

STATE OF WISCONSIN

1983 - 1984

Zion Environmental Radioactivity Survey



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Division of Health
Bureau of Environmental Health
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INTRODUCTION

This environmental monitoring report is for the Zion nuclear generating plant. The report is for the calendar years January, 1983 - December, 1984. Results of environmental radioactivity monitoring are listed in tabular form following the references.

Samples of surface air, precipitation, surface water, soil, milk, well water and vegetation were collected from selected locations at planned sampling intervals. A description of the sampling sites and sampling intervals is included in the following report.

PROGRAM MODIFICATIONS

The collection of air particulate matter and air iodine was initiated at ZI-1 in August, 1983.

Air station, ZI-3, for the collection of air particulate matter and air iodine was moved from the Pleasant Prairie Safety Building to the Pleasant Prairie School and air collection was initiated in January, 1984. Collection of soil and vegetation samples for site ZI-3 were also moved to the Pleasant Prairie School. Milk sampling was initiated at the John Steinbrink farm, ZI-9, in March, 1984.

SAMPLING TECHNIQUES

Air Samples

Continuous air samples are collected weekly from five sampling stations. Air particulate samples are collected on 47 mm. glass fiber filters. Air iodine samples are collected on impregnated charcoal cartridges. The nominal sampling rate is 1 - 2.5 cubic feet of air per minute.

Precipitation

Individual samples of precipitation are collected semi-monthly in which rainfall over 0.10 inch occurs. The samples are collected at the same stations as the air samples. A five gallon polyethylene container with a 0.16 square meter collection head is used to obtain the precipitation samples.

Surface Water - Lake Michigan

A surface water sample is collected quarterly from the Kenosha water intake. The sample is a grab sample and is collected at a point in intake prior to purification or other treatment.

Soil

Soil samples are collected semi-annually at six locations. Random three inch plugs on soil are collected and combined at each sampling station.

Vegetation

Samples of vegetation are collected semi-annually at the same six stations where soil samples are collected.

Milk

A one gallon sample of milk is collected each month as a grab sample from the Steinbrink farm, ZI-9.

Well water

Well water samples are collected semi-annually at two locations. The samples are collected prior to purification or other treatment.

ANALYTICAL PROCEDURES

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

Place the monthly composite on a GeLi detector and collect the gamma spectrum. Scan the gamma 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.

Surface Water - Gamma Isotopic

A 3.5 liter sample is placed in a Marinelli beaker and analyzed on a GeLi detector. Scan the gamma 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 - Iodine 131 Chemical Extraction

A stable iodine carrier is added to a 2 liter surface water sample. 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 correcting for counter efficiency and for decay.

Vegetation - Alpha, Beta and Gamma Isotopic

Dry sample at 110 degrees Celsius, grind, weigh into 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 GeLi detector. Scan the gamma 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 is the same as for Surface Water.

Milk - Iodine 131 Chemical Extraction

Procedure is the 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 correcting for counter efficiency and for decay.

Surface Water - Strontium 89 & 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 coprecipitation with barium as a chromate. The ingrowing yttrium is separated from the parent strontium through the use of hydroxide scavenging. Then 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.

Precipitation - Beta Gamma

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

Well Water - Alpha, Beta Gamma

Evaporate an aliquot containing not more than 100 mg. of dried solids in a two inch stainless steel planchet. Beta and alpha count in an external gas flow proportional counter. Calculate activity correcting for self-absorption and counter efficiency.

Soil - Alpha, Beta and Gamma Isotopic

Dry sample, grind, sieve and weigh 0.1 gram into a 2 inch stainless steel planchet. Beta and alpha count in an external gas flow proportional counter. Calculate alpha and beta activities correcting for self-absorption and counter efficiency.

The sample is dried, sieved and packed to the 500 ml mark of a 500 ml Marinelli beaker. The sample is then weighed and counted on a GeLi detector. Scan the gamma 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.

QUALITY ASSURANCE

The analysis of the samples is performed under subcontract with the State Laboratory of Hygiene (SLH). SLH maintains their own quality assurance program.

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 and has performed satisfactorily over the report period. The quality assurance program 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. EPA Cross Check results can be reviewed at the State Laboratory of Hygiene or at the Section of Radiation Protection.

SENSITIVITIES AND ERROR - WISCONSIN DATA

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 concentrations 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.

The MDC for each radioisotope has been calculated from the following equation and is listed in Table 1:

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

Where:

MDC is the "a priori" lower limit of detection as defined above, as pCi/g or pCi/ml 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,

λ 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 a 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 is then possible as well as a better evaluation of distributions and trends in the environmental data. 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 (+/-).

Table 1 - Minimum Detectable Concentration (MDC)

Wisconsin Division of Health
Section of Radiation Protection

	Air Particulate Composite (pCi/M ³)	Air Particulate (pCi/M ³)	Air Iodine (pCi/M ³)	Milk (pCi/liter)
Gross beta		0.003		
Be-7	0.080			
K-40				180
Sr-90				1.5
Zr-95	0.006			
Ru-103	0.006			
Ru-106	0.030			
I-131			0.046	0.4
Cs-134	0.006			12
Cs-137	0.006			12
Ba, La-140				15
Ce-141	0.015			
Co-144	0.030			

	Surface Water (pCi/liter)	Precipitation (nCi/M ²) (wet)	Soil Sediment (pCi/kg) (dry)	Vegetation (pCi/kg) (wet)
Gross beta	1.5	0.03	5200	2300
Gross alpha	2.5	0.05	7300	3200
H-3	700	14		
Sr-89	5			
Sr-90	1.5			
Be-7				1100
K-40			1100	2100
Mn-54	10			
Fe-59	22			
Zn-65	20			
Co-58	15		100	140
Co-60	13		130	150
Zr-95	15			250
I-131	15			140
Cs-134	14		110	120
Cs-137	14		100	130
Tl-208			300	
Bi-214			200	
Pb-214			180	
Ra-226			1900	
Ac-228			320	

Well water has the same MDC's as surface water for gross beta, gross alpha and tritium.

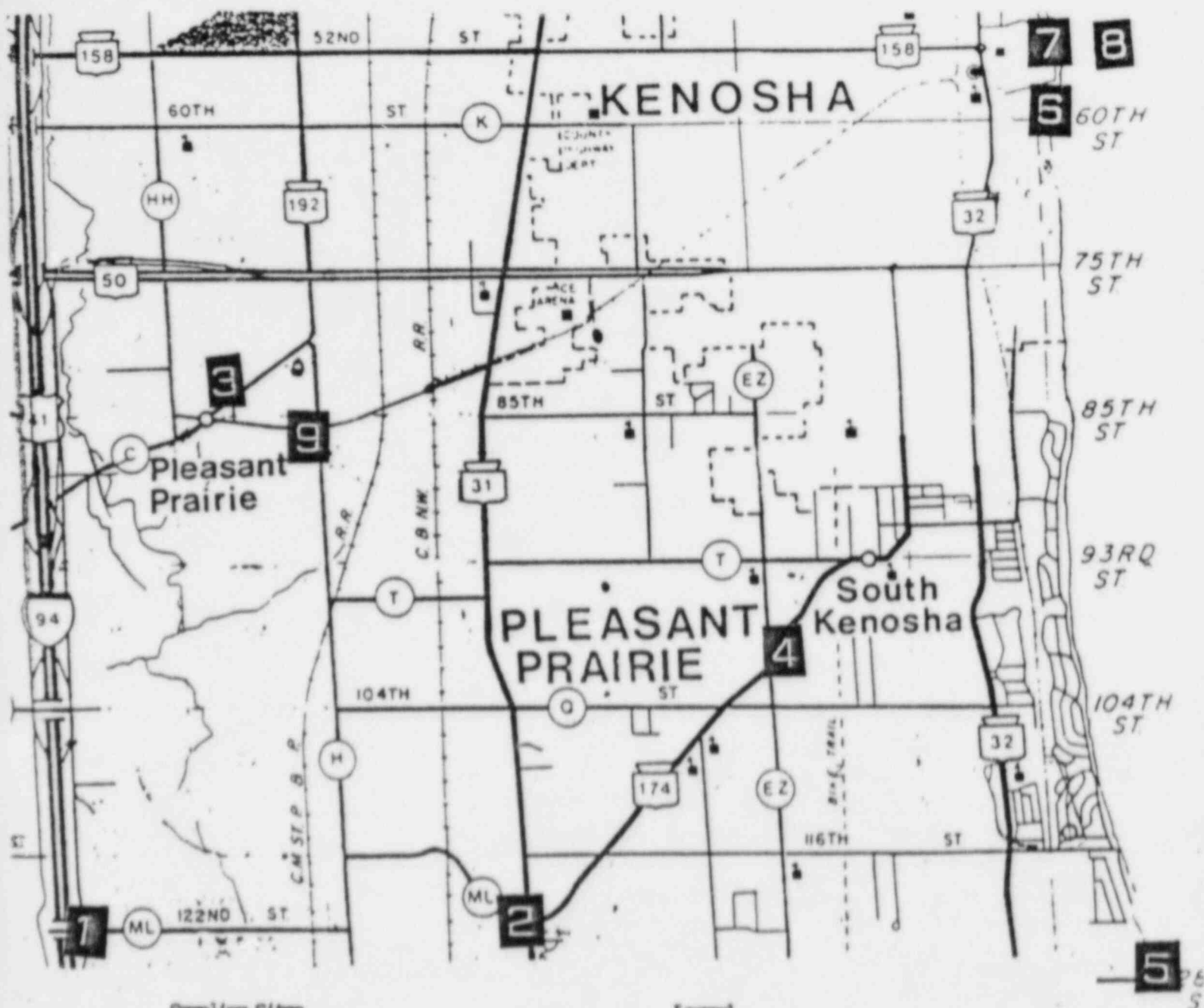
ZION ENVIRONMENTAL MONITORING SAMPLING SITES

The sampling sites are indicated in Table 2. The table lists for each site a description of each site and its direction and distance from the monitored power plant. A map showing the actual location for each sampling site is presented on the following page and includes the types of samples that are collected.

Table 2. Zion Environmental Monitoring sampling sites.

SITE	DISTANCE & DIRECTION (MILES)	LOCATION
ZI-1	8.5 WNW	Junction of Highway 41 and County ML.
ZI-2	5.9 NW	Junction of Highway 31 and County ML.
ZI-3	9.9 NW	Pleasant Prairie school.
ZI-4	6.0 NNW	Pleasant Prairie Town Hall. Junction of Highway 174 and County EZ.
ZI-5	3.3 N	Trident Marina.
ZI-6	9.5 N	Wolfenbittel Park. Junction of 60th Street and 3rd Avenue.
ZI-7	9.8 N	Kenosha Municipal Building, 625 - 52nd Street
ZI-8	10.0 N	Water intake - 4700 feet from shore.
ZI-9	9.3 NW	J. Steinbrink farm.

Zion - Environmental Sampling Sites



Sampling Sites

- 1 - AP, AI, VE, SO
- 2 - VE, SO
- 3 - AP, AI, VE, SO
- 4 - AP, AI, VE, SO, WW
- 5 - AP, AI, VE, SO, WW

- 6 - VE, SO
- 7 - AP, AI
- 8 - SW
- 9 - MI

Legend

- AP Air particulate
- AI Air iodine
- VE Vegetation
- SO Soil
- SW Surface water

SAMPLE COLLECTION SUMMARY

The following types and number of samples collected are listed in Table 3. An explanation for missing samples is listed in Table 4.

Table 3. Sample collection summary for 1983 and 1984.

Sampling Period January - December, 1983				
Sample Type	Collection and Frequency*	Number of Locations	Number of Samples Collected	Number of Samples Missed
air particulate	C/W	4	167	3
precipitation	C/BW	1	1	---
surface water	G/Q	1	4	0
vegetation	G/SA	6	12	0
soil	G/SA	6	12	0
well water	G/SA	2	4	0
TLD	C/Q	5	18	2

Sampling period January - December, 1984				
Sample Type	Collection and Frequency*	Number of Locations	Number of Samples Collected	Number of Samples Missed
air particulate	C/W	5	258	0
precipitation	C/BW	1	8	---
surface water	G/Q	1	4	0
vegetation	G/SA	6	12	0
soil	G/SA	6	12	0
well water	G/SA	2	4	0
milk	G/M	1	9	1
TLD	C/Q	5	20	0

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

Table 4. Missing sample report for 1983 and 1984.

Sample type	Date	Location	Explanation
Air particulate	06/02/83-06/23/83	ZI-5	Air pump inoperative.
Precipitation	01/01/83-04/30/83	ZI-7	Samples were not collected.
	06/03/83-12/31/83	ZI-7	Samples were not collected.
TLD	01/13/83-07/21/83	site 6	Missing dosimeter.
Precipitation	01/01/84-05/15/84	ZI-7	Samples were not collected.
	11/30/84-12/31/84	ZI-7	Samples were not collected.
Milk	October, 1984	ZI-9	Sample was not collected.

