S T A T E O F W I S C O N S I N

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Kewaunee Environmental Radioactivity Survey

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State of Wisconsin

1980

Kewaunee Environmental Radioactivity Survey

INTRODUCTION

This report is prepared under U. S. Nuclear Regulatory Commission Contract NRC-05-80-275 by the State of Wisconsin, Department of Health and Social Services, Section of Radiation Protection. This report covers the calendar year 1980. Results of environmental radioactivity monitoring are listed in tabular form. The data presented consists of duplicative sample analysis such as air and TLD data and split 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 are also given.

SAMPLING TECHNIQUES

Direct Radiation - Thermoluminescent Dosimeters (TLD's)

Continuous monitoring of direct radiation is performed quarterly using thermoluminescent dosimeters. The dosimeters are placed at five locations in the area of the Kewaunee nuclear power facility.

Air Samples

Continuous air samples are collected weekly from two stations. Air particulate samples are collected on 47 mm. plastic filters. Air iodine samples are collected using charcoal absorbers mounted in tandem with the air particulate filters. The sampling rate is one cubic foot of air per minute.

Liquid Effluent

A split sample consisting of 3.5 liters of liquid effluent is collected quarterly 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.

Milk

A raw milk sample is collected quarterly from the Stangel farm located 3.5 miles northeast of the Kewaunee nuclear power facility.

Fish

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

Algae

Algae growing on rocks which are a part of the boat launching ramp at Two Creeks Park is harvested periodically for determination of gross beta activity.

Vegetation

Vegetation in the form of grass is collected from several locations in the area of Point Beach and Kewaunee.

ANALYTICAL PROCEDURES

The procedures given are abstracted to present only the basic steps.

Air Particulate Samples - Beta Gamma

Place the 47 mm. plastic filter on a 2 inch stainless steel planchet. Beta count in a Widebeta I external gas flow proportional counter. Calculate activity correcting for counter efficiency.

Air Particulate Samples - Gamma

Place all of the 47 mm. plastic filters for a month on the 4" x 4" NaI crystal detector. Determine the gamma spectrum using 256 channels of an ND130A 512 channel gamma spectrometer set at 0.01 MeV per channel. Calculate activity correcting for counter efficiency.

Rain Water - Beta Gamma

Evaporate a 500 ml. aliquot on a weighed 2 inch stainless steel planchet. Beta count in a Widebeta I external gas flow proportional counter. Calculate activity correcting for counter efficiency.

Lake Water - Alpha, Beta Gamma

Filter 500 ml. aliquot of sample. Evaporate filtrate in a 2 inch stainless steel planchet. Beta and alpha count in a Widebeta I external gas flow proportional counter. Place filter paper in a 2 inch stainless steel planchet and dry at 103°C. Beta and alpha count in a Widebeta I external gas flow proportional counter. Calculate activity correcting for counter efficiency.

Lake Water - Cesium 137

Place 3.5 liter sample in Marinelli beaker on 4" x 4" NaI crystal detector. Count for 100 minutes on ND130A gamma spectrometer using 256 channels set at 0.01 MeV per channel. Calculate activity correcting for counter efficiency.

Vegetation - Alpha, Beta and Gamma Isotopic

Dry sample in [illegible], grind, weigh into stainless steel planchet. Beta and alpha count in a Widebeta I external gas flow proportional counter. Calculate activity correcting for self-absorption and counter efficiency.

Prepare a similar sample of 6 grams and place into a 4½ oz. graduated plastic container. Count for 100 minutes on a GeLi detector. Determine the gamma spectrum using 4096 channel gamma spectrometer set at 0.5 Kev per channel. Calculate the activity correcting for counter efficiency.

Milk - Cesium 137, Iodine 131 Gamma Scan

Procedure same as for Lake Water - Cesium 137.

Milk - Iodine 131 - Chemical Extraction

A stabile 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 I_2 by hydroxylamine hydrochloride, the iodine is extracted into CCl4, reduced with bisulfite, and back extracted into water. The iodine is precipitated as palladous iodide with the chemical yield determined gravimetrically and counted in a Widebeta I counter correcting for counter efficiency and decay.

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 and precipitated as yttrium oxalate, filtered and weighed to determine yield and beta counted in a Widebeta I counter correcting for counter efficiency and decay.

Fish - Beta Gamma, Gamma Isotopic

Whole fish are put through a meat grinder and the ground fish well mixed. A representative fish sample of five grams is weighed into a stainless steel planchet. The sample is dried at 110°C and then ashed by slowly bringing the temperature to 550-600°C. Beta count in a Widebeta I external gas flow proportional counter. Calculate activity correcting for counter efficiency.

A 50 gram sample is ashed in a similar manner. Place the sample on a GeLi detector and count for 100 minutes. Determine the gamma spectrum using 4096 channels of the 4096 channel gamma spectrometer set at 0.5 Kev per channel. Calculate the activity correcting for counter efficiency.

