STATE OF WISCONSIN

1987

Kewaunee

Environmental Radioactivity Survey

NRC 30-83-647

Wisconsin Department of Health and Social Services
Division of Health
Bureau of Environmental Health
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STATE OF WISCONSIN DHSS

1987

KEWAUNEE ENVIRONMENTAL RADIOACTIVITY SURVEY

INTRODUCTION

This report covering the calendar year 1987 is prepared under U.S. Nuclear Regulatory Commission Contract NRC 30-83-647 by the State of Wisconsin, Department of Health and Social Services, Section of Radiation Protection. Results of environmental radioactivity monitoring are listed in tabular form. The data presented consists of duplicative sample analysis conducted by the state radiation protection laboratory or subcontractor and the licensee. A brief description of sample collection techniques and analytical procedures conducted by the state laboratory is also given. A sample collection summary for 1987 is included in Table 5. The sample summary includes type and number of samples collected, Minimum Detectable Concentrations (MDC's) or Lower Limits of Detection (LLD) as well as the range of reported activities for each type of sample analysis.

SAMPLING TECHNIQUES

Whenever possible a split sample is taken inorder to obtain a valid comparison between WI DHSS and Kewaunee results. Split sampling involves the thorough mixing of a sample into a homogeneous mixture that is then split between WI DHSS and Kewaunee.

Direct Radiation - Thermoluminescent Dosimeters (TLD's)

Continuous monitoring of direct radiation is performed quarterly using thermoluminescent dosimeters. The dosimeters are placed at 43 locations in the area of the Kewaunee and the Point Beach nuclear power plants.

Air Samples

Continuous air samples are collected weekly from two stations. Air particulate samples are collected on 47 mm. glass fiber filters. Air iodine samples are collected using charcoal absorbers mounted in tandem with the air particulate filters. The nominal sampling rate is in the range of 1 - 2.5 cubic feet of air per minute depending on the air pump used.

Surface Water

A split sample consisting of 3.5 liters of liquid effluent is collected monthly at a point close to the discharge of the Kewaunee effluent channel. This sample is a grab sample and is collected while the plant is discharging liquid to the channel. A background surface water sample is also taken at the Green Bay Pumping Station - Rostok, 11.5 miles NNE.

Milk

A raw milk sample is collected monthly from the D. Stangel farm, 3.0 miles N, of the Kewaunee nuclear power facility.

Sediment

Sediment is collected from four locations on an annual basis.

Fish

Both migratory and non-migratory fish are collected periodically from Lake Michigan locations in the Point Beach - Kewaunee area.

Food Products

Split samples of food products were collected from a local farm and a fruit stand. Food products that were sampled included cabbage, tomatoes and sweet corn.

ANALYTICAL PROCEDURES

The procedures given are condensed to present only the basic method. The analysis of the samples has been subcontracted to the State Laboratory of Hygiene. A detailed description of the procedures used is available from the State Laboratory of Hygiene.

Air Particulate Samples - Beta Gamma

Place the 47 mm. glass fiber filter on a 2-inch stainless steel planchet. Beta count in an external gas flow proportional counter. Calculate activity correcting for counter efficiency.

Air Particulate Samples - Gamma

The quarterly composite of air particulate filters is placed on a Ge(Li) detector and the gamma spectrum is collected. Scan the spectrum for any peaks and print out regions of interest which would include possible plant attributable radionuclides. Calculate the activity for isotopes in the regions of interest, regardless if they are above or below the minimum detectable concentration, correcting for counter efficiency and for decay.

Surface Water - Alpha, Beta Gamma

Filter a 500 ml. aliquot of sample. Evaporate filtrate in a 2-inch stainless steel planchet. Place filter paper in a 2-inch stainless steel planchet and dry at 103 degrees Celsius. Beta and alpha count the soluble and insoluble portions in an external gas flow proportional counter. Calculate activity correcting for counter efficiency and for self-absorption.

Surface Water - Iodine 131 Chemical Extraction

A stable iodine carrier is added to a 2 liter sample of raw milk. The sample is passed through an anion exchange column and the iodine is removed from the resin by batch/extraction using NaOCl. After reduction to elemental iodine by hydroxylamine hydrochloride, the iodine is extracted into carbon tetrachloride reduced with bisulfite, and back extracted into water. The iodine is precipitated as palladous iodide with the chemical yield determined gravimetrically and counted in an external gas flow proportional counter. Calculate activity correcting for counter efficiency and for decay.

Surface Water - Gamma Isotopic

A 3.5 liter sample is placed in a Marinelli beaker and analyzed on a GeLi detector. Scan the spectrum for any peaks and print out regions of interest which would include possible plant attributable radionuclides. Calculate the activity for isotopes in the regions of interest, regardless if they are above or below the minimum detectable concentration, correcting for counter efficiency and for decay.

Surface Water - Strontium 89 and Strontium 90

Strontium and yttrium carriers are added to the surface water samples. The procedure follows through a series of chemical separations whereby all interfering substances are removed. Calcium is removed by precipitating strontium and barium by nitrate precipitation thereby leaving the calcium in solution. Radium is removed by co-precipitation with barium as a chromate. The ingrowing yttrium is separated from the parent strontium through the use of carbonate and scavenging. The purified strontium is converted to a carbonate and beta counted in an external gas flow proportional counter. After two weeks ingrowth yttrium-90 is separated from the strontium carbonate via a series of hydroxide precipitations and finally converted to an oxalate and beta counted in an external gas flow proportional counter. The strontium-90 activity is calculated from the yttrium-90 count and the strontium-89 activity is calculated using the previous calculation for strontium-90 as well as total strontium activity from the strontium carbonate counting.

Vegetation or Food Product - Alpha, Beta and Gamma Isotopic

Dry sample at 110 degrees Celsius, grind and weigh into a stainless steel planchet. Beta and alpha count in an external gas flow proportional counter. Calculate activity correcting for self-absorption and counter efficiency.

The food product sample is finely chopped. The sample is packed to the 500 ml mark of a 500 ml Marinelli beaker, weighed and counted on a Ge(Li) detector. Scan the spectrum for any peaks and print out regions of interest which would include possible plant attributable radionuclides. Calculate the activity for isotopes in the regions of interest, regardless if they are above or below the minimum detectable concentration, correcting for counter efficiency and for decay.

Soil or Sediment - Alpha, Beta and Gamma Isotopic

Dry sample at 110 degrees Celsius, grind and weigh into a stainless steel planchet. Beta and alpha count in an external gas flow proportional counter. Calculate activity correcting for self-absorption and counter efficiency.

The dried sample is added to a 500 ml Marinelli beaker, weighed and counted on a Ge(Li) detector. Scan the spectrum for any peaks and print out regions of interest which would include possible plant attributable radionuclides. Calculate the activity for isotopes in the regions of interest, regardless if they are above or below the minimum detectable concentration, correcting for counter efficiency and for decay.

Milk - Gamma Isotopic

Procedure same as for Surface Water.

Milk - Iodine 131 Chemical Extraction

Procedure same as for Surface Water.

Milk - Strontium 90

Strontium and yttrium carriers are added to milk which has been aged two to four weeks. A one liter sample is passed successively through cation and anion exchange columns. The yttrium is eluted from the anion resin with hydrochloric acid, precipitated as yttrium oxalate, filtered and weighed to determine chemical yield. Beta count in an external gas flow proportional counter. Calculate the activity correcting for counter efficiency and for decay.

Fish - Gamma Isotopic

A sample is placed in a 500 ml. Marinelli beaker. Place the sample on a GeLi detector and collect the gamma spectrum. Scan the spectrum for any peaks and print out regions of interest which would include possible plant attributable radionuclides. Calculate the activity for isotopes in the regions of interest, regardless if they are above or below the minimum detectable concentration, correcting for counter efficiency and for decay.

Direct Radiation

Thermoluminescent dosimeters are supplied by the U.S. Nuclear Regulatory Commission. The exposed TLD's are shipped to NRC Region I and are read by the Commission.

QUALITY ASSURANCE

The analysis of the samples is performed under subcontract with the State Laboratory of Hygiene (SLH). SLH maintains its own quality assurance program which was also reviewed by the NRC in January, 1985.

Analytical procedures provide for routine replicate analyses to verify methods and instrument operation. Traceable sources are used to regularly calibrate the counters and daily performance checks are made between calibrations. In addition, quality control charts are maintained on the counters.

SLH participates in the EPA Cross Check program. The quality assurance progam that the SLH participates in include analysis of blind samples, air filters, food, milk, gamma in water, alpha-beta in water, iodine in water, strontium in water and tritium in water. The EPA Cross Check code for SLH is "AF". A complete listing of the EPA Cross Check results for 1986 and 1987 is included in Table 6.

SENSITIVITIES AND ERROR - WISCONSIN DHSS

Following the recommendations of the Health Physics Society, detection limits will be expressed as a minimum detectable concentration (MDC). The minimum detectable concentration or MDC is an "a priori" estimate of the capability for detecting an activity concentration by a given measurement system, procedure, and type of sample. The MDC should not be viewed as an absolute activity concentration that can or cannot be detected. Minimum detectable concentrations (MDC) are based on the analysis performed and for gamma isotopic analysis have been calculated for a zero decay time. Minimum detectable concentrations (MDC's) are listed in Table 5.

The WI DHSS definition for minimum detectable concentration follows closely the equation for the lower limits of detection as defined in NRC contract NRC-30-83-647. Activities defined by the equation for MDC will be used in this report.

The MDC for each radioisotope has been calculated from the following equation:

$$MDC = \frac{4.66\ s_b}{E * V * 2.22 * Y * S * \exp(-dt)}$$

Where:

MDC is the "a priori" lower limit of detection as defined above, as picocuries per unit mass or volume,

s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate, as counts per minute,

E is the counting efficiency, as counts per disintegration,

V is the sample size in units of mass or volume,

2.22 is the number of disintegrations per minute per picocurie,

Y is the fractional radiochemical yield, when applicable,

S is the self-absorption correction factor,

d is the radioactive decay constant for the particular radionuclide, and

t for environmental samples is the elapsed time between sample collection, or end of the sample collection period, and time of counting.

Guidelines adopted by the U.S. Environmental Protection Agency are used in the reporting of specific analyses. Results from specific analyses will be reported whether the results are negative, zero, or positive. Caution should be exercised in the interpretation of individual negative values. While a negative activity value does not have physical significance, it is significant when taken together with other observations which indicate that the true value of e distribution is near zero. This procedure will allow all of the data to be reported and will allow a statistical evaluation without an arbitrary cutoff of small or negative numbers. An estimation of bias in the nuclide analyses as well as a better evaluation of distributions and trends in the environmental data is then possible. It is important when reviewing the data in the following tables to compare the reported result to the actual minimum detectable concentration (MDC) for that analysis.