RESULTS AND DISCUSSION

Air Particulate

The yearly gross beta activity from a log-normal distribution for the air particulate samples is included in Table 5 for the following sample sites; ZI-1 (8.5 miles WNW), ZI-3 (9.9 miles NW), ZI-4 (6.0 miles NNW), ZI-5 (3.3 miles N) and ZI-7 (9.8 miles N).

Table 5. Yearly averages from a log-normal distribution for gross beta activity in the air particulate samples for 1983 & 1984.

Measurements in pCi/M³

Year	ZI-1	ZI-3	ZI-4	ZI-5	ZI-7
1982	* a	* b	0.027±0.002	0.022±0.002	0.021±0.002
1983	0.016±0.002	* b	0.016±0.002	0.016±0.002	0.015±0.002
1984	0.013±0.002	0.014±0.002	0.016±0.002	0.016±0.002	0.017±0.002

* a - Air sampling was initiated in August, 1983.

* b - Air sampling was initiated in January, 1984.

From the yearly gross beta activities it may be noted that there are no significant differences between the ZI-5 station and the ZI-1, ZI-3, ZI-4 and ZI-7 stations. With no significant differences between an indicator station (ZI-5) and control stations (ZI-1, ZI-3, ZI-4, and ZI-7) an increase in gross beta activity attributable to the Zion plant operation is not evident.

The gamma isotopic analysis of the monthly air particulate filter composites detected only small amounts of the radioisotopes listed in Table 6. All other isotopes were below their respective minimum detectable concentration.

Table 6. Radioisotopes detected in the air filter composites for 1983 & 1984.

Isotope	number of composites detected	range (pCi/M ³)
	1983	
Be-7	13	0.08 - 0.18
	1984	
Be-7	34	0.08 - 0.12

Beryllium-7 is constantly produced through nuclear reactions between cosmic rays and nuclei in the atmosphere and is commonly detected in air composites from other areas of the state.

Influence by the Zion nuclear facility on air quality is not evident when comparing the data from the indicator and the control sites.

Air Iodine

Air iodine measurements for 1983 and 1984 were all below the MDC of 0.046 pCi/M³ for all sites.

Direct Radiation - Thermoluminescent Dosimeters (TLD's)

Direct radiation (TLD) from Wisconsin data was comparable for all sites. Significant differences in exposure were not noticed at different distances from the Zion nuclear power facility. The yearly exposure from the five sites was in the range $(50 \pm 9) - (64 \pm 8)$ milliroentgens for 1983 and in the range $(59 \pm 12) - (79 \pm 13)$ milliroentgens for 1984. The exposure ranges for 1983 and 1984 are at background levels and are comparable to other areas within Wisconsin.

Direct radiation data for 1983 and 1984 from the Nuclear Regulatory Commission monitoring network has been included as general information. For the seven (7) stations located in Wisconsin the average cumulative yearly exposure would be in the range $(57.9 \pm 1.7) - (66.1 \pm 1.7)$ milliroentgens for 1983 and $(56.7 \pm 1.7) - (71.6 \pm 1.7)$ milliroentgens for 1984. The exposure ranges for 1983 and 1984 are at background levels and are comparable to other areas within Wisconsin.

Precipitation

The gross beta activity in precipitation was within the normal range of activity when compared to previous years data.

Surface Water

The surface water samples showed no unusual activities. For the gamma isotopic analysis all isotopes were below their respective minimum detectable concentration. All detected activities are at background levels and are comparable to Lake Michigan surface water data from the Point Beach - Kewaunee area. The surface water samples uniformly show activities well below the standards for uncontrolled areas specified in ICRP Report No. 2 or 10 CFR 20. Drinking water for the city of Kenosha is taken from Lake Michigan and the samples also showed activities well below the limits specified by the U.S. Environmental Protection Agency's National Primary Drinking Water Regulations for gross beta, gross alpha, tritium, and strontium-90.

Vegetation

Analysis of the vegetation samples showed no unusual activities. The gamma isotopic analysis detected only small amounts of the naturally occurring radioisotopes beryllium-7 and potassium-40 listed in Table 7. All other isotopes were below their respective minimum detectable concentration. Influence by the Zion nuclear facility is not evident.

Table 7. Radioisotopes detected in vegetation samples for 1983 & 1984.

Isotope	number of samples detected	range (pCi/kg)
1983		
Be-7	5	1100 - 2900
K-40	8	2200 - 6000
1984		
Be-7	8	1200 - 6300
K-40	12	4800 - 8000

Soil

Analysis of the soil samples showed no unusual activities. The gamma isotopic analysis detected only small amounts of the radionuclides listed in Table 8. Potassium-40 and those from the thorium and uranium decay series are naturally occurring radioisotopes. The reported activities for cesium-137, at the levels mentioned, were also detected in previous years and are probably attributable to fallout from previous atmospheric nuclear tests. Gross beta and gross alpha activities were all comparable to reported results from previous years.

Table 8. Radioisotopes detected in soil samples for 1983 and 1984.

Isotope	number of samples detected	range (pCi/kg dry)
1983		
K-40	12	10200 - 24900
Cs-137	12	140 - 1200
* a	12	320 - 2800
1984		
K-40	12	8700 - 22400
Cs-137	12	160 - 800
* a	12	320 - 2300

* a - Naturally occurring radioisotopes from the thorium-232 and uranium-238 decay series.

Well Water

The well water samples showed no unusual gross alpha and gross beta activities and all activities for tritium (H-3) were less than its minimum detectable concentration. The measured activities are all below the U.S. Environmental Protection Agency's Drinking Water Standards for gross alpha, gross beta and tritium.

Milk

The gamma isotopic analysis of the milk samples detected the radioisotopes listed in Table 9 with all other isotopes below their respective minimum detectable concentration. All activities for iodine-131 were below the minimum detectable concentration. Potassium-40 is a naturally occurring radioisotope and the detected activities for strontium-90 are comparable to detected activities from other areas within Wisconsin. The strontium-90 activities, at the levels mentioned, are probably attributable to fallout from previous atmospheric nuclear tests. Influence by the Zion nuclear facility is not evident.

Table 9. Radioisotopes detected in milk samples for 1984.

Isotope	number of samples detected	range (pCi/liter)
K-40	9	1130 - 1530
Sr-90	8	1.7 - 3.8

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Table 10. Air particulate gross beta and air iodine (I-131) results for January - December, 1983. ZI-1

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1983

Measurements in units of pCi/M³

Weigh station - Junction of Hwy 41 & Co ML
ZI-1 * a

Collection date	Air Particulate	Air Iodine	Collection date	Air Particulate	Air Iodine
			09/01/83	0.020+/-0.001	0.000+/-0.018
			09/08/83	0.025+/-0.002	0.000+/-0.018
			09/15/83	0.017+/-0.002	0.000+/-0.04
			09/22/83	0.013+/-0.001	0.000+/-0.016
			10/06/83	0.016+/-0.001	0.008+/-0.016
			10/11/83	0.018+/-0.002	0.013+/-0.02
			10/21/83	0.016+/-0.001	-0.02+/-0.03
			10/27/83	0.008+/-0.001	0.000+/-0.03
			11/03/83	0.013+/-0.001	0.016+/-0.04
			11/09/83	0.017+/-0.002	0.013+/-0.03
			11/16/83 * b	-0.002+/-0.007	0.000+/-0.05
			11/23/83	0.010+/-0.001	0.001+/-0.04
			12/01/83	0.012+/-0.001	0.000+/-0.03
			12/07/83	0.018+/-0.002	0.000+/-0.02
			12/14/83	0.020+/-0.002	0.000+/-0.04
			12/20/83	0.016+/-0.002	0.000+/-0.015
			12/28/83	0.016+/-0.001	0.005+/-0.012

* a - Air station was installed on 08/25/83.

* b - Only small amount of particulate matter on the particulate filter which would indicate possible air leakage through the cartridge holder.

Table 11. Air particulate gross beta and air iodine (I-131) results for January - December, 1983. ZI-4

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1983

Measurements in units of pCi/M³

Pleasant Prairie Town Hall
ZI-4

Collection date	Air Particulate	Air Iodine	Collection date	Air Particulate	Air Iodine
01/06/83	0.023+/-0.001	0.013+/-0.03	07/05/83	0.013+/-0.002	0.03+/-0.04
11/13/83	0.020+/-0.002	0.02+/-0.03	07/15/83	0.017+/-0.001	0.018+/-0.04
01/20/83	0.013+/-0.001	-0.010+/-0.03	07/22/83	0.017+/-0.002	0.011+/-0.03
01/26/83	0.022+/-0.002	-0.006+/-0.03	07/27/83 * a	-0.05+/-0.12	0.3+/-1.1
02/03/83	0.020+/-0.002	-0.011+/-0.04	08/03/83	0.023+/-0.002	0.018+/-0.02
02/08/83	0.015+/-0.002	0.009+/-0.04	08/11/83	0.075+/-0.003	0.000+/-0.015
02/17/83	0.019+/-0.001	0.009+/-0.02	08/18/83	0.017+/-0.002	0.006+/-0.02
02/25/83	0.011+/-0.005	-0.013+/-0.11	08/25/83 * a	-0.075+/-0.11	0.6+/-2.0
03/03/83	0.030+/-0.002	-0.004+/-0.03	09/01/83	0.018+/-0.002	0.003+/-0.03
03/10/83	0.023+/-0.002	-0.06+/-0.03	09/08/83	0.021+/-0.002	0.004+/-0.019
03/17/83	0.012+/-0.001	0.009+/-0.03	09/15/83	0.016+/-0.002	0.000+/-0.02
03/23/83	0.016+/-0.002	0.010+/-0.03	09/22/83	0.013+/-0.001	0.000+/-0.02
03/30/83 * a	-0.002+/-0.004	-0.011+/-0.04	10/05/83	0.027+/-0.001	0.002+/-0.05
04/06/83	0.014+/-0.001	0.011+/-0.04	10/11/83	0.017+/-0.002	-0.009+/-0.02
04/12/83	0.005+/-0.001	0.017+/-0.03	10/20/83	0.019+/-0.001	-0.002+/-0.012
04/21/83	0.015+/-0.001	0.012+/-0.03	10/27/83	0.011+/-0.001	0.03+/-0.02
04/29/83	0.016+/-0.001	-0.013+/-0.04	11/03/83	0.016+/-0.002	0.000+/-0.05
05/05/83	0.009+/-0.001	-0.008+/-0.04	11/09/83	0.029+/-0.002	0.02+/-0.02
05/12/83 * a	0.000+/-0.004	-0.016+/-0.10	11/16/83	0.022+/-0.002	0.004+/-0.017
05/18/83 * a	-0.004+/-0.005	-0.006+/-0.05	11/22/83	0.014+/-0.002	0.03+/-0.02
05/24/83	0.011+/-0.001	0.03+/-0.04	11/30/83	0.016+/-0.001	0.004+/-0.02
06/02/83	0.012+/-0.001	-0.004+/-0.03	12/07/83	0.025+/-0.002	0.000+/-0.03
06/09/83	0.003+/-0.004	0.05+/-0.08	12/14/83	0.031+/-0.002	0.000+/-0.03
06/16/83	0.019+/-0.002	-0.005+/-0.04	12/20/83	0.020+/-0.002	0.007+/-0.04
06/23/83	0.013+/-0.001	0.012+/-0.03	12/28/83	0.023+/-0.002	0.006+/-0.03
06/30/83 * a	0.005+/-0.14	-0.04+/-0.6			

* a - Only small amount of particulate matter on the particulate filter which would indicate possible air leakage through the cartridge holder.