Algae - Beta Gamma

Five to seven grams of wet algae are weighed into a two inch stainless steel planchet. The sample is dried at 110°C and ashed at 550-600°C. Beta count in a Widebeta I external gas flow proportional counter. Calculate activity correcting for counter efficiency.

Direct Radiation

Thermoluminescent dosimeters are supplied under a subcontract by the Eberline Corporation, Santa Fe. New Mexico. The dosimeters are read by Eberline and the data is reported to the State Radiation Protection Section.

CONCLUSIONS

A slight increase in beta activity for air particulate filters was noted during November and December. The increased levels were two or three times the normal levels. Analysis for air radioiodine and gamma isotopic analysis for composite air particulate filters did not detect any increase in activity levels over previous years' data. The increased level for beta activity was also noticed at other monitoring stations in the state and the increased levels are probably attributable to radioactive fallout resulting from an atmospheric nuclear weapons test conducted by the Chinese on October 16, 1980.

No unusual activities were detected in the other environmental samples such as milk, surface water and fish. The activity levels for these environmental samples were consistent with previous years' data.

Necessary Wisconsin data that is missing is due to problems associated with the laboratory that the State of Wisconsin contracted with for the analysis of the environmental samples. The contracting laboratory did not perform the required analyses due to difficulty in obtaining qualified personnel and has experienced difficulty with timely reporting of the required analyses causing this report to be late.

Missing data from 1979 has not been received from the contracting laboratory and much of the data is lost due to the aging of samples which contained isotopes of very short half lives, i.e., Iodine 131. Milk analysis for Iodine 131 during 1980 has not been reported to the required lower limit of detection since the chemical procedure was not performed on the samples.

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QUARTERLY RADIATION DOSE MEASUREMENTS IN THE VICINITY OF

KEWAUNEE NUCLEAR POWER PLANT FROM TLD READINGS (mrem)

Location	1st Quarter 1/1/80-3/31/80		2nd Quarter 4/1/80-6/30/80		3rd Quarter 7/1/80-9/30/80		4th Quarter 10/1/80-12/31/80	
	Wisconsin	Kewaunee	Wisconsin	Kewaunee	Wisconsin	Kewaunee	Wisconsin	Kewaunee
2566-11 K-1 Meteorological Tower	21.6 ± 3.9	16.5 ± 0.6	10.4 ± 1.1	15.2 ± 0.5	13.2 ± 3.0	16.4 ± 0.5	21.5 ± 2.1	15.0 ± 0.6
2566-12 K-4 Stangel Farm	23.7 ± 4.2	17.8 ± 0.5	11.0 ± 1.9	17.1 ± 0.6	15.5 ± 7.7	17.9 ± 1.1	20.2 ± 2.1	17.0 ± 0.3
2566-13 K-5 Paplham Farm	23.3 ± 5.6	17.1 ± 0.5	10.9 ± 2.3	17.9 ± 0.5	17.8 ± 9.3	17.7 ± 0.2	22.8 ± 5.1	17.8 ± 0.5
2566-14 K-8 St. Mary's Church	26.9 ± 4.1	22.3 ± 0.5	11.3 ± 1.9	20.0 ± 0.5	17.6 ± 7.4	21.5 ± 0.6	26.9 ± 4.4	20.7 ± 1.7
2566-15 Control K-16	22.7 ± 4.4	20.7 ± 0.5	10.6 ± 2.7	19.1 ± 0.5	15.1 ± 3.8	20.6 ± 0.6	19.2 ± 2.9	18.8 ± 0.9

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

January, February, March, 1980

Kewaunee

AIR PARTICULATES - GROSS BETA (pCi/M^3)

Date	Meteorological Tower (on-site)		Reference Station	
	Wisconsin	Kewaunee	Wisconsin (NNE 11.7 mi)	Kewaunee (K-16, Green Bay, NW 27 mi)
January				
1st wk.	0.011 ± 0.007	0.007 ± 0.001	0.018 ± 0.001	0.007 ± 0.001
2nd wk.	0.022 ± 0.003	0.009 ± 0.002		0.156 ± 0.012(a)
3rd wk.	0.028 ± 0.002	0.009 ± 0.002	0.018 ± 0.002	0.007 ± 0.001
4th wk.	Pump malfunction	0.008 ± 0.001	0.015 ± 0.002	0.011 ± 0.001
February				
1st wk.	0.013 ± 0.002	0.009 ± 0.001	0.020 ± 0.003	< .001 (b)
2nd wk.	0.017 ± 0.002	0.005 ± 0.001	0.011 ± 0.002	0.010 ± 0.002
3rd wk.	0.022 ± 0.003	0.012 ± 0.001	0.000 ± 0.001	0.015 ± 0.007
4th wk.	0.025 ± 0.003	0.011 ± 0.002	0.026 ± 0.003	0.015 ± 0.001
March				
1st wk.	0.017 ± 0.002	0.009 ± 0.001	0.019 ± 0.003	0.015 ± 0.001
2nd wk.	0.019 ± 0.002	0.009 ± 0.002	0.023 ± 0.003	0.009 ± 0.001
3rd wk.	0.017 ± 0.003	0.007 ± 0.001	0.018 ± 0.002	0.013 ± 0.002
4th wk.	0.015 ± 0.002	0.005 ± 0.001	0.018 ± 0.002	0.011 ± 0.001
5th wk.	0.016 ± 0.002	0.005 ± 0.001	0.013 ± 0.002	0.010 ± 0.002

(a) Elevated activity are to low volume.