Results for specific analyses will be reported as an activity followed by an error term for that analysis. The error term is a plus or minus counting error term at the 2 sigma (95%) confidence interval and is printed as (+/-).

SAMPLE COLLECTION SUMMARY

The following types and number of samples collected are listed in Table 1. An explanation for missing samples is listed in Table 2.

Table 1. Sample collection summary for 1987.

Sample Type	Collection and Frequency*	Number of Locations	Number of Samples Collected	Number of Samples Missed
air particulate	C/W	2	98	2
air iodine	C/W	2	98	2
surface water	G/M	2	10	2
sediment	G/A	4	4	0
fish	G/SA	1	6	0
food product	G/A	2	4	0
milk	G/M	1	12	0

*Collection type: C/ = continuous; G/ = grab
Frequency: /W = weekly; /M = monthly; /Q = quarterly; /A = annually
/SA = semi-annually

Table 2. Missing sample report for 1987.

Sample type	Date	Location	Explanation
air particulate	05/13 - 05/21	Indicator	Inoperable air pump.
air particulate	05/29 - 06/05	Control	Filter lost in the field.
air iodine	05/13 - 05/21	Indicator	Inoperable air pump.
air iodine	05/29 - 06/05	Control	Cartridge lost in the field.
surface water	October, 1987	Indicator	Sample was not collected.
surface water	May, 1987	Control	Sample was not collected.

RESULTS AND DISCUSSION

A sample collection summary for 1987 is included in Table 5. The sample summary includes the type and number of samples collected as well as the range of reported activities for each type of sample analysis. Results from the individual sample analyses are listed in Tables 7-20.

Air Particulate

WI DHSS and Kewaunee maintain separate air sampling stations. The indicator site for both WI DHSS and for Kewaunee is located at the meteorological tower, 0.12 miles S. The control site for WI DHSS is located at the Green Bay Pumping Station - Rostok, 11.5 miles NNE, and for Kewaunee at the WPS building - Kewaunee, 9.5 miles NNE.

A summary of reported gross beta activities by WI DHSS and Kewaunee from air particulate samples is included in Table 5. Results from the individual sample analyses are listed in Tables 7-10.

The yearly averages, from a log-normal distribution, for the gross beta analysis on the air particulate filters are given in Table 3.

The WI DHSS and Kewaunee yearly averages for gross beta activity from the air particulate filters are comparable and showed no significant differences between their respective indicator and control sites.

A summary of reported gamma isotopic activities for WI DHSS and Kewaunee from the quarterly air particulate filter composites is included in Table 5. Results from the individual sample analyses are listed in Tables 11-12.

In the WI DHSS gamma isotopic analysis, beryllium-7 (Be-7) was detected in all composites from both the indicator and the control sites. Beryllium-7 (Be-7) is a naturally occurring radioisotope that is constantly produced through nuclear reactions between cosmic rays and nuclei in the atmosphere. All other radionuclides were below their respective MDC for the 1st, 2nd, 3rd and 4th quarter composites.

Table 3. Comparison of yearly log-normal averages for gross beta activities of the air particulate samples.

WI - Section of Radiation Protection		Kewaunee	
units of pCi/M^3			
Indicator	Control	Indicator	Control
0.013 ± 0.002	0.012 ± 0.002	0.019 ± 0.003	0.018 ± 0.003

For Kewaunee, naturally occurring beryllium-7 (Be-7) was detected in all quarterly composites from both the indicator and the control sites. All other radionuclides were below their respective LLD for the 1st, 2nd, 3rd and 4th quarter composites.

At the observed lower levels of activity the WI DHSS and Kewaunee data are comparable in the gamma isotopic analysis on the air particulate samples. Influence by the Kewaunee nuclear facility on air quality is not evident when comparing the data from the indicator and control sites for the 1st, 2nd, 3rd and 4th quarters of 1987.

Air Iodine

Air iodine samples are taken at the same sites as the air particulate samples.

A summary of reported air iodine activities for WI DHSS and Kewaunee is included in Table 5. Results from the individual sample analyses are listed in Tables 7-10.

All reported WI DHSS and Kewaunee air iodine (I-131) measurements were below the WI DHSS MDC or the Kewaunee LLD for both the indicator and the control sites.

Surface Water

Surface water at the effluent channel is collected as a grab sample on a monthly basis and is then split between WI DHSS and Kewaunee. Surface water at the control site, Green Bay Pumping Station - Rostok, is also collected as a grab sample on a monthly basis. The control site is not a split sample as WI DHSS and Kewaunee sample on different days during the month.

A summary of reported activities by WI DHSS and Kewaunee from the monthly surface water samples is included in Table 5. Results from the individual sample analyses are listed in Tables 13-16.

All reported activities by WI DHSS and Kewaunee are at background levels for the samples taken at the control sites. All reported gamma isotopic activities were less than the respective WI DHSS MDC or the respective Kewaunee LLD. Gross beta activities reported by WI DHSS and Kewaunee were all at background levels for samples collected at the control sites. The gross beta yearly averages for WI DHSS of 3.2 ± 1.5 pCi/liter and for Kewaunee of 2.5 ± 0.5 pCi/liter for the control sites are not significantly different from previous years.

For samples taken at the indicator site, effluent channel, all reported gamma isotopic activities were less than the respective WI DHSS MDC or the respective Kewaunee LLD. WI DHSS reported one iodine-131 (I-131) activity of 5.2 ± 0.9 pCi/liter above its MDC of 0.4 pCi/liter. Kewaunee does not perform a chemical procedure for iodine-131 (I-131) and the reported WI DHSS activity is less than the

Kewaunee LLD for iodine-131 (I-131) in its gamma isotopic analysis. The WI DHSS and Kewaunee reported activities for tritium (H-3) are comparable except for the 03/02/87 WI DHSS activity of 28100±600 pCi/liter and the 07/01/87 WI DHSS activity of 11500±600 pCi/liter. The Kewaunee quarterly reported activities for tritium (H-3) were all less than 330 pCi/liter. The gross beta yearly averages for WI DHSS of 3.5±1.5 pCi/liter and for Kewaunee of 2.4±0.5 pCi/liter is not significantly different from previous years.

All activities reported by either WI DHSS or Kewaunee are below the standards for uncontrolled areas specified in ICRP Report No. 2 or 10 CFR 20. Plant influence is not evident after comparing the WI DHSS and Kewaunee data from the indicator and control sites.

Fish

Split samples were not taken for fish. Fish samples for WI DHSS were collected by the Point Beach facility in the vicinity of the Kewaunee and Point Beach plants.

A summary of reported activities by WI DHSS and Kewaunee for fish samples is included in Table 5. Results from the individual sample analyses are listed in Table 17.

For WI DHSS, the detected levels of activity for cesium-137 (Cs-137) and for naturally occurring potassium-40 (K-40) were also reported in previous years. For Kewaunee, activities for cesium-137 (Cs-137) were also reported in previous years. Except for one Kewaunee sample, all reported WI DHSS and Kewaunee activities for cesium-137 (Cs-137) were less than the required NRC LLD of 150 pCi/kilogram.

At the low level of reported activities the WI DHSS and Kewaunee data are comparable.

Shoreline Sediments

Split samples were taken for shoreline sediments at four locations.

A summary of reported activities by WI DHSS and Kewaunee for shoreline sediment samples is included in Table 5. Results from the individual sample analyses are listed in Table 18.

From the WI DHSS gamma isotopic analysis, naturally occurring potassium-40 (K-40) and radioisotopes from uranium and thorium decay series were detected in all four samples. Cesium-137 (Cs-137) was detected at site K-1c and all other reported activities were below the respective WI DHSS MDC.

For Kewaunee, activities for cesium-137 (Cs-137) and naturally naturally occurring potassium-40 (K-40) were reported for all four sites. All of the reported Kewaunee activities for cesium-137 (Cs-137) were less than the respective WI DHSS MDC.

All reported WI DHSS and Kewaunee activities for cesium-137 (Cs-137) are less than the required NRC LLD of 180 pCi/kilogram as stated in the NRC 30-83-647 contract. At these low levels of activity the data for WI DHSS and Kewaunee are comparable.

Milk

Milk is collected as a grab sample on a monthly basis. A split sample is not taken as WI DHSS and Kewaunee sample on different dates.

A summary of reported activities by WI DHSS and Kewaunee for milk samples is included in Table 5. Results from the individual sample analyses are listed in Table 19.

WI DHSS detected naturally occurring potassium-40 (K-40) in all samples and cesium-137 (Cs-137) in one sample in its gamma isotopic analysis. All activities for iodine-131 (I-131) were below the MDC of 0.4 pCi/liter. All other activities were below the respective WI DHSS MDC.

Kewaunee detected only naturally occurring potassium-40 (K-40) in its gamma isotopic analysis. Reported activities for iodine-131 (I-131) were all less than 0.5 pCi/liter.

The WI DHSS and Kewaunee data are comparable although a direct comparison is not possible since split samples were not taken.

Influence by the Kewaunee nuclear facility in the milk pathway is not evident after reviewing the WI DHSS and Kewaunee data.

Vegetation - Food Products

A split sample for food products was taken at two locations.

A summary of reported activities by WI DHSS and Kewaunee for food product samples is included in Table 5. Results from the individual sample analyses are listed in Table 20.

The WI DHSS and Kewaunee gamma isotopic analysis detected only naturally occurring potassium-40 in all four samples. Iodine-131 (I-131) was not detected in any of the WI DHSS or Kewaunee samples.

From the comparison of the Wisconsin and the Kewaunee data, influence by the Kewaunee nuclear facility is not evident.

Dose to an Average Individual

Dose calculations for gaseous and liquid effluent releases were performed according to the mathematical models illustrated in USNRC Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I". The doses, listed in Table 4, were calculated for the average exposed individual for WI DHSS samples with activities greater than MDC.

Doses resulting from gaseous and liquid effluent releases from the Kewaunee nuclear facility are in compliance with 10 CFR Part 50, Appendix I.

The dose to an average individual from the ingestion of milk and fish are most likely due to background levels of radiation attributable to fallout from previous atmospheric nuclear tests and not to the operation of the Kewaunee facility. The dose to an average individual from the ingestion of milk is due specifically to the detected strontium-90 (Sr-90) activities. The dose to an average individual from the ingestion of fish is due specifically to the detected cesium-137 (Cs-137) activities.

The doses listed in Table 4 are well below the state and federal standards of 500 mrem/year.

Table 4. Calculated doses to an average exposed individual for WI DHSS samples with activities greater than MDC.

Sample type	Description	population	Average Exposed Individual (mrem/year) whole body	bone	thryoid
milk	yearly average	infant	1.6	6.3	---
		child	1.5	5.8	---
		teenager	0.8	3.3	---
		adult	0.4	1.7	---
fish	average of six	infant	---	---	---
		child	0.01	0.09	---
		teenager	0.03	0.07	---
		adult	0.06	0.07	---

References

Food and Drug Administration, Background for Protective Action Recommendations: Accidental Radioactive Contamination of Food and Animal Feeds, HHS Publication FDA 82-8196, August, 1982.

