0.003	0.012±0.003	0.017±0.003	0.013±0.003	0.014±0.003
05/29-06/05	0.012±0.003	0.012±0.003	0.017±0.003	0.012±0.003	0.014±0.003
06/05-06/12	0.016±0.002	0.017±0.002	0.020±0.002	0.021±0.002	0.014±0.002
06/12-06/19	0.016±0.003	0.018±0.003	0.022±0.004	0.020±0.003	0.016±0.003
06/19-06/26	0.022±0.003	0.024±0.004	0.023±0.003	0.022±0.003	0.018±0.003
06/26-07/03	0.018±0.002	0.021±0.003	0.021±0.003	0.021±0.003	0.020±0.003
07/03-07/10	0.019±0.003	0.024±0.003	0.020±0.003	0.022±0.003	0.018±0.002
07/10-07/17	0.018±0.003	0.023±0.003	0.024±0.003	0.019±0.003	0.016±0.003
07/17-07/24	0.024±0.004	0.032±0.004	0.026±0.004	0.029±0.004	0.026±0.004
07/24-07/31	0.014±0.002	0.017±0.002	0.018±0.002	0.016±0.002	0.014±0.002
07/31-08/07	0.024±0.004	0.026±0.004	0.027±0.004	0.024±0.004	0.023±0.004
08/07-08/14	0.019±0.003	0.020±0.003	0.021±0.003	0.018±0.003	0.016±0.003
08/14-08/21	0.023±0.003	0.027±0.004	0.026±0.004	0.024±0.004	0.021±0.003
08/21-08/28	0.034±0.004	0.036±0.004	0.035±0.004	0.031±0.004	0.025±0.003
08/28-09/04	0.018±0.003	0.018±0.003	0.018±0.003	0.020±0.003	0.018±0.003
09/04-09/11	0.021±0.003	0.024±0.004	0.023±0.003	0.022±0.003	0.016±0.003
09/11-09/18	0.018±0.003	0.021±0.004	0.021±0.004	0.022±0.004	0.019±0.004
09/18-09/25	0.016±0.003	0.017±0.003	0.018±0.003	0.016±0.003	0.016±0.003
09/25-10/02	0.024±0.003	0.027±0.003	0.028±0.003	0.023±0.003	0.024±0.003
10/02-10/09	0.019±0.003	0.019±0.003	0.019±0.003	0.018±0.003	0.016±0.003

TABLE D-1 (Cont'd)

Collection Period	CL-7	CL-8	CL-11[d]	CL-15	CL-94
01/02/91-01/09/91	0.023±0.004	0.022±0.004	0.022±0.004	0.024±0.004	0.022±0.004
01/09-01/16	0.035±0.003	0.035±0.003	0.034±0.003	0.036±0.003	0.036±0.003
01/16-01/23	0.031±0.003	0.029±0.003	0.032±0.004	0.032±0.004	0.035±0.004
01/23-01/30	0.021±0.004	0.023±0.004	0.024±0.004	0.024±0.004	0.025±0.004
01/30-02/06	0.023±0.004	0.023±0.004	0.021±0.004	0.024±0.004	0.030±0.004
02/06-02/13	0.026±0.004	0.026±0.003	0.028±0.004	0.025±0.003	0.029±0.004
02/13-02/20	0.019±0.003	0.019±0.003	0.021±0.003	0.020±0.003	0.014±0.003
02/20-02/27	0.019±0.004	0.022±0.004	0.020±0.004	0.024±0.004	0.024±0.004
02/27-03/06	0.023±0.004	0.024±0.004	0.027±0.004	0.025±0.004	0.027±0.004
03/06-03/13	0.018±0.004	0.027±0.004	0.025±0.004	0.026±0.004	0.025±0.004
03/13-03/20	[illegible]±0.003	0.013±0.003	0.014±0.003	0.014±0.003	0.014±0.003
03/20-03/27	[illegible]±0.003	0.025±0.003	0.020±0.003	0.023±0.003	0.022±0.003
03/27-04/03	[illegible]±0.003	0.021±0.003	0.017±0.003	0.022±0.003	0.021±0.003
04/03-04/10	0.016±0.003	0.018±0.003	0.020±0.003	0.019±0.003	0.019±0.003
04/10-04/17	0.010±0.002	0.010±0.002	0.013±0.002	0.013±0.002	0.013±0.002
04/17-04/24	0.014±0.003	0.013±0.003	0.014±0.003	0.015±0.003	0.015±0.003
04/24-05/01	0.011±0.003	0.014±0.003	0.016±0.004	0.012±0.003	0.015±0.004
05/01-05/08	0.013±0.003	0.016±0.003	0.017±0.003	0.017±0.003	0.015±0.003
05/08-05/15	0.014±0.003	0.019±0.004	0.019±0.004	0.020±0.004	0.019±0.004
05/15-05/22	0.012±0.002	0.017±0.002	0.019±0.002	0.015±0.002	0.015±0.002
05/22-05/29	0.007±0.003	0.006±0.003	0.013±0.003	0.014±0.003	0.012±0.003
05/29-06/05	0.012±0.003	0.015±0.003	0.017±0.003	0.014±0.003	0.015±0.003
06/05-06/12	0.015±0.002	0.015±0.002	0.016±0.002	0.019±0.002	0.016±0.002
06/12-06/19	0.012±0.003	0.019±0.003	0.018±0.003	0.016±0.003	0.019±0.003
06/19-06/26	0.021±0.003	0.021±0.003	0.025±0.004	0.021±0.003	0.022±0.003
06/26-07/03	0.016±0.002[b]	0.021±0.003	0.019±0.002	0.019±0.002	0.023±0.003
07/03-07/10	0.021±0.003	0.020±0.003	0.018±0.002	0.022±0.003	0.022±0.003
07/10-07/17	0.020±0.003	0.023±0.003	0.024±0.004	0.020±0.003	0.024±0.004
07/17-07/24	0.025±0.004	0.029±0.004	0.028±0.004	0.028±0.004	0.028±0.004
07/24-07/31	0.019±0.002	0.017±0.002	0.021±0.002	0.017±0.002	0.018±0.002
07/31-08/07	0.028±0.004	0.028±0.004	0.029±0.004	0.025±0.004	0.023±0.004
08/07-08/14	0.019±0.003	0.021±0.004	0.018±0.003	0.020±0.003	0.019±0.003
08/14-08/21	0.025±0.004	0.025±0.004	0.024±0.004	0.026±0.004	0.024±0.004
08/21-08/28	0.031±0.004	0.031±0.004	0.032±0.004	0.030±0.004	0.028±0.004
08/28-09/04	0.019±0.003	0.020±0.003	0.017±0.003	0.015±0.003	0.016±0.003
09/04-09/11	0.022±0.003	0.023±0.004	0.022±0.003	0.021±0.003	0.019±0.003
09/11-09/18	0.018±0.003	0.019±0.004	0.021±0.004	0.019±0.004	0.020±0.004
09/18-09/25	0.020±0.003	0.015±0.003	0.017±0.003	0.017±0.003	0.016±0.003
09/25-10/02	0.024±0.003	0.026±0.003	0.025±0.003	0.025±0.003	0.024±0.003
10/02-10/09	0.018±0.003	0.019±0.003	0.017±0.003	0.021±0.003	0.019±0.003

TABLE D-1 (Cont'd)

Collection Period	CL-1	CL-2	CL-3	CL-4	CL-6
10/09-10/16	0.018±0.003	0.020±0.003	0.022±0.004	0.021±0.004	0.017±0.003
10/16-10/23	0.029±0.003	0.026±0.003	0.028±0.003	0.026±0.003	0.024±0.003
10/23-10/30	0.013±0.003	0.013±0.003	0.013±0.003	0.015±0.003	0.013±0.003
10/30-11/06	0.028±0.004	0.031±0.004	0.030±0.004	0.031±0.004	0.029±0.004
11/06-11/13	0.026±0.004	0.025±0.004	0.026±0.004	0.030±0.004	0.023±0.003
11/13-11/20	0.033±0.004	0.037±0.004	0.037±0.004	0.037±0.004	0.034±0.004
11/20-11/26	0.018±0.004	0.015±0.003	0.016±0.004	0.018±0.004	0.017±0.004
11/26-12/04[e]	0.026±0.003	0.026±0.004	0.024±0.004	0.028±0.003	0.023±0.003
12/04-12/11[f]	0.027±0.004	0.028±0.004	0.031±0.004	0.032±0.004	0.028±0.004
12/11-12/18	0.024±0.004	0.027±0.004	0.026±0.004	0.024±0.004	0.022±0.003
12/18-12/25	0.018±0.003	0.018±0.003	0.019±0.004	0.019±0.004	0.018±0.003
12/25/91-01/02/92	0.028±0.003	0.027±0.003	0.027±0.003	0.026±0.003	0.027±0.003

Collection Period	CL-7	CL-8	CL-11[d]	CL-15	CL-94
10/09-10/16	0.022±0.004	0.022±0.004	0.022±0.004	0.018±0.003	0.019±0.003
10/16-10/23	0.022±0.003	0.027±0.003	0.026±0.003	0.026±0.003	0.027±0.003
10/23-10/30	0.010±0.003	0.014±0.003	0.013±0.003	0.012±0.003	0.014±0.003
10/30-11/06	0.023±0.004	0.028±0.004	0.026±0.004	0.028±0.004	0.030±0.004
11/06-11/13	0.021±0.003	0.029±0.004	0.025±0.004	0.025±0.004	0.026±0.004
11/13-11/20	0.033±0.004	0.035±0.004	0.041±0.004	0.035±0.004	0.036±0.004
11/20-11/26	0.014±0.003	0.016±0.004	0.017±0.004	0.018±0.004	0.015±0.003
11/26-12/04[e]	0.025±0.003	0.024±0.003	0.026±0.004	0.028±0.004	0.029±0.003
12/04-12/11[f]	0.026±0.004	0.028±0.004	0.027±0.005	0.028±0.004	0.034±0.004
12/11-12/18	0.024±0.004	0.025±0.004	0.0[illegible]±0.004	0.018±0.003	0.027±0.004
12/18-12/25	0.018±0.003	0.021±0.004	0.0[illegible]0±0.004	0.017±0.003	0.020±0.004
12/25/91-01/02/92	0.027±0.003	0.034±0.004	0.032±0.004	0.028±0.003	0.030±0.004

a all I-131 activity is <0.07 pCi/m^3 unless otherwise noted in Table A-2

b unreliable result, excluded from the mean (see Table A-3 for explanation)

c No data. Electrical supply problem

d control locat [illegible] other locations are indicators

e CL-4, CL-6 and CL-8 collection period was 11/26-12/05

f CL-4, CL-6 and CL-8 collection period was 12/05-12/11

TABLE D-2

GAMMA ISOTOPIC ACTIVITY IN COMPOSITED AIR PARTICULATE FILTERS*
($pCi/m^3 \pm 2\sigma$)