Table 12. Air particulate gross beta and air iodine (I-131) results for January - December, 1983. ZI-5

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1983

Measurements in units of pCi/M³

Trident Marina
ZI-5

Collection date	Air Particulate	Air Iodine	Collection date	Air Particulate	Air Iodine
01/06/83	0.026+/-0.002	0.003+/-0.03	07/05/83	0.012+/-0.002	0.005+/-0.04
11/13/83	0.008+/-0.001	-0.001+/-0.02	07/15/83	0.016+/-0.001	-0.002+/-0.03
01/20/83	0.011+/-0.001	0.002+/-0.03	07/21/83	0.015+/-0.002	0.009+/-0.04
01/26/83	0.020+/-0.002	0.016+/-0.03	07/27/83	0.080+/-0.003	0.004+/-0.03
02/03/83	0.022+/-0.002	-0.012+/-0.04	08/03/83	0.020+/-0.002	0.03+/-0.03
02/08/83	0.016+/-0.002	0.014+/-0.04	08/11/83	0.052+/-0.002	0.007+/-0.013
02/17/83	0.019+/-0.001	-0.005+/-0.03	08/18/83	0.016+/-0.001	0.008+/-0.03
02/25/83	0.015+/-0.001	0.016+/-0.04	08/25/83	0.016+/-0.001	0.03+/-0.03
03/03/83	0.018+/-0.002	0.000+/-0.04	09/01/83	0.016+/-0.001	0.000+/-0.02
03/10/83	0.015+/-0.002	0.007+/-0.03	09/08/83	0.021+/-0.002	0.000+/-0.02
03/16/83	0.005+/-0.001	-0.005+/-0.03	09/15/83	0.014+/-0.001	0.003+/-0.03
03/23/83 * a	-0.002+/-0.008	0.03+/-0.16	09/22/83	0.012+/-0.001	0.008+/-0.03
03/30/83	0.016+/-0.002	0.002+/-0.04	10/07/83	0.023+/-0.001	0.02+/-0.04
04/06/83	0.014+/-0.002	-0.004+/-0.03	10/11/83	0.015+/-0.002	0.005+/-0.019
04/12/83	0.005+/-0.001	0.006+/-0.04	10/20/83	0.018+/-0.001	0.004+/-0.012
04/21/83	0.014+/-0.001	0.012+/-0.03	10/27/83	0.010+/-0.002	0.005+/-0.018
04/29/83	0.014+/-0.001	0.002+/-0.04	11/03/83 * a	-0.001+/-0.002	0.009+/-0.06
05/05/83	0.008+/-0.001	0.019+/-0.04	11/09/83	0.025+/-0.002	0.012+/-0.013
05/12/83	0.014+/-0.002	0.000+/-0.04	11/16/83	0.017+/-0.002	0.000+/-0.016
05/18/83	0.023+/-0.002	0.008+/-0.04	11/22/83	0.015+/-0.002	0.014+/-0.04
05/24/83	0.013+/-0.002	0.019+/-0.04	11/30/83	0.013+/-0.001	0.010+/-0.018
06/02/83	0.010+/-0.002	-0.011+/-0.04	12/07/83	0.023+/-0.002	0.009+/-0.03
06/07/83 * b			12/14/83	0.028+/-0.002	0.007+/-0.019
06/16/83 * b			12/20/83	0.022+/-0.002	0.000+/-0.03
06/23/83 * b			12/28/83	0.025+/-0.002	0.000+/-0.04
06/30/83	0.027+/-0.002	-0.001+/-0.05			

* a - Only small amount of particulate matter on the particulate filter which would indicate possible air leakage through the cartridge holder.

* b - Air station was inoperative from 6/02/83 - 6/23/83.

Table 13. Air particulate gross beta and air iodine (I-131) results for January - December, 1983. ZI-7

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1983

Measurements in units of pCi/M³

Kenosha City-Co. building
ZI-7

Collection date	Air Particulate	Air Iodine	Collection date	Air Particulate	Air Iodine
01/06/83	0.028+/-0.002	0.005+/-0.018	07/06/83	0.026+/-0.002	0.013+/-0.03
01/11/83	0.013+/-0.002	0.016+/-0.03	07/13/83	0.018+/-0.002	-0.009+/-0.06
01/20/83	0.010+/-0.001	0.016+/-0.03	07/20/83	0.019+/-0.002	-0.013+/-0.04
01/26/83	0.015+/-0.002	-0.005+/-0.02	07/27/83	0.016+/-0.002	0.02+/-0.04
02/03/83	0.016+/-0.001	-0.005+/-0.04	08/03/83	0.024+/-0.002	0.019+/-0.02
02/08/83	0.010+/-0.002	0.004+/-0.03	08/09/83	0.017+/-0.002	0.016+/-0.02
02/16/83	0.012+/-0.001	0.018+/-0.03	08/15/83	0.014+/-0.002	0.03+/-0.03
02/21/83	0.010+/-0.002	0.009+/-0.03	08/26/83	0.018+/-0.001	0.000+/-0.02
02/28/83	0.002+/-0.001	0.002+/-0.03	09/02/83	0.019+/-0.002	0.008+/-0.019
03/11/83	0.011+/-0.002	0.03+/-0.05	09/09/83	0.023+/-0.002	0.000+/-0.03
03/16/83	0.008+/-0.001	0.015+/-0.018	09/15/83	0.012+/-0.002	0.000+/-0.02
03/22/83	0.009+/-0.002	0.012+/-0.03	09/22/83	0.013+/-0.001	0.010+/-0.03
03/29/83	0.012+/-0.001	0.012+/-0.02	10/06/83	0.023+/-0.001	-0.009+/-0.017
04/04/83	0.009+/-0.001	0.006+/-0.04	10/12/83	0.029+/-0.003	-0.016+/-0.02
04/15/83	0.002+/-0.001	-0.001+/-0.03	10/21/83	0.018+/-0.001	-0.03+/-0.03
04/20/83	0.008+/-0.002	0.017+/-0.04	10/27/83	0.013+/-0.002	0.02+/-0.05
04/27/83	0.011+/-0.001	-0.013+/-0.05	11/03/83	0.017+/-0.002	0.000+/-0.04
05/04/83	0.009+/-0.001	0.008+/-0.03	11/09/83	0.030+/-0.003	0.04+/-0.04
05/10/83 * a	-0.004+/-0.009	-0.010+/-0.13	11/17/83	0.062+/-0.03	0.018+/-0.018
05/16/83	0.015+/-0.002	0.018+/-0.04	11/25/83	0.018+/-0.002	0.03+/-0.04
05/25/83	0.016+/-0.001	0.000+/-0.03	12/02/83	0.015+/-0.002	0.000+/-0.04
06/02/83	0.011+/-0.001	0.011+/-0.03	12/08/83	0.028+/-0.002	0.000+/-0.018
06/07/83	0.008+/-0.002	-0.008+/-0.04	12/16/83	0.024+/-0.002	0.000+/-0.04
06/16/83	0.018+/-0.001	-0.008+/-0.04	12/21/83	0.028+/-0.002	0.000+/-0.04
06/22/83	0.010+/-0.002	0.03+/-0.03	12/28/83	0.028+/-0.002	0.000+/-0.02
06/28/83	0.014+/-0.002	0.002+/-0.04			

* a - Only small amount of particulate matter on the particulate filter which would indicate possible air leakage through the cartridge holder.

Table 14. Air particulate gross beta and air iodine (I-131) results
for January - December, 1984. ZI-1

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1984

Measurements in units of pCi/M³

Weigh station - Junction of Hwy 41 & Co. ML
ZI-1

Collection date	Air Particulate	Air Iodine	Collection date	Air Particulate	Air Iodine
01/04/84	0.019+/-0.002	0.004+/-0.02	07/06/84	0.009+/-0.001	-0.006+/-0.015
01/11/84	0.012+/-0.001	0.003+/-0.02	07/13/84	0.010+/-0.001	-0.015+/-0.03
01/19/84	0.009+/-0.001	0.000+/-0.03	07/19/84	0.015+/-0.002	-0.006+/-0.03
01/24/84	0.015+/-0.001	0.002+/-0.03	07/26/84	0.013+/-0.001	0.02+/-0.04
02/02/84	0.010+/-0.001	0.010+/-0.03	08/02/84	0.013+/-0.001	0.009+/-0.02
02/08/84	0.020+/-0.002	0.03+/-0.02	08/09/84	0.017+/-0.002	-0.006+/-0.02
02/16/84	0.011+/-0.001	0.002+/-0.018	08/16/84	0.011+/-0.001	-0.003+/-0.03
02/23/84	0.038+/-0.002	-0.004+/-0.02	08/23/84	0.016+/-0.002	-0.003+/-0.02
03/01/84	0.029+/-0.002	0.002+/-0.02	08/30/84	0.018+/-0.002	0.012+/-0.03
03/12/84	0.015+/-0.001	0.013+/-0.018	09/07/84	0.011+/-0.001	-0.003+/-0.014
03/15/84	0.040+/-0.003	-0.008+/-0.03	09/13/84	0.018+/-0.002	0.001+/-0.014
03/22/84	0.010+/-0.001	-0.007+/-0.017	09/21/84	0.014+/-0.001	0.006+/-0.015
03/29/84	0.010+/-0.001	-0.002+/-0.02	09/27/84	0.013+/-0.001	-0.004+/-0.02
04/05/84	0.009+/-0.001	-0.005+/-0.019	10/03/84	0.021+/-0.002	0.002+/-0.03
04/12/84	0.015+/-0.001	0.010+/-0.02	10/11/84	0.016+/-0.001	-0.003+/-0.019
04/18/84	0.007+/-0.001	0.02+/-0.03	10/18/84	0.018+/-0.002	0.000+/-0.02
04/26/84	0.008+/-0.001	0.000+/-0.02	10/24/84	0.015+/-0.002	-0.011+/-0.02
05/01/84	0.011+/-0.001	0.014+/-0.02	11/01/84	0.012+/-0.001	-0.006+/-0.02
05/11/84	0.011+/-0.001	0.010+/-0.02	11/06/84	0.019+/-0.002	0.004+/-0.03
05/16/84	0.010+/-0.001	0.001+/-0.02	11/14/84	0.014+/-0.001	-0.008+/-0.02
05/23/84	0.010+/-0.001	0.03+/-0.02	11/21/84	0.011+/-0.001	0.007+/-0.03
05/30/84	0.008+/-0.001	-0.02+/-0.03	11/28/84	0.016+/-0.002	-0.007+/-0.02
06/06/84	0.013+/-0.001	-0.001+/-0.02	12/05/84	0.015+/-0.001	-0.007+/-0.013
06/14/84	0.008+/-0.001	0.000+/-0.02	12/12/84	0.027+/-0.002	-0.003+/-0.02
06/22/84	0.010+/-0.001	0.003+/-0.014	12/19/84	0.013+/-0.001	0.005+/-0.013
06/28/84	0.011+/-0.001	-0.015+/-0.02	12/27/84	0.019+/-0.001	-0.001+/-0.018
			01/02/85	0.017+/-0.002	0.004+/-0.02

Table 15. Air particulate gross beta and air iodine (I-131) results
for January - December, 1984. ZI-3

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1984

Measurements in units of pCi/M³

Pleasant Prairie School

ZI-3 * a

Collection date	Air Particulate	Air Iodine	Collection date	Air Particulate	Air Iodine
			07/06/84	0.010+/-0.001	-0.008+/-0.02
			07/13/84	0.012+/-0.001	-0.010+/-0.03
			07/19/84	0.016+/-0.002	0.003+/-0.013
02/02/84	0.018+/-0.002	0.05+/-0.03	08/02/84	0.015+/-0.001	-0.006+/-0.018
02/08/84	0.027+/-0.002	0.03+/-0.02	08/09/84	0.022+/-0.002	0.009+/-0.014
02/16/84	0.021+/-0.002	0.001+/-0.015	08/16/84	0.014+/-0.001	-0.007+/-0.03
02/23/84	0.048+/-0.002	0.007+/-0.02	08/23/84	0.017+/-0.002	-0.007+/-0.02
03/01/84	0.025+/-0.002	0.02+/-0.02	08/30/84	0.021+/-0.002	-0.03+/-0.03
03/09/84	0.009+/-0.001	0.006+/-0.03	09/07/84	0.009+/-0.001	0.006+/-0.014
03/15/84	0.025+/-0.001	0.012+/-0.02	09/13/84	0.017+/-0.002	-0.003+/-0.02
03/22/84	0.010+/-0.001	0.003+/-0.01	09/21/84	0.013+/-0.001	0.004+/-0.014
03/29/84	0.012+/-0.001	0.007+/-0.02	09/27/84	0.012+/-0.001	0.005+/-0.02
04/05/84	0.011+/-0.001	-0.004+/-0.119	10/03/84	0.015+/-0.002	0.006+/-0.03
04/12/84	0.015+/-0.001	0.017+/-0.02	10/11/84	0.020+/-0.001	0.009+/-0.019
04/18/84	0.006+/-0.001	0.012+/-0.03	10/18/84	0.011+/-0.001	0.001+/-0.02
04/26/84	0.008+/-0.001	0.005+/-0.02	10/24/84	0.013+/-0.001	0.004+/-0.02
05/01/84	0.010+/-0.001	0.011+/-0.018	11/01/84	0.012+/-0.001	-0.006+/-0.02
05/11/84	0.010+/-0.001	-0.003+/-0.02	11/06/84	0.013+/-0.002	-0.009+/-0.016
05/18/84	0.009+/-0.001	-0.005+/-0.02	11/14/84	0.016+/-0.002	0.004+/-0.02
05/23/84	0.013+/-0.001	0.02+/-0.02	11/21/84	0.013+/-0.001	-0.006+/-0.014
05/30/84	0.010+/-0.001	0.000+/-0.03	11/28/84	0.015+/-0.001	0.005+/-0.02
06/06/84	0.015+/-0.001	-0.013+/-0.02	12/05/84	0.019+/-0.002	0.011+/-0.014
06/14/84	0.009+/-0.001	-0.006+/-0.02	12/12/84	0.029+/-0.002	-0.001+/-0.02
06/22/84	0.008+/-0.001	-0.013+/-0.02	12/19/84	0.016+/-0.001	0.000+/-0.012
06/28/84	0.011+/-0.001	-0.006+/-0.02	12/27/84	0.020+/-0.001	0.001+/-0.018
			01/02/85	0.021+/-0.002	-0.004+/-0.02

* a - Air station was installed on 01/27/84.