Radiation Protection Standards, Federal Radiation Council, Report No. 2, September 1961.

U.S. Environmental Protection Agency, Environmental Radiation Protection Requirements for Normal Operations of Activities in the Uranium Fuel Cycle, 40 CFR 190, November, 1976.

U.S. Environmental Protection Agency, Upgrading Environmental Radiation Data, Health Physics Society Committee Report HPSR-1 (1980), EPA 520/1-80-012, August 1980.

U.S. Nuclear Regulatory Commission, Title 10, Part 20.

Wisconsin Department of Health and Social Services, Division of Health, Section of Radiation Protection. NRC 30-83-647, 1985 Annual report, Kewaunee Environmental Radioactivity Survey.

Table 5. Sample summary for 1987 from the environmental split sample monitoring program conducted by WI DHSS and Kewaunee.

Sample type (units)	Wisconsin data: MDC	Number of Samples *a	Analysis	range	Kewaunee data: NRC MDC	Number Samples *a	Analysis	range
air particulate (pCi/M^3)	0.003	100/98	gross beta	0.005 - 0.045	0.01	104/100	gross beta	<0.004 - 0.039
		8	gamma isotopic			8	gamma isotopic	
	0.025	8/8	Be-7	0.067 - 0.113	----	8/8	Be-7	0.052 - 0.081
	0.007	8/0	Zr-95	-0.001 - 0.001	----	8/0	Zr-95	<0.0021 - <0.0038
	0.004	8/0	Ru-103	-0.001 - 0.000	----	8/0	Ru-103	<0.0015 - <0.0089
	0.016	8/0	Ru-106	-0.003 - 0.002	----	8/0	Ru-106	<0.0079 - <0.013
	0.002	8/0	Cs-134	0.000	0.05	8/0	Cs-134	<0.0007 - <0.0016
	0.002	8/0	Cs-137	0.000	0.06	8/0	Cs-137	<0.0009 - <0.0019
	0.006	8/0	Ce-141	0.000	----	8/0	Ce-141	<0.0015 - <0.0033
	0.009	8/0	Ce-144	0.000	----	8/0	Ce-144	<0.0036 - <0.0079
air iodine (pCi/M^3)	0.046	100/0	I-131	-0.02 - 0.03	0.00	104/0	I-131	<0.03
surface water (pCi/liter)	1.6	22/22	gross beta	2.0 - 6.1	4	24/24	gross beta	1.6 - 3.8
	750	22/2	H-3	-400 - 28100	2000	8/0	H-3	<330
	0.8	22/1	I-131	-0.3 - 5.2	1	24	I-131	* b
	5.0	22/0	Sr-89	-0.9 - 2.0		8/0	Sr-89	<0.4 - <1.6
	1.5	22/0	Sr-90	0.0 - 1.4		8/2	Sr-90	<0.5 - 0.7
		22	gamma isotopic			24	gamma isotopic	
	9	22/0	Mn-54	-6 - 2	15	24/0	Mn-54	<15
	20	22/0	Fe-59	-8 - 7	30	24/0	Fe-59	<30
	13	22/0	Co-58	-4 - 3	15	24/0	Co-58	<15
	11	22/0	Co-60	-3 - 2	15	24/0	Co-60	<15
	22	22/0	Zn-65	-15 - 5	30	24	Zn-65	* b
	13	22/0	Cs-134	-3 - 3	15	24/0	Cs-134	<10
	12	22/0	Cs-137	-5 - 3	18	24/0	Cs-137	<10
	15	22/0	Zr-95	-16 - 5	15	24/0	Zr-95	<15
	15	22/0	Ba-140	-15 - 4	15	24/0	Ba-140	<15
shoreline sediment (pCi/kg dry)	5100	4/2	gross beta	1000 - 11000	----	4/4	gross beta	3000 - 8800
		4	gamma isotopic			4	gamma isotopic	
	70	4/0	Co-58	-1 - 30	----	4/0	Co-58	<8 - <15
	70	4/0	Co-60	8 - 40	----	4/0	Co-60	<10 - <34
	60	4/0	Cs-134	3 - 18	150	4/0	Cs-134	<5 - <19
	80	4/1	Cs-137	16 - 90	180	4/4	Cs-137	12 - 44
	450	4/4	K-40	4300 - 8100	----	4/4	K-40	3620 - 7340
	100	4/4	Ra-226	150 - 350	----	4	Ra-226	* b
	150	4/1	Pb-214	110 - 350	----	4	Pb-214	* b
	150	4/2	Bi-214	130 - 310	----	4	Bi-214	* b
	180	4/1	Tl-208	120 - 290	----	4	Tl-208	* b
	180	4/1	Ac-228	80 - 360	----	4	Ac-228	* b

Table 5. (continued)

Sample type (units)	Wisconsin data MDC	Number of Samples *a	Analysis	range	Kewaunee data NRC MDC	Number Samples *a	Analysis	range
fish		5	gamma isotopic			4	gamma isotopic	
(pCi/kg wet)	550	5/5	K-40	2600 - 3600	----	4/4	K-40	* b
	40	5/0	Mn-54	-9 - 13	130	4/0	Mn-54	<6 - <13
	120	5/0	Fe-59	-15 - 40	260	4/0	Fe-59	<20 - <88
	54	5/0	Co-58	-8 - 9	130	4/0	Co-58	<7 - <23
	50	5/0	Co-60	4 - 30	130	4/0	Co-60	<6 - <11
	110	5/0	Zn-65	3 - 40	260	4	Zn-65	* b
	45	5/1	Cs-134	-4 - 50	130	4/1	Cs-134	<5 - 9
	55	5/5	Cs-137	80 - 160	150	4/4	Cs-137	59 - 155
milk	0.4	12/0	I-131	-0.8 - 0.2	1	12/0	I-131	<0.5
(pCi/liter)	---	12	Sr-89	*b		12/3	Sr-89	<0.3 - 0.8
	1.5	12/10	Sr-90	1.3 - 3.3		12/12	Sr-90	1.0 - 2.3
(pCi/liter)		12	gamma isotopic			12	gamma isotopic	
	200	12/12	K-40	1270 - 1600	----	12/12	K-40	1150 - 1470
	12	12/0	Cs-134	0 - 8	15	12/0	Cs-134	<10
	12	12/0	Cs-137	-1 - 13	18	12/0	Cs-137	<10
	15	12/0	La-140	-19 - 6	15	12/0	Ba-140	<15
food product	1100	4/4	gross beta	1800 - 3500	----	4/4	gross beta	1150 - 3060
(pCi/kg wet)		4	gamma isotopic			4	gamma isotopic	
	300	4/0	Be-7	1 - 170	----	4/0	Be-7	<55 - <140
	600	4/4	K-40	1700 - 4300	----	4/4	K-40	1250 - 3390
	50	4/0	Co-58	-3 - 7	----	4	Co-58	* b
	55	4/0	Co-60	-3 - 40	----	4	Co-60	* b
	80	4/0	Zr-95	-20 - 40	----	4/0	Zr-95	<13 - <35
	60	4/0	I-131	-4 - 12	60	4	I-131	* b
	50	4/0	Cs-134	13 - 40	60	4	Cs-134	* b
	60	4/0	Cs-137	-2 - 20	80	4/0	Cs-137	<7 - <17
	60	4/0	Ru-103	<MDC	----	4/0	Ru-103	<7 - <16
	525	4/0	Ru-106	<MDC	----	4/0	Ru-106	<61 - <130
	50	4/0	Ce-141	<MDC	----	4/0	Ce-141	<12 - <17
	135	4/0	Ce-144	<MDC	----	4/0	Ce-144	<48 - <68

* a - Number of samples / number of analyses detected above MDC or LLD.

* b - Analysis not required.

Table 6. U.S. Environmental Protection Agency's crosscheck program, comparision of EPA and State Laboratory of Hygiene (SLH) results.

Sample Type	Date Collected	Analysis	Concentration in pCi/sample *a SLH result +/- 1 sigma	EPA result +/- 1 sigma	Deviation Known
Water	01-10-86	Sr-89	32.0+/-1.2	31.0+/-5.0	0.3
		Sr-90	13.3+/-0.7	15.0+/-1.5	-1.9
Water	01-24-86	Alpha	4.0+/-1.4	3.0+/-5.0	0.3
		Beta	7.3+/-1.4	7.0+/-5.0	0.1
Food	01-31-86	Sr-89	No data provided	25.0+/-5.0	
		Sr-90	No data provided	10.0+/-1.5	
		I-131	19+/-9	20.0+/-6.0	-0.2
		Cs-137	18+/-8	15.0+/-5.0	0.9
		K	1030+/-170	950+/-143	1.0
Water	02-07-86	Cr-51	LT 40	38.0+/-5.0	
		Co-60	17+/-3	18.0+/-5.0	-0.2
		Zn-65	38+/-6	40.0+/-5.0	-0.6
		Ru-106	LT 31	0.0+/-5.0	
		Cs-134	28+/-3	30.0+/-5.0	-0.6
		Cs-137	23+/-3	22.0+/-5.0	0.5
Water	02-14-86	H-3	4913+/-370	5227+/-523	-1.0
Water	02-21-86	U (nat)	10+/-5	9.0+/-6.0	0.4
Water	02-28-86	I-131	9.0+/-1.0	9.0+/-6.0	0.0
Water	03-14-86	Ra-226	3.9+/-0.5	4.1+/-0.6	-0.7
		Ra-228	11.9+/-1.8	12.4+/-1.9	-0.4
Water	03-21-86	Alpha	15.7+/-1.5	15.0+/-5.0	0.2
		Beta	10.3+/-1.3	8.0+/-5.0	0.8
Water	04-04-86	I-131	8.0+/-1.5	9.0+/-6.0	-0.3
Filter	04-25-86	Alpha	19.0+/-1.5	15.0+/-5.0	1.4
		Beta	47+/-2	47.0+/-5.0	0.1
		Sr-90	17.0+/-1.5	18.0+/-1.5	-1.2
		Cs-137	11.7+/-3	10.0+/-5.0	0.6

Table 6 (continued)