Site	Collection Date	Be-7
CL-1	01/02/91 to 04/03/91	0.052±0.013
CL-2	01/02/91 to 0[illegible]3/91	0.066±0.014
CL-3	01/02/91 to [illegible]3/91	0.063±0.009
CL-4	01/02/91 to 04/03/91	0.053±0.012
CL-6	01/02/91 to 04/03/91	0.052±0.012
CL-7	01/02/91 to 04/03/91	0.059±0.016
CL-8	01/02/91 to 04/03/91	0.047±0.012
CL-11	01/02/91 to 04/03/91	0.059±0.012
CL-15	01/02/91 to 04/03/91	0.060±0.009
CL-94	01/02/91 to 04/03/91	0.058±0.007
CL-1	04/03/91 to 07/03/91	0.055±0.011
CL-2	04/03/91 to 07/03/91	0.055±0.014
CL-3	04/03/91 to 07/03/91	0.067±0.016
CL-4	04/03/91 to 07/03/91	0.062±0.018
CL-6	04/03/91 to 07/03/91	0.053±0.016
CL-7	04/03/91 to 07/03/91	0.041±0.012
CL-8	04/03/91 to 07/03/91	0.061±0.015
CL-11	04/03/91 to 07/03/91	0.050±0.018
CL-15	04/03/91 to 07/03/91	0.059±0.020
CL-94	04/03/91 to 07/03/91	0.077±0.015
CL-1	07/03/91 to 10/02/91	0.057±0.013
CL-2	07/03/91 to 10/02/91	0.058±0.009
CL-3	07/03/91 to 10/02/91	0.067±0.013
CL-4	07/03/91 to 10/02/91	0.04[illegible]±0.008
CL-6	07/03/91 to 10/02/91	0.030±0.009
CL-7	07/03/91 to 10/02/91	0.040±0.008
CL-8	07/03/91 to 10/02/91	0.061±0.012
CL-11	07/03/91 to 10/02/91	0.070±0.014
CL-15	07/03/91 to 10/02/91	0.045±0.015
CL-94	07/03/91 to 10/02/91	0.049±0.016
CL-1	10/02/91 to 01/02/92	0.038±0.007
CL-2	10/02/91 to 01/02/92	0.044±0.009
CL-[illegible]	10/02/91 to 01/02/92	0.044±0.009
CL-4	10/02/91 to 01/02/92	0.043±0.008
CL-6	10/02/91 to 01/02/92	0.030±0.009
CL-7	10/02/91 to 01/02/92	0.040±0.008
CL-8	10/02/91 to 01/02/92	0.042±0.010
CL-11	10/02/91 to 01/02/92	0.067±0.018
CL-15	10/02/91 to 01/02/92	0.046±0.009
CL-94	10/02/91 to 01/02/92	0.046±0.010

* Only gamma emitters detected [illegible] reported; typical LLD values are found in Table D-20.

TABLE D-3

1991 CPS REMP QUARTERLY TLD RESULTS

Location	mR/91 Days (Net Exposure) 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
CL-1	14.5±0.4	17.0±0.6	16.2±0.4	17.4±[illegible]
CL-2	15.7±0.8	17.0±0.4	17.[illegible]±0.9	17.[illegible]
CL-3	14.4±0.6	17.6±0.8	16.[illegible]±0.6	17.[illegible]
CL-4	15.8±0.8	16.4±0.4	17.7±0.8	17.3±[illegible]
CL-5	16.7±0.9	16.2±0.5	19.7±1.3	17.3±0.4
CL-6	13.1±0.5	14.8±0.3	14.6±0.6	16.1±0.4
CL-7	14.6±0.4	18.3±0.6	16.4±0.7	19.2±0.5
CL-8	15.8±1.0	17.2±1.1	18.6±0.5	17.7±0.4
CL-11[a]	14.3±0.3	16.3±0.4	15.8±0.5	16.2±0.2
CL-15	11.6±0.3	12.2±0.3	13.4±0.3	13.0±0.7
CL-20	14.5±0.5	18.0±0.7	17.1±0.3	17.7±0.9
CL-21	15.6±0.5	17.0±0.3	18.6±0.8	18.4±0.9
CL-22	15.3±0.7	17.3±0.6	17.4±1.1	18.2±0.4
CL-23	12.0±0.7	12.8±0.4	13.5±0.8	14.0±0.4
CL-24	15.8±0.4	17.[illegible]±0.7	18.2±0.7	18.0±0.7
CL-25	10.9±0.3	13.1±0.4	12.1±0.5	14.2±0.7
CL-26	13.6±0.4	15.4±0.5	14.7±0.9	15.9±0.3
CL-27	14.5±0.3	16.7±0.5	15.9±0.4	17.0±0.4
CL-28	15.7±0.9	17.3±0.4	18.0±1.0	18.5±0.6
CL-29	14.6±0.5	18.0±0.6	17.0±0.6	19.3±0.3
CL-30	15.6±0.4	20.8±0.8	17.3±0.5	21.2±0.5
CL-31	[illegible].5±0.7	16.4±0.5	15.3±0.7	17.2±0.2
CL-32	14.2±0.4	17.2±0.6	16.5±0.3	18.4±0.4
CL-33[a]	15.4±0.4	19.9±0.7	19.0±0.7	21.4±0.4
CL-34	17.2±0.5	24.7±1.1	21.0±0.7	22.4±0.3
CL-35	15.3±0.6	16.9±0.9	17.2±0.8	16.3±0.4
CL-36	14.0±0.4	17.3±0.7	16.7±0.3	17.9±0.4
CL-37	14.0±0.3	18.0±0.6	16.6±0.5	18.2±1.2
CL-38	15.8±0.4	18.6±0.8	18.4±1.0	19.2±0.8
CL-39	13.4±0.3	16.2±0.4	14.7±0.5	16.3±0.3
CL-40	14.9±0.7	17.5±0.7	16.5±0.9	16.8±0.5
CL-41	14.7±0.4	17.7±0.4	17.3±0.9	17.4±0.4
CL-42	13.0±0.4	15.6±0.3	15.9±0.6	16.1±0.4
CL-43	14.5±0.4	17.9±1.1	17.0±0.7	18.0±0.5
CL-44	16.4±0.8	18.1±0.6	19.5±0.7	19.1±0.4
CL-45	15.0±0.5	18.8±0.5	18.2±0.8	19.9±1.1
CL-46	13.6±0.4	16.7±0.3	17.6±1.1	17.7±0.3
CL-47	15.9±1.0	19.0±0.9	19.1±0.7	19.1±0.7
CL-48	14.2±0.3	17.2±0.5	16.9±0.6	19.6±1.1
CL-49	15.7±0.5	19.3±0.4	18.3±0.4	20.1±0.7
CL-50	15.0±0.2	19.8±1.2	17.4±0.5	19.8±0.3
CL-51	16.2±0.6	19.5±0.8	18.4±0.5	19.9±1.1
CL-52	16.2±0.6	18.1±0.7	18.8±0.6	19.5±1.2
CL-53	13.0±0.3	16.5±0.3	16.1±0.6	17.9±0.4
CL-54	14.8±0.5	17.4±0.4	16.8±0.7	18.6±0.4
CL-55	14.7±0.4	16.2±0.4	16.8±0.7	17.0±1.1

TABLE D-3 (Cont'd)

Location	mR/91 Days (Net Exposure) 1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
CL-56	14.6±0.5	17.7±0.8	16.9±0.6	17.9±0.4
CL-57	14.8±0.7	17.0±0.4	17.2±0.8	17.7±0.6
CL-58	14.2±0.4	17.0±0.6	15.8±0.6	17.3±0.6
CL-59	15.3±0.3	16.5±0.5	16.9±0.5	16.6±0.4
CL-60	15.9±1.1	18.0±0.6	17.3±0.9	19.2±1.0
CL-61	15.9±1.0	17.2±0.5	18.2±1.2	19.3±1.2
CL-62	15.8±0.6	18.4±0.7	17.5±0.5	19.9±0.7
CL-63	17.1±0.5	20.1±0.9	19.2±0.3	21.4±0.6
CL-64	16.9±1.1	18.7±0.7	18.9±1.2	20.4±1.4
CL-65	16.7±0.8	20.4±1.5	19.0±0.8	20.9±0.7
CL-66	13.4±0.4	16.2±0.9	14.0±0.5	17.7±0.5
CL-67	14.8±0.7	15.9±0.4	16.3±0.7	17.3±0.4
CL-68	15.6±0.8	17.4±0.6	17.5±0.9	19.7±1.0
CL-69	15.4±0.9	17.3±1.0	16.0±0.6	18.2±0.6
CL-70	12.0±0.5	16.2±0.5	13.5±0.7	17.8±0.3
CL-71	15.9±1.0	16.2±0.9	17.8±1.2	17.4±0.5
CL-72	13.7±0.3	15.0±0.6	16.0±0.6	16.6±0.6
CL-73	16.4±1.2	18.5±1.1	18.9±0.9	20.5±1.1
CL-74	14.3±0.4	16.4±0.3	16.3±0.5	17.9±0.6
CL-75	16.3±0.8	17.0±0.4	17.9±0.7	18.9±0.4
CL-76	15.4±0.7	16.2±0.3	16.5±0.8	18.4±0.6
CL-77	14.6±0.6	15.0±0.5	17.1±0.6	16.5±0.5
CL-78	13.7±0.5	16.8±0.4	16.8±0.5	17.3±0.4
CL-79	15.0±0.5	17.2±0.7	17.9±0.6	19.2±0.5
CL-80	15.7±0.6	16.7±0.7	18.1±0.8	18.2±0.7
CL-81	16.5±0.9	18.9±0.5	19.1±1.1	21.0±0.8
CL-82	14.7±0.3	17.8±0.9	16.7±0.6	19.4±1.4
CL-83	16.6±0.6	18.6±0.5	19.0±0.6	19.7±0.9
CL-84	15.2±0.5	17.1±0.5	16.5±0.5	17.8±0.4
CL-85	15.5±0.5	17.6±0.6	18.4±0.4	18.4±0.3
CL-86	16.3±1.0	16.6±0.7	18.1±0.9	18.0±0.4
CL-87	[illegible] 1±1.2	18.2±1.3	19.8±1.2	19.7±0.9
CL-95[a]	ND[b]	ND[b]	16.9±0.7	16.8±0.5
CL-96[a]	ND[b]	ND[b]	15.4±0.5	14.4±0.5
CL-97[a]	ND[b]	ND[b]	15.8±0.8	9.6±0.2
CL-109	13.6±0.5	16.1±0.7	15.2±0.8	16.8±0.5
CL-110	15.4±0.6	16.2±0.5	17.7±0.6	17.2±0.5
CL-111	15.1±0.5	10.7±0.3	17.4±0.8	10.3±0.2
CL-112	16.2±0.6	16.0±0.6	18.4±0.8	16.7±0.6
CL-113	15.4±0.8	16.8±0.7	19.1±0.8	18.0±0.8
Mean ± s.d.	15.0±1.3	17.2±1.8	17.1±1.6	17.9±2.1

a control location

b ND = No data. New location. TLD not placed until beginning of 3rd Qtr.

