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STATE OF WISCONSIN

1984

La Crosse Boiling Water Reactor

NRC 30-83-647

Wisconsin Department of Health and Social Services
Division of Health
Bureau of Environmental Health
Section of Radiation Protection
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STATE OF WISCONSIN

1984

LA CROSSE BOILING WATER REACTOR ENVIRONMENTAL RADIOACTIVITY SURVEY

INTRODUCTION

This report is prepared under U.S. Nuclear Regulatory Commission Contract NRC 30-83-647 by the State of Wisconsin, Department of Health and Social Services, Section of Radiation Protection. This report covers the calendar year 1984. 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 is 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 29 locations in the area of the La Crosse Boiling Water Reactor (LACBWR) nuclear power plant.

Air Samples

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

Surface Water

A split sample is collected monthly at a point close to the discharge of the LACBWR effluent channel. This sample is a grab sample and is collected while the plant is discharging wastewater to the channel. A background surface water sample is also taken from Lock and Dam #8.

Milk

A raw milk sample is collected monthly from one of three local farms located in the Genoa, Wisconsin area.

Sediment

Sediment is collected from three locations in the Mississippi River channel on an annual basis.

Fish

Game and scavenger fish are collected periodically from locations in the Mississippi River near the LACBWR nuclear power plant.

Food Products

A blended sample of mixed vegetables was collected from a local garden.

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

The monthly composite of air particulate filters is placed on a Ge(Li) detector. Determine the gamma spectrum using 2048 channels of the Canberra Model 85 multichannel analyzer. 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. The sample is counted for 100 minutes using 2048 channels at 1.0 Kev per channel. 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.

Vegetation or Food Product - 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 for 900 minutes on a Ge(Li) 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.

Soil or Sediment -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 dried soil is added to a 500 ml Marinelli beaker, weighed and counted for 100 minutes on a Ge(Li) 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 same as for Surface Water.

Milk - Iodine 131 Chemical Extraction

A stable iodine carrier is added to a 2 liter sample of raw milk. The sample is passed through an anion exchange column and the iodine is removed from the resin by batch/extraction using NaOCl. After reduction to elemental iodine by hydroxylamine hydrochloride, the iodine is extracted into carbon tetrachloride reduced with bisulfite, and back extracted into water. The iodine is precipitated as palladous iodide with the chemical

yield determined gravimetrically and counted in an external gas flow proportional counter correcting for counter efficiency and for decay.

Fish - Gamma Isotopic

An edible portion is placed in a 500 ml. Marinelli beaker. Place the sample on a GeLi detector and count for 100 minutes. Determine the gamma spectrum using 2048 channels set at 1.0 Kev per channel. 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.

Direct Radiation

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

QUALITY ASSURANCE

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

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

SLH participates in the EPA Cross Check program. The quality assurance 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. The EPA Cross Check code for SLH is "AF". A complete listing of the EPA Cross Check results is included in Table 13 following the conclusion section.

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 concentration that can or cannot be detected. Minimum detectable concentrations (MDC) are based on the analysis

performed and for gamma isotopic analysis have been calculated for a zero decay time.

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

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

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

Where:

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

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

E is the counting efficiency, as counts per disintegration,

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

2.22 is the number of disintegrations per minute per picocurie,

Y is the fractional radiochemical yield, when applicable,

S is the self-absorption correction factor,

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

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

Guidelines adopted by the U.S. Environmental Protection Agency are used in the reporting of specific analyses. Results from specific analyses will be reported whether the results are negative, zero, or positive. Caution should be exercised in the interpretation of individual negative values. While a negative activity value does not have physical significance, it is significant when taken together with other observations which indicate that the true value of 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 (+/-).

SENSITIVITIES - LACBWR DATA

Lower limits of detection (LLD) or minimum detectable activity (MDA) as reported by LACBWR are defined in their manual LACBWR, HEALTH & SAFETY DEPARTMENT PROCEDURE, LACBWR ENVIRONMENTAL MONITORING PROGRAM. The method for calculating the LLD and a representative table of LLD's for LACBWR is included on pages 25 and 26 of this report. In most cases, reported activities for LACBWR are less than the required LLD's indicated on page 26.

CONCLUSIONS

Air Particulate

Wisconsin and LACBWR maintain separate air sampling stations. The indicator site for both Wisconsin and LACBWR is located at Lock & Dam #8, 0.7 miles N. The control site for Wisconsin is located at the state office building in La Crosse, 16 miles N and for LACBWR at the Dairyland Power office in La Crosse.

The yearly averages, from a log-normal distribution for the gross beta analysis on the air particulate filters, are given in Table 1.

Table 1. Comparison of gross beta activity for air particulate filters for 1984.

| | | | |
|--------------------------------------|---------------|---------------|---------------|
| WI - Section of Radiation Protection | | LACBWR | |
| units of pCi/M ³ | | | |
| Indicator | Control | Indicator | Control |
| 0.018+/-0.003 | 0.017+/-0.002 | 0.037+/-0.004 | 0.048+/-0.005 |

The LACBWR yearly averages for both the indicator and control sites is approximately twice as high as the reported Wisconsin yearly averages for respective sites. This difference is apparently due to the counting instrument used. With the purchase in early 1985 of a low background alpha/beta gas flow proportional counting Canberra system, LACBWR has experienced an approximate 50% decrease in its gross beta activities.