Sample Type	Date Collected	Analysis	Concentration in pCi/sample *a SLH result +/- 1 sigma	EPA result +/- 1 sigma	Deviation Known
Blind	04-20-86	Alpha	14+/-2	17.0+/-5.0	-0.9
		Beta	33+/-3	35.0+/-5.0	-0.7
		Ra-226	3.1+/-0.4	2.90+/-0.44	0.7
		Ra-228	2.1+/-0.3	2.00+/-0.30	0.8
		U (nat)	3.7+/-5.0	5.0+/-6.0	-0.4
		Sr-89	6.7+/-0.9	7.0+/-5.0	-0.1
		Sr-90	6.0+/-0.7	7.0+/-1.5	-1.2
		Co-60	10+/-3	10.0+/-5.0	-0.1
		Cs-134	4+/-2	5.0+/-5.0	-0.3
		Cs-137	5+/-2	5.0+/-5.0	0.0
Water	05-09-86	Sr-89	5.0+/-2	5.0+/-5.0	0.0
		Sr-90	5.0+/-1.5	5.0+/-1.5	0.0
Water	07-06-86	Cr-51	<38	0.0+/-5.0	
		Co-60	65+/-5	66.0+/-5.0	-0.5
		Zn-65	86+/-5	86.0+/-5.0	0.0
		Ru-106	47+/-5	50.0+/-5.0	-0.9
		Cs-134	45+/-5	49.0+/-5.0	-1.4
		Cs-137	8+/-5	10.0+/-5.0	-0.7
Water	06-20-86	Ra-226	7.3+/-1.3	8.6+/-1.3	-1.7
		Ra-228	12.2+/-2.5	16.7+/-2.5	-3.1
Milk	06-27-86	Sr-89	No data provided	0.0+/-5.0	
		Sr-90	16.6+/-1.7	16.0+/-1.5	0.8
		I-131	39+/-5	41.0+/-6.0	-0.5
		Cs-137	38+/-5	31.0+/-5.0	2.4
		K	1660+/-120	1600+/-80	1.4
Water	07-18-86	Alpha	8+/-2	6.0+/-5.0	0.7
		Beta	18+/-2	18.0+/-5.0	-0.7
Food	07-25-86	Sr-89	No data provided	30+/-5	
		Sr-90	No data provided	19+/-1.5	
		I-131	24+/-5	30.0+/-6.0	-1.6
		Cs-137	21+/-5	20.0+/-5.0	0.2
		K	1180+/-120	1150+/-58	0.9
Water	08-08-86	I-131	41+/-10	45.0+/-6.0	-1.2
Water	08-22-86	U (Nat)	4+/-4	4.0+/-6.0	0.1
Water	09-12-86	Ra-226	6.5+/-0.9	6.1+/-0.9	0.8
		Ra-228	10.3+/-1.5	9.1+/-1.4	1.5

Table 6 (continued)

Sample Type	Date Collected	Analysis	Concentration in pCi/sample *a SLH result +/- 1 sigma	EPA result +/- 1 sigma	Deviation Known
Filter	09-12-86	Alpha	20+/-2	22.0+/-5.0	-0.7
		Beta	67+/-2	66.0+/-5.0	0.3
		Sr-90	21.3+/-1.8	22.0+/-1.5	-0.8
		Cs-137	28+/-5	22.0+/-5.0	2.0
Water	09-19-86	Alpha	11.3+/-2	15.0+/-5.0	-1.3
		Beta	8.7+/-1.5	8.0+/-5.0	0.2
Water	10-10-86	Cr-51	61+/-10	59.0+/-5.0	0.6
		Co-60	32+/-5	31.0+/-5.0	0.2
		Zn-65	88+/-5	85.0+/-5.0	1.0
		Ru-106	68+/-5	74.0+/-5.0	-2.2
		Cs-134	29+/-5	28.0+/-5.0	0.3
		Cs-137	46+/-5	44.0+/-5.0	0.6
Water	10-17-86	H-3	5300+/-300	5973+/-597	-2.0
Water	10-22-86	Alpha	39+/-2	40.0+/-5.0	-0.5
		Beta	50+/-2	51.0+/-5.0	-0.2
		Ra-226	6.2+/-1.0	6.0+/-0.9	0.3
		Ra-228	3.5+/-0.8	5.0+/-0.8	-3.5
		U (nat)	9.3+/-7.0	10.0+/-6.0	-0.2
		Sr-89	10.7+/-2.5	10.0+/-5.0	0.2
		Sr-90	3.7+/-1.5	4.0+/-1.5	-0.4
		Co-60	27+/-5	24.0+/-5.0	1.0
		Cs-134	11+/-4	12.0+/-5.0	-0.5
		Cs-137	10+/-4	8.0+/-5.0	0.7
Water	11-21-86	Alpha	16+/-2	20.0+/-5.0	-1.4
		Beta	23.7+/-2	20.0+/-5.0	1.3
Water	12-12-86	Ra-226	6.2+/-1.0	6.8+/-1.0	-1.0
		Ra-228	10.5+/-1.7	11.1+/-1.7	-0.6

Table 6 (continued)

Sample Type	Date Collected	Analysis	Concentration in pCi/sample *a SLH result +/- 1 sigma	EPA result +/- 1 sigma	Deviation Known
Water	01-09-87	Sr-89	25+/-5	25.0+/-5.0	0.1
		Sr-90	24.7+/-1.5	25.0+/-1.5	-0.4
Water	01-23-87	Alpha	10+/-2	11.0+/-5.0	-0.2
		Beta	12.3+/-1.7	10.0+/-5.0	0.8
Food	01-30-87	Sr-90	No data provided	49.0+/-10.0	
		I-131	76+/-10	78.0+/-8.0	-0.4
		Cs-137	89+/-8	84.0+/-5.0	1.6
		K	1070+/-110	980+/-49	3.3
Water	02-06-87	Co-60	49+/-7	50.0+/-5.0	-0.5
		Zn-65	92+/-8	91.0+/-5.0	0.5
		Ru-106	90+/-20	100.0+/-5.0	-4.2
		Cs-134	50+/-8	59.0+/-5.0	-3.0
		Cs-137	85+/-8	87.0+/-5.0	-0.6
Water	02-13-87	H-3	4200+/-400	4209+/-420	-0.2
Water	02-20-87	U	11+/-6	8.0+/-6.0	0.7
Milk	02-27-87	I-131	9.3+/-1.0	9.0+/-0.9	0.6
Water	03-13-87	Ra-226	7.4+/-1.1	7.3+/-1.1	0.2
		Ra-228	8.1+/-1.1	7.5+/-1.1	0.9
Water	03-20-87	Alpha	3.7+/-1.5	3.0+/-5.0	0.2
		Beta	14.0+/-1.8	13.0+/-5.0	0.3
Water	04-03-87	I-131	7.0+/-1.0	7.0+/-0.7	0.0
Filter	04-10-87	Alpha	16+/-2	14.0+/-5.0	0.7
		Beta	44+/-3	43.0+/-5.0	0.2
		Sr-90	18.0+/-1.5	17.0+/-1.5	1.2
		Cs-137	8+/-4	8.0+/-5.0	0.1
Blind	04-20-87	Alpha	29+/-5	30.0+/-8.0	-0.3
		Ra-226	3.4+/-1.0	3.9+/-0.6	-0.4
		Ra-228	3.8+/-1.0	4.0+/-0.6	-0.7
		U	6+/-5	5.0+/-6.0	0.3
		Beta	66+/-5	66.0+/-5.0	-0.1
		Sr-89	20+/-3	19.0+/-5.0	0.3
		Sr-90	9.0+/-1.5	10.0+/-1.5	-1.2
		Co-60	8+/-3	8.0+/-5.0	-0.5
		Cs-134	17+/-3	20.0+/-5.0	-0.9
		Cs-137	15+/-3	15.0+/-5.0	-0.1

Table 6 (continued)

Sample Type	Date Collected	Analysis	Concentration in pCi/sample *a SLH result +/- 1 sigma	EPA result +/- 1 sigma	Deviation Known
Water	05-08-87	Sr-89	39+/-3	41.0+/-5.0	-0.7
		Sr-90	20.7+/-1.5	20.0+/-1.5	0.8
Water	05-22-87	Alpha	9+/-2	11.0+/-5.0	-0.8
		Beta	9.3+/-1.8	7.0+/-5.0	0.8
Water	06-05-87	Cr-51	LT 45	41.0+/-5.0	
		Co-60	65+/-5	64.0+/-5.0	0.2
		Zn-65	9+/-5	10.0+/-5.0	-0.3
		Ru-106	66+/-5	75.0+/-5.0	-3.1
		Cs-134	35+/-5	40.0+/-5.0	-1.6
		Cs-137	77+/-5	80.0+/-5.0	-1.2
Water	06-12-87	H-3	3000+/-300	2895+/-357	0.4
Water	06-19-87	Ra-226	6.8+/-1.5	7.3+/-1.1	-0.8
		Ra-228	19+/-2	15.2+/-2.3	2.6
Milk	06-26-87	Sr-89	No data provided	69.0+/-5.0	
		Sr-90	37+/-3	35.0+/-1.5	2.7
		I-131	62+/-5	59.0+/-6.0	0.9
		Cs-137	77+/-5	74.0+/-5.0	1.0
		K	1680+/-190	1525+/-76	3.4
Water	07-24-87	Alpha	5.3+/-1.6	5.0+/-5.0	0.1
		Beta	5.0+/-1.2	5.0+/-5.0	0.0
Food	07-31-87	Sr-89	No data provided	20.0+/-5.0	
		Sr-90	No data provided	30.0+/-1.5	
		I-131	76+/-7	80.0+/-8.0	-0.7
		Cs-137	49+/-6	50.0+/-5.0	-0.2
		K	1820+/-150	1680+/-84	2.9
Water	08-07-87	I-131	44+/-11	48.0+/-6.0	-1.2
Water	08-21-87	U	14+/-6	13.0+/-6.0	0.2
Filter	08-28-87	Alpha	12.0+/-1.8	10.0+/-5.0	0.7
		Beta	30.0+/-1.5	30.0+/-1.5	0.0
		Sr-90	9.0+/-0.8	10.0+/-1.5	-1.2
		Cs-137	12+/-5	10.0+/-5.0	0.7
Water	09-11-87	Ra-226	9.8+/-1.5	9.7+/-1.5	0.2
		Ra-228	6.7+/-0.8	6.3+/-1.0	0.7

Table 6 (continued)

Sample Type	Date Collected	Analysis	Concentration in pCi/sample *a SLH result +/- 1 sigma	EPA result +/- 1 sigma	Deviation Known
Water	09-18-87	Alpha	4.0+/-1.8	4.0+/-5.0	-0.1
		Beta	13.0+/-1.3	12.0+/-5.0	0.4
Water	10-09-87	Cr-51	55+/-5	70.0+/-5.0	-5.1
		Co-60	15+/-4	15.0+/-5.0	-0.1
		Zn-65	41+/-5	46.0+/-5.0	-1.9
		Ru-106	48+/-6	61.0+/-5.0	-4.5
		Cs-134	26+/-4	25.0+/-5.0	0.4
		Cs-137	51+/-5	51.0+/-5.0	0.1
Water	10-16-87	H-3	4303+/-300	4492+/-449	-0.7
Water	10-21-87	alpha	32+/-3	28.0+/-7.0	1.0
		beta	73+/-5	72.0+/-5.0	0.5
		Ra-226	4.5+/-0.7	4.80+/-0.72	-0.7
		Ra-228	4.5+/-0.5	3.60+/-0.54	2.8
		U (nat)	4+/-5	3.0+/-6.0	0.4
		Sr-89	16+/-3	16.0+/-5.0	0.0
		Sr-90	9.7+/-1.5	10.0+/-1.5	-0.4
		Co-60	14+/-5	16.0+/-5.0	-0.7
		Cs-134	15+/-5	16.0+/-5.0	-0.5
		Cs-137	22+/-4	24.0+/-5.0	-0.8
Water	11-20-87	alpha	7+/-2	7.0+/-5.0	0.0
		beta	20+/-2	19.0+/-5.0	0.5
Water	12-04-87	I-131	26+/-4	26.0+/-6.0	0.0
Water	12-11-87	Ra-226	4.6+/-0.6	4.80+/-0.72	-0.6
		Ra-228	6.4+/-0.8	5.30+/-0.80	2.5