TABLE D-4

SURFACE WATER GROSS BETA AND GAMMA* ISOTOPIC ACTIVITY
(pCi/l±2σ)

Location	Collection Date	Gross Beta
CL-9	01/30/91	4.4±0.4
CL-10	01/30/91	3.9±0.3
CL-13	01/30/91	2.9±0.4
CL-9	02/27/91	1.6±0.3
CL-10	02/27/91	1.3±0.5
CL-13	02/27/91	2.6±0.6
CL-9	03/27/91	1.8±0.4
CL-10	03/27/91	2.5±0.4
CL-13	03/27/91	2.1±0.2
CL-9	04/24/91	2.6±0.4
CL-10	04/24/91	2.3±0.6
CL-13	04/24/91	1.7±0.6
CL-9	05/29/91	2.4±0.7
CL-10	05/29/91	2.5±0.3
CL-13	05/29/91	2.6±0.7
CL-9	06/26/91	2.6±0.4
CL-10	06/26/91	2.4±0.3
CL-13	06/26/91	2.4±0.2
CL-9	07/31/91	2.9±0.4
CL-10	07/31/91	2.1±0.4
CL-13	07/31/91	3.2±0.4
CL-9	08/28/91	3.0±0.6
CL-10	08/28/91	2.2±0.6
CL-13	08/28/91	2.3±0.6
CL-9	09/25/91	2.4±0.7
CL-10	09/25/91	3.2±0.8
CL-13	09/25/91	3.8±0.8
CL-9	10/30/91	2.7±0.4
CL-10	10/30/91	2.4±0.4
CL-13	10/30/91	2.7±0.6
CL-9	11/26/91	2.4±0.6
CL-10	11/26/91	2.5±0.6
CL-13	11/26/91	2.0±0.6
CL-9	12/25/91	2.7±0.4
CL-10	12/25/91	2.1±0.4
CL-13	12/25/91	2.5±0.2

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.
CL-10 is a control location.

TABLE D-5

SURFACE WATER GROSS BETA, GROSS ALPHA, I-131
AND GAMMA* ISOTOPIC ACTIVITY
(pCi/l±2σ)

Location	Collection Date	Gross[a] Alpha	Gross Beta	I-131[b]
CL-90	12/26/90 to 01/30/91	0.7±0.4	2.8±0.4	
CL-90	01/30/91 to 02/27/91		3.0±0.6	
CL-90	02/27/91 to 03/27/91		2.3±0.4	
CL-90	03/27/91 to 04/24/91	1.4±0.5	3.3±0.4	
CL-90	04/24/91 to 05/29/91		2.2±0.3	
CL-90	05/29/91 to 06/26/91	1.1±0.5	2.9±0.4	
CL-90	06/26/91 to 07/31/91	1.1±0.5	3.4±0.4	
CL-90	07/31/91 to 08/28/91		2.6±0.6	
CL-90	08/28/91 to 09/25/91		3.1±0.4	
CL-90	09/25/91 to 10/30/91		2.8±0.4	
CL-90	10/30/91 to 11/26/91	0.7±0.4	2.4±0.4	
CL-90	11/26/91 to 12/25/91		3.3±0.4	

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a Only gross alpha detected is reported; typical LLD values are found in Table D-20

b Only I-131 detected is reported; typical LLD values are found in Table D-20.

TABLE D-6

SURFACE WATER GROSS BETA, GROSS ALPHA, TRITIUM
AND GAMMA* ISOTOPIC ACTIVITY
(pCi/l±2σ)

Location	Collection Date	Gross[a,b] Alpha	Gross[a] Beta	Tritium[a]
CL-91	12/26/90 to 01/30/91		2.5±0.3	
CL-92	12/26/90 to 01/30/91		3.3±0.4	
CL-93	01/30/91		3.7±0.9	
CL-91	01/30/91 to 02/27/91		1.0±0.3	
CL-92	01/30/91 to 02/27/91		2.1±0.3	
CL-93	02/27/91		4.2±1.7	
CL-91	02/27/91 to 03/27/91	0.8±0.5	1.3±0.3	
CL-92	02/27/91 to 03/27/91		2.1±0.3	
CL-93	03/27/91		3.5±1.2	
CL-91	03/27/91 to 04/24/91		1.6±0.3	
CL-92	03/27/91 to 04/24/91		2.2±0.4	
CL-93	04/24/91		4.8±1.2	
CL-91	04/24/91 to 05/29/91		2.4±0.4	
CL-92	04/24/91 to 05/29/91		2.6±0.6	
CL-93	05/29/91		2.4±1.8	
CL-91	05/29/91 to 06/26/91		2.4±0.4	
CL-92	05/29/91 to 06/26/91		2.6±0.4	
CL-93	06/26/91		2.6±1.9	
CL-91	06/26/91 to 07/31/91	1.8±0.4	3.2±0.4	
CL-92	06/26/91 to 07/31/91		2.6±0.4	
CL-93	07/31/91			
CL-91	07/31/91 to 08/28/91		2.4±0.4	
CL-92	07/31/91 to 08/28/91		2.3±0.6	
CL-93	08/28/91			
CL-91	08/28/91 to 09/25/91	1.3±0.4	4.8±0.4	
CL-92	08/28/91 to 09/25/91		6.0±0.6	
CL-93	09/25/91		2.6±1.2	
CL-91	09/25/91 to 10/30/91	0.9±0.4	4.8±0.4	
CL-92	09/25/91 to 10/30/91		2.9±0.6	
CL-93	10/30/91		2.2±1.2	
CL-91	10/30/91 to 11/26/91	0.6±0.4	2.4±0.4	
CL-92	10/30/91 to 11/26/91		2.3±0.4	
CL-93	11/26/91		2.2±1.2	
CL-91	11/26/91 to 12/25/91	1.1±0.6	2.8±0.4	
CL-92	11/26/91 to 12/25/91		2.7±0.7	
CL-93	12/25/91		2.0±1.2	

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a Only gross alpha, gross beta and tritium detected are reported; typical LLD values are found in Table D-20.

b Gross alpha analysis only required for CL-91.

TABLE D-7

SURFACE WATER QUARTERLY TRITIUM* COMPOSITE
(pCi/l±2σ)

1991	CL-9	CL-10[a]	CL-13	CL-90
1st Qtr	<LLD	<LLD	<LLD	216±102
2nd Qtr	<LLD	<LLD	<LLD	<LLD
3rd Qtr	<LLD	<LLD	<LLD	<LLD
4th Qtr	<LLD	<LLD	<LLD	<LLD

a control location

TABLE D-8

WELL WATER QUARTERLY TRITIUM* COMPOSITE
(pCi/l±2σ)

1991	CL-7	CL-12 Untreated	CL-12 Treated
1st Qtr	<LLD	<LLD	<LLD
2nd Qtr	<LLD	<LLD	<LLD
3rd Qtr	<LLD	<LLD	<LLD
4th Qtr	<LLD	<LLD	<LLD

* Only tritium detected is reported; typical LLD values are found in Table D-20.

TABLE D-9

WELL WATER GROSS BETA, GROSS ALPHA, I-131[c]
AND GAMMA* ISOTOPIC ACTIVITY
(pCi/l±2σ)

Location[a]	Collection Date	Gross[b] Alpha	Gross[b] Beta	I-131[b,c]
CL-7D	01/02/91			
CL-12u	01/02/91			
CL-12t	01/02/91			
CL-7D	01/16/91			
CL-12u	01/16/91			
CL-12t	01/16/91			
CL-7D	01/30/91			
CL-12u	01/30/91			
CL-12t	01/30/91			
CL-7D	01/02/91, 01/16/91 and 01/30/91	0.9±0.6	1.1±0.4	
CL-12u	01/02/91, 01/16/91 and 01/30/91		2.3±0.9	
CL-12t	01/02/91, 01/16/91 and 01/30/91		4.0±0.9	
CL-7D	02/13/91			
CL-12u	02/13/91			
CL-12t	02/13/91			
CL-7D	02/27/91			
CL-12u	02/27/91			
CL-12t	02/27/91			
CL-7D	02/13/91 and 02/27/91		1.2±0.6	
CL-12u	02/13/91 and 02/27/91			
CL-12t	02/13/91 and 02/27/91		3.2±1.2	
CL-7D	03/13/91			
CL-12u	03/13/91			
CL-12t	03/13/91			
CL-7D	03/27/91			
CL-12u	03/27/91			
CL-12t	03/27/91			
CL-7D	03/13/91 and 03/27/91		1.2±0.4	
CL-12u	03/13/91 and 03/27/91		1.4±0.8	
CL-12t	03/13/91 and 03/27/91		2.6±0.9	

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a The "u" and "t" found after CL-12 denote "untreated" and "treated".

b Only gross alpha, gross beta, and I-131 detected are reported; typical LLD values are found in Table D-20.

c Only I-131 analysis is performed on semi-monthly samples.