(b) No air particulate matter on filter paper.

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

April, May, June, 1980

Kewaunee

AIR PARTICULATES - GROSS BETA (pCi/M^3)

Date	Meteorological Tower (on-site)		Reference Station	
	Wisconsin	Kewaunee	Wisconsin (NNE 11.7 mi)	Kewaunee (K-16, Green Bay, NW 27 mi)
April				
1st wk.	0.014 ± 0.002	0.006 ± 0.001	0.015 ± 0.002	0.010 ± 0.002
2nd wk.	0.011 ± 0.002	0.003 ± 0.001	0.009 ± 0.002	0.005 ± 0.001
3rd wk.	0.016 ± 0.002	0.005 ± 0.001	0.015 ± 0.002	0.014 ± 0.002
4th wk.	0.009 ± 0.002	0.006 ± 0.001	0.008 ± 0.002	0.007 ± 0.001
May				
1st wk.	0.013 ± 0.003	0.008 ± 0.001	0.010 ± 0.001	0.013 ± 0.002
2nd wk.	0.006 ± 0.002	0.002 ± 0.001		0.004 ± 0.001
3rd wk.	0.014 ± 0.002	0.003 ± 0.001	0.007 ± 0.002	0.007 ± 0.001
4th wk.	0.019 ± 0.003	0.004 ± 0.001	0.017 ± 0.002	0.016 ± 0.001
5th wk.			0.012 ± 0.002	
June				
1st wk.	0.006 ± 0.002	0.002 ± 0.001	0.006 ± 0.002	0.008 ± 0.001
2nd wk.	0.017 ± 0.003	0.002 ± 0.001	0.032 ± 0.003	0.002 ± 0.001
3rd wk.	0.013 ± 0.002	0.006 ± 0.002	0.017 ± 0.002	0.015 ± 0.002
4th wk.	0.172 ± 0.009	0.006 ± 0.001	0.015 ± 0.002	0.008 ± 0.001
5th wk.	0.010 ± 0.002	0.007 ± 0.002		0.011 ± 0.002

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

July, August, September, 1980

Kewaunee

AIR PARTICULATES - GROSS BETA (pCi/M^3)

Date	Meteorological Tower (on-site)		Reference Station	
	Wisconsin	Kewaunee	Wisconsin (NNE 11.7 mi)	Kewaunee (K-16, Green Bay, NW 27 mi)
July				
1st wk.	0.013 ± 0.002	0.005 ± 0.001	0.011 ± 0.002	0.009 ± 0.001
2nd wk.	0.017 ± 0.002	0.007 ± 0.001	0.013 ± 0.003	0.014 ± 0.002
3rd wk.	0.030 ± 0.004	0.003 ± 0.001	0.040 ± 0.003	0.002 ± 0.001
4th wk.	0.027 ± 0.003	< .002	0.052 ± 0.004	0.009 ± 0.001
August				
1st wk.	0.038 ± 0.004	0.004 ± 0.001	0.014 ± 0.001	0.012 ± 0.001
2nd wk.	0.006 ± 0.002	0.003 ± 0.001		0.008 ± 0.001
3rd wk.	0.005 ± 0.002	0.003 ± 0.001	0.031 ± 0.003	0.003 ± 0.001
4th wk.	0.042 ± 0.004	< 0.002	0.011 ± 0.002	0.008 ± 0.001
5th wk.	0.014 ± 0.002			
September				
1st wk.	0.049 ± 0.004	0.006 ± 0.001	0.012 ± 0.001	0.007 ± 0.001
2nd wk.	0.022 ± 0.003	0.009 ± 0.001		0.011 ± 0.001
3rd wk.	0.014 ± 0.003	0.004 ± 0.001	0.017 ± 0.003	0.007 ± 0.001
4th wk.	0.033 ± 0.003	0.004 ± 0.001	0.024 ± 0.003	0.040 ± 0.007
5th wk.		0.001 ± 0.001		0.008 ± 0.001

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

October, November, December, 1980

Kewaunee

AIR PARTICULATES - GROSS BETA (pCi/M^3)