* a - pCi/sample refers to the following:

Sample	Units
water	pCi/liter
milk	pCi/liter except for K mg/liter
food	pCi/kg except for K mg/kg
filter	pCi/filter

Table 7. Air particulate gross beta and air iodine (I-131) results for January - June, 1987. Indicator site.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/M^3

WI - Section of Radiation Protection data

Meteorological Tower
0.12 miles S

Collection date	Air Particulate	Air Iodine
01/07/87	0.016+/-0.002	0.005+/-0.017
01/15/87	0.018+/-0.001	-0.016+/-0.03
01/23/87	0.011+/-0.001	-0.002+/-0.016
01/29/87	0.017+/-0.002	-0.001+/-0.03
02/04/87	0.017+/-0.002	-0.006+/-0.02
02/12/87	0.012+/-0.001	-0.001+/-0.02
02/18/87	0.013+/-0.001	-0.006+/-0.02
02/26/87	0.011+/-0.001	-0.001+/-0.016
03/04/87	0.010+/-0.001	0.002+/-0.019
03/12/87	0.016+/-0.001	-0.006+/-0.03
03/20/87	0.017+/-0.001	-0.007+/-0.019
03/26/87	0.006+/-0.001	0.019+/-0.04
04/01/87	0.010+/-0.001	-0.009+/-0.018
04/10/87	0.012+/-0.001	-0.013+/-0.03
04/16/87	0.014+/-0.002	-0.004+/-0.04
04/23/87	0.008+/-0.001	-0.003+/-0.03
04/30/87	0.011+/-0.001	-0.019+/-0.03
05/08/87	0.008+/-0.001	-0.004+/-0.018
05/13/87	0.017+/-0.002	0.004+/-0.03
* a		
05/29/87	0.008+/-0.001	-0.003+/-0.03
06/03/87	0.007+/-0.001	-0.001+/-0.02
06/11/87	0.013+/-0.001	-0.007+/-0.03
06/19/87	0.016+/-0.001	-0.010+/-0.02
06/26/87	0.016+/-0.002	0.016+/-0.03
07/02/87	0.009+/-0.001	0.010+/-0.04

Kewaunee data

Meteorological Tower
0.12 miles S

Collection date	Air Particulate	Air Iodine
01/06/87	0.028+/-0.004	<0.03
01/13/87	0.032+/-0.004	<0.03
01/20/87	0.028+/-0.004	<0.03
01/27/87	0.018+/-0.003	<0.03
02/03/87	0.033+/-0.004	<0.03
02/10/87	* b	* b
02/17/87	0.015+/-0.003	<0.03
02/24/87	0.019+/-0.003	<0.03
03/03/87	0.017+/-0.003	<0.03
03/10/87	0.023+/-0.003	<0.03
03/17/87	0.027+/-0.004	<0.03
03/24/87	0.022+/-0.003	<0.03
03/31/87	0.018+/-0.003	<0.03
04/07/87	0.020+/-0.003	<0.03
04/14/87	0.022+/-0.003	<0.03
04/21/87	0.011+/-0.003	<0.03
04/28/87	0.015+/-0.003	<0.03
05/05/87	0.020+/-0.003	<0.03
05/12/87	0.017+/-0.003	<0.03
05/19/87	0.018+/-0.003	<0.03
05/26/87	0.010+/-0.003	<0.03
06/02/87	0.019+/-0.004	<0.03
06/09/87	0.014+/-0.003	<0.03
06/16/87	0.019+/-0.003	<0.03
06/23/87	0.025+/-0.003	<0.03
06/30/87	0.019+/-0.003	<0.03

* a - Air sample was not taken during the period of 05/13/87 - 05/21/87 due to an inoperative air pump.
* b - No data, sample lost in shipment.

Table 8. Air particulate gross beta and air iodine (I-131) results for July - December, 1987. Indicator site.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/M^3

WI - Section of Radiation Protection data

Meteorological Tower
0.12 miles S

Collection date	Air Particulate	Air Iodine
07/08/87	0.014+/-0.001	-0.001+/-0.03
07/17/87	0.012+/-0.001	0.008+/-0.03
07/24/87	0.024+/-0.002	-0.009+/-0.03
07/29/87	0.009+/-0.002	-0.001+/-0.02
08/06/87	0.016+/-0.001	-0.004+/-0.02
08/12/87	0.011+/-0.002	0.004+/-0.02
08/21/87	0.014+/-0.001	-0.003+/-0.03
08/28/87	0.013+/-0.001	0.003+/-0.03
09/03/87	0.013+/-0.002	-0.004+/-0.03
09/11/87	0.017+/-0.001	0.008+/-0.02
[illegible]/18/87	0.014+/-0.001	-0.003+/-0.03
[illegible]/25/87	0.008+/-0.001	-0.02+/-0.03
10/02/87	0.018+/-0.002	0.00+/-0.02
10/07/87	0.008+/-0.001	-0.002+/-0.03
10/14/87	0.016+/-0.001	-0.001+/-0.02
10/20/87	0.022+/-0.002	-0.002+/-0.03
10/28/87	0.008+/-0.001	-0.002+/-0.03
11/04/87	0.020+/-0.002	-0.009+/-0.02
11/13/87	0.017+/-0.001	0.007+/-0.02
11/19/87	0.020+/-0.002	0.02+/-0.03
11/24/87	0.014+/-0.002	0.009+/-0.03
12/02/87	0.007+/-0.001	-0.001+/-0.02
12/11/87	0.012+/-0.001	-0.002+/-0.03
12/18/87	0.008+/-0.001	0.001+/-0.02
12/23/87	0.023+/-0.002	-0.001+/-0.02
12/30/87	0.020+/-0.002	0.007+/-0.04

Kewaunee data

Meteorological Tower
0.12 miles S

Collection date	Air Particulate	Air Iodine
07/07/87	0.009+/-0.003	<0.03
07/14/87	0.022+/-0.004	<0.03
07/21/87	0.025+/-0.004	<0.03
07/28/87	0.026+/-0.004	<0.03
08/04/87	0.024+/-0.004	<0.03
08/11/87	0.008+/-0.002	<0.03
08/18/87	0.018+/-0.003	<0.03
08/25/87	0.014+/-0.003	<0.03
09/01/87	0.023+/-0.003	<0.03
09/08/87	0.024+/-0.003	<0.03
09/15/87	0.018+/-0.003	<0.03
09/22/87	0.018+/-0.003	<0.03
09/29/87	0.019+/-0.004	<0.03
10/06/87	0.014+/-0.003	<0.03
10/13/87	0.016+/-0.002	<0.03
10/20/87	0.039+/-0.004	<0.03
10/27/87	0.012+/-0.003	<0.03
11/03/87	0.025+/-0.004	<0.03
11/10/87	0.024+/-0.004	<0.03
11/17/87	0.035+/-0.004	<0.03
11/24/87	0.023+/-0.003	<0.03
12/01/87	0.013+/-0.003	<0.03
12/08/87	0.020+/-0.003	<0.03
12/16/87	0.004+/-0.002	<0.03
12/22/87	0.028+/-0.004	<0.03
12/29/87	0.038+/-0.004	<0.03

Table 9. Air particulate gross beta and air iodine (I-131) results for January - June, 1987. Control site.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/M^3

WI - Section of Radiation Protection data

Green Bay Pumping Station - Rostok
11.5 miles NNE

Collection date	Air Particulate	Air Iodine
01/09/87	0.014+/-0.001	0.011+/-0.03
01/16/87	0.017+/-0.001	0.000+/-0.018
01/23/87	0.013+/-0.001	-0.005+/-0.017
01/30/87	0.012+/-0.001	0.005+/-0.018
02/06/87	0.014+/-0.001	-0.001+/-0.017
02/13/87	0.012+/-0.001	-0.001+/-0.02
02/19/87	0.013+/-0.001	-0.003+/-0.03
02/17/87	0.013+/-0.001	-0.002+/-0.018
03/06/87	0.010+/-0.001	0.004+/-0.03
03/13/87	0.017+/-0.001	-0.004+/-0.03
03/20/87	0.015+/-0.001	-0.008+/-0.03
03/27/87	0.007+/-0.001	0.006+/-0.018
04/03/87	0.009+/-0.001	-0.007+/-0.03
04/10/87	0.013+/-0.001	-0.008+/-0.03
04/17/87	0.012+/-0.001	-0.015+/-0.03
04/24/87	0.008+/-0.001	-0.003+/-0.03
05/01/87	0.010+/-0.001	-0.006+/-0.03
05/08/87	0.013+/-0.001	-0.003+/-0.03
05/15/87	0.011+/-0.001	-0.003+/-0.03
05/22/87	0.008+/-0.001	-0.005+/-0.03
05/29/87	0.006+/-0.001	0.000+/-0.019
06/05/87	* a	* a
06/12/87	0.014+/-0.001	0.000+/-0.03
06/19/87	0.015+/-0.001	0.03+/-0.03
07/02/87	0.012+/-0.001	-0.001+/-0.02

Kewaunee data

WPS building - Kewaunee
9.5 miles NNE

Collection date	Air Particulate	Air Iodine
01/06/87	0.025+/-0.004	<0.03
01/13/87	0.027+/-0.004	<0.03
01/20/87	0.027+/-0.004	<0.03
01/27/87	0.021+/-0.003	<0.03
02/03/87	0.034+/-0.004	<0.03
02/10/87	* b	<0.03
02/17/87	0.020+/-0.003	<0.03
02/24/87	0.015+/-0.003	<0.03
03/03/87	0.020+/-0.003	<0.03
03/10/87	<0.004	<0.03
03/17/87	<0.005	<0.03
03/24/87	0.015+/-0.003	<0.03
03/31/87	0.016+/-0.003	<0.03
04/07/87	0.020+/-0.003	<0.03
04/14/87	0.023+/-0.004	<0.03
04/21/87	0.017+/-0.004	<0.03
04/28/87	0.012+/-0.003	<0.03
05/05/87	0.023+/-0.003	<0.03
05/12/87	0.018+/-0.003	<0.03
05/19/87	0.015+/-0.003	<0.03
05/26/87	0.009+/-0.003	<0.03
06/02/87	0.017+/-0.004	<0.03
06/09/87	0.016+/-0.004	<0.03
06/16/87	0.022+/-0.003	<0.03
06/23/87	0.030+/-0.004	<0.03
06/30/87	0.020+/-0.003	<0.03

* a - Filter and cartridge were not enclosed in the envelope.
* b - No data; sample lost in shipment.