TABLE D-9 (cont'd)

WELL WATER GROSS BETA, GROSS ALPHA, I-131[c]
AND GAMMA* ISOTOPIC ACTIVITY
($pCi/l \pm 2\sigma$)

Location[a]	Collection Date	Gross[b] Alpha	Gross[b] Beta	I-131[b,c]
CL-7D	04/10/91			
CL-12u	04/10/91			
CL-12t	04/10/91			
CL-7D	04/24/91			
CL-12u	04/24/91			
CL-12t	04/24/91			
CL-7D	04/10/91 and 04/24/91		0.9±0.3	
CL-12u	04/10/91 and 04/24/91		2.1±0.9	
CL-12t	04/10/91 and 04/24/91		3.0±0.9	
CL-7D	05/08/91			
CL-12u	05/08/91			
CL-12t	05/08/91			
CL-7D	05/22/91			
CL-12u	05/22/91			
CL-12t	05/22/91			
CL-7D	05/08/91 and 05/22/91		0.9±0.4	
CL-12u	05/08/91 and 05/22/91		3.1±0.9	
CL-12t	05/08/91 and 05/22/91		1.7±0.8	
CL-7D	06/05/91			
CL-12u	06/05/91			
CL-12t	06/05/91			
CL-7D	06/19/91			
CL-12u	06/19/91			
CL-12t	06/19/91			
CL-7D	06/05/91 and 06/19/91		1.4±0.4	
CL-12u	06/05/91 and 06/19/91		2.9±0.9	
CL-12t	06/05/91 and 06/19/91		2.1±u.9	
CL-7D	07/03/91			
CL-12u	07/03/91			
CL-12t	07/03/91			
CL-7D	07/17/91			
CL-12u	07/17/91			
CL-12t	07/17/91			
CL-7D	07/31/91			
CL-12u	07/31/91			
CL-12t	07/31/91			

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a The "u" and "t" found after CL-12 denote "untreated" and "treated".

b Only gross alpha, gross beta, and I-131 detected are reported; typical LLD values are found in Table D-20.

c Only I-131 analysis is performed on semi-monthly samples.

TABLE D-9 (cont'd)

WELL WATER GROSS BETA, GROSS ALPHA, I-131[c] AND GAMMA* ISOTOPIC ACTIVITY

(pCi/l±2σ)

Location[a]	Collection Date	Gross[b] Alpha	Gross[b] Beta	I-131[b]
CL-7D	07/03/91, 07/17/91, 07/31/91		1.0±0.4	
CL-12u	07/03/91, 07/17/91, 07/31/91			
CL-12t	07/03/91, 07/17/91, 07/31/91		2.7±0.9	
CL-7D	08/14/91			
CL-12u	08/14/91			
CL-12t	08/14/91			
CL-7D	08/28/91			
CL-12u	08/28/91			
CL-12t	08/28/91			
CL-7D	08/14/91, 08/28/91		1.1±0.7	
CL-12u	08/14/91, 08/28/91		2.5±0.9	
CL-12t	08/14/91, 08/28/91		3.6±1.5	
CL-7D	09/12/91			
CL-1[illegible]	09/12/91			
CL-12t	09/12/91			
CL-7D	09/25/91			
CL-12u	09/25/91			
CL-12t	09/25/91			
CL-7D	09/12/91 and 09/25/91		1.5±0.4	
CL-12u	09/12/91 and 09/25/91		1.5±0.8	
CL-12t	09/12/91 and 09/25/91		2.9±0.9	
CL-7D	10/09/91			
CL-12u	10/09/91			
CL-12t	10/09/91			
CL-7D	10/23/91			
CL-12u	10/23/91			
CL-12t	10/23/91			
CL-7D	10/09/91 and 10/23/91	0.3±0.2	2.2±0.5	
CL-12u	10/09/91 and 10/23/91		3.2±0.9	
CL-12t	10/09/91 and 10/23/91		2.8±0.9	

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a The "u" and "t" found after CL-12 denote "untreated" and "treated".

b Only gross alpha, gross beta, and I-131 detected are reported; typical LLD values are found in Table D-20.

c Only I-131 analysis is performed on semi-monthly samples.

TABLE D-9 (cont'd)

WELL WATER GROSS BETA, GROSS ALPHA, I-131[c]
AND GAMMA* ISOTOPIC ACTIVITY
(pCi/l±2σ)

Location[a]	Collection Date	Gross[b] Alpha	Gross[b] Beta	I-131[b]
CL-7D	11/06/91			
CL-12u	11/06/91			
CL-12t	11/06/91			
CL-7D	11/20/91			
CL-12u	11/20/91			
CL-12t	11/20/91			
CL-7D	11/06/91 and 11/20/91		1.8±0.5	
CL-12u	11/06/91 and 11/20/91		1.4±0.8	
CL-12t	11/06/91 and 11/20/91		2.4±0.9	
CL-7D	12/04/91			
CL-12u	12/04/91			
CL-12t	12/04/91			
CL-7D	12/18/91			
CL-12u	12/18/91			
CL-12t	12/18/91			
CL-7D	12/04/91 and 12/18/91			
CL-12u	12/04/91 and 12/18/91		1.4±0.8	
CL-12t	12/04/91 and 12/18/91		2.6±0.6	

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a The "u" and "t" found after CL-12 denote "untreated" and "treated".

b Only gross alpha, gross beta, and I-131 detected are reported; typical LLD values are found in Table D-20.

c Only I-131 analysis is performed on semi-monthly samples.

TABLE D-10

DRINKING WATER GROSS BETA, GROSS ALPHA, TRITIUM[a] AND GAMMA* ISOTOPIC ACTIVITY

(pCi/l±2σ)

Location	Date Collected	Gross[b] Alpha	Gross[b] Beta	Tritium[b]
CL-14	01/30/91		2.0±0.2	
CL-14	02/27/91		1.5±0.1	
CL-14	03/27/91		1.8±0.2	
CL-14	Composite			
CL-14	04/24/91		1.3±0.1	
CL-14	05/29/91		2.3±0.1	
CL-14	06/26/91		2.1±0.2	
CL-14	Composite			
CL-14	07/31/91	0.3±0.2	2.1±0.2	
CL-14	08/28/91		2.1±0.2	
CL-14	09/25/91		2.4±0.2	
CL-14	Composite			
CL-14	10/30/91	0.4±0.2	2.6±0.2	
CL-14	11/26/91		2.5±0.1	
CL-14	12/25/91		2.6±0.2	
CL-14	Composite			

a Tritium analysis is performed once a quarter on a composite of monthly samples.

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

b Only gross alpha, gross beta, and tritium detected are reported; typical LLD values are found in Table D-20.

TABLE D-11

MILK I-131, Sr-90 AND GAMMA* ISOTOPIC ACTIVITY
(pCi/l±2σ)

Location	Date Collected	Sr-90[a]	I-131[a]	K-40
CL-116	01/30/91	1.8±0.4		1330±50
CL-116	02/27/91	1.5±0.4		1200±40
CL-116	03/27/91	1.1±0.3		1220±60
CL-116	04/24/91	2.6±0.4		1120±50
CL-116	05/08/91	3.0±0.4		1160±40
CL-116	05/22/91	2.9±0.6		1170±50
CL-116	06/05/91	2.6±0.5		1150±60
CL-116	06/19/91	3.6±0.6		1240±80
CL-116	07/03/91	2.9±0.6		1190±50
CL-116	07/17/91	3.2±0.5		14[illegible]0±50
CL-116	07/31/91	2.5±0.5		1260±50
CL-116	08/14/91	2.5±0.6		1250±50
CL-116	08/29/91	4.8±0.8		1180±50
CL-116	09/11/91	1.7±0.4		1[illegible]0±50
CL-116	09/25/91	4.0±0.6		1390±[illegible]0
CL-116	10/09/91	1.3±0.4		1260±70
CL-116	10/23/91	1[illegible]±0.5		1250±50
CL-116	11/26/91	1.1±0.4		1200±60
CL-116	12/25/91	1.0±0.4		1200±50

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.
a Only Sr-90 and I-131 detected are reported; typical LLD values are found in Table D-20.

TABLE D-12

GRASS GAMMA[*] ISOTOPIC ACTIVITY
(pCi/g wet±2σ)

Location[a]	Date Collected	Be-7	K-40	Cs-137
CL-1	02/27/91	6.50±0.19	4.81±0.31	
CL-2	02/27/91	9.09±0.22	4.64±0.30	
CL-8	02/27/91	5.70±0.19	4.52±0.29	
CL-11	02/27/91	7.39±0.16	2.72±0.16	
CL-116	02/27/91	7.25±0.19	3.47±0.25	
CL-1	03/27/91	8.09±0.11	5.46±0.14	
CL-2	03/27/91	7.44±0.19	2.88±0.19	
CL-8	03/27/91	3.32±0.11	5.69±0.25	
CL-11	03/27/91	3.65±0.13	5.02±0.20	
CL-116	03/27/91	4.27±0.12	2.86±0.16	
CL-1	04/24/91	1.07±0.06	6.00±0.20	
CL-2	04/24/91	3.81±0.16	9.52±0.29	
CL-8	04/24/91	0.86±0.07	6.93±0.23	
CL-11	04/24/91	1.26±0.08	7.25±0.20	
CL-116	04/24/91	1.19±0.06	6.17±0.25	
CL-1	05/08/91	0.73±0.07	4.78±0.27	
CL-2	05/08/91	1.02±0.09	6.22±0.22	
CL-8	05/08/91	[illegible].27±0.04	4.51±0.21	
CL-11	05/08/91	0.40±0.07	6.06±0.19	
CL-116	05/08/91	0.45±0.07	4.20±0.18	
CL-1	05/22/91	2.74±0.11	4.84±0.25	
CL-2	05/22/91	0.82±0.06	4.50±0.23	
CL-8	05/22/91	1.41±0.09	4.47±0.18	
CL-11	05/22/91	1.66±0.10	4.14±0.18	
CL-116	05/22/91	0.53±0.03	4.42±0.11	
CL-1	06/05/91	0.87±0.08	5.14±0.21	
CL-2	06/05/91	0.57±0.07	5.98±0.23	
CL-8	06/05/91	0.87±0.06	5.15±0.23	
CL-11	06/05/91	1.46±0.08	7.88±0.22	
CL-116	06/05/91	0.77±0.04	4.41±0.13	
CL-1	06/19/91	0.93±0.08	6.72±0.31	
CL-2	0[illegible]/19/91	0.88±0.12	6.93±0.29	
CL-8	06/19/91	1.00±0.07	6.43±0.28	
CL-11	06/19/91	0.54±0.07	4.61±0.20	
CL-116	06/19/91	0.99±0.11	5.74±0.27	

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a CL-11 and CL-116 are control locations.