Date	Meteorological Tower (on-site)		Reference Station	
	Wisconsin	Kewaunee	Wisconsin (NNE 11.7 mi)	Kewaunee (K-16, Green Bay, NW 27 mi)
October				
1st wk.	0.015 ± 0.003	0.005 ± 0.001	0.062 ± 0.005	0.013 ± 0.001
2nd wk.	0.011 ± 0.002	0.046 ± 0.008	0.015 ± 0.003	0.007 ± 0.001
3rd wk.	0.014 ± 0.002	0.004 ± 0.001	0.013 ± 0.003	0.009 ± 0.001
4th wk.	0.023 ± 0.004	0.004 ± 0.001	0.012 ± 0.003	0.004 ± 0.001
November				
1st wk.	0.033 ± 0.003	0.009 ± 0.002	0.125 ± 0.007	0.016 ± 0.002
2nd wk.	0.242 ± 0.010	0.014 ± 0.002	0.085 ± 0.006	0.020 ± 0.002
3rd wk.	0.051 ± 0.005	0.010 ± 0.002	0.050 ± 0.005	0.017 ± 0.001
4th wk.	0.054 ± 0.004	0.016 ± 0.002		0.021 ± 0.003
December				
1st wk.	0.064 ± 0.005	0.017 ± 0.001	0.040 ± 0.002	0.024 ± 0.002
2nd wk.	0.071 ± 0.005	0.011 ± 0.001	0.140 ± 0.007	0.020 ± 0.001
3rd wk.	0.056 ± 0.005	0.022 ± 0.002	0.112 ± 0.007	0.033 ± 0.002
4th wk.	0.059 ± 0.006	0.016 ± 0.001	0.059 ± 0.003	0.029 ± 0.002
5th wk.	0.092 ± 0.006	0.027 ± 0.002		0.031 ± 0.002

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

January, February, March, 1980

Kewaunee

AIR IODINE - I-131 pCi/M^3

Date	Meteorological Tower (on-site)		Green Bay Pumping Station	
	Wisconsin	Kewaunee	Wisconsin (NNE 11.7 mi)	Kewaunee (K-2)
January				
1st wk.	-0.003 ± 0.2		0.006 ± 0.003	
2nd wk.	-0.009 ± 0.009	< 0.01		< 0.01
3rd wk.	-0.060 ± 0.01		0.012 ± 0.004	
4th wk.	Pump malfunction	< 0.01	-0.001 ± 0.001	< 0.01
February				
1st wk.	0.021 ± 0.03		0.004 ± 0.03	
2nd wk.	-0.020 ± 0.03	< 0.01	-0.005 ± 0.03	< 0.01
3rd wk.	-0.002 ± 0.04		-0.002 ± 0.03	
4th wk.	-0.003 ± 0.03	< 0.01	-0.005 ± 0.03	< 0.01
March				
1st wk.	0.012 ± 0.02		0.017 ± 0.03	
2nd wk.	0.012 ± 0.03	< 0.01	0.027 ± 0.03	< 0.01
3rd wk.	0.003 ± 0.03		-0.006 ± 0.03	
4th wk.	-0.004 ± 0.03	< 0.01	0.015 ± 0.03	< 0.01
5th wk.	0.000 ± 0.02		0.006 ± 0.03	

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

April, May, June, 1980

Kewaunee

AIR IODINE - I-131 pCi/M^3

Date	Meteorological Tower (on-site)		Green Bay Pumping Station	
	Wisconsin	Kewaunee	Wisconsin (NNE 11.7 mi)	Kewaunee (K-2)
April				
1st wk.	0.002 ± 0.2	< 0.01	-0.013 ± 0.019	< 0.01
2nd wk.	-0.005 ± 0.02		-0.009 ± 0.019	
3rd wk.	0.001 ± 0.02	< 0.01	0.001 ± 0.018	< 0.01
4th wk.	-0.06 ± 0.03		0.005 ± 0.018	
May				
1st wk.	-0.003 ± 0.03	< 0.01	0.002 ± 0.012	< 0.01
2nd wk.	-0.002 ± 0.017		-0.018 ± 0.018	
3rd wk.	0.009 ± 0.02	< 0.01	0.010 ± 0.02	< 0.01
4th wk.	0.003 ± 0.018		-0.001 ± 0.018	
June				
1st wk.	0.014 ± 0.03	< 0.01	-0.009 ± 0.017	< 0.01
2nd wk.	0.018 ± 0.02		0.011 ± 0.017	
3rd wk.	0.016 ± 0.02	< 0.01	0.026 ± 0.017	< 0.01
4th wk.	0.018 ± 0.02		0.012 ± 0.019	
5th wk.	0.045 ± 0.03	< 0.01		< 0.01