Table 10. Air particulate gross beta and air iodine (I-131) results for July - December, 1987. Control site.

SCONSIN DIVISION OF HEALTH
ECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/M^3

WI - Section of Radiation Protecti

Green Bay Pumping Station - Rostok
11.5 miles NNE

Collection date	Air Particulate	Air Iodine
07/09/87	0.013+/-0.001	0.000+/-0.03
07/17/87	0.009+/-0.001	0.007+/-0.02
07/31/87	0.013+/-0.001	-0.001+/-0.02
08/07/87	0.011+/-0.002	0.006+/-0.02
08/14/87	0.013+/-0.002	-0.003+/-0.04
08/21/87	0.012+/-0.002	0.006+/-0.04
08/28/87	0.013+/-0.002	-0.009+/-0.04
09/11/87	0.023+/-0.002	0.006+/-0.04
09/18/87	0.010+/-0.002	-0.012+/-0.003
09/25/87	0.007+/-0.001	0.004+/-0.03
/05/87	0.014+/-0.001	-0.003+/-0.02
10/09/87	0.005+/-0.002	0.017+/-0.05
10/19/87	0.017+/-0.001	-0.012+/-0.02
10/23/87	0.006+/-0.002	0.008+/-0.04
11/02/87	0.012+/-0.001	-0.001+/-0.02
11/09/87	0.045+/-0.002	-0.014+/-0.02
11/16/87	0.020+/-0.002	-0.002+/-0.012
11/20/87	0.011+/-0.002	0.004+/-0.03
11/30/87	0.010+/-0.001	0.001+/-0.010
12/04/87	0.009+/-0.002	-0.002+/-0.03
12/11/87	0.010+/-0.001	-0.006+/-0.03
12/18/87	0.007+/-0.001	-0.001+/-0.03
12/28/87	0.019+/-0.001	-0.012+/-0.02

Kewaunee data

WPS building - Kewaunee
9.5 miles NNE

Collection date	Air Particulate	Air Iodine
07/07/87	0.013+/-0.003	<0.03
07/14/87	0.019+/-0.003	<0.03
07/21/87	0.021+/-0.003	<0.03
07/28/87	0.022+/-0.004	<0.03
08/04/87	0.026+/-0.004	<0.03
08/11/87	0.008+/-0.002	<0.03
08/18/87	0.019+/-0.003	<0.03
08/25/87	0.014+/-0.003	<0.03
09/01/87	0.018+/-0.003	<0.03
09/08/87	0.026+/-0.003	<0.03
09/15/87	0.021+/-0.003	<0.03
09/22/87	0.013+/-0.003	<0.03
09/29/87	0.018+/-0.004	<0.03
10/06/87	0.025+/-0.004	<0.03
10/13/87	0.016+/-0.002	<0.03
10/20/87	0.036+/-0.004	<0.03
10/27/87	0.013+/-0.003	<0.03
11/03/87	0.023+/-0.004	<0.03
11/09/87	0.033+/-0.004	<0.03
11/16/87	0.018+/-0.003	<0.03
11/23/87	0.005+/-0.002	<0.03
12/01/87	0.005+/-0.002	<0.03
12/07/87	0.005+/-0.002	<0.03
12/14/87	0.004+/-0.002	<0.03
12/21/87	0.007+/-0.003	<0.03
12/26/87	0.014+/-0.003	<0.03

Table 11. Gamma isotopic results for January - December, 1987 from the quarterly composite of air particulate samples. Indicator site.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/M^3

WI - Section of Radiation Protection data

Meteorological Tower
0.12 miles S

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	0.087+/-0.011	0.113+/-0.013	0.080+/-0.011	0.074+/-0.014
Zr-95	0.000+/-0.002	0.000+/-0.002	0.000+/-0.002	0.000+/-0.002
Ru-103	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001
Ru-106	0.000+/-0.004	0.000+/-0.005	0.000+/-0.003	-0.003+/-0.006
I-131	0.000+/-0.03	-0.010+/-0.06	-0.002+/-0.03	-0.007+/-0.05
Cs-134	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001
Cs-137	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001
Ce-141	0.000+/-0.001	0.000+/-0.002	0.000+/-0.001	0.000+/-0.002
Ce-144	0.000+/-0.002	0.000+/-0.003	0.000+/-0.002	0.000+/-0.003

Isotopes other than those reported were not detected.

Kewaunee data

Meteorological Tower
0.12 miles S

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	0.071+/-0.014	0.081+/-0.027	0.067+/-0.014	0.052+/-0.012
Nb-95	<0.0019	<0.0023	<0.0029	<0.0020
Zr-95	<0.0028	<0.0036	<0.0038	<0.0030
Ru-103	<0.0015	<0.0025	<0.0020	<0.0016
Ru-106	<0.0079	<0.0117	<0.013	<0.0089
Cs-134	<0.0009	<0.0016	<0.0013	<0.0012
Cs-137	<0.0009	<0.0019	<0.0014	<0.0012
Ce-141	<0.0015	<0.0024	<0.0028	<0.0023
Ce-144	<0.0036	<0.0065	<0.0074	<0.0059

Table 12. Gamma isotopic results for January - December, 1987 from the quarterly composite of air particulate samples. Control site.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/M^3

WI - Section of Radiation Protection data

Green Bay Pumping Station - Rostok
11.5 miles NNE

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	0.084+/-0.011	0.081+/-0.011	0.078+/-0.012	0.067+/-0.013
Zr-95	-0.001+/-0.001	0.000+/-0.002	0.001+/-0.002	0.000+/-0.002
Ru-103	0.000+/-0.001	-0.001+/-0.001	0.000+/-0.001	0.000+/-0.001
Ru-106	0.000+/-0.004	-0.001+/-0.004	0.002+/-0.006	0.000+/-0.005
I-131	0.000+/-0.02	-0.001+/-0.03	-0.004+/-0.04	-0.002+/-0.05
Cs-134	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001
Cs-137	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001
Ce-141	0.000+/-0.001	0.000+/-0.001	0.000+/-0.002	0.000+/-0.002
Ce-144	0.000+/-0.002	0.000+/-0.002	0.000+/-0.003	0.000+/-0.003

Isotopes other than those reported were not detected.

Kewaunee data

WPS building - Kewaunee
9.5 miles NNE

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Be-7	0.066+/-0.024	0.081+/-0.016	0.073+/-0.022	0.075+/-0.02
Nb-95	<0.0019	<0.0009	<0.0022	<0.0032
Zr-95	<0.0028	<0.0021	<0.022	<0.0032
Ru-103	<0.0018	<0.0089	<0.0023	<0.0022
Ru-106	<0.013	<0.0087	<0.012	<0.013
Cs-134	<0.0014	<0.0007	<0.0014	<0.0013
Cs-137	<0.0018	<0.0010	<0.0012	<0.0016
Ce-141	<0.0033	<0.0021	<0.0028	<0.0024
Ce-144	<0.0079	<0.0055	<0.0067	<0.0054

Table 13. Analysis of surface water samples from January - June, 1987. Indicator site.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/liter
WI - Section of Radiation Protection data

Effluent channel
0.1 mile E

Collection Date	01/05/87	02/02/87	03/02/87	04/01/87	05/04/87	06/01/87
Gross Alpha-sol.	0.0+/-0.9	2.0+/-1.4	0.2+/-1.0	1.0+/-1.7	0.4+/-1.2	0.3+/-1.1
Gross Alpha-insol	-0.3+/-0.6	-0.2+/-0.6	0.7+/-0.8	-0.1+/-0.5	-0.1+/-0.5	0.9+/-0.8
Gross Beta-sol.	2.0+/-1.2	3.2+/-1.2	3.1+/-1.2	3.9+/-1.3	1.9+/-1.1	2.7+/-1.2
Gross Beta-insol.	0.3+/-0.9	0.8+/-1.0	3.0+/-1.2	1.6+/-1.0	1.2+/-1.0	0.8+/-1.0
H-3	350+/-310	640+/-310	28100+/-600	360+/-310	200+/-310	30+/-320
Sr-89	-0.7+/-0.4	-0.2+/-0.4	0.1+/-0.3	-0.9+/-0.4	0.2+/-0.4	0.3+/-0.4
Sr-90	0.4+/-0.4	0.9+/-0.4	0.6+/-0.3	1.4+/-0.4	0.4+/-0.4	0.6+/-0.4
I-131	1.8+/-2.0	-0.1+/-0.5	0.1+/-0.1	5.2+/-0.9	0.5+/-0.3	0.1+/-0.1
Gamma Isotopic						
Mn-54	-1+/-2	-5+/-7	-4+/-7	-4+/-8	2+/-6	-6+/-6
Fe-59	-5+/-5	-7+/-20	-2+/-16	-2+/-19	3+/-13	-1+/-12
Co-58	-2+/-2	1+/-9	-3+/-7	-3+/-9	-1+/-7	-4+/-6
Co-60	-2+/-2	-1+/-8	0+/-8	-3+/-8	-1+/-5	-2+/-6
Zn-65	1+/-4	0+/-17	-15+/-18	-1+/-19	3+/-12	0+/-13
Cs-134	-1+/-2	-2+/-7	1+/-7	-2+/-7	2+/-6	-3+/-6
Cs-137	-2+/-2	-5+/-9	-4+/-8	-3+/-9	-1+/-6	1+/-7
Zr-95	-2+/-6	-5+/-23	1+/-17	-8+/-21	-15+/-13	1+/-14
Ba,La-140	-15+/-13	-1+/-25	-3+/-8	-3+/-30	-2+/-13	-1+/-9

Isotopes other than those reported were not detected.

Kewaunee data

Effluent channel
0.1 mile E

Collection Date	01/05/87	02/02/87	03/02/87	04/01/87	05/04/87	06/01/87
Gross Alpha-sol.	NR	NR	NR	NR	NR	NR
Gross Alpha-insol	NR	NR	NR	NR	NR	NR
Gross Beta-sol.	1.6+/-0.5	2.0+/-0.4	2.2+/-0.5	2.3+/-0.4	1.8+/-0.6	2.7+/-0.6
Gross Beta-insol.	<0.6	<0.4	<0.6	<0.6	<0.5	<0.7
H-3			<330			<330
Sr-89			<1.3			<0.7
Sr-90			<1.1			0.7+/-0.3
I-131	NR	NR	NR	NR	NR	NR
Gamma Isotopic						
Mn-54	<15	<15	<15	<15	<15	<15
Fe-59	<30	<30	<30	<30	<30	<30
Co-58	<15	<15	<15	<15	<15	<15
Co-60	<15	<15	<15	<15	<15	<15
Cs-134	<10	<10	<10	<10	<10	<10
Cs-137	<10	<10	<10	<10	<10	<10
Zr-95	<15	<15	<15	<15	<15	<15
Ba,La-140	<15	<15	<15	<15	<15	<15

NR - Analysis is not required.