TABLE D-12 (cont'd)

GRASS GAMMA* ISOTOPIC ACTIVITY

(pCi/g wet±2σ)

Location[a]	Date Collected	Be-7	K-40	Cs-137
CL-1	07/03/91	1.30±0.15	6.78±0.28	
CL-2	07/03/91	0.92±0.07	5.56±0.20	
CL-8	07/03/91	0.89±0.12	6.40±0.27	
CL-11	07/03/91	0.78±0.13	4.16±0.27	
CL-116	07/03/91	1.44±0.12	5.56±0.26	
CL-1	07/17/91	0.28±0.06	5.45±0.30	
CL-2	07/17/91	2.33±0.14	5.07±0.26	
CL-8	07/17/91	0.78±0.11	6.33±0.27	
CL-11	07/17/91	0.42±0.07	4.64±0.28	
CL-116	07/17/91	2.85±0.11	4.25±0.22	
CL-1	07/31/91	0.78±0.09	4.95±0.21	
CL-2	07/31/91	0.95±0.09	7.14±0.23	
CL-8	07/31/91	0.38±0.03	5.89±0.21	
CL-11	07/31/91	0.28±0.03	4.03±0.12	
CL-116	07/31/91	0.55±0.04	5.87±0.15	
CL-1	08/14/91	0.82±0.07	4.38±0.24	
CL-2	08/14/91	1.24±0.07	6.01±0.22	
CL-8	08/14/91	0.69±0.07	6.98±0.20	
CL-11	08/14/91	0.49±0.06	3.56±0.22	
CL-116	08/14/91	0.94±0.07	4.52±0.23	
CL-1	08/28/91	0.58±0.07	4.52±0.16	
CL-2	08/28/91	0.80±0.06	6.20±0.23	
CL-8	08/28/91	0.65±0.07	8.28±0.35	
CL-11	08/28/91	0.12±0.06	5.30±0.22	
CL-116	08/28/91	0.66±0.08	4.00±0.20	
CL-1	09/11/91	1.42±0.07	4.50±0.17	
CL-2	09/11/91	1.45±0.08	3.38±0.18	
CL-8	09/11/91	1.10±0.08	7.05±0.31	
CL-11	09/11/91	1.82±0.11	7.81±0.25	
CL-116	09/11/91	1.38±0.09	5.08±0.27	
CL-1	09/25/91	1.55±0.10	5.67±0.19	
CL-2	09/25/91	1.91±0.07	6.52±0.16	
CL-8	09/25/91	1.15±0.09	6.46±0.32	
CL-11	09/25/91	1.22±0.10	7.14±0.28	
CL-116	09/25/91	1.33±0.07	4.90±0.20	

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a CL-11 and CL-116 are control locations.

TABLE D-12 (cont'd)

GRASS GAMMA* ISOTOPIC ACTIVITY
(pCi/g wet±2σ)

Location[a]	Date Collected	Be-7	K-40	Cs-137
CL-1	10/09/91	2.70±0.09	4.27±0.15	
CL-2	10/09/91	2.54±0.09	6.23±0.21	
CL-8	10/09/91	2.01±0.10	7.01±0.30	
CL-11	10/09/91	1.82±0.10	5.20±0.24	
CL-116	10/09/91	2.75±0.13	5.96±0.31	
CL-1	10/23/91	3.11±0.13	5.59±0.22	
CL-2	10/23/91	2.[illegible]8±0.11	6.70±0.20	
CL-8	10/23/91	1.4[illegible]±0.08	6.55±0.29	
CL-11	10/23/91	1.08±0.07	6.70±0.29	
CL-116	10/23/91	3.00±0.09	6.18±0.19	
CL-1	11/26/91	9.81±0.26	2.43±0.23	
CL-2	11/26/91	9.21±0.25	2.69±0.38	0.029±0.010
CL-8	11/26/91	6.43±0.19	3.04±0.23	
CL-11	11/26/91	9.52±0.24	3.75±0.28	
CL-116	11/26/91	9.14±0.26	3.83±0.28	0.023±0.010
CL-1	12/25/91	6.36±0.19	0.84±0.15	
CL-2	12/25/91	6.56±0.18	1.29±0.14	
CL-8	12/25/91	5.12±0.16	0.96±0.13	
CL-11	12/25/91	5.58±0.14	1.46±0.12	
CL-116	12/25/91	7.28±0.20	1.15±0.16	

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a CL-11 and CL-116 are control locations.

TABLE D-13

GREEN LEAFY VEGETABLE GROSS BETA AND GAMMA* ISOTOPIC ACTIVITY

(pCi/g wet±2σ)

Location[a]	Date Collected	Gross Beta	Be-7	K-40	Cs-137
CL-114 Lettuce	06/26/91	3.6±0.1	0.082±0.021	2.60±0.13	
CL-114 Cabbage	06/26/91	3.0±0.1	0.084±0.053	3.16±0.14	
CL-114 Swiss Chard	06/26/91	5.7±0.2		5.60±0.22	
CL-115 Lettuce	06/26/91	4.7±0.2	0.24±0.05	4.46±0.15	
CL-115 Cabbage	06/26/91	2.9±0.1	0.080±0.041	2.48±0.19	
CL-117 Lettuce	06/26/91	4.0±0.1	0.15±0.01	3.45±0.76	0.007±0.002
CL-117 Cabbage	06/26/91	3.0±0.1		2.63±0.10	
CL-117 Swiss Chard	06/26/91	4.2±0.2		3.79±0.17	
CL-114 Lettuce	07/31/91	5.3±0.2		5.41±0.17	
CL-114 Cabbage	07/31/91	2.5±0.1		1.91±0.10	
CL-114 Swiss Chard	07/31/91	3.5±0.1		4.32±0.16	
CL-115 Lettuce	07/31/91	4.5±0.2		4.37±0.22	
CL-115 Cabbage	07/31/91	2.9±0.1		2.16±0.12	
CL-117 Cabbage	07/31/91	2.1±0.1			
CL-117 Swiss Chard	07/31/91	7.1±0.2		4.62±0.14	
CL-114 Cabbage	08/28/91	2.51±0.08		2.31±0.14	
CL-114 Swiss Chard	08/28/91	3.67±0.08		3.42±0.12	
CL-115 Cabbage	08/28/91	2.50±0.08		1.92±0.11	
CL-117 Swiss Chard	08/28/91	2.52±0.09	0.12±0.06	2.46±0.13	
CL-114 Cabbage	09/25/91	2.30±0.05		2.15±0.10	
CL-114 Swiss Chard	09/25/91	3.42±0.08	0.12±0.04	3.28±0.10	
CL-117 Swiss Chard	09/25/91	3.31±0.08	0.13±0.03	2.83±0.16	

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a CL-114 is a control location.

TABLE D-14

MEAT GAMMA* ISOTOPIC ACTIVITY
(pCi/g wet±2σ)

Location	Date Collected	K-40
CL-106 Bovine Thyroid	01/17/91	1.67±0.11
CL-106 Hamburger	01/17/91	2.02±0.13
CL-106 Bovine Liver	01/17/91	2.49±0.13

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

TABLE D-15

FISH GAMMA* ISOTOPIC ACTIVITY
(pCi/g wet±2σ)

Location[a]	Date Collected	K-40
CL-19 Blue Gill	04/15/91	2.24±0.13
CL-19 Crappie	04/15/91	2.89±0.17
CL-19 Carp	04/15/91	3.02±0.14
CL-19 Largemouth Bass	04/15/91	3.01±0.15
CL-105 Blue Gill	04/16/91	2.58±0.12
CL-105 Crappie	04/16/91	2.34±0.14
CL-105 Carp	04/16/91	2.22±0.18
CL-105 Largemouth Bass	04/16/91	2.98±0.14
CL-19 Blue Gill	10/21/91	2.46±0.16
CL-19 Crappie	10/21/91	2.72±0.13
CL-19 Carp	10/21/91	2.63±0.19
CL-19 Largemouth Bass	10/21/91	2.96±0.16
CL-105 Blue Gill	10/22/91	2.46±0.15
CL-105 Crappie	10/22/91	2.96±0.11
CL-105 Carp	10/22/91	2.44±0.12
CL-105 Largemouth Bass	10/22/91	2.76±0.13

* Only gamma emitters detected are reported; typical LLD values are found in Table D-[illegible]0.

a CL-105 is a control location.

TABLE D-16

AQUATIC VEGETATION GAMMA* ISOTOPIC ACTIVITY

(pCi/g wet±2σ)

Location[a]	Date Collected	Be-7	K-40	Cs-137
CL-7B	04/15/91	0.45±0.072	1.89±0.21	
CL-7C	04/15/91	0.81±0.047	2.08±0.12	0.036±0.005
CL-9	04/15/91	0.76±0.045	1.95±0.13	0.036±0.005
CL-10	04/15/91	1.62±0.20	2.87±0.42	0.079±0.018
CL-19	04/15/91	0.58±0.089	3.05±0.15	
CL-105	04/16/91	0.82±0.12	3.12±0.29	0.078±0.014
CL-7B	06/13/91	0.52±0.15	1.92±0.44	0.045±0.016
CL-7C	06/13/91	0.32±0.05	1.42±0.17	0.034±0.006
CL-9	06/13/91	0.31±0.05	1.62±0.18	0.027±0.007
CL-10	06/13/91	0.45±0.09	1.30±0.18	0.035±0.009
CL-19	06/13/91	0.49±0.09	2.57±0.36	0.058±0.014
CL-7B	08/13/91	0.52±0.16	1.44±0.48	0.040±0.019
CL-7C	08/13/91	0.42±0.18	2.10±0.54	0.032±0.020
CL-9	08/13/91	0.49±0.22	2.35±0.61	0.068±0.027
CL-10	08/13/91		2.26±0.33	
CL-19	08/13/91	0.62±0.17	2.61±0.54	0.058±0.018
CL-7B	10/21/91		1.49±0.55	0.037±0.020
CL-7C	10/21/91	0.21±0.17	0.98±0.22	0.022±0.009
CL-9	10/21/91		0.69±0.20	
CL-10	10/21/91		1.16±0.22	
CL-19	10/21/91		1.82±0.24	
CL-105	10/22/91		1.50±0.25	

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a CL-105 is a control location.