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

July, August, September, 1980

Kewaunee

AIR IODINE - I-131 pCi/M^3

Date	Meteorological Tower (on-site)		Green Bay Pumping Station	
	Wisconsin	Kewaunee	Wisconsin (NNE 11.7 mi)	Kewaunee (K-2)
July				
1st wk.	0.001 ± 0.02		-0.001 ± 0.017	
2nd wk.	-0.015 ± 0.02	< 0.01	0.015 ± 0.03	< 0.01
3rd wk.	-0.022 ± 0.02		0.000 ± 0.017	
4th wk.	0.008 ± 0.017	< 0.01	0.004 ± 0.015	< 0.01
August				
1st wk.	-0.007 ± 0.018		-0.001 ± 0.10	
2nd wk.	0.008 ± 0.02	< 0.01		< 0.01
3rd wk.	0.004 ± 0.03		0.000 ± 0.016	
4th wk.	0.006 ± 0.C	< 0.01	0.004 ± 0.019	< 0.01
5th wk.	0.002 ± 0.02			
September				
1st wk.	0.012 ± 0.03		-0.008 ± 0.014	
2nd wk.	-0.005 ± 0.02	< 0.01		< 0.01
3rd wk.	-0.019 ± 0.02		0.002 ± 0.02	
4th wk.	0.010 ± 0.017	< 0.01	0.008 ± 0.02	< 0.01

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

October, November, December, 1980

Kewaunee

AIR IODINE - I-131 pCi/M^3

Date	Meteorological Tower (on-site)		Green Bay Pumping Station	
	Wisconsin	Kewaunee	Wisconsin (NNE 11.7 mi)	Kewaunee (K-2)
October				
1st wk.	0.003 ± 0.02	< 0.01	-0.002 ± 0.03	< 0.01
2nd wk.	0.002 ± 0.018		-0.004 ± 0.02	
3rd wk.	0.008 ± 0.03	< 0.01	0.019 ± 0.02	< 0.01
4th wk.	0.005 ± 0.03		0.012 ± 0.02	
November				
1st wk.	0.009 ± 0.02	< 0.01	-0.003 ± 0.02	< 0.02
2nd wk.	0.012 ± 0.02		-0.007 ± 0.02	
3rd wk.	0.016 ± 0.02	< 0.01	0.007 ± 0.02	< 0.01
4th wk.	0.024 ± 0.03		0.000 ± 0.013	
5th wk.	0.001 ± 0.017			
December				
1st wk.	-0.001 ± 0.018	< 0.01	0.000 ± 0.02	< 0.01
2nd wk.	0.016 ± 0.03		0.018 ± 0.02	
3rd wk.	0.011 ± 0.04	< 0.01	-0.001 ± 0.014	< 0.01
4th wk.	-0.003 ± 0.02			
5th wk.		< 0.01		< 0.01

AIR PARTICULATLS

Monthly Composite Gamma Analysis (Measurements in Units of pCi/M^3)

Kewaunee (Wisconsin Data)

Location	^{144}Ce	^{137}Cs	^{95}Zr-^{95}Nb	^{7}Be	^{106}Ru
January, 1980					
Meteorological Tower Kewaunee (#18)	(-0.010) ± 0.03	(-0.006) ± 0.006	(-0.007) ± 0.007	0.08 ± 0.08	0.03
Green Bay Pumping Station (15.9 mi NNE) (#17)	0.011 ± 0.015	0.001 ± 0.003	(-0.001) ± 0.004	0.06 ± 0.04	0.018 ± 0.014
February, 1980					
Meteorological Tower Kewaunee (#18)	0.006 ± 0.017	(-0.001) ± 0.003	(-0.002) ± 0.007	0.08 ± 0.08	0.007 ± 0.015
Green Bay Pumping Station (15.9 mi NNE) (#17)	(-0.013) ± 0.017	(-0.001) ± 0.003	(-0.002) ± 0.007	0.07 ± 0.08	0.014 ± 0.016
March, 1980					
Meteorological Tower Kewaunee (#18)	(-0.010) ± 0.017	0.000 ± 0.003	(-0.004) ± 0.007	0.06 ± 0.09	0.010 ± 0.015
Green Bay Pumping Station (15.9 mi NNE) (#17)	(-0.003) ± 0.014	0.000 ± 0.002	(-0.002) ± 0.006	0.04 ± 0.08	0.007 ± 0.013

AIR PARTICULATES

Monthly Composite Gamma Analysis (Measurements in Units of pCi/M^3)

Kewaunee (Wisconsin Data)

Location	^{144}Ce	^{137}Cs	^{95}Zr-^{95}Nb	^{7}Be	^{106}Ru
April, 1980					
Meteorological Tower Kewaunee (#18)	(-0.016) ± 0.013	(-0.002) ± 0.003	(-0.003) ± 0.003	(-0.12) ± 0.04	0.008 ± 0.012
Green Bay Pumping Station (15.9 mi NNE) (#17)	(-0.017) ± 0.015	0.000 ± 0.003	(-0.002) ± 0.004	0.04 ± 0.04	0.013 ± 0.014
May, 1980					
Meteorological Tower Kewaunee (#18)	(-0.006) ± 0.011	0.000 ± 0.002	(-0.003) ± 0.002	0.06 ± 0.03	0.023 ± 0.011
Green Bay Pumping Station (15.9 mi NNE) (#17)	0.000 ± 0.014	(-0.001 ± 0.003	(-0.002) ± 0.003	0.08 ± 0.04	0.028 ± 0.013
June, 1980					
Meteorological Tower Kewaunee (#18)	0.005 ± 0.016	0.002 ± 0.003	0.001 ± 0.004	0.07 ± 0.04	0.021 ± 0.015
Green Bay Pumping Station (15.9 mi NNE) (#17)	0.011 ± 0.012	0.001 ± 0.002	0.000 ± 0.003	0.09 ± 0.03	0.028 ± 0.011