Table 16. Air particulate gross beta and air iodine (I-131) results
for January - December, 1984. ZI-4

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1984

Measurements in units of pCi/M³

Pleasant Prairie Island Town Hall
ZI-4

Collection date	Air Particulate	Air Iodine	Collection date	Air Particulate	Air Iodine
01/04/84	0.027+/-0.002	0.000+/-0.019	07/06/84	0.009+/-0.001	-0.004+/-0.03
01/11/84	0.017+/-0.002	0.007+/-0.03	07/13/84	0.011+/-0.001	-0.004+/-0.016
01/19/84	0.020+/-0.002	0.000+/-0.04	07/19/84	0.016+/-0.002	0.02+/-0.03
01/24/84	0.026+/-0.002	0.001+/-0.017	07/26/84	0.018+/-0.002	-0.004+/-0.03
02/02/84	0.019+/-0.002	0.013+/-0.03	08/02/84	0.013+/-0.001	0.005+/-0.019
02/08/84	0.028+/-0.002	0.000+/-0.019	08/09/84	0.019+/-0.002	-0.005+/-0.02
02/16/84	0.026+/-0.002	0.002+/-0.03	08/16/84	0.014+/-0.002	-0.015+/-0.03
02/23/84	0.048+/-0.003	0.004+/-0.017	08/23/84	0.015+/-0.002	0.004+/-0.014
03/01/84	0.031+/-0.002	0.000+/-0.03	08/30/84	0.019+/-0.002	-0.005+/-0.019
03/09/84	0.014+/-0.001	0.012+/-0.03	09/07/84	0.012+/-0.001	0.000+/-0.03
03/15/84	0.026+/-0.002	0.000+/-0.03	09/13/84	0.016+/-0.002	-0.006+/-0.03
03/22/84	0.012+/-0.001	0.014+/-0.04	09/21/84	0.017+/-0.002	0.000+/-0.03
03/29/84	0.013+/-0.002	0.002+/-0.04	09/27/84	0.014+/-0.002	0.005+/-0.016
04/05/84	0.012+/-0.001	0.03+/-0.04	10/03/84	0.022+/-0.002	-0.004+/-0.03
04/12/84	0.015+/-0.002	-0.012+/-0.03	10/11/84	0.020+/-0.002	-0.007+/-0.03
04/18/84	0.009+/-0.001	0.05+/-0.03	10/18/84	0.021+/-0.002	0.012+/-0.016
04/26/84	0.008+/-0.001	0.001+/-0.02	10/24/84	0.017+/-0.002	-0.006+/-0.03
05/01/84	0.012+/-0.002	0.008+/-0.03	11/01/84	0.015+/-0.001	-0.001+/-0.03
05/11/84	0.013+/-0.001	0.009+/-0.03	11/06/84	0.021+/-0.002	-0.003+/-0.002
05/16/84	0.008+/-0.002	0.03+/-0.03	11/14/84	0.017+/-0.002	-0.003+/-0.014
05/23/84	0.013+/-0.002	0.005+/-0.02	11/21/84	0.016+/-0.002	0.02+/-0.04
05/30/84	0.009+/-0.001	0.02+/-0.03	11/28/84	0.019+/-0.002	-0.002+/-0.014
06/06/84	0.015+/-0.002	-0.013+/-0.02	12/05/84	0.020+/-0.002	-0.011+/-0.02
06/14/84	0.010+/-0.001	-0.001+/-0.016	12/12/84	0.030+/-0.002	0.013+/-0.03
06/22/84	0.011+/-0.001	-0.006+/-0.02	12/19/84	0.017+/-0.002	-0.001+/-0.02
06/28/84	0.011+/-0.002	-0.001+/-0.016	12/27/84	0.023+/-0.002	-0.006+/-0.015
			01/02/85	0.020+/-0.002	0.007+/-0.03

Table 17. Air particulate gross beta and air iodine (I-131) results for January - December, 1984. ZI-5

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1984

Measurements in units of pCi/M³

Trident Marina

ZI-5

Collection date	Air Particulate	Air Iodine	Collection date	Air Particulate	Air Iodine
01/04/84	0.025+/-0.002	0.02+/-0.03	07/06/84	0.010+/-0.001	-0.015+/-0.02
01/11/84	0.017+/-0.001	0.04+/-0.02	07/13/84	0.011+/-0.001	0.006+/-0.016
01/19/84	0.018+/-0.001	0.012+/-0.03	07/19/84	0.015+/-0.002	-0.008+/-0.03
01/24/84	0.026+/-0.002	0.007+/-0.03	07/26/84	0.016+/-0.001	0.001+/-0.03
02/02/84	0.019+/-0.002	0.005+/-0.02	08/02/84	0.015+/-0.001	0.008+/-0.03
02/08/84	0.028+/-0.002	0.000+/-0.014	08/09/84	0.019+/-0.002	-0.013+/-0.019
02/16/84	0.025+/-0.002	-0.003+/-0.02	08/16/84	0.012+/-0.001	0.015+/-0.03
02/23/84	0.097+/-0.003	0.002+/-0.015	08/23/84	0.015+/-0.001	-0.007+/-0.019
03/01/84	0.028+/-0.002	0.000+/-0.015	08/30/84	0.019+/-0.002	-0.002+/-0.017
03/09/84	0.012+/-0.001	0.02+/-0.03	09/07/84	0.012+/-0.001	-0.005+/-0.02
03/15/84	0.036+/-0.002	-0.002+/-0.016	09/13/84	0.016+/-0.002	-0.001+/-0.02
03/23/84	0.011+/-0.001	-0.002+/-0.016	09/21/84	0.017+/-0.001	-0.008+/-0.012
03/29/84	0.013+/-0.002	0.011+/-0.04	09/27/84	0.012+/-0.001	-0.001+/-0.013
04/05/84	0.009+/-0.001	-0.003+/-0.019	10/03/84	0.024+/-0.002	-0.019+/-0.02
04/12/84	0.013+/-0.001	0.007+/-0.02	10/11/84	0.018+/-0.001	-0.004+/-0.03
04/18/84	0.008+/-0.001	0.03+/-0.03	10/18/84	0.019+/-0.002	0.005+/-0.013
04/26/84	0.008+/-0.001	0.003+/-0.02	10/24/84	0.017+/-0.002	0.009+/-0.02
05/01/84	0.010+/-0.001	0.005+/-0.02	11/01/84	0.014+/-0.001	-0.008+/-0.02
05/11/84	0.010+/-0.001	0.006+/-0.02	11/06/84	0.019+/-0.002	-0.002+/-0.03
05/16/84	0.008+/-0.001	-0.008+/-0.02	11/14/84	0.015+/-0.001	-0.008+/-0.011
05/23/84	0.010+/-0.001	-0.013+/-0.02	11/28/84	0.018+/-0.002	0.000+/-0.017
05/30/84	0.009+/-0.001	0.02+/-0.03	12/05/84	0.019+/-0.002	0.004+/-0.02
06/06/84	0.015+/-0.001	0.006+/-0.02	12/12/84	0.031+/-0.002	-0.008+/-0.02
06/14/84	0.010+/-0.001	-0.005+/-0.014	12/19/84	0.016+/-0.001	-0.004+/-0.02
06/22/84	0.009+/-0.001	0.009+/-0.015	12/26/84	0.023+/-0.002	-0.001+/-0.02
06/28/84	0.011+/-0.001	0.000+/-0.014	01/02/85	0.021+/-0.002	-0.016+/-0.02

Table 18. Air particulate gross beta and air iodine (I-131) results for January - December, 1984. ZI-7

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1984

Measurements in units of pCi/M³

Kenosha City-Co. building
ZI-7

Collection date	Air Particulate	Air Iodine	Collection date	Air Particulate	Air Iodine
01/04/84	0.029+/-0.002	0.000+/-0.04	07/06/84	0.010+/-0.001	-0.006+/-0.04
01/11/84	0.013+/-0.002	0.000+/-0.03	07/13/84	0.011+/-0.002	-0.017+/-0.03
01/19/84	0.018+/-0.002	0.011+/-0.03	07/19/84	0.014+/-0.003	0.012+/-0.03
01/24/84	0.032+/-0.002	0.02+/-0.03	07/27/84	0.020+/-0.004	0.008+/-0.04
02/02/84	0.030+/-0.002	0.02+/-0.02	08/03/84	0.015+/-0.004	-0.003+/-0.05
02/08/84	0.035+/-0.002	0.03+/-0.02	08/09/84	0.024+/-0.006	0.004+/-0.05
02/16/84	0.028+/-0.002	0.011+/-0.03	08/16/84	0.015+/-0.002	0.03+/-0.04
02/23/84	0.119+/-0.004	0.007+/-0.03	08/23/84	0.014+/-0.002	-0.008+/-0.017
03/01/84	0.030+/-0.002	0.004+/-0.03	08/31/84	0.022+/-0.002	0.008+/-0.04
03/09/84	0.015+/-0.001	0.000+/-0.03	09/07/84	0.015+/-0.002	0.002+/-0.02
03/15/84	0.030+/-0.002	0.004+/-0.03	09/13/84	0.019+/-0.002	0.005+/-0.017
03/22/84	0.014+/-0.002	0.013+/-0.03	09/21/84	0.017+/-0.002	0.000+/-0.03
03/29/84	0.014+/-0.002	0.003+/-0.03	09/27/84	0.014+/-0.002	0.010+/-0.03
04/04/84	0.011+/-0.002	0.011+/-0.04	10/04/84	0.021+/-0.002	0.005+/-0.03
04/12/84	0.014+/-0.001	0.04+/-0.03	10/11/84	0.022+/-0.002	-0.02+/-0.03
04/18/84	0.008+/-0.001	0.006+/-0.03	10/18/84	0.022+/-0.002	0.002+/-0.03
04/26/84	0.009+/-0.001	0.003+/-0.03	10/24/84	0.018+/-0.002	0.011+/-0.03
05/01/84	0.011+/-0.002	0.013+/-0.03	11/01/84	0.014+/-0.001	-0.019+/-0.03
05/11/84	0.011+/-0.001	-0.007+/-0.03	11/06/84	0.019+/-0.003	0.006+/-0.03
05/16/84	0.009+/-0.002	0.018+/-0.03	11/14/84	0.018+/-0.002	-0.004+/-0.03
05/23/84	0.012+/-0.002	0.002+/-0.03	11/21/84	0.018+/-0.002	0.010+/-0.03
05/31/84	0.011+/-0.001	-0.006+/-0.03	12/05/84	0.021+/-0.003	0.003+/-0.02
06/06/84	0.016+/-0.002	-0.016+/-0.03	12/12/84	0.031+/-0.003	-0.03+/-0.04
06/15/84	0.007+/-0.001	-0.003+/-0.015	12/19/84	0.022+/-0.003	0.010+/-0.04
06/22/84	0.010+/-0.001	-0.007+/-0.02	12/26/84	0.027+/-0.003	-0.001+/-0.03
06/29/84	0.012+/-0.002	0.008+/-0.03	01/02/85	0.028+/-0.002	-0.003+/-0.05

Table 19. Gamma isotopic results for January - December, 1983 from the monthly composite of air particulate samples.
ZI-1 & ZI-4

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion 1983

Measurements in units of pCi/M³

WI - Section of Radiation Protection data

Weigh station - Junction of Hwy 41 & Co ML

ZI-1 * b

	January	February	March	April	May	June
Be-7						
Zr,Nb-95						
Ru-106						
Cs-134						
Cs-137						
Ce-144						

	July	August	September	October	November	December
Be-7			0.08+/-0.02	0.054+/-0.011	0.07+/-0.03	0.044+/-0.013
Zr,Nb-95			0.004+/-0.004	0.002+/-0.002	0.000+/-0.005	0.000+/-0.003
Ru-106			0.009+/-0.015	0.004+/-0.005	0.006+/-0.016	0.003+/-0.010
Cs-134			0.000+/-0.002	0.000+/-0.001	0.000+/-0.002	0.000+/-0.001
Cs-137			0.000+/-0.002	0.000+/-0.001	-0.001+/-0.002	0.000+/-0.001
Ce-144			0.009+/-0.009	0.001+/-0.003	-0.001+/-0.011	0.001+/-0.006

Pleasant Prairie Town Hall

ZI-4

	January	February	March	April	May	June
Be-7	0.043+/-0.017	0.03+/-0.03	0.06+/-0.02	0.10+/-0.02	0.001+/-0.017	0.11+/-0.03
Zr,Nb-95	0.000+/-0.001	-0.001+/-0.002	0.000+/-0.002	0.001+/-0.004	0.000+/-0.008	-0.002+/-0.006
Ru-106	0.016+/-0.006	0.018+/-0.009	0.020+/-0.007	0.002+/-0.014	-0.006+/-0.03	0.012+/-0.014
Cs-134	* a	* a	* a	* a	0.000+/-0.003	0.000+/-0.002
Cs-137	0.000+/-0.001	0.000+/-0.002	0.000+/-0.002	0.001+/-0.001	0.000+/-0.004	0.003+/-0.002
Ce-144	0.003+/-0.006	0.009+/-0.009	0.000+/-0.007	0.001+/-0.008	0.001+/-0.017	-0.003+/-0.010

	July	August	September	October	November	December
Be-7	0.09+/-0.02	0.063+/-0.019	0.064+/-0.016	0.067+/-0.013	0.085+/-0.018	0.050+/-0.011
Zr,Nb-95	0.003+/-0.003	0.001+/-0.004	0.001+/-0.003	0.003+/-0.002	0.000+/-0.003	0.000+/-0.002
Ru-106	0.007+/-0.009	0.013+/-0.010	0.004+/-0.007	0.008+/-0.006	0.002+/-0.007	0.000+/-0.008
Cs-134	0.000+/-0.001	0.001+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001
Cs-137	0.001+/-0.001	0.000+/-0.001	0.001+/-0.001	0.000+/-0.001	-0.001+/-0.001	0.000+/-0.001
Ce-144	0.004+/-0.006	0.002+/-0.006	0.000+/-0.005	0.003+/-0.004	-0.001+/-0.005	0.000+/-0.004

* a - Isotope was not specifically analyzed for.