TABLE D-17

SHORELINE SEDIMENT GROSS ALPHA, GROSS BETA, Sr-90 AND GAMMA* ISOTOPIC ACTIVITY

(pCi/g dry±2σ)

Location[a]	Date Collected	Gross[b] Alpha	Gross[b] Beta	Sr-90[b]	Be-7	K-40
CL-7B	04/15/91		7.1±1.8		0.25±0.056	6.48±0.16
CL-7C	04/15/91	5.0±2.7	9.2±2.0			6.61±0.25
CL-10	04/15/91		7.4±0.8			8.09±0.18
CL-19	04/15/91		9.0±2.0		0.19±0.060	7.86±0.20
CL-88	04/15/91		7.5±1.9			4.98±0.15
CL-89	04/15/91	2.9±1.5	10.1±1.3		0.15±0.055	9.46±0.24
CL-93	04/15/91	8.5±2.1	11.6±1.3		0.94±0.088	4.51±0.24
CL-105	04/16/91		9.0±2.0		0.16±0.070	10.12±0.30

Location[a]	Date Collected	Cs-137	Ac-228	Bi-214	Pb-212	Pb-214
CL-7B	04/15/91		0.15±0.021	0.15±0.016	0.19±0.010	0.16±0.018
CL-7C	04/15/91		0.16±0.027	0.13±0.014	0.21±0.016	0.14±0.023
CL-10	04/15/91	0.016±0.008	0.32±0.032	0.25±0.017	0.32±0.014	0.28±0.017
CL-19	04/15/91		0.19±0.038	0.16±0.017	0.20±0.010	0.16±0.017
CL-88	04/15/91		0.15±0.023	0.11±0.011	0.15±0.008	0.12±0.012
CL-89	04/15/91	0.032±0.008	0.36±0.044	0.23±0.020	0.36±0.014	0.24±0.021
CL-93	04/15/91	0.048±0.011	0.31±0.039	0.44±0.029	0.50±0.023	0.47±0.034
CL-105	04/16/91		0.20±0.045	0.16±0.024	0.16±0.019	0.18±0.022

Location[a]	Date Collected	Ra-226	Tl-208
CL-7B	04/15/91	0.48±0.13	0.16±0.022
CL-7C	04/15/91	0.54±0.14	0.15±0.020
CL-10	04/15/91	0.59±0.17	0.33±0.027
CL-19	04/15/91	0.44±0.12	0.20±0.024
CL-88	04/15/91	0.29±0.096	0.16±0.020
CL-89	04/15/91	0.67±0.14	0.32±0.033
CL-93	04/15/91	2.18±0.21	0.28±0.028
CL-105	04/16/91	0.24±0.24	0.20±0.034

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a CL-105 is a control location.

b Only detected values are reported; typical LLD values are found in Table D-20.

TABLE D-17 (cont'd)

SHORELINE SEDIMENT GROSS ALPHA, GROSS BETA,
Sr-90 AND GAMMA* ISOTOPIC ACTIVITY
(pCi/g dry±2σ)

Location[a]	Date Collected	Gross[b] Alpha	Gross[b] Beta	Sr-90[b]	Be-7	K-40
CL-7B	10/21/91		5.9±2.1			5.46±0.24
CL-7C	10/21/91		7.0±1.6			8.59±0.18
CL-10	10/21/91		7.4±1.8			6.99±0.26
CL-19	10/21/91		11.9±2.9	0.007±0.004		6.76±0.33
CL-88	10/21/91		9.9±1.9			6.61±0.18
CL-89	10/21/91	8.0±4.2	16.3±2.5		0.15±0.07	9.65±0.18
CL-93	10/21/91	6.7±4.4	14.1±3.0	0.043±0.011	0.38±0.16	5.21±0.27
CL-105	10/22/91	5.1±3.9	9.2±2.5			5.92±0.38

Location[a]	Date Collected	Cs-137	Ac-228	Bi-214	Pb-212	Pb-214
CL-7B	10/21/91				0.19±0.02	0.11±0.02
CL-7C	10/21/91		0.16±0.04	0.12±0.02	0.18±0.01	0.16±0.01
CL-10	10/21/91				0.20±0.01	0.13±0.02
CL-19	10/21/91				0.12±0.02	0.14±0.02
CL-88	10/21/91		0.14±0.03	0.11±0.01	0.16±0.01	0.13±0.01
CL-89	10/21/91	0.035±0.006	0.47±0.03	0.27±0.02	0.49±0.01	0.34±0.02
CL-93	10/21/91	0.034±0.017	0.28±0.06	0.21±0.04	0.25±0.04	0.30±0.04
CL-105	10/22/91		0.13±0.07	0.096±0.033	0.11±0.03	0.14±0.02

Location[a]	Date Collected	Ra-226	Tl-208
CL-7B	10/21/91		0.15±0.04
CL-7C	10/21/91	0.41±0.14	0.18±0.02
CL-10	10/21/91	0.43±0.11	0.13±0.02
CL-19	10/21/91	0.22±0.12	0.13±0.03
CL-88	10/21/91	0.34±0.11	0.14±0.02
CL-89	10/21/91	0.83±0.15	0.41±0.03
CL-93	10/21/91	0.55±0.46	0.18±0.06
CL-105	10/22/91	0.28±0.28	0.12±0.05

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a CL-105 is a control location.

b Only detected values are reported; typical LLD values are found in Table D-20.

TABLE D-18

BOTTOM SEDIMENT GROSS ALPHA, GROSS BETA, Sr-90 AND GAMMA* ISOTOPIC ACTIVITY

(pCi/g dry±2σ)

Location[a]	Date Collected	Gross[b] Alpha	Gross[b] Beta	Sr-90[b]	Be-7	K-40
CL-7C	04/15/91	14.5±2.4	27.4±1.8	0.022±0.005		14.80±0.52
CL-10	04/15/91	14.7±2.2	27.5±1.5			13.04±0.53
CL-13A	04/15/91	7.1±3.2	19.7±2.6	0.007±0.004		12.55±0.17
CL-17	04/15/91	8.6±3.3	18.9±2.5	0.012±0.006	0.20±0.047	13.00±0.46
CL-19	04/15/91	5.0±3.0	14.1±2.0	0.008±0.004		12.30±0.41
CL-89	04/15/91	12.5±2.[illegible]	23.8±[illegible]	0.010±0.005		14.80±0.51
CL-105	04/16/91	14.6±2.4	30.1±[illegible]	0.013±0.006	0.34±0.17	13.15±0.55

Location[a]	Date Collected	Cs-137	Ac-228	Bi-212	Bi-214	Pb-212
CL-7C	04/15/91	0.25±0.017	1.28±0.066		0.80±0.042	1.59±0.051
CL-10	04/15/91	0.38±0.027	1.27±0.11		0.68±0.070	1.34±0.064
CL-13A	04/15/91	0.59±0.007	0.60±0.031		0.41±0.019	0.71±0.015
CL-17	04/15/91	0.053±0.009	0.54±0.032		0.41±0.023	0.78±0.025
CL-19	04/15/91	0.088±0.009	0.59±0.038		0.47±0.024	0.84±0.024
CL-89	04/15/91	0.20±0.017	1.12±0.058		0.77±0.038	1.26±0.042
CL-105	04/16/91	0.30±0.031	1.10±0.12		0.56±0.058	1.19±0.044

Location[a]	Date Collected	Pb-214	Ra-226	Tl-208
CL-7C	04/15/91	1.29±0.099	2.70±0.30	1.03±0.065
CL-10	04/15/91	0.88±0.075	2.51±0.86	1.15±0.10
CL-13A	04/15/91	0.50±0.021	1.38±0.19	0.60±0.032
CL-17	04/15/91	0.44±0.031	1.08±0.12	0.58±0.032
CL-19	04/15/91	0.49±0.030	1.16±0.14	0.58±0.033
CL-89	04/15/91	1.11±0.086	2.14±0.26	0.86±0.050
CL-105	04/16/91	0.62±0.063	2.02±0.50	0.97±0.073

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a CL-105 is a control location.

b Only detected values are reported; typical LLD values are found in Table D-20.

TABLE D-18 (cont'd)

BOTTOM SEDIMENT GROSS ALPHA, GROSS BETA,
Sr-90 AND GAMMA* ISOTOPIC ACTIVITY
(pCi/g dry±2σ)

Location[a]	Date Collected	Gross[b] Alpha	Gross[b] Beta	Sr-90[b]	Be-7	K-40
CL-7C	10/21/91	9.2±3.4	27.0±2.6	0.018±0.008	0.37±0.08	15.50±0.42
CL-10	10/21/91	14.1±3.0	26.5±1.9	0.022±0.011		14.10±0.67
CL-13A	10/21/91		8.4±2.5			5.56±0.26
CL-17	10/21/91		16.4±3.1			13.30±0.43
CL-19	10/21/91		13.9±2.2			10.20±0.27
CL-89	10/21/91	8.1±4.6	22.7±3.4		0.51±0.16	17.73±0.42
CL-105	10/22/91	8.6±5.2	23.0±3.7	0.025±0.008		8.20±0.31

Location[a]	Date Collected	Cs-137	Ac-228	Bi-212	Bi-214	Pb-212
CL-7C	10/21/91	0.36±0.01	1.10±0.04		0.87±0.03	1.72±0.04
CL-10	10/21/91	0.43±0.03	1.10±0.14		0.94±0.07	1.36±0.07
CL-13A	10/21/91		0.16±0.05		0.15±0.03	0.23±0.03
CL-17	10/21/91	0.073±0.009	0.68±0.05		0.44±0.03	0.96±0.03
CL-19	10/21/91	0.17±0.003	0.24±0.02		0.20±0.01	0.38±0.01
CL-89	10/21/91	0.14±0.02	1.07±0.08	1.25±0.24	0.79±0.05	1.22±0.04
CL-105	10/22/91	0.22±0.02	0.55±0.09		0.27±0.04	0.62±0.04

Location[a]	Date Collected	Pb-214	Ra-226	Tl-208
CL-7C	10/21/91	0.96±0.05	2.42±0.15	1.11±0.04
CL-10	10/21/91	1.06±0.07	2.83±0.58	1.21±0.11
CL-13A	10/21/91	0.17±0.04	0.61±0.24	0.17±0.04
CL-17	10/21/91	0.48±0.03	1.33±0.16	0.61±0.04
CL-19	10/21/91	0.22±0.01	0.51±0.07	0.23±0.02
CL-89	10/21/91	1.00±0.05	2.58±0.39	1.17±0.07
CL-105	10/22/91	0.32±0.05	0.94±0.46	0.43±0.06

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a CL-105 is a control location.

b Only detected values are reported; typical LLD values are found in Table D-20.