AIR PARTICULATES

Monthly Composite Gamma Analysis (Measurements in Units of pCi/M^3)

Kewaunee (Wisconsin Data)

Location	^{144}Ce	^{137}Cs	^{95}Zr-^{95}Nb	^{7}Be	^{106}Ru
July, 1980					
Meteorological Tower Kewaunee (#18)	(-0.003) ± 0.013	0.001 ± 0.003	(-0.001) ± 0.003	0.05 ± 0.03	0.019 ± 0.012
Green Bay Pumping Station (15.9 mi NNE) (#17)	0.013 ± 0.016	0.001 ± 0.003	0.001 ± 0.004	0.08 ± 0.04	0.026 ± 0.015
August, 1980					
Meteorological Tower Kewaunee (#18)	0.020 ± 0.017	0.000 ± 0.003	(-0.001) ± 0.004	0.10 ± 0.04	0.034 ± 0.016
Green Bay Pumping Station (15.9 mi NNE) (#17)	0.002 ± 0.014	0.002 ± 0.003	(-0.002) ± 0.003	0.07 ± 0.04	0.021 ± 0.013
September, 1980					
Meteorological Tower Kewaunee (#18)	0.010 ± 0.015	0.002 ± 0.003	(-0.002) ± 0.003	0.08 ± 0.04	0.018 ± 0.014
Green Bay Pumping Station (15.9 mi NNE) (#17)	0.009 ± 0.012	0.001 ± 0.002	0.001 ± 0.003	0.04 ± 0.03	0.011 ± 0.011

AIR PARTICULATES

Monthly Composite Gamma Analysis (Measurements in Units of pCi/M^3)

Kewaunee (Wisconsin Data)

Location	^{144}Ce	^{137}Cs	^{95}Zr-^{95}Nb	^{7}Be	^{106}Ru
October, 1980					
Meteorological Tower Kewaunee (#18)	(-0.001) ± 0.011	0.001 ± 0.002	0.001 ± 0.003	0.06 ± 0.03	0.016 ± 0.010
Green Bay Pumping Station (15.9 mi NNE) (#17)	(-0.001) ± 0.014	0.000 ± 0.003	0.000 ± 0.003	0.07 ± 0.04	0.016 ± 0.013
November, 1980					
Meteorological Tower Kewaunee (#18)	0.010 ± 0.014	0.002 ± 0.003	0.004 ± 0.003	0.106 ± 0.04	0.035 ± 0.013
Green Bay Pumping Station (15.9 mi NNE) (#17)	0.008 ± 0.02	0.003 ± 0.004	0.005 ± 0.008	0.12 ± 0.06	0.031 ± 0.019
December, 1980					
Meteorological Tower Kewaunee (#18)	0.021 ± 0.012	0.003 ± 0.002	0.010 ± 0.003	0.11 ± 0.03	0.039 ± 0.011
Green Bay Pumping Station (15.9 mi NNE) (#17)	0.012 ± 0.013	0.002 ± 0.002	0.008 ± 0.003	0.09 ± 0.04	0.028 ± 0.012

AIR PARTICULATES

Monthly Composite Gamma Analysis (Measurements in Units of pCi/M^3)

Kewaunee (Kewaunee Data)

Location	^{144}Ce	^{137}Cs	^{95}Zr-^{95}Nb	^{7}Be	^{106}Ru
1st Quarter Composites March, 1980					
Meteorological Tower Kewaunee (K-1f)	< 0.0031	< 0.0006	< 0.0018	0.042 ± 0.010	< 0.0044
Green Bay Pumping Station (K-2)	< 0.0026	< 0.0004	< 0.0017	0.046 ± 0.010	< 0.0034
2nd Quarter Composites June, 1980					
Meteorological Tower Kewaunee (K-1f)	< 0.0027	< 0.0005	< 0.0024	0.040 ± 0.010	< 0.0048
Green Bay Pumping Station (K-2)	< 0.0035	< 0.0007	< 0.0025	0.048 ± 0.013	< 0.0060
3rd Quarter Composites September, 1980					
Meteorological Tower Kewaunee (K-1f)	< 0.0024	< 0.0005	< 0.0023	< 0.016	< 0.0038
Green Bay Pumping Station (K-2)	< 0.0033	< 0.0006	< 0.0030	< 0.014	< 0.0051
4th Quarter Composites December, 1980					
Meteorological Tower Kewaunee (K-1f)	< 0.0061	< 0.0006	< 0.0054	< 0.025	< 0.0011
Green Bay Pumping Station (K-2)	< 0.0053	< 0.0016	< 0.0094	< 0.027	< 0.0086