Table 14. Analysis of surface water samples from July - December, 1987. Indicator site.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/liter
WI - Section of Radiation Protection data

Effluent channel
0.1 mile W

Collection Date	07/01/87	08/03/87	09/01/87	* a	11/02/87	12/01/87
Gross Alpha-sol.	0.0+/-0.8	1.3+/-1.5	0.9+/-1.4		1.0+/-1.2	0.2+/-1.2
Gross Alpha-insol	-0.2+/-0.6	-0.5+/-0.6	-0.6+/-0.6		0.9+/-0.7	0.6+/-0.8
Gross Beta-sol.	2.8+/-1.1	2.7+/-1.2	2.1+/-1.2		3.6+/-1.2	3.3+/-1.2
Gross Beta-insol.	-0.5+/-0.9	0.5+/-0.9	0.0+/-0.8		2.2+/-1.0	0.3+/-0.9
H-3	11500+/-600	-20+/-330	-10+/-330		120+/-270	-150+/-280
Sr-89	2.0+/-0.4	-0.3+/-0.4	0.1+/-0.4		-0.3+/-0.3	0.3+/-0.5
Sr-90	0.0+/-0.4	0.8+/-0.4	0.3+/-0.4		0.7+/-0.3	0.8+/-0.4
I-131	0.4+/-0.4	-0.3+/-0.6	0.4+/-0.2		-0.1+/-0.2	0.1+/-0.2
Gamma Isotopic						
Mn-54	0+/-5	-1+/-6	-1+/-2		-2+/-5	-2+/-5
Fe-59	2+/-14	-4+/-12	0+/-3		-3+/-9	7+/-11
Co-58	3+/-7	-2+/-6	-1+/-2		-3+/-5	-1+/-5
Co-60	-1+/-5	0+/-5	-1+/-2		-1+/-6	-1+/-6
Zn-65	4+/-12	-1+/-11	-2+/-4		2+/-12	0+/-11
Cs-134	-1+/-6	-1+/-7	0+/-2		1+/-6	-2+/-7
Cs-137	2+/-6	1+/-6	1+/-2		-1+/-6	2+/-6
Zr-95	-16+/-14	-10+/-18	-1+/-4		-1+/-13	-3+/-13
[illegible],La-140	-4+/-20	-10+/-20	0+/-3		-2+/-7	-5+/-7

a - A surface water sample was not collected.
Isotopes other than those reported were not detected.

Kewaunee data

Effluent channel
0.1 mile E

Collection Date	07/01/87	08/03/87	09/01/87	10/05/87	11/02/87	12/01/87
Gross Alpha-sol.	NR	NR	NR	NR	NR	NR
Gross Alpha-insol	NR	NR	NR	NR	NR	NR
Gross Beta-sol.	2.1+/-0.4	2.8+/-0.4	2.0+/-0.4	2.4+/-0.4	3.4+/-0.5	3.0+/-0.5
Gross Beta-insol.	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
H-3			<330			<330
Sr-89			<0.4			<0.7
Sr-90			<0.5			<0.7
I-131	NR	NR	NR	NR	NR	NR
Gamma Isotopic						
Mn-54	<15	<15	<15	<15	<15	<15
Fe-59	<30	<30	<30	<30	<30	<30
Co-58	<15	<15	<15	<15	<15	<15
Co-60	<15	<15	<15	<15	<15	<15
Cs-134	<10	<10	<10	<10	<10	<10
Cs-137	<10	<10	<10	<10	<10	<10
[illegible]-95	<15	<15	<15	<15	<15	<15
[illegible],La-140	<15	<15	<15	<15	<15	<15

NR - Analysis is not required.

Table 15. Analysis of surface water samples from January - June, 1987. Control site.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/liter
WI - Section of Radiation Protection data

Green Bay Pumping Station - Rostok
11.5 miles NNE

Collection Date	01/01/87	02/02/87	03/02/87	04/06/87	* a	06/22/87
Gross Alpha-sol.	1.1+/-1.2	0.5+/-1.0	-0.2+/-0.9	0.7+/-1.1		0.6+/-1.2
Gross Alpha-insol	0.1+/-0.7	0.0+/-0.7	0.3+/-1.1	0.2+/-0.7		-0.1+/-0.6
Gross Beta-sol.	3.1+/-1.2	3.5+/-1.2	3.8+/-1.2	3.3+/-1.2		2.6+/-1.2
Gross Beta-insol.	0.4+/-1.2	0.4+/-0.9	-0.3+/-1.4	0.3+/-0.9		0.5+/-1.0
H-3	-5+/-300	210+/-310	540+/-310	360+/-320		-400+/-500
Sr-89	-0.8+/-0.5	-0.2+/-0.4	-0.4+/-0.4	0.1+/-0.4		0.4+/-0.4
Sr-90	1.3+/-0.5	0.5+/-0.4	0.8+/-0.4	0.4+/-0.4		0.7+/-0.4
I-131	0.4+/-0.2	0.0+/-0.2	0.4+/-0.2	0.2+/-0.1		0.2+/-0.2
Gamma Isotopic						
Mn-54	-1+/-5	1+/-6	-1+/-5	0+/-5		0+/-4
Fe-59	-1+/-12	1+/-10	-8+/-8	-3+/-9		-2+/-8
Co-58	2+/-6	0+/-5	3+/-7	-1+/-5		-1+/-4
Co-60	0+/-6	2+/-6	-1+/-6	0+/-5		0+/-4
Zn-65	1+/-11	-1+/-11	-3+/-13	5+/-12		-1+/-8
Cs-134	2+/-7	0+/-6	3+/-6	1+/-6		0+/-4
Cs-137	-1+/-7	-1+/-6	0+/-6	2+/-6		-1+/-4
Zr-95	-6+/-15	-10+/-15	1+/-14	-2+/-13		-3+/-11
La-140	-3+/-7	-1+/-8	-5+/-8	-2+/-6		0+/-7

*a - A sample was not collected.
Isotopes other than those reported were not detected.

Kewaunee data

Green Bay Pumping Station - Rostok
11.5 miles NNE

Collection Date	01/05/87	02/02/87	03/02/87	04/01/87	05/04/87	06/01/87
Gross Alpha-sol.	NR	NR	NR	NR	NR	NR
Gross Alpha-insol	NR	NR	NR	NR	NR	NR
Gross Beta-sol.	2.9+/-0.4	1.9+/-0.5	2.1+/-0.5	1.9+/-0.4	2.3+/-0.6	2.2+/-0.7
Gross Beta-insol.	<0.6	<0.4	<0.5	<0.6	<0.5	<0.7
H-3 * a			<330			<330
Sr-89 * a			<1.6			<0.7
Sr-90 * a			<0.9			0.6+/-0.4
I-131	NR	NR	NR	NR	NR	NR
Gamma Isotopic						
Mn-54	<15	<15	<15	<15	<15	<15
Fe-59	<30	<30	<30	<30	<30	<30
Co-58	<15	<15	<15	<15	<15	<15
Co-60	<15	<15	<15	<15	<15	<15
Cs-134	<15	<15	<15	<15	<15	<15
Cs-137	<10	<10	<10	<10	<10	<10
Zr-95	<15	<15	<15	<15	<15	<15
La-140	<15	<15	<15	<15	<15	<15

NR - Analysis is not required.
* a - Analysis is performed on a quarterly composite.

Table 16. Analysis of surface water samples from July - December, 1987. Control site.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/liter
WI - Section of Radiation Protection data

Green Bay Pumping
11.5 miles NNE

Collection Date	07/06/87	08/03/87	09/04/87	10/01/87	11/02/87	12/02/87
Gross Alpha-sol.	0.5+/-1.3	-0.4+/-1.3	0.7+/-1.5	1.3+/-1.3	-0.1+/-1.2	1.1+/-1.2
Gross Alpha-insol	-0.2+/-0.6	-0.1+/-0.8	-0.3+/-0.7	0.4+/-0.7	0.1+/-0.6	0.7+/-0.8
Gross Beta-sol.	2.9+/-1.2	2.3+/-1.2	2.1+/-1.2	4.0+/-1.2	2.7+/-1.2	3.2+/-1.2
Gross Beta-insol.	0.2+/-1.0	2.1+/-1.0	0.2+/-0.8	1.1+/-0.9	0.6+/-0.9	1.5+/-1.0
H-3	-20+/-500	780+/-580	140+/-330	130+/-240	190+/-270	50+/-280
Sr-89	0.4+/-0.4	0.4+/-0.4	-0.1+/-0.4	-0.5+/-0.3	0.0+/-0.3	-0.5+/-0.4
Sr-90	0.2+/-0.3	0.3+/-0.4	0.8+/-0.4	0.9+/-0.3	0.4+/-0.3	0.3+/-0.4
I-131	0.1+/-0.1	0.0+/-0.2	0.05+/-0.2	0.2+/-0.2	0.3+/-0.2	-0.1+/-0.2
Gamma Isotopic						
Mn-54	-3+/-5	-3+/-5	-1+/-5	-5+/-6	-2+/-5	0+/-4
Fe-59	-3+/-9	-1+/-10	4+/-11	-3+/-16	-2+/-10	-2+/-8
Co-58	-1+/-5	-1+/-5	-2+/-5	-2+/-7	-2+/-5	-2+/-3
Co-60	1+/-5	-3+/-5	0+/-6	0+/-8	0+/-6	0+/-4
Zn-65	2+/-11	5+/-12	3+/-12	0+/-16	-3+/-11	-2+/-8
Cs-134	0+/-6	-1+/-6	3+/-6	1+/-8	0+/-6	-1+/-4
Cs-137	1+/-6	3+/-6	-3+/-6	1+/-9	-1+/-6	0+/-4
Zr-95	-8+/-12	5+/-14	5+/-14	3+/-17	2+/-14	-3+/-10
Ba,La-140	-1+/-7	0+/-7	-1+/-9	4+/-9	-1+/-8	-1+/-5

Isotopes other than those reported were not detected.