TABLE D-19

SOIL GROSS ALPHA, GROSS BETA
AND GAMMA* ISOTOPIC ACTIVITY
(pCi/g dry±2σ)

Location[a]	Date Collected	Gross[b] Alpha	Gross[b] Beta	K-40	Cs-137	Ac-228
CL-1	10/17/91	11.7±4.1	26.4±2.7	17.84±0.60	0.47±0.04	1.27±0.13
CL-2	10/17/91	13.2±5.6	23.7±3.8	15.13±0.34	0.27±0.02	1.18±0.07
CL-3	10/17/91	12.2±3.6	21.9±2.3	14.10±0.33	0.24±0.01	0.95±0.04
CL-4	10/18/91	10.1±3.7	19.8±2.5	16.18±0.44	0.062±0.016	1.14±0.10
CL-6	10/18/91	10.6±5.1	23.8±3.6	16.07±0.38	0.015±0.012	0.67±0.06
CL-7	10/16/91	12.8±3.9	22.1[illegible]5	17.04±0.42	0.14±0.02	0.91±0.08
CL-8	10/16/91	7.8±3.3	24.[illegible]	14.75±0.35	0.35±0.[illegible]	1.05±0.08
CL-11	10/16/91	9.7±3.7	24.8±2.8	9.79±0.50	0.32±0.02	0.71±0.11
CL-16	10/17/91	10.2±3.7	23.8±2.7	18.24±0.43	0.097±0.016	1.00±0.09
CL-94	10/16/91	16.8±6.4	26.6±3.8	16.09±0.43	0.56±0.03	1.03±0.09

Location[a]	Date Collected	Bi-212	Bi-214	Pb-212	Pb-214	Ra-226
CL-1	10/17/91	1.69±0.36	1.13±0.07	1.61±0.05	1.36±0.08	3.40±0.61
CL-2	10/17/91	1.39±0.19	0.99±0.04	1.41±0.03	1.17±0.04	2.88±0.29
CL-3	10/17/91		0.84±[illegible]	1.44±0.03	0.88±0.04	2.31±0.11
CL-4	10/18/91		0.98±0.05	1.36±0.04	1.20±0.05	3.01±0.42
CL-6	10/18/91		0.51±0.04	0.80±0.03	0.65±0.03	1.45±0.32
CL-7	10/16/91	1.29±0.20	0.75±0.20	1.03±0.04	0.91±0.04	2.18±0.34
CL-8	10/16/91	1.38±0.21	0.83±0.04	1.26±0.03	0.98±0.04	2.43±0.29
CL-11	10/16/91		0.53±0.05	0.92±0.04	0.66±0.04	2.08±0.49
CL-16	10/17/91		0.81±0.05	1.15±0.03	0.98±0.04	2.52±0.32
CL-94	10/16/91		0.89±0.05	1.20±0.04	1.06±0.06	2.82±0.42

Location[a]	Date Collected	Tl-208
CL-1	10/17/91	1.53±0.11
CL-2	10/17/91	1.[illegible]8±0.07
CL-3	10/17/91	0.99±0.04
CL-4	10/18/91	1.30±0.08
CL-6	10/18/91	0.73±0.06
CL-7	10/16/91	1.08±0.06
CL-8	10/16/91	1.19±0.06
CL-11	10/16/91	0.86±0.08
CL-16	10/17/91	1.14±0.07
CL-94	10/16/91	1.20±0.08

* Only gamma emitters detected are reported; typical LLD values are found in Table D-20.

a CL-11 is a control location.

b Only detected values are reported; typical LLD values are found in Table D-20.

TABLE D-20

DETECTION REQUIREMENTS FOR ENVIRONMENTAL SAMPLE ANALYSIS[a,b]

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[c]	___		---	---	---
Mn-54	15	---	130	---	---	---
Fe-59	30	---	260	---	---	---
Co-58,60	15	---	130	---	---	---
Zn-65	30	---	260	---	---	---
Zr-95	30	---	---	---	---	---
Nb-95	15	---	---	---	---	---
I-131	1[d]	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	---	---

Table Notations

a This list does not mean that only these nuclides are to be considered. Other peaks that are identified, together with those of the above nuclides, shall also be analyzed and reported.

b Required detection capabilities for TLDs used for environmental measurements shall be in accordance with the recommendations of Regulatory Guide 4.13, Revision 1, July 1977.

c If no drinking water pathway exists, a value of 3,000 pCi/l may be used.

d If no drinking water pathway exists, a value of 15 pCi/l may be used.

APPENDIX E

CPS Radiological Environmental Monitoring
Quality Control Check Results
1991

TABLE E-1

U. S. EPA CROSSCHECK PROGRAM[a]

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2 s.d.[c]	EPA Result[d] ±1 s.d., N=1	Control Limits
STW-618	Water	Jan 1991	Sr-89	4.3±1.2	5.0±5.0	0.0-13.7
			Sr-90	4.7±1.2	5.0±5.0	0.0-13.7
STW-619	Water	Jan 1991	Pu-239	3.6±0.2	3.3±0.3	2.8 3.8
STW-620	Water	Jan 1991	Gr.alpha	6.7±3.0	5.0±5.0	0.0-13.7
			Gr.beta	6.3±1.2	5.0±5.0	0.0-13.7
STW-621	Water	Feb 1991	Co-60	41.3±8.4	40.0±5.0	31.3-48.7
			Zn-65	166.7±19.7	149.0±15.0	123.0-175.0
			Ru-106	209.7±18.6	186.0±19.0	153.0-219.0
			Cs-134	9.0±2.0	8.0±5.0	0.0-16.7
			Cs-137	9.7±1.2	8.0±5.0	0.0-16.7
			Ba-133	85.7±9.2	75.0±8.0	61.1-88.9
STW-622	Water	Feb 1991	I-131	81.3±6.1	75.0±8.0	61.1-88.9
STW-623	Water	Feb 1991	H-3	4310.0±144.2	4418.0±442.0	3651.2-5184.8
STW-624	Water	Mar 1991	Ra-226	31.4±3.2	31.8±4.8	23.5-40.1
			Ra-228	ND[e]	21.1±5.3	11.9-30.3
STW 625	Water	Mar 1991	U	6.7±0.4	7.6±3.0	2.4-12.8
STAF-626	Filter	Mar 1991	Gr.alpha	38.7±1.2[f]	25.0±6.0	14.6-35.4
			Gr.beta	130.0±4.0	124.0±6.0	113.6-134.4
			Sr-90	35.7±1.2	40.0±5.0	31.3-48.7
			Cs-137	33.7±4.2	40.0±5.0	31.3-48.7
STW-627 628	Water	Apr 1991				
	Sample A		Gr.alpha	51.0±6.0	54.0±14.0	29.7-78.3
			Ra-226	7.0±0.8	8.0±1.2	5.9-10.1
			Ra-228	9.7±1.9	15.2±3.8	8.6-21.8
			U	27.7±2.4	29.8±3.0	24.6-35.0
	Sample B		Gr.beta	93.3±6.4	115.0±17.0	85.5-144.5
			Sr-89	21.0±3.5	28.0±5.0	19.3-36.7
			Sr-90	23.0±0.0	26.0±5.0	17.3-34.7
			Cs-134	27.3±1.2	24.0±5.0	15.3-32.7
			Cs-137	29.0±2.0	25.0±5.0	16.3-33.7

TABLE E-1 (cont'd)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b]		
				TIML Result	EPA Result[d]	
				±2 s.d.[c]	±1 s.d., N=1	Control Limits
STM-629	Milk	Apr 1991	Sr-89	24.0±8.7	32.0±5.0	23.3-40.7
			Sr-90	28.0±2.0	32.0±5.0	23.3-40.7
			I-131	65.3±14.7	60.0±6.0	49.6-70.4
			Cs-137	54.7±11.0	49.0±5.0	40.3-57.7
			K	1591.7±180.1	1650.0±83.0	1506.0-1794.0
STW-630	Water	May 1991	Sr-89	40.7±2.3	39.0±5.0	30.3-47.7
			Sr-90	23.7±1.2	24.0±5.0	15.3-32.7
STW-631	Water	May 1991	Gr.alpha	27.7±5.8	24.0±6.0	13.6-34.4
			Gr.beta	46.0±0.0	46.0±5.0	37.3-54.7
STW-632	Water	Jun 1991	Co-60	11.3±1.2	10.0±5.0	1.3-18.7
			Zn-65	119.3±16.3	108.0±11.0	88.9-127.1
			Ru-106	162.3±19.0	149.0±15.0	123.0-175.0
			Cs-134	15.3±1.2	15.0±5.0	6.3-23.7
			Cs-137	16.3±1.2	14.0±5.0	5.3-22.7
			Ba-133	74.0±6.9[g]	62.0±6.0	51.6-72.4
STW-633	Water	Jun 1991	H-3	13470.0±385.8	12480.0±1248.0	10314.8-14645.2
STW-634		Jul 1991	Ra-226	14.9±0.4	15.9±2.4	11.7-20.1
			Ra-228	17.6±1.8	16.7±4.2	9.4-24.0
STW-635	Water	Jul 1991	U	12.8±0.1	14.2±3.0	9.0-19.4
STW-636	Water	Aug 1991	I-131	19.3±1.2	20.0±6.0	9.6-30.4
STW-637	Water	Aug 1991	Pu-239	21.4±0.5	19.4±1.9	16.1-22.7
STAF-638	Filter	Aug 1991	Gr.alpha	33.0±2.0	25.0±6.0	14.6-35.4
			Gr.beta	88.7±1.2	92.0±10.0	80.4-103.6
			Sr-90	27.0±4.0	30.0±5.0	21.3-38.7
			Cs-137	26.3±1.2	30.0±5.0	21.3-38.7
STW-639	Water	Sep 1991	Sr-89	47.0±10.4	49.0±5.0	40.3-57.7
			Sr-90	24.0±2.0	25.0±5.0	16.3-33.7
STW-640	Water	Sep 1991	Gr.alpha	12.0±4.0	10.0±5.0	1.3-18.7
			Gr.beta	20.3±1.2	20.0±5.0	11.3-28.7