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

Kewaunee

Effluent Sample

1st Quarter - collected 3/27/80

Analyzed for	Results µCi/mℓ	
	Wisconsin	Kewaunee
Gross Beta	$(2 \pm 3) \times 10^{-9}$	$(3.1 \pm 0.5) \times 10^{-9}$
Tritium		$(230 \pm 90) \times 10^{-9}$
Sr-89		$< 0.6 \times 10^{-9}$
Sr-90		$< 0.8 \times 10^{-9}$
Gamma Isotopic		
Co-58		$< 2.6 \times 10^{-9}$
Co-60		$< 2.9 \times 10^{-9}$
I-131		$< 30 \times 10^{-9}$
Cs-137		$< 1.9 \times 10^{-9}$
Cs-134		$< 2.1 \times 10^{-9}$

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

Kewaunee

Effluent Sample

2nd Quarter - collected 6/25/80

Analyzed for	Results µCi/ml	
	Wisconsin	Kewaunee
Gross Beta	$(2.9 \pm 1.0) \times 10^{-9}$	$(2.1 \pm 0.4) \times 10^{-9}$
Tritium		$(300 \pm 140) \times 10^{-9}$
Sr-89	< 0	$< 1.9 \times 10^{-9}$
Sr-90	$(0.7 \pm 0.5) \times 10^{-9}$	$< 1.3 \times 10^{-9}$
Gamma Isotopic		
Co-53	$(-1.6 \pm 4) \times 10^{-9}$	$< 2.2 \times 10^{-9}$
Co-60	$(1.2 \pm 4) \times 10^{-9}$	$< 1.9 \times 10^{-9}$
I-131	$(-0.5 \pm 5) \times 10^{-9}$	
Cs-137	$(1.2 \pm 5) \times 10^{-9}$	$< 1.8 \times 10^{-9}$
Cs-134	$(-1.6 \pm 4) \times 10^{-9}$	$< 2.1 \times 10^{-9}$

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

Kewaunee

Effluent Sample

3rd Quarter - collected 9/24/80

Analyzed for	Results µCi/mℓ	
	Wisconsin	Kewaunee
Gross Beta		$(3.4 \pm 0.6) \times 10^{-9}$
Tritium		$(210 \pm 110) \times 10^{-9}$
Sr-89	< 0	$< 2.3 \times 10^{-9}$
Sr-90	$(1.2 \pm 0.5) \times 10^{-9}$	$(2.2 \pm 0.9) \times 10^{-9}$
Gamma Isotopic		
Co-58	$(-2.5 \pm 4) \times 10^{-9}$	$< 4.4 \times 10^{-9}$
Co-60	$(-3.1 \pm 4) \times 10^{-9}$	$< 1.7 \times 10^{-9}$
I-131	$(-3.1 \pm 5) \times 10^{-9}$	
Cs-137	$(-1.5 \pm 5) \times 10^{-9}$	$< 1.6 \times 10^{-9}$
Cs-134	$(-2.5 \pm 4) \times 10^{-9}$	$< 1.6 \times 10^{-9}$

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

Kewaunee

Effluent Sample

4th Quarter - collected 10/29/80

Analyzed for	Results µCi/mℓ	
	Wisconsin	Kewaunee
Gross Beta		
Tritium		
Sr-89	< 0	
Sr-90	$(0.9 \pm 0.5) \times 10^{-9}$	
Gamma Isotopic		
Co-58	-0.4×10^{-9}	
Co-60	-0.5×10^{-9}	
I-131	$(2 \pm 5) \times 10^{-9}$	
Cs-137	-1.5×10^{-9}	
Cs-134	-0.4×10^{-9}	

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

Kewaunee

Effluent Sample

4th Quarter - collected 12/4/80

Analyzed for		Results µCi/mℓ	
		Wisconsin	Kewaunee
Gross Beta	Soluble	$(2.6 \pm 1.3) \times 10^{-9}$	
	Insoluble	$(1.4 \pm 1.1) \times 10^{-9}$	$(2.8 \pm 0.5) \times 10^{-9}$
Tritium			$(180 \pm 80) \times 10^{-9}$
Sr-89		< 0	$< 1.1 \times 10^{-9}$
Sr-90		$(1.0 \pm 0.4) \times 10^{-9}$	$< 0.6 \times 10^{-9}$
Gamma Isotopic			
Co-58		$(-0.2 \pm 4) \times 10^{-9}$	$< 3.2 \times 10^{-9}$
Co-60		$(-1.8 \pm 4) \times 10^{-9}$	$< 1.8 \times 10^{-9}$
I-131		$(-4.7 \pm 13) \times 10^{-9}$	
Cs-137		$(-0.6 \pm 5) \times 10^{-9}$	$< 1.5 \times 10^{-9}$
Cs-134		$(-0.2 \pm 4) \times 10^{-9}$	$< 1.7 \times 10^{-9}$

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

Kewaunee - 1980

Wisconsin Results

MILK - pCi/liter

Date Collected	Sample Identification	Sr-89	Sr-90	I-131*	Cs-137*	K-40*
2/20/80	Stangel Farm		2.5	(-2.3)	(-4.6)	1320 ± 70
5/29/80	" "			1.3	(-2.6)	1310 ± 70
8/26/80	" "		5.6	4.4	(-2.6)	1300 ± 70
11/19/80	Stangel Farm		2.8	2.0	(-2.3)	1210 ± 70

*Data from gamma spectroscopy.