Kewaunee data

Green Bay Pumping
11.5 miles NNE

Collection Date	07/01/87	08/03/87	09/01/87	10/05/87	11/02/87	12/07/87
Gross Alpha-sol.	NR	NR	NR	NR	NR	NR
Gross Alpha-insol	HR	NR	NR	NR	NR	NR
Gross Beta-sol.	2.1+/-0.4	2.8+/-0.5	2.2+/-0.4	2.9+/-0.5	3.0+/-0.5	3.8+/-0.5
Gross Beta-insol.	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
H-3 * a			<330			<330
Sr-89 * a			<0.5			<0.6
Sr-90 * a			<0.6			<0.6
I-131	NR	NR	NR	NR	NR	NR
Gamma Isotopic						
Mn-54	<15	<15	<15	<15	<15	<15
Fe-59	<30	<30	<30	<30	<30	<30
Co-58	<15	<15	<15	<15	<15	<15
Co-60	<15	<15	<15	<15	<15	<15
Cs-134	<15	<15	<15	<15	<15	<15
Cs-137	<10	<10	<10	<10	<10	<10
Zr-95	<15	<15	<15	<15	<15	<15
Ba,La-140	<15	<15	<15	<15	<15	<15

R - Analysis is not required.
* a - Analysis is performed on a quarterly composite.

Table 17. Analysis of fish samples for 1987.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/kg (wet)

WI - Section of Radiation Protection

Collection Date	03/11/87	06/10/87	10/01/87	10/01/87	10/01/87
Type	lake trout	trout	trout	trout	trout
Location	Point Beach	Point Beach	Point Beach	Point Beach	Point Beach
Gamma Isotopic					
K-40	2600+/-500	2500+/-400	3200+/-500	3400+/-500	2100+/-400
Mn-54	10+/-20	8+/-14	-2+/-20	13+/-17	-7+/-20
Fe-59	30+/-50	5+/-40	80+/-90	70+/-60	60+/-90
Co-58	4+/-30	-1+/-20	20+/-30	15+/-20	40+/-30
Co-60	-1+/-30	3+/-20	-5+/-30	4+/-20	4+/-30
Zn-65	40+/-60	20+/-40	50+/-60	-1+/-60	40+/-50
Cs-134	0+/-20	11+/-16	16+/-20	20+/-20	6+/-20
Cs-137	130+/-30	120+/-30	130+/-30	130+/-30	110+/-30

Isotopes other than those reported were not detected.

Kewaunee data

Collection date	04/16/87	04/18/87	09/01/87	10/28/87
Type	burbot	coho	trout	salmon
Location	Kewaunee	Kewaunee	Kewaunee	Kewaunee
Gamma Isotopic				
Mn-54	<9	<6	<13	<6.8
Fe-49	<32	<20	<88	<54
Co-58	<11	<7	<23	<14
Co-60	<10	<6	<11	<5.9
Cs-134	<8	9+/-4	<10	<5,3
Cs-137	155+/-13	112+/-9	100+/-10	59+/-5

Table 18. Analysis of shoreline sediments for 1987.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/kg (dry)

WI - Section of Radiation Protection data

Collection Date	11/02/87	11/02/87	11/02/87	11/02/87
Type	shoreline sed.	shoreline sed.	shoreline sed.	shoreline sed.
Location	500' N	Discharge	500' S	GBPS
	K-1c	K-1d	K-1j	K-9
Analysis				
Gross beta (dry)	11000+/-4000	3000+/-3000	4000+/-4000	10000+/-4000
Gross alpha (dry)	800+/-5000	-1800+/-4000	100+/-5000	-500+/-5000
Gamma Isotopic				
Co-58	-1+/-30	30+/-30	20+/-30	0+/-20
Co-60	40+/-30	40+/-20	40+/-20	8+/-20
Cs-134	18+/-20	3+/-20	7+/-18	4+/-18
Cs-137	90+/-20	50+/-20	60+/-20	16+/-20
K-40	8100+/-600	4400+/-400	4300+/-400	7800+/-400
Ra-226 * a	350+/-30	150+/-20	160+/-20	160+/-20
Pb-214 * a	350+/-50	120+/-40	110+/-40	140+/-30
Bi-214 * a	310+/-50	130+/-50	140+/-40	160+/-30
Tl-208 * a	290+/-80	160+/-60	120+/-50	130+/-40
Ac-228 * a	360+/-100	80+/-70	130+/-70	160+/-60

*a - Naturally occurring radioisotopes Ac-228 and Tl-208 are from the Thorium-232 decay series. Ra-226, Pb-214, and Bi-214 are from the Uranium-238 decay series.

Isotopes other than those reported were not detected.

Kewaunee data

Collection Date	11/02/87	11/02/87	11/02/87	11/02/87
Type	shoreline sed.	shoreline sed.	shoreline sed.	sboreline sed.
Location	500' N	Discharge	500' S	GBPS
	K-1c	K-1d	K-1j	K-9
Analysis				
Gross beta (dry)	7400+/-2600	3000+/-2400	3600+/-1600	8800+/-2600
Gross alpha (dry)	NR	NR	NR	NR
Gamma Isotopic				
Co-58	<15	<10	<8	<8
Co-60	<19	<13	<34	<10
Cs-134	<19	<11	<5	<10
Cs-137	43+/-11	34+/-6	44+/-7	12+/-5
K-40	7340+/-370	3630+/-190	3620+/-140	6090+/-160

NR - Analysis not required.

Table 19. Analysis of milk samples for January - December, 1987. Stangel farm.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/liter

Stangel farm
3.0 miles N

WI - Section of Radiation Protection data

Collection date	01/07/87	02/04/87	03/04/87	04/01/87	05/21/87	06/03/87
Isotope:						
I-131	0.2+/-0.1	-0.2+/-0.1	0.0+/-0.1	-0.3+/-0.1	-0.8+/-0.2	-0.1+/-0.1
La-140	-2+/-8	-2+/-7	-19+/-30	-2+/-6	-5+/-7	-4+/-5
Cs-134	7+/-8	1+/-7	1+/-10	3+/-6	0+/-6	6+/-7
Cs-137	13+/-8	-1+/-8	1+/-12	4+/-8	6+/-6	4+/-9
K-40	1270+/-180	1340+/-190	1500+/-200	1460+/-190	1600+/-160	1480+/-190
Sr-90	3.3+/-0.7	1.8+/-0.5	1.7+/-0.5	3.1+/-0.9	1.5+/-0.6	2.0+/-0.6

Collection date	07/08/87	08/12/87	09/02/87	10/07/87	11/04/87	12/02/87
Isotope:						
I-131	-0.1+/-0.1	-0.06+/-0.2	-0.3+/-0.2	-0.1+/-0.2	0.2+/-0.2	-0.2+/-0.2
La-140	0+/-6	-2+/-7	-1+/-7	6+/-9	0+/-6	-1+/-7
Cs-134	8+/-7	2+/-6	6+/-9	7+/-7	7+/-8	1+/-8
Cs-137	-1+/-8	7+/-7	8+/-9	7+/-7	6+/-8	4+/-7
K-40	1410+/-190	1500+/-190	1300+/-200	1330+/-180	1500+/-200	1340+/-180
Sr-90	1.5+/-0.6	2.0+/-0.6	1.4+/-0.5	2.0+/-0.8	2.3+/-0.7	1.3+/-0.9

Kewaunee data

Stangel farm
3.0 miles N

Collection date	01/06/87	02/03/87	03/03/87	04/02/87	05/19/87	06/02/87
Isotope:						
I-131	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
La-140	<15	<15	<15	<15	<15	<15
Cs-134	<10	<10	<10	<10	<10	<10
Cs-137	<10	<10	<10	<10	<10	<10
K-40	1230+/-160	1340+/-140	1410+/-140	1320+/-160	1260+/-140	1150+/-160
Sr-89	<0.7	<0.8	<0.7	<0.6	<0.5	<0.6
Sr-90	1.7+/-0.4	2.0+/-0.6	1.9+/-1.4	1.4+/-0.6	1.3+/-0.4	2.3+/-0.6

Collection date	07/02/87	08/18/87	09/02/87	10/06/87	11/03/87	12/02/87
Isotope:						
I-131	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
La-140	<15	<15	<15	<15	<15	<15
Cs-134	<10	<10	<10	<10	<10	<10
Cs-137	<10	<10	<10	<10	<10	<10
K-40	1390+/-140	1340+/-160	1340+/-150	1410+/-140	1300+/-140	1470+/-170
Sr-89	<0.3	0.4+/-0.3	0.8+/-0.7	0.8+/-0.7	<0.8	<0.5
Sr-90	1.2+/-0.3	1.6+/-0.2	1.0+/-0.4	1.2+/-0.4	1.4+/-0.4	1.1+/-0.4

Table 20. Analysis of food product samples for 1987.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Kewaunee
1987

Measurements in units of pCi/kilogram (wet)

WI - Section of Radiation Protection data

Collection Date	09/02/87	09/02/87	09/02/87	09/02/87
Type	tomatoes	corn	potatoes	cabbage
Location	Bertler's K-26 10.7 miles SSW	Bertler's K-26 10.7 miles SSW	Bertler's K-26 10.7 miles SSW	Jansky K-17 4.25 miles W
Analysis				
Gross beta (wet)	1800+/-200	2500+/-900	3500+/-800	3000+/-400
Gross alpha (wet)	100+/-200	-100+/-1100	900+/-1100	-200+/-300
Gamma Isotopic				
Be-7	100+/-100	170+/-190	1+/-150	150+/-160
K-40	1700+/-300	2400+/-500	4300+/-600	2700+/-500
Co-58	7+/-12	-1+/-20	-2+/-17	-3+/-17
Co-60	2+/-13	-3+/-30	4+/-20	40+/-30
Zr-95	30+/-30	20+/-50	-20+/-50	40+/-50
I-131	1+/-12	-4+/-30	-1+/-19	12+/-20
Cs-134	19+/-13	13+/-20	40+/-30	30+/-20
Cs-137	-2+/-14	20+/-30	17+/-20	8+/-20

Isotopes other than those reported were not detected.

Kewaunee data

Collection Date	09/02/87	09/02/87	09/02/87	09/02/87
Type	tomatoes	corn	potatoes	cabbage
Location	Bertler's K-26 10.7 miles SSW	Bertler's K-26 10.7 miles SSW	Bertler's K-26 10.7 miles SSW	Jansky K-17 4.25 miles W
Analysis				
Gross beta (wet)	1830+/-60	2630+/-80	3060+/-90	1150+/-40
Gross alpha (wet)	NR	NR	NR	NR
Gamma Isotopic				
Be-7	<65	<140	<55	<68
K-40	2290+/-150	1250+/-200	3390+/-140	1950+/-170
Co-58	NR	NR	NR	NR
Co-60	NR	NR	NR	NR
Zr-95	<14	<35	<13	<14
I-131	NR	NR	NR	NR
Cs-134	NR	NR	NR	NR
Cs-137	<7	<17	<7	<9
Ru-103	<8	<16	<7	<8
Ru-106	<67	<130	<61	<70
Ce-141	<14	<17	<12	<14
Ce-144	<56	<68	<48	<61

NR - Analysis is not required.