TABLE E-1 (cont'd)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2 s.d.[c]	EPA Result[d] ±1 s.d., N=1	Control Limits
STM-641	Milk	Sep 1991	Sr-89	20.3±5.0	25.0±5.0	16.3-33.7
			Sr-90	19.7±3.1	25.0±5.0	16.3-33.7
			I-131	130.7±16.8[h]	108.0±11.0	88.9-127.1
			Cs-137	33.7±3.2	30.0±5.0	21.3-38.7
			K	1743.3±340.8	1740.0±87.0	1589.1-1890.9
STW-642	Water	Oct 1991	Co-60	29.7±1.2	29.0±5.0	20.3-37.7
			Zn-65	75.7±8.3	73.0±7.0	60.9-85.1
			Ru-106	196.3±15.1	199.0±20.0	164.3-233.7
			Cs-134	9.7±1.2	10.0±5.0	1.3-18.7
			Cs-137	11.0±2.0	10.0±5.0	1.3-18.7
			Ba-133	94.7±3.1	98.0±10.0	80.7-115.3
STW-643	Water	Oct 1991	H-3	2640.0±156.2	2454.0±352.0	1843.3-3064.7
STW-644	Water	Oct 1991				
645	Sample A		Gr. alpha	73.0±13.1	82.0±21.0	45.6-118.4
			Ra-226	20.9±2.0	22.0±3.3	16.3-27.7
			Ra-228	19.6±2.3	22.2±5.6	12.5-31.9
			U	13.5±0.6	13.5±3.0	8.3-18.7
	Sample B		Gr. beta	55.3±3.1	65.0±10.0	47.7-82.3
			Sr-89	9.7±3.1	10.0±5.0	1.3-18.7
			Sr-90	8.7±1.2	10.0±5.0	1.3-18.7
			Co-60	[illegible].3±1.2	20.0±5.0	11.3-28.7
			Cs-134	9.0±5.3	10.0±5.0	1.3-18.7
			Cs-137	14.7±5.0	11.0±5.0	2.3-19.7
STW-646	Water	Nov 1991	Ra-226	5.6±1.2	6.5±1.0	4.8-8.2
			Ra-228	9.6±0.5	8.1±2.0	4.6-11.6
STW-647	Water	Nov 1991	U	24.7±2.3	24.9±3.0	19.7-30.1

a Results obtained by Teledyne Isotopes Midwest Laboratory as a participant in the environmental sample crosscheck program operated by the Intercomparison and Calibration Section, Quality Assurance Branch, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency (EPA), Las Vegas, Nevada.

b All results are in the pCi/l, except for elemental potassium (K) data in milk, which are in mg/l; air filter samples, which are in pCi/filter; and food, which is in mg/kg.

c Unless otherwise indicated, the TIML results are given as the mean ±2 standard deviations for three determinations.

d USEPA results are presented as the known values and expected laboratory precision (1 s.d., 1 determination) and control limits as defined by EPA.

TABLE E-1 (cont'd)

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l[b] TIML Result ±2 s.d.[c]	EPA Result[d] ±1 s.d., N=1	Control Limits

e No data; sample lost during analyses.

f Cause of high results is the difference in geometry between standard used in the TIML lab and the EPA filter.

g Sample was reanalyzed. Results of reanalyses 63.8±6.9 pCi/L. No further action taken.

h Cause of high result is unknown. In-house spike sample was prepared with activity of I-131 68.3±6.8 pCi/L. Result of the analysis was 69.1±9.7 pCi/L.

TABLE E-2

IN-HOUSE SPIKED SAMPLES

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l: TIML Result n=3	Known Activity	Expected Precision ±1 s.d., n=3
QC-MI-33	Milk	Jan 1991	Sr-89	20.7±3.3	21.6±5.0	5.0
			Sr-90	19.0±1.4	23.0±3.0	3.0
			Cs-134	22.2±1.7	19.6±5.0	5.0
			Cs-137	26.1±1.6	22.3±5.0	5.0
QC-MI-34	Milk	Feb 1991	I-131	42.7±1.8	40.1±6.0	6.0
QC-W-75	Water	Mar 1991	Sr-89	18.8±1.5	23.3±5.0	5.0
			Sr-90	16.0±0.8	17.2±3.0	3.0
QC-W-76	Water	Apr 1991	I-131	56.5±1.7	59.0±5.9	5.9
QC-W-77	Water	Apr 1991	Co-60	16.4±2.7	15.7±5.0	5.0
			Cs-134	23.8±2.5	22.6±5.0	5.0
			Cs-137	25.0±2.4	21.1±5.0	5.0
QC-W-78	Water	Apr 1991	H-3	4027±188	4080±408	408
QC-MI-35	Milk	Apr 1991	I-131	48.0±0.8	49.2±6.0	6.0
			Cs-134	29.2±2.0	22.6±5.0	5.0
			Cs-137	22.8±2.2	22.1±5.0	5.0
QC-W-79	Water	Jun 1991	Gr.alpha	7.4±0.7	7.8±5.0	5.0
			Gr.beta	11.0±0.7	11.0±5.0	5.0
QC-MI-36	Milk	Jul 1991	Sr-89	28.1±2.1	34.0±10.0	10.0
			Sr-90	11.6±0.7	11.5±3.0	3.0
			I-131	14.4±1.9	18.3±5.0	5.0
			Cs-137	34.3±3.0	35.1±5.0	5.0
QC-W-80	Water	Oct 1991	Sr-89	27.4±6.9	24.4±5.0	5.0
			Sr-90	11.7±1.4	14.1±5.0	5.0
QC-W-81	Water	Oct 1991	I-131	19.1±0.7	20.6±4.2	4.2
QC-W-82	Water	Oct 1991	Co-60	22.6±2.7	22.1±5.0	5.0
			Cs-134	15.5±1.8	17.6±5.0	5.0
			Cs-137	17.5±2.1	17.6±5.0	5.0
QC-W-83	Water	Oct 1991	H-3	4639±137	4382±438	438
QC-MI-37	Milk	Oct 1991	I-131	23.6±3.2	25.8±5.0	5.0
			Cs-134	22.7±2.8	22.1±5.0	5.0
			Cs-137	38.3±3.0	35.1±5.0	5.0

TABLE E-2 (Cont'd)

IN-HOUSE SPIKED SAMPLES

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l TIML Result n=3	Known Activity	Expected Precision ±1 s.d., n=3
QC-W-84	Water	Dec 1991	Gr.alpha	6.2±0.6	7.8±5.0	5.0
			Gr.beta	11.0±0.7	11.0±5.0	5.0

TABLE E-3

IN-HOUSE BLANK SAMPLES

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l Results (4.66 s.d.)	Acceptance Criteria (4.66 s.d.)
SPS-406	Milk	Jan 1991	Sr-89	<0.4	<5
			Sr-90	1.8±0.4[a]	<1
			Cs-134	<3.7	<5
			Cs-137	<5.2	<5
SPS-421	Milk	Feb 1991	I-131	<0.3	<1
SPW-451	Water	Feb 1991	Ra-226	<0.1	<1
			Ra-228	<0.6	<1
SPW-514	Water	Mar 1991	Sr-89	<1.1	<5
			Sr-90	<0.9	<1
SPW-566	Water	Apr 1991	I-131	<0.2	<1
			Cs-134	<2.4	<5
			Cs-137	<2.2	<5
SPS-587	Milk	Apr 1991	I-131	<0.2	<1
			Cs-134	<1.7	<5
			Cs-137	<1.9	<5
SPW-837	Water	Jun 1991	Gr.alpha	<0.6	<1
			Gr.beta	<1.1	<4
SPM-953	Milk	Jul 1991	Sr-89	<0.7	<5
			Sr-90	0.4±0.3[a]	<1
			I-131	<0.2	<1
			Cs-137	<4.9	<5
SPM-1236	Milk	Oct 1991	I-131	<0.2	<1
			Cs-134	<3.7	<5
			Cs-137	<4.6	<5
SPW-1254	Water	Oct 1991	Sr-89	<2.8	<5
			Sr-90	<0.7	<1
SPW-1256	Water	Oct 1991	I-131	<0.4	<1
			Co-60	<3.6	<5
			Cs-134	<4.0	<5
			Cs-137	<3.6	<5
SPW-1259	Water	Oct 1991	H-3	<160	<300

TABLE E-3 (Cont'd)

IN-HOUSE BLANK SAMPLES

Lab Code	Sample Type	Date Collected	Analysis	Concentration in pCi/l: Results (4.66 s.d.)	Acceptance Criteria (4.66 s.d.)
SPW-1444	Water	Dec 1991	Gr.alpha	<0.4	<1
			Gr.beta	<0.8	<4

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a Low level (1-5 pCi/l) of Sr-90 concentration in milk is not unusual.

TABLE E-4

CROSS CHECK PROGRAM RESULTS,
THERMOLUMINESCENT DOSIMETERS (TLDs)

Lab Code	TLD Type	Measurement	mR Teledyne Result ±2 s.d.[a]	Known Value[b]
Teledyne Testing				
91-1[c]	Teledyne	Lab	33.4±2.0	32.0
	$CaSO_4$:Dy		55.2±4.7	58.8
	Cards		87.8±6.2	85.5

a Lab result given is the mean ±2 standard deviations of three determinations.

b Value determined by sponsor of the intercomparison using continuously operated pressurized ion chamber.

c Irradiated cards were provided by Teledyne Isotopes, INC., Westwood, NJ. Irradiated on October 8, 1991.

TABLE E-5

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	5 pCi/liter
	>100 pCi/liter or kg	5% of known value
Strontium-89[b]	5 to 50 pCi/liter or kg	5 pCi/liter
	>50 pCi/liter or kg	10% of known value
Strontium-90[b]	2 to 30 pCi/liter or kg	3.0 pCi/liter
	>30 pCi/liter of kg	10% of known value
Potassium	>0.1 g/liter or kg	5% of known value
Gross Alpha	<20 pCi/liter	5 pCi/liter
	>20 pCi/liter	25% of known value
Gross Beta	<100 pCi/liter	5 pCi/liter
	>100 pCi/liter	5% of known value
Tritium	<4,000 pCi/liter	1 s.d. = (pCi/liter) = $169.85 \times (\text{known})^{.0933}$
	>4,000 pCi/liter	10% of known value
Radium-226 Radium-228	<0.1 pCi/liter	15% of known value
Plutonium	0.1 pCi/liter, gram or sample	10% of known value
Iodine-131, Iodine-129[b]	<55 pCi/liter	6 pCi/liter
	>55 pCi/liter	10% of known value
Uranium-238, Nickel-63[b], Technetium-99[b]	<35 pCi/liter	6 pCi/liter
	>35 pCi/liter	15% of known value
Iron-55[b]	50 to 100 pCi/liter	10 pCi/liter
		10% of known value

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

b TIML limit.

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