* b - Air station was installed on 08/25/83.

Isotopes other than those reported were not detected.

Table 20. Gamma isotopic results for January - December, 1983 from the monthly composite of air particulate samples.
ZI-5 & ZI-7

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion 1983

Measurements in units of pCi/M³

WI - Section of Radiation Protection data

Kenosha City-Co. Building

ZI-7

	January	February	March	April	May	June
Be-7	0.019+/-0.017	0.030+/-0.017	0.04+/-0.02	0.050+/-0.018	0.06+/-0.03	0.05+/-0.02
Zr,Nb-95	0.000+/-0.001	0.001+/-0.002	0.000+/-0.002	0.000+/-0.002	0.004+/-0.005	-0.001+/-0.004
Ru-106	0.008+/-0.006	0.010+/-0.006	0.014+/-0.008	0.021+/-0.007	0.002+/-0.015	0.002+/-0.013
Cs-134	* a	* a	* a	* a	-0.001+/-0.002	0.000+/-0.001
Cs-137	0.000+/-0.001	0.000+/-0.001	0.000+/-0.002	0.000+/-0.001	0.001+/-0.002	0.000+/-0.001
Ce-144	0.005+/-0.006	0.002+/-0.006	-0.005+/-0.008	0.004+/-0.007	-0.001+/-0.011	-0.002+/-0.008
	July	August	September	October	November	December
Be-7	0.098+/-0.018	0.076+/-0.017	0.11+/-0.03	0.065+/-0.018	0.10+/-0.02	0.068+/-0.016
Zr,Nb-95	0.004+/-0.003	0.004+/-0.002	0.000+/-0.005	0.000+/-0.004	0.000+/-0.005	0.001+/-0.004
Ru-106	-0.001+/-0.008	0.001+/-0.006	0.006+/-0.024	0.000+/-0.014	0.000+/-0.017	0.001+/-0.013
Cs-134	0.000+/-0.001	0.000+/-0.001	0.000+/-0.002	0.000+/-0.001	0.001+/-0.002	0.000+/-0.001
Cs-137	0.000+/-0.001	0.001+/-0.001	0.002+/-0.002	0.001+/-0.002	-0.001+/-0.002	-0.001+/-0.002
Ce-144	0.001+/-0.005	0.001+/-0.004	0.001+/-0.013	0.005+/-0.008	0.002+/-0.010	-0.001+/-0.008

Trident Marina

ZI-5

	January	February	March	April	May	June
Be-7	0.045+/-0.014	0.04+/-0.02	0.05+/-0.02	0.09+/-0.02	0.07+/-0.03	0.18+/-0.05
Zr,Nb-95	0.000+/-0.001	0.001+/-0.002	0.000+/-0.002	-0.001+/-0.005	0.002+/-0.006	0.005+/-0.010
Ru-106	0.016+/-0.005	0.013+/-0.007	0.019+/-0.008	0.000+/-0.016	-0.001+/-0.017	-0.009+/-0.03
Cs-134	* a	* a	* a	* a	0.000+/-0.002	0.001+/-0.003
Cs-137	0.000+/-0.001	0.000+/-0.002	0.000+/-0.002	0.000+/-0.002	0.000+/-0.002	0.003+/-0.003
Ce-144	0.005+/-0.005	0.005+/-0.008	0.000+/-0.008	-0.006+/-0.009	0.002+/-0.011	0.004+/-0.02
	July	August	September	October	November	December
Be-7	0.084+/-0.018	0.08+/-0.02	0.073+/-0.016	0.078+/-0.016	0.088+/-0.019	0.059+/-0.011
Zr,Nb-95	0.001+/-0.003	0.000+/-0.004	0.002+/-0.002	0.003+/-0.003	0.001+/-0.003	0.000+/-0.002
Ru-106	-0.001+/-0.008	0.000+/-0.015	0.001+/-0.008	0.003+/-0.011	0.003+/-0.010	0.000+/-0.006
Cs-134	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001
Cs-137	0.001+/-0.001	-0.001+/-0.002	-0.001+/-0.001	0.000+/-0.001	-0.001+/-0.001	0.000+/-0.001
Ce-144	0.000+/-0.005	0.009+/-0.008	0.001+/-0.004	0.000+/-0.007	-0.001+/-0.006	0.000+/-0.003

* a - Isotope was not specifically analyzed for.
Isotopes other than those reported were not detected.

Table 21. Gamma isotopic results for January - December, 1984 from the monthly composite of air particulate samples.
ZI-1 & ZI-4

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion
1984

Measurements in units of pCi/M³

WI - Section of Radiation Protection data

Weigh station
ZI-1

	January	February	March	April	May	June
Be-7	0.044+/-0.015	0.052+/-0.011	0.064+/-0.014	0.099+/-0.015	0.07+/-0.02	0.079+/-0.016
Zr-95	0.000+/-0.003	0.000+/-0.002	0.000+/-0.002	0.001+/-0.002	-0.002+/-0.003	0.002+/-0.003
Ru-103	* a	* a	0.000+/-0.001	0.001+/-0.001	0.000+/-0.002	0.000+/-0.001
Ru-106	0.005+/-0.009	0.002+/-0.008	0.005+/-0.008	0.005+/-0.007	-0.003+/-0.013	-0.005+/-0.007
Cs-134	0.001+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	-0.001+/-0.001
Cs-137	-0.001+/-0.001	0.001+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.002	0.000+/-0.001
Ce-141	* a	* a	0.000+/-0.001	0.001+/-0.001	0.001+/-0.003	-0.001+/-0.001
Ce-144	0.003+/-0.007	-0.004+/-0.005	0.002+/-0.004	0.002+/-0.003	0.002+/-0.007	0.003+/-0.004
	July	August	September	October	November	December
Be-7	0.09+/-0.02	0.11+/-0.03	0.09+/-0.02	0.04+/-0.02	0.073+/-0.017	0.075+/-0.015
Zr-95	-0.002+/-0.004	0.000+/-0.006	0.000+/-0.004	-0.004+/-0.005	-0.001+/-0.003	0.000+/-0.002
Ru-103	-0.001+/-0.002	0.000+/-0.003	0.000+/-0.002	0.002+/-0.003	-0.001+/-0.001	0.000+/-0.001
Ru-106	-0.001+/-0.015	-0.005+/-0.019	-0.005+/-0.015	-0.001+/-0.018	0.004+/-0.010	0.003+/-0.008
Cs-134	0.000+/-0.002	-0.001+/-0.002	0.000+/-0.002	-0.001+/-0.002	0.000+/-0.001	0.000+/-0.001
Cs-137	0.000+/-0.002	-0.001+/-0.002	-0.001+/-0.002	0.002+/-0.002	0.000+/-0.001	0.000+/-0.001
Ce-141	0.002+/-0.003	0.002+/-0.004	0.002+/-0.003	0.002+/-0.004	0.002+/-0.002	0.000+/-0.002
Ce-144	0.003+/-0.009	0.009+/-0.011	0.001+/-0.008	-0.001+/-0.010	0.006+/-0.005	0.001+/-0.004

Pleasant Prairie Town Hall
ZI-4

	January	February	March	April	May	June
Be-7	0.071+/-0.014	0.066+/-0.016	0.10+/-0.02	0.114+/-0.017	0.102+/-0.018	0.09+/-0.02
Zr-95	0.002+/-0.002	-0.001+/-0.002	0.000+/-0.004	-0.001+/-0.002	0.000+/-0.003	0.000+/-0.004
Ru-103	* a	* a	-0.001+/-0.002	0.000+/-0.001	0.000+/-0.001	0.001+/-0.002
Ru-106	0.012+/-0.005	-0.002+/-0.009	0.009+/-0.016	0.001+/-0.008	-0.003+/-0.009	0.001+/-0.015
Cs-134	0.000+/-0.001	-0.001+/-0.001	-0.001+/-0.001	0.000+/-0.001	0.000+/-0.001	-0.001+/-0.001
Cs-137	0.001+/-0.001	0.000+/-0.001	0.000+/-0.002	0.000+/-0.001	0.000+/-0.001	0.000+/-0.002
Ce-141	* a	* a	0.002+/-0.003	0.000+/-0.001	0.000+/-0.002	-0.001+/-0.003
Ce-144	-0.001+/-0.004	0.003+/-0.005	-0.001+/-0.008	0.002+/-0.004	-0.002+/-0.004	-0.004+/-0.008
	July	August	September	October	November	December
Be-7	0.087+/-0.017	0.11+/-0.02	0.096+/-0.017	0.060+/-0.017	0.09+/-0.03	0.079+/-0.016
Zr-95	0.000+/-0.003	0.001+/-0.004	0.001+/-0.003	-0.002+/-0.003	0.000+/-0.006	0.001+/-0.003
Ru-103	0.000+/-0.001	0.000+/-0.002	0.001+/-0.002	0.000+/-0.002	-0.001+/-0.003	0.001+/-0.001
Ru-106	-0.002+/-0.008	-0.001+/-0.010	0.002+/-0.009	0.006+/-0.011	-0.004+/-0.021	-0.001+/-0.008
Cs-134	0.000+/-0.001	0.001+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.002	-0.001+/-0.001
Cs-137	0.000+/-0.001	0.000+/-0.001	-0.001+/-0.001	0.000+/-0.001	0.002+/-0.003	0.001+/-0.001
Ce-141	0.000+/-0.002	0.001+/-0.003	0.002+/-0.002	0.000+/-0.002	0.002+/-0.004	0.000+/-0.002
Ce-144	0.000+/-0.005	0.004+/-0.007	0.004+/-0.005	-0.001+/-0.006	0.001+/-0.012	0.003+/-0.005

* a - Isotope was not specifically analyzed for.
Isotopes other than those reported were not detected.

Table 22. Gamma isotopic results for January - December, 1984 from the monthly composite of air particulate samples.
ZI-3

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion
1984

Measurements in units of pCi/M³

WI - Section of Radiation Protection data

Pleasant Prairie School
ZI-3

	January	February	March	April	May	June
Be-7	0.06+/-0.07	0.032+/-0.017	0.074+/-0.015	0.087+/-0.014	0.08+/-0.02	0.087+/-0.016
Zr-95	0.015+/-0.013	-0.002+/-0.003	0.000+/-0.002	0.001+/-0.002	0.001+/-0.004	0.000+/-0.003
Ru-103	* a	* a	-0.001+/-0.001	0.000+/-0.001	0.002+/-0.002	0.000+/-0.001
Ru-106	0.03+/-0.04	0.006+/-0.013	0.003+/-0.008	-0.002+/-0.006	0.002+/-0.013	0.002+/-0.008
Cs-134	0.007+/-0.005	-0.001+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001
Cs-137	-0.003+/-0.006	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001	0.001+/-0.001
Ce-141	* a	* a	0.000+/-0.001	0.001+/-0.001	0.000+/-0.002	0.000+/-0.001
Ce-144	0.03+/-0.04	-0.006+/-0.008	-0.001+/-0.003	0.001+/-0.003	-0.001+/-0.007	0.001+/-0.004
	July	August	September	October	November	December
Be-7	0.09+/-0.002	0.12+/-0.03	0.086+/-0.016	0.05+/-0.02	0.067+/-0.016	0.082+/-0.015
Zr-95	0.001+/-0.005	0.003+/-0.006	0.001+/-0.003	0.000+/-0.005	0.001+/-0.003	-0.001+/-0.002
Ru-103	0.002+/-0.003	0.001+/-0.003	0.001+/-0.001	0.001+/-0.003	0.000+/-0.001	0.000+/-0.001
Ru-106	0.000+/-0.015	-0.002+/-0.019	0.002+/-0.008	0.004+/-0.018	-0.001+/-0.009	0.003+/-0.007
Cs-134	0.000+/-0.002	0.001+/-0.002	0.000+/-0.001	0.000+/-0.002	0.001+/-0.001	0.000+/-0.001
Cs-137	-0.001+/-0.002	0.002+/-0.002	0.000+/-0.001	0.000+/-0.002	0.000+/-0.001	0.000+/-0.001
Ce-141	-0.001+/-0.003	0.001+/-0.004	0.001+/-0.002	-0.001+/-0.004	0.000+/-0.002	0.001+/-0.002
Ce-144	0.000+/-0.008	0.002+/-0.011	0.001+/-0.005	-0.001+/-0.010	0.002+/-0.006	0.004+/-0.004

* a - Isotope was not specifically analyzed for.
Isotopes other than those reported were not detected.