Kewaunee Results

Date Collected	Sample Identification	Sr-89	Sr-90	I-131	Cs-137	K-40
August Composite	Stangel Farm (K-4)	< 1.3	1.5 ± 4	< 0.5	< 3.7	1350 ± 80

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

Kewaunee

Fish - pCi/gram (wet) Wisconsin Data - 1980

Date Sample	7/1/80 Lake Trout	9/9/80 Brown Trout
Isotope		
Co-58	$(0.019 \pm 0.04) \times 10^{-6}$	$(0.003 \pm 0.006) \times 10^{-6}$
Co-60	$(-0.02 \pm 0.05) \times 10^{-6}$	$(0.004 \pm 0.006) \times 10^{-6}$
I-131		
Cs-134	$(-0.006 \pm 0.05) \times 10^{-6}$	$(0.002 \pm 0.005) \times 10^{-6}$
Cs-137	$(0.072 \pm 0.010) \times 10^{-6}$	$(0.104 \pm 0.012) \times 10^{-6}$

Date Sample	12/80 Brown Trout	12/80 Brown Trout
Isotope		
Co-58	$(0.016 \pm 0.016) \times 10^{-6}$	$(-0.004 \pm 0.014) \times 10^{-6}$
Co-60	$(-0.004 \pm 0.008) \times 10^{-6}$	$(-0.001 \pm 0.009) \times 10^{-6}$
I-131		
Cs-134	$(0.004 \pm 0.008) \times 10^{-6}$	$(0.003 \pm 0.008) \times 10^{-6}$
Cs-137	$(0.093 \pm 0.017) \times 10^{-6}$	$(0.117 \pm 0.018) \times 10^{-6}$

RESULTS OF THE ANALYSES OF OFF-SITE SAMPLES

Kewaunee

Fish - pCi/gram (wet) Kewaunee Data - 1980

Date Sample	1st Quarter	2nd Quarter Trout (Flesh)	2nd Quarter Trout (Bones)
Isotope			
Co-58	NA	$< 0.01 \times 10^{-6}$	NA
Co-60	NA	$< 0.008 \times 10^{-6}$	NA
I-131	NA	< 1.6 x 10-6	NA
Cs-134	NA	$< 0.006 \times 10^{-6}$	NA
Cs-137	NA	$(0.17 \pm 0.2) \times 10^{-6}$	NA
Sr-89	NA	NA	$< 0.10 \times 10^{-6}$
Sr-90	NA	NA	$(0.02 \pm 0.01) \times 10^{-6}$
Gross Beta	NA	$(3.0 \pm 0.1) \times 10^{-6}$	$(2.2 \pm 0.6) \times 10^{-6}$

Date Sample	3rd Quarter Trout (Flesh)	3rd Quarter Trout (Bones)	4th Quarter Trout (Flesh)	4th Quarter Trout (Bones)
Isotope				
Co-58	$< 0.01 \times 10^{-6}$	NA	$< 0.05 \times 10^{-6}$	NA
Co-60	$< 0.01 \times 10^{-6}$	NA	$< 0.02 \times 10^{-6}$	NA
I-131	$< 0.05 \times 10^{-6}$	NA	---	NA
Cs-134	$< 0.01 \times 10^{-6}$	NA	$< 0.02 \times 10^{-6}$	NA
Cs-137	$(0.05 \pm 0.01) \times 10^{-6}$	NA	$(0.17 \pm 0.03) \times 10^{-6}$	NA
Sr-89	NA	$< 0.08 \times 10^{-6}$	NA	$< 0.010 \times 10^{-6}$
Sr-90	NA	$(0.45 \pm 0.10) \times 10^{-6}$	NA	$(0.61 \pm 0.05) \times 10^{-6}$
Gross Beta	$(2.0 \pm 0.1) \times 10^{-6}$	$(3.3 \pm 1.0) \times 10^{-6}$	$(3.3 \pm 0.1) \times 10^{-6}$	$(2.9 \pm 0.5) \times 10^{-6}$

NA: Not analyzed, analysis not required.

VEGETATION

Gamma Isotopic and Gross Beta Activity

(Activities in pCi/gm Dry Weight)

Location	Date	Type	Kewaunee - 1980 ^{137}Ce	Kewaunee Data ^{40}K	^{95}Zr-^{95}Nb	^{144}Ce	^{7}Be	Gross Beta
Stangel Farm (K-4)	10-01-80	Grass	< 0.16	43 ± 5	< 0.42	< 1.5	< 1.4	41.0 ± 1.5