Table 23. Gamma isotopic results for January - December, 1984 from the monthly composite of air particulate samples.
ZI-5 & ZI-7

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion
1984

Measurements in units of pCi/M³

WI - Section of Radiation Protection data

Kenosha City-Co. Building

ZI-7

	January	February	March	April	May	June
Be-7	0.05+/-0.02	0.07+/-0.02	0.10+/-0.02	0.11+/-0.02	0.08+/-0.02	0.10+/-0.02
Zr-95	0.007+/-0.003	-0.004+/-0.004	0.001+/-0.003	-0.001+/-0.004	0.000+/-0.004	0.000+/-0.003
Ru-103	* a	* a	-0.001+/-0.001	0.000+/-0.002	0.000+/-0.002	-0.001+/-0.002
Ru-106	0.005+/-0.011	0.010+/-0.018	-0.003+/-0.010	0.008+/-0.014	0.001+/-0.016	-0.001+/-0.010
Cs-134	0.000+/-0.001	0.000+/-0.002	0.001+/-0.001	0.000+/-0.001	-0.001+/-0.002	0.000+/-0.001
Cs-137	0.000+/-0.001	0.001+/-0.002	0.000+/-0.001	0.000+/-0.002	0.000+/-0.002	0.000+/-0.001
Ce-141	* a	* a	0.000+/-0.002	0.000+/-0.003	0.001+/-0.003	0.000+/-0.002
Ce-144	0.005+/-0.008	-0.009+/-0.010	0.003+/-0.005	0.002+/-0.007	0.004+/-0.009	0.002+/-0.005
	July	August	September	October	November	December
Be-7	0.11+/-0.04	0.12+/-0.04	0.10+/-0.03	0.07+/-0.03	0.07+/-0.03	0.07+/-0.02
Zr-95	-0.002+/-0.009	0.001+/-0.009	0.001+/-0.006	0.001+/-0.007	0.000+/-0.006	0.000+/-0.005
Ru-103	-0.001+/-0.004	-0.001+/-0.005	0.002+/-0.003	0.001+/-0.004	0.001+/-0.003	-0.001+/-0.002
Ru-106	0.014+/-0.03	0.009+/-0.03	-0.003+/-0.019	-0.012+/-0.02	-0.001+/-0.019	-0.003+/-0.014
Cs-134	0.000+/-0.003	-0.001+/-0.003	0.000+/-0.002	-0.001+/-0.002	-0.001+/-0.002	0.000+/-0.002
Cs-137	0.000+/-0.003	0.001+/-0.004	0.000+/-0.002	0.000+/-0.003	-0.001+/-0.002	0.001+/-0.002
Ce-141	0.003+/-0.006	0.003+/-0.007	0.004+/-0.004	0.005+/-0.005	-0.002+/-0.004	0.002+/-0.003
Ce-144	-0.010+/-0.016	-0.014+/-0.017	-0.002+/-0.011	0.001+/-0.014	0.008+/-0.012	0.006+/-0.009

Trident Marina

ZI-5

	January	February	March	April	May	June
Be-7	0.062+/-0.013	0.055+/-0.014	0.08+/-0.02	0.098+/-0.015	0.084+/-0.016	0.08+/-0.02
Zr-95	0.002+/-0.002	0.000+/-0.002	-0.002+/-0.004	0.000+/-0.002	0.001+/-0.002	0.002+/-0.004
Ru-103	* a	* a	0.000+/-0.002	0.000+/-0.001	-0.001+/-0.001	0.000+/-0.002
Ru-106	0.002+/-0.006	0.005+/-0.008	0.003+/-0.013	0.002+/-0.007	-0.001+/-0.008	0.002+/-0.013
Cs-134	0.000+/-0.001	0.000+/-0.001	-0.001+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001
Cs-137	0.001+/-0.001	0.000+/-0.001	-0.001+/-0.001	0.000+/-0.001	0.000+/-0.001	0.000+/-0.001
Ce-141	* a	* a	0.002+/-0.003	0.000+/-0.001	0.000+/-0.001	0.001+/-0.003
Ce-144	0.001+/-0.003	0.000+/-0.004	0.003+/-0.007	0.002+/-0.003	0.000+/-0.004	0.000+/-0.007
	July	August	September	October	November	December
Be-7	0.111+/-0.017	0.09+/-0.03	0.052+/-0.016	0.057+/-0.015	0.11+/-0.04	0.07+/-0.02
Zr-95	0.001+/-0.003	-0.003+/-0.005	0.001+/-0.003	0.001+/-0.003	0.000+/-0.007	0.000+/-0.004
Ru-103	0.000+/-0.001	0.000+/-0.003	0.000+/-0.001	-0.001+/-0.001	0.000+/-0.004	-0.001+/-0.002
Ru-106	0.000+/-0.008	-0.004+/-0.017	-0.002+/-0.008	0.003+/-0.009	-0.007+/-0.02	-0.002+/-0.014
Cs-134	0.000+/-0.001	0.000+/-0.002	0.000+/-0.001	0.000+/-0.001	0.000+/-0.002	0.000+/-0.001
Cs-137	0.000+/-0.001	0.001+/-0.002	0.000+/-0.001	0.001+/-0.001	0.002+/-0.003	-0.001+/-0.002
Ce-141	0.000+/-0.002	0.001+/-0.004	0.000+/-0.002	0.000+/-0.002	0.002+/-0.005	-0.001+/-0.002
Ce-144	0.002+/-0.005	0.001+/-0.010	0.001+/-0.005	-0.001+/-0.005	-0.003+/-0.014	0.000+/-0.008

* a - Isotope was not specifically analyzed for.
Isotopes other than those reported were not detected.

Table 24. Wisconsin TLD network for 1983 & 1984.

ZION

1983 & 1984

Measurements in units of milliroentgens (mR)

Exposure period: 1st quarter 01/13/83 - 04/21/83 (98) 2nd quarter 04/21/83 - 07/21/83 (91)
3rd quarter 07/21/83 - 10/09/83 (84) 4th quarter 10/09/83 - 01/11/84 (95)

Site	Location Azimuth/Distance (Degrees) (Miles)	1st quarter	2nd quarter	3rd quarter	4th quarter
		Exposure Rate	Exposure Rate	Exposure Rate	Exposure Rate
		mr/Std. Qtr. +/- 2 sigma	mr/Std. Qtr. +/- 2 sigma	mr/Std. Qtr. +/- 2 sigma	mr/Std. Qtr. +/- 2 sigma
6	337	6.3	* a	15.0+/-6.8	17.8+/-9.0
7	355	6.0	15.8+/-2.9	16.3+/-4.3	12.3+/-1.9
8	310	6.0	17.5+/-5.0	14.6+/-4.0	14.4+/-2.3
9	359	3.3	15.3+/-6.4	15.2+/-6.4	12.0+/-2.8
10	355	10.0	12.9+/-2.6	13.1+/-5.7	13.4+/-4.0
					15.1+/-4.3

Exposure period: 1st quarter 01/11/84 - 04/04/84 (83) 2nd quarter 04/04/84 - 07/06/84 (93)
3rd quarter 07/06/84 - 10/03/84 (89) 4th quarter 10/03/84 - 01/09/85 (98)

Site	Location Azimuth/Distance (Degrees) (Miles)	1st quarter	2nd quarter	3rd quarter	4th quarter
		Exposure Rate	Exposure Rate	Exposure Rate	Exposure Rate
		mr/Std. Qtr. +/- 2 sigma	mr/Std. Qtr. +/- 2 sigma	mr/Std. Qtr. +/- 2 sigma	mr/Std. Qtr. +/- 2 sigma
6	337	6.3	17.4+/-3.2	17.4+/-4.2	18.8+/-5.8
7	355	6.0	17.4+/-2.5	17.9+/-5.1	17.6+/-6.4
8	310	6.0	20.6+/-10.6	15.8+/-3.3	17.1+/-5.0
9	359	3.3	14.1+/-2.0	13.4+/-3.8	16.7+/-5.8
10	355	10.0	15.6+/-8.0	12.1+/-4.3	13.9+/-6.1
					17.0+/-5.4

* a - Data not available due to missing dosimeter.

Table 25. U.S. Nuclear Regulatory Commission TLD network for Zion during 1983.

ZION

1983

Measurements in units of milliroentgens (mR)

Exposure period: 1st quarter 12/23/82 - 04/11/83 (85) 3rd quarter 06/07/83 - 10/07/83 (93)
2nd quarter 03/17/83 - 07/07/83 (81) 4th quarter 09/17/83 - 01/10/83 (96)

Site	Location Azimuth/Distance (Degrees) (Miles)	1st quarter	2nd quarter	3rd quarter	4th quarter
		Exposure Rate	Exposure Rate	Exposure Rate	Exposure Rate
		mR/Std. Qtr. +/- Rdm; Tot.	mR/Std. Qtr. +/- Rdm; Tot.	mR/Std. Qtr. +/- Rdm; Tot.	mR/Std. Qtr. +/- Rdm; Tot.
1	287	1.0 * a	10.7+/-0.7	* a	14.5+/-0.7
2	192	1.0 10.8+/-0.7	15.0+/-0.8	* a	17.9+/-0.8
3	187	1.5 * a	9.8+/-0.7	11.2+/-0.6	13.2+/-0.7
4	227	2.4 15.7+/-0.8	17.4+/-0.9	13.7+/-0.7	21.6+/-0.9
5	257	1.8 8.6+/-0.7	19.7+/-0.9	13.0+/-0.7	22.8+/-0.9
6	264	1.2 14.5+/-0.8	16.8+/-0.9	12.0+/-0.7	* a
7	287	1.6 * a	16.8+/-0.9	12.7+/-0.7	21.1+/-0.9
8	320	1.8 14.3+/-0.8	15.9+/-0.8	11.3+/-0.6	18.4+/-0.8
9	343	2.6 15.0+/-0.8	16.5+/-0.9	12.3+/-0.7	20.3+/-0.9
10	356	4.5 13.1+/-0.8	15.3+/-0.8	10.4+/-0.6	19.1+/-0.8
11	337	4.5 8.4+/-0.7	17.5+/-0.9	12.8+/-0.7	21.8+/-0.9
12	310	4.0 17.1+/-0.9	18.3+/-0.9	14.2+/-0.7	22.9+/-0.9
13	293	3.5 16.9+/-0.9	19.7+/-0.9	15.7+/-0.7	* a
14	280	4.5 18.2+/-0.9	18.4+/-0.9	15.0+/-0.7	23.4+/-0.9
15	239	3.2 15.9+/-0.8	20.0+/-0.9	13.7+/-0.7	23.0+/-0.9
16	227	3.5 17.4+/-0.9	17.8+/-0.9	14.2+/-0.7	20.9+/-0.9
17	210	4.5 14.7+/-0.8	13.7+/-0.8	13.3+/-0.7	17.3+/-0.8
18	208	2.8 15.4+/-0.8	16.3+/-0.9	12.6+/-0.7	19.5+/-0.8
19	342	2.7 15.0+/-0.8	16.4+/-0.9	12.3+/-0.7	18.8+/-0.8
20	197	14. 11.3+/-0.7	19.8+/-0.9	15.1+/-0.7	22.8+/-0.9
21	352	7.9 14.2+/-0.8	17.5+/-0.9	* a	19.7+/-0.9
22	348	8.3 * a	* a	12.4+/-0.7	20.2+/-0.9
23	336	8.5 15.5+/-0.8	17.1+/-0.9	11.8+/-0.7	19.0+/-0.8
24	314	5.8 15.3+/-0.8	17.0+/-0.9	12.9+/-0.7	* a
25	220	6.3 16.3+/-0.8	16.4+/-0.9	13.3+/-0.7	20.8+/-0.9
26	195	8.0 15.3+/-0.8	15.7+/-0.8	12.3+/-0.7	19.6+/-0.9
28	197	14. 18.1+/-0.9	21.3+/-1.0	15.7+/-0.7	23.3+/-0.9
30	320	9.8 17.6+/-0.9	15.1+/-0.8	14.6+/-0.7	18.8+/-0.8
31	229	8.0 15.8+/-0.8	17.7+/-0.9	12.4+/-0.7	20.8+/-0.9

* a - The data was not available due to damaged or missing dosimeters.

The following sites are located in Wisconsin: 10, 11, 21, 22, 23, 24, 30.

NRC TLD DIRECT RADIATION MONITORING NETWORK, U.S. Nuclear Regulatory Commission, NUREG-0837, Washington, Vol. 3, No. 1, 2, 3 & 4, 1983.

Table 26. U.S. Nuclear Regulatory Commission TLD network for Zion during 1984.

ZION

1984

Measurements in units of milliroentgens (mR)

Exposure period: 1st quarter 12/09/83 - 04/07/84 (87) 3rd quarter 07/30/84 - 10/04/84 (49)
2nd quarter 03/19/84 - 08/13/84 (135) 4th quarter 09/13/84 - 01/07/84 (94)

Site	Location Azimuth/Distance (Degrees) (Miles)	1st quarter 2nd quarter *b 3rd quarter *b 4th quarter			
		Exposure Rate			
		mR/Std. Qtr. +/- Rdm; Tot.			
1	287 1.0	11.6+/-0.7	* a	* a	16.2+/-0.6
2	192 1.0	14.6+/-0.8	18.6+/-0.6	10.0+/-0.3	12.7+/-0.5
3	187 1.5	15.8+/-0.8	20.1+/-0.6	11.3+/-0.3	13.6+/-0.5
4	227 2.4	17.0+/-0.8	22.2+/-0.7	13.0+/-0.4	16.0+/-0.6
5	257 1.8	16.8+/-0.8	22.6+/-0.7	13.1+/-0.4	16.7+/-0.6
6	264 1.2	16.1+/-0.8	21.5+/-0.6	12.4+/-0.4	14.6+/-0.5
7	287 1.6	14.3+/-0.8	* a	13.0+/-0.4	15.3+/-0.6
8	320 1.8	14.6+/-0.8	20.0+/-0.6	11.7+/-0.3	13.4+/-0.5
9	343 2.6	14.2+/-0.8	21.4+/-0.6	12.5+/-0.4	* a
10	356 4.5	15.4+/-0.8	* a	11.0+/-0.3	13.4+/-0.5
11	337 4.5	15.6+/-0.8	24.2+/-0.7	12.6+/-0.4	16.5+/-0.6
12	310 4.0	17.8+/-0.9	25.7+/-0.8	14.3+/-0.4	18.0+/-0.6
13	293 3.5	17.8+/-0.9	24.4+/-0.7	14.5+/-0.4	17.3+/-0.6
14	280 4.5	16.4+/-0.8	24.6+/-0.7	13.9+/-0.4	16.3+/-0.6
15	239 3.2	17.4+/-0.9	22.8+/-0.7	13.0+/-0.4	16.3+/-0.6
16	227 3.5	14.1+/-0.8	24.4+/-0.7	13.1+/-0.4	17.2+/-0.6
17	210 4.5	15.0+/-0.8	20.5+/-0.6	12.6+/-0.4	14.7+/-0.5
18	208 2.8	15.3+/-0.8	20.0+/-0.6	11.9+/-0.4	14.2+/-0.5
19	342 2.7	18.5+/-0.9	20.8+/-0.6	11.7+/-0.4	13.2+/-0.5
20	197 14.	12.3+/-0.7	26.6+/-0.8	14.8+/-0.4	17.8+/-0.6
21	352 7.9	12.3+/-0.7	20.1+/-0.6	10.3+/-0.3	14.0+/-0.5
22	348 8.3	13.6+/-0.8	20.6+/-0.6	12.4+/-0.4	14.6+/-0.5
23	336 8.5	15.1+/-0.8	21.4+/-0.6	11.7+/-0.4	14.0+/-0.5
24	314 5.8	14.7+/-0.8	* a	* a	17.8+/-0.6
25	220 6.3	16.1+/-0.8	21.6+/-0.6	11.9+/-0.4	14.7+/-0.5
26	195 8.0	14.4+/-0.8	20.1+/-0.6	11.9+/-0.4	14.4+/-0.5
28	197 14.	17.7+/-0.9	26.1+/-0.8	14.4+/-0.4	18.0+/-0.6
30	320 9.8	17.4+/-0.9	23.6+/-0.7	14.5+/-0.4	16.1+/-0.6
31	229 8.0	15.6+/-0.8	22.7+/-0.7	12.8+/-0.4	15.2+/-0.6
32	193 14.				18.2+/-0.6

* a - The data was not available due to damaged or missing dosimeters.

* b - Gross exposure is presented TLD controls were missing in order to compute Net Exposure Rate (mR/Std. Qtr.).

The following sites are located in Wisconsin: 10, 11, 21, 22, 23, 24, 30.

NRC TLD DIRECT RADIATION MONITORING NETWORK, U.S. Nuclear Regulatory Commission, NUREG-0837, Washington, Vol. 4, No. 1, 2, 3 & 4, 1984.

Table 27. Precipitation analysis for 1983 and 1984.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1983 & 1984

Measurements in units of nCi/M² *a

Sample period 1983	Precipitation (inches)	ZI-7 Gross beta	ZI-7 tritium
05/01/ - 06/02	3.68	0.05+/-0.03	1.9+/-7

Sample period 1984	Precipitation (inches)	ZI-7 Gross beta	ZI-7 tritium
05/15 - 06/07	2.50	0.05+/-0.03	-3.9+/-8
06/07 - 06/28	3.05	0.05+/-0.03	-1.0+/-9
06/28 - 07/13	2.81	0.04+/-0.02	4+/-8
07/13 - 08/03	0.73	0.05+/-0.03	3+/-8
08/03 - 08/23	1.54	0.05+/-0.03	4+/-8
08/23 - 09/07	1.47	0.14+/-0.03	-4+/-8
09/07 - 10/11	2.12	0.05+/-0.03	-6+/-7
10/11 - 11/29	5.42	0.03+/-0.03	2+/-7

*a - Nanocuries per square meter.

Table 28. Analysis of surface water samples for 1983 & 1984.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1983 & 1984

Measurements in units of pCi/liter

WI - Section of Radiation Protection data

Collection Date	01/10/83	04/12/83	08/16/83	10/18/83
Location	ZI-8	ZI-8	ZI-8	ZI-8
Gross Alpha-sol.	0.3+/-0.7	0.8+/-0.8	0.0+/-0.7	0.8+/-0.8
Gross Alpha-insol	0.6+/-0.6	0.9+/-0.7	0.1+/-0.5	-0.1+/-0.5
Gross Beta-sol.	2.3+/-1.2	2.7+/-1.2	4.8+/-2.0	2.7+/-1.1
Gross Beta-insol.	0.4+/-1.0	1.6+/-1.1	-0.1+/-1.1	-0.1+/-0.9
H-3	-50+/-290	10+/-290	-290+/-420	-140+/-390
Sr-89	<0	0.02+/-0.5	0.8+/-0.6	0.3+/-0.6
Sr-90	1.5+/-0.8	0.3+/-0.4	0.05+/-0.6	0.16+/-0.6
Gamma Isotopic				
Mn-54	-1+/-4	0+/-2	4+/-6	1+/-4
Fe-59	-1+/-10	1+/-5	-6+/-12	0+/-11
Co-58	1+/-5	0+/-3	1+/-6	-1+/-6
Co-60	5+/-5	2+/-3	9+/-7	5+/-3
Zn-65	-2+/-9	-30+/-6	1+/-12	5+/-9
I-131	0.8+/-0.8	-0.04+/-0.17	0.4+/-0.11	-0.25+/-0.15
Cs-134	2+/-4	-1+/-3	0+/-6	-1+/-5
Cs-137	-1+/-5	4+/-3	3+/-8	0+/-6
Zr-95	5+/-10	0+/-6	2+/-13	4+/-11
Ba,La-140	4+/-10	1+/-4	6+/-5	6+/-5

Collection Date	01/18/84	04/11/84	07/11/84	10/10/84
Location	ZI-8	ZI-8	ZI-8	ZI-8
Gross Alpha-sol.	1.0+/-1.0	0.0+/-0.8	-0.3+/-0.4	0.2+/-0.9
Gross Alpha-insol	0.6+/-0.7	-0.1+/-0.5	0.1+/-0.7	0.1+/-0.6
Gross Beta-sol.	3.4+/-1.2	3.2+/-1.2	3.3+/-1.2	2.7+/-1.2
Gross Beta-insol.	1.0+/-1.0	0.0+/-1.0	-0.1+/-0.9	0.4+/-1.0
H-3	-130+/-360	470+/-340	-70+/-330	-90+/-280
Sr-89	0.5+/-0.5	0.3+/-0.6	0.3+/-0.6	-1.3+/-0.5
Sr-90	0.3+/-0.5	0.4+/-0.6	0.3+/-0.6	0.8+/-0.5
Gamma Isotopic				
Mn-54	0+/-4	-2+/-4	1+/-4	-2+/-4
Fe-59	-3+/-9	4+/-9	-2+/-7	0+/-8
Co-58	6+/-3	2+/-5	0+/-4	1+/-4
Co-60	1+/-6	1+/-6	2+/-6	0+/-5
Zn-65	15+/-8	-1+/-10	0+/-9	-8+/-8
I-131	-0.17+/-0.11	-0.4+/-0.3	0.10+/-0.15	-0.14+/-0.16
Cs-134	1+/-6	0+/-5	4+/-5	1+/-5
Cs-137	1+/-5	0+/-6	1+/-5	4+/-5
Zr-95	6+/-9	-4+/-10	5+/-12	0+/-11
Ba,La-140	5+/-4	-1+/-6	-3+/-6	-3+/-7

Isotopes other than those reported were not detected.

Table 29. Analysis of vegetation samples for 1983.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1983

WI - Section of Radiation Protection data

Measurements in units of pCi/kilogram (wet)

Collection Date	05/25/83	05/25/83	05/25/83	05/25/83	05/25/83	05/25/83
Type	vegetation	vegetation	vegetation	vegetation	vegetation	vegetation
Location	ZI-1	ZI-2	ZI-3	ZI-4	ZI-5	ZI-6
Analysis						
Gross beta (dry)	26000+/-4000	35000+/-4000	27000+/-4000	25000+/-3000	30000+/-4000	33000+/-4000
Gross alpha (dry)	-400+/-2000	900+/-3000	1800+/-3000	0+/-2000	-400+/-2000	-400+/-2000
Gamma Isotopic (wet)						
Be-7	400+/-300	20+/-360	1300+/-400	1100+/-400	300+/-400	600+/-400
K-40	1600+/-600	2600+/-700	1600+/-700	2000+/-600	3000+/-700	2000+/-600
Co-58	10+/-30	7+/-30	-12+/-50	18+/-40	10+/-40	0+/-40
Co-60	20+/-50	20+/-40	30+/-40	0+/-50	30+/-50	3+/-40
Zr-95	-30+/-80	-15+/-90	80+/-90	4+/-80	30+/-90	30+/-60
I-131	-13+/-50	40+/-50	8+/-60	6+/-50	2+/-70	-9+/-60
Cs-134	-30+/-40	-10+/-30	8+/-40	14+/-40	30+/-30	0+/-30
Cs-137	9+/-40	-16+/-40	70+/-50	-4+/-50	30+/-40	2+/-40

Collection Date	10/18/83	10/18/83	10/18/83	10/18/83	10/18/83	10/18/83
Type	vegetation	vegetation	vegetation	vegetation	vegetation	vegetation
Location	ZI-1	ZI-2	ZI-3	ZI-4	ZI-5	ZI-6
Analysis						
Gross beta (dry)	14000+/-3000	25000+/-3000	20000+/-3000	15000+/-3000	31000+/-4000	26000+/-4000
Gross alpha (dry)	600+/-3000	1700+/-3000	0+/-3000	3000+/-3000	1700+/-3000	1100+/-3000
Gamma Isotopic (wet)						
Be-7	2700+/-700	800+/-500	2200+/-600	2900+/-1100	400+/-500	400+/-600
K-40	3400+/-1700	5700+/-1500	4200+/-1000	2200+/-1600	3200+/-1400	6000+/-1800
Co-58	-70+/-70	3+/-50	1+/-40	40+/-90	40+/-50	-30+/-60
Co-60	10+/-110	-40+/-80	40+/-60	-40+/-100	0+/-70	-30+/-90
Zr-95	-4+/-150	-50+/-120	80+/-90	180+/-200	-100+/-120	-20+/-120
I-131	-30+/-80	60+/-50	-30+/-60	0+/-300	-80+/-60	-9+/-90
Cs-134	-10+/-70	10+/-50	4+/-50	-13+/-80	50+/-50	8+/-50
Cs-137	50+/-70	30+/-60	-40+/-50	100+/-90	2+/-70	40+/-60

Isotopes other than those reported were not detected.

Table 30. Analysis of vegetation samples for 1984.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1984

WI - Section of Radiation Protection data

Measurements in units of pCi/kilogram (wet)

Collection Date	05/23/84	05/23/84	05/23/84	05/23/84	05/23/84	05/23/84
Type	vegetation	vegetation	vegetation	vegetation	vegetation	vegetation
Location	ZI-1	ZI-2	ZI-3	ZI-4	ZI-5	ZI-6
Analysis						
Gross beta (wet)	8000+/-4000	6000+/-4000	9000+/-4000	8000+/-4000	7000+/-4000	6000+/-4000
Gross alpha (wet)	-600+/-700	200+/-500	-100+/-700	-100+/-600	100+/-500	-200+/-400
Gamma Isotopic (wet)						
Be-7	120+/-600	700+/-400	1200+/-700	1400+/-500	200+/-300	800+/-400
K-40	6300+/-1600	4800+/-900	5600+/-1500	5700+/-1000	5800+/-1000	5400+/-900
Co-58	5+/-70	4+/-30	5+/-70	30+/-40	16+/-30	2+/-30
Co-60	50+/-80	40+/-40	50+/-80	50+/-50	70+/-40	60+/-40
Zr-95	50+/-150	-2+/-70	60+/-150	60+/-90	2+/-70	6+/-70
I-131	40+/-90	-9+/-40	30+/-80	-50+/-50	-40+/-40	-50+/-40
Cs-134	50+/-70	3+/-30	30+/-60	9+/-40	-3+/-30	15+/-30
Cs-137	11+/-80	-9+/-30	60+/-80	-2+/-40	10+/-40	8+/-40

Collection Date	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84
Type	vegetation	vegetation	vegetation	vegetation	vegetation	vegetation
Location	ZI-1	ZI-2	ZI-3	ZI-4	ZI-5	ZI-6
Analysis						
Gross beta (wet)	6700+/-1800	7200+/-1700	8000+/-1900	7200+/-1800	7000+/-2000	11000+/-3000
Gross alpha (wet)	200+/-2000	-600+/-1700	200+/-2000	-600+/-1700	300+/-2000	1300+/-3000
Gamma Isotopic (wet)						
Be-7	4900+/-900	4900+/-900	3700+/-600	3500+/-600	6300+/-1000	6300+/-800
K-40	5400+/-1700	5700+/-1700	7700+/-1200	6100+/-1200	9000+/-2000	5100+/-1300
Co-58	90+/-80	100+/-80	14+/-40	9+/-40	20+/-80	-30+/-50
Co-60	50+/-100	0+/-90	30+/-50	40+/-50	90+/-110	60+/-70
Zr-95	70+/-160	210+/-170	-5+/-90	40+/-100	220+/-190	60+/-130
I-131	70+/-80	130+/-80	-8+/-40	7+/-50	130+/-90	0+/-60
Cs-134	30+/-70	50+/-70	17+/-40	2+/-40	100+/-80	20+/-50
Cs-137	70+/-80	40+/-80	9+/-40	-11+/-40	150+/-100	-1+/-60

Isotopes other than those reported were not detected.

Table 31. Analysis of soil samples for 1983.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1983

WI - Section of Radiation Protection data

Measurements in units of pCi/ki ogram (dry)

Collection Date	05/25/83	05/25/83	05/25/83	05/25/83	05/25/83	05/25/83
Type	soil	soil	soil	soil	soil	soil
Location	ZI-1	ZI-2	ZI-3	ZI-4	ZI-5	ZI-6
Analysis						
Gross beta (dry)	31000+/-4000	32000+/-4000	31000+/-4000	31000+/-4000	21000+/-3000	30000+/-4000
Gross alpha (dry)	8000+/-4000	5000+/-3000	9000+/-4000	7000+/-4000	2000+/-3000	8000+/-4000
Gamma Isotopic						
Co-58	16+/-60	-3+/-60	19+/-60	-1+/-60	-10+/-50	-60+/-70
Co-60	-10+/-90	0+/-90	20+/-90	-40+/-90	-10+/-70	30+/-90
Cs-134	30+/-60	7+/-60	30+/-70	30+/-60	60+/-50	50+/-60
Cs-137	840+/-90	600+/-90	580+/-90	140+/-70	1200+/-100	890+/-100
K-40	23600+/-1700	24900+/-1800	22300+/-1800	24800+/-1700	13500+/-1300	19800+/-1700
Ra-226 * a	2500+/-1000	2800+/-1100	2700+/-1200	1200+/-1000	1900+/-900	2700+/-1100
Pb-214 * a	810+/-130	880+/-140	930+/-140	850+/-120	500+/-120	900+/-150
Bi-214 * a	730+/-150	1000+/-160	890+/-150	790+/-130	460+/-120	950+/-150
Tl-208 * a	750+/-190	800+/-200	1000+/-200	700+/-170	420+/-150	700+/-200
Ac-228 * a	800+/-200	900+/-200	1200+/-300	700+/-300	400+/-200	900+/-200

Collection Date	10/18/83	10/18/83	10/18/83	10/18/83	10/18/83	10/18/83
Type	soil	soil	soil	soil	soil	soil
Location	ZI-1	ZI-2	ZI-3	ZI-4	ZI-5	ZI-6
Analysis						
Gross beta (dry)	27000+/-4000	33000+/-4000	27000+/-4000	28000+/-4000	17000+/-3000	27000+/-4000
Gross alpha (dry)	9000+/-4000	9000+/-4000	8000+/-4000	8000+/-4000	7000+/-4000	10000+/-4000
Gamma Isotopic						
Co-58	-30+/-40	-13+/-40	-30+/-40	-40+/-40	-20+/-30	2+/-40
Co-60	-10+/-50	-5+/-50	0+/-50	10+/-50	0+/-40	40+/-50
Cs-134	-14+/-40	20+/-40	80+/-40	20+/-40	20+/-30	50+/-40
Cs-137	750+/-70	440+/-50	380+/-60	150+/-40	660+/-60	570+/-60
K-40	17200+/-1300	21000+/-1100	17200+/-1300	19000+/-1300	10200+/-1000	17800+/-1100
Ra-226 * a	1200+/-600	2200+/-900	1300+/-600	1300+/-600	600+/-500	1500+/-700
Pb-214 * a	540+/-90	860+/-100	530+/-90	570+/-80	320+/-70	850+/-100
Bi-214 * a	710+/-100	820+/-100	530+/-100	630+/-90	360+/-80	840+/-110
Tl-208 * a	630+/-130	760+/-120	640+/-130	570+/-80	180+/-90	760+/-120
Ac-228 * a	620+/-170	850+/-150	650+/-180	620+/-160	350+/-120	680+/-160

*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.

Table 32. Analysis of soil samples for 1984.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1984

WI - Section of Radiation Protection data

Measurements in units of pCi/kilogram (dry)

Collection Date	05/23/84	05/23/84	05/23/84	05/23/84	05/23/84	05/23/84
Type	soil	soil	soil	soil	soil	soil
Location	ZI-1	ZI-2	ZI-3	ZI-4	ZI-5	ZI-6
Analysis						
Gross beta (dry)	33000+/-4000	32000+/-4000	29000+/-4000	34000+/-4000	15000+/-3000	27000+/-4000
Gross alpha (dry)	10000+/-4000	8000+/-4000	7000+/-4000	13000+/-5000	1100+/-3000	4000+/-4000
Gamma Isotopic						
Co-58	4+/-40	-6+/-40	-2+/-60	5+/-30	16+/-40	40+/-30
Co-60	10+/-70	40+/-50	20+/-70	10+/-50	20+/-40	20+/-40
Cs-134	12+/-60	9+/-40	80+/-50	80+/-40	-3+/-50	50+/-40
Cs-137	720+/-80	540+/-60	300+/-70	160+/-40	650+/-70	360+/-50
K-40	19000+/-1400	22400+/-1100	18900+/-1400	12400+/-1000	8700+/-900	19600+/-1000
Ra-226 * a	1700+/-1200	1800+/-800	3500+/-1200	2300+/-700	800+/-900	2100+/-700
Pb-214 * a	940+/-130	1000+/-100	920+/-140	930+/-90	430+/-100	830+/-100
Bi-214 * a	750+/-140	870+/-100	760+/-150	850+/-90	360+/-100	770+/-90
Tl-208 * a	910+/-180	690+/-130	1050+/-190	780+/-120	240+/-130	760+/-120
Ac-228 * a	700+/-200	800+/-160	800+/-200	610+/-140	350+/-140	790+/-150

Collection Date	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84	11/07/84
Type	soil	soil	soil	soil	soil	soil
Location	ZI-1	ZI-2	ZI-3	ZI-4	ZI-5	ZI-6
Analysis						
Gross beta (dry)	32000+/-5000	34000+/-5000	30000+/-5000	28000+/-5000	17000+/-4000	18000+/-5000
Gross alpha (dry)	7000+/-6000	7000+/-6000	8000+/-6000	5000+/-6000	8000+/-6000	6000+/-6000
Gamma Isotopic						
Co-58	30+/-50	70+/-50	5+/-60	60+/-50	30+/-20	-2+/-40
Co-60	30+/-80	80+/-70	-5+/-70	20+/-70	5+/-40	0+/-50
Cs-134	20+/-60	-3+/-60	70+/-60	16+/-60	19+/-30	30+/-40
Cs-137	710+/-80	460+/-70	360+/-70	170+/-60	800+/-60	210+/-50
K-40	20200+/-1400	21000+/-1500	20900+/-1500	19300+/-1300	9900+/-800	14100+/-1100
Ra-226 * a	3000+/-1100	3000+/-1100	1700+/-1100	2300+/-1000	1000+/-600	1400+/-800
Pb-214 * a	720+/-120	830+/-120	770+/-120	720+/-110	320+/-60	580+/-90
Bi-214 * a	760+/-130	810+/-130	890+/-140	590+/-120	360+/-70	610+/-100
Tl-208 * a	710+/-160	620+/-180	860+/-170	720+/-110	270+/-90	500+/-120
Ac-228 * a	800+/-200	900+/-200	900+/-200	600+/-200	270+/-110	270+/-160

*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.

Table 33. Well water analysis for 1983 and 1984.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1983 & 1984

WI - Section of Radiation Protection data

Measurements in units of pCi/liter

Collection date	05/25/83	05/25/83	10/18/83	10/18/83
Location	ZI-4	ZI-5	ZI-4	ZI-5
Gross alpha	0.8+/-1.0	-0.3+/-0.8	0.3+/-0.9	1.2+/-1.4
Gross beta	2.0+/-1.2	0.8+/-1.1	2.6+/-1.2	1.3+/-1.1
Tritium (H-3)	150+/-290	4+/-290	-700+/-400	-130+/-390

Collection date	05/23/84	05/23/84	11/07/84	11/07/84
Location	ZI-4	ZI-5	ZI-4	ZI-5
Gross alpha	-0.2+/-1.2	0.9+/-1.6	0.3+/-1.1	0.8+/-1.5
Gross beta	2.6+/-1.2	0.7+/-1.1	3.0+/-1.2	1.3+/-1.1
Tritium (H-3)	-230+/-320	30+/-330	60+/-280	-140+/-290

Table 34. Analysis of milk samples for 1984 from ZI-9.
Steinbrink farm.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Zion

1984

Measurements in units of pCi/liter

WI - Section of Radiation Protection data

Collection date Isotope:	03/06/84	04/17/84	05/15/84	06/27/84
K-40	1280+/-180	1130+/-210	1520+/-180	1490+/-180
Sr-90	2.5+/-0.6	2.5+/-1.2	1.7+/-0.6	* c
I-131	0.12+/-0.2	0.10+/-0.19	0.06+/-0.16	4+/-9 * b
Cs-134	6+/-7	-1+/-9	8+/-6	7+/-5
Cs-137	1+/-8	9+/-9	5+/-6	8+/-5
Ba,La-140	0+/-4	-1+/-8	4+/-4	4+/-6

Collection date Isotope:	07/18/84	08/22/84	09/26/84	* a	11/29/84	12/18/84
K-40	1530+/-190	1460+/-180	1440+/-180		1320+/-170	1530+/-180
Sr-90	2.3+/-0.8	1.8+/-0.6	1.7+/-0.5		3.8+/-0.9	3.4+/-1.1
I-131	0.3+/-0.2	0+/-7 * b	-0.29+/-0.17		0.03+/-0.12	0.3+/-0.3
Cs-134	4+/-6	6+/-5	9+/-4		7+/-5	5+/-6
Cs-137	1+/-7	-1+/-7	10+/-5		3+/-7	5+/-6
Ba,La-140	6+/-6	-4+/-7	-2+/-4		2+/-5	-4+/-8

* a - Sample was not collected.

* b - Results from a gamma isotopic analysis.

* c - Results were not available due to spoiled sample.

Isotopes other than those reported were not detected.