The Wisconsin and LACBWR yearly averages for gross beta on the air particulate filters showed no significant differences between their respective indicator and control sites.

The Wisconsin and LACBWR gamma isotopic analysis of the monthly air particulate filter composites detected the following radioisotopes above their respective minimum detectable concentration for the indicated months.

Table 2. Radioisotopes detected in the monthly air particulate filter composites.

| WI - Section of Radiation Protection | | |
|--------------------------------------|----------------|--------------|
| Isotope | Indicator | Control |
| | Month detected | |
| Be-7 | 1,2,3,4,5,6,7, | 1,3,4,5,6,7, |
| | 8,9,10,11,12 | 8,9,10,11,12 |

Table 2 continued.

| LACBWR | | |
|---------|---------------------------|--------------|
| | Indicator | Control |
| Isotope | Month detected | |
| I-131 | 3,4,11,12 | 9 |
| Cs-137 | 1,5,8,9, | 1,9,12 |
| Ce-144 | 12 | |
| Co-60 | 1,2,3,4,5,7,8 10,11,12 | 1,5,6,7,8,12 |
| Mn-54 | 1,8,10 | 11 |
| Ba-140 | 5 | |
| Ce-141 | | 1 |
| Co-57 | | 3 |
| Co-58 | | 1,5 |

LACBWR does not report naturally occurring radioisotopes and no comparison can be made for beryllium-7 as reported by Wisconsin. All of the reported radioisotopes for LACBWR were at trace activity levels and all were less than the respective Wisconsin MDC's.

At the observed lower levels of activity, the Wisconsin and LACBWR data compared favorably in the gross beta and gamma isotopic analysis on the air particulate samples. Influence by the LACBWR nuclear facility on air quality is not evident when comparing the data from the indicator and control sites.

Air Iodine

All reported air iodine measurements of the cartridges, for both Wisconsin and LACBWR, were all below the required NRC LLD of 0.07 pCi/M³ for the sites at Lock and Dam #8 and at La Crosse.

Surface Water

The surface water samples are split samples taken as a grab sample on a monthly basis. The discharge channel is taken as the indicator site and Lock and Dam #8 is taken as the control site.

The Wisconsin and LACBWR gamma isotopic analysis of the surface water samples detected the following radioisotopes above the respective minimum detectable concentration for the indicated months.

Table 3. Radioisotopes detected in the monthly surface water samples.

WI - Section of Radiation Protection

| | Indicator | Control |
|---------|----------------|---------|
| Isotope | Month detected | |
| Mn-54 | 1,2,3,6 | ----- |
| Co-58 | 1 | ----- |
| Co-60 | 1,2,3,6,8,11 | ----- |
| Zn-65 | 2 | ----- |
| Cs-137 | 3 | ----- |

LACBWR

| | Indicator | Control |
|---------|-----------------|-------------------|
| Isotope | Month detected | |
| Mn-54 | 2 *a,6 *a,8 *a | 2 *a,8 *a,9 *a,11 |
| Co-57 | 4 *a,6 *a,7 *a | 3 *a,10 *a |
| Co-60 | 1,3,8,9 | 8 *a,9 |
| Nb-95 | 2 *a,7 *a,11 *a | 9 *a |
| Ce-141 | 7 *a | 4 *a |
| Cs-137 | | 6 *a |
| Zn-65 | | 10 *a |

*a - The reported LACBWR results are less than the respective Wisconsin MDC.

Differences in reported activities between Wisconsin and LACBWR existed in both the indicator and control sites. The reported differences are indicated in Table 4.

Table 4. Differences in reported results between Wisconsin and LACBWR for surface water samples.

Discharge Channel - Indicator Site

results expressed as pCi/l

| Collection | Analysis | WI | LACBWR |
|------------|------------|------------|------------|
| 01/10/84 | gross beta | 228+/-6 | 148+/-4 |
| | Mn-54 | 105+/-16 | <MDA |
| | Co-58 | 30+/-10 | <MDA |
| 02/15/84 | gross beta | 54+/-4 | 35.6+/-2.7 |
| | H-3 | 4000+/-450 | <MDA |
| | Co-60 | 68+/-12 | <MDA |
| | Zn-65 | 24+/-14 | <MDA |
| 03/28/84 | gross beta | 66+/-4 | 34.1+/-2.3 |
| | Mn-54 | 27+/-8 | <MDA |
| | Co-60 | 74+/-13 | 33+/-7 |
| 05/09/84 | H-3 | -80+/-300 | 3951 |

Table 4 continued.

Discharge Channel - Indicator Site

results expressed as pCi/l

| Collection | Analysis | WI | LACBWR |
|------------|----------|------------|-------------|
| 06/13/84 | H-3 | 760+/-350 | 3410 |
| | Co-60 | 96+/-15 | <MDA |
| 08/15/84 | H-3 | 2500+/-360 | 3508 |
| 09/12/84 | H-3 | -50+/-310 | 1430 |
| | Co-60 | 5+/-6 | 50.3+/-27.3 |
| 11/15/84 | H-3 | 9500+/-400 | 2197 |
| | Co-60 | 25+/-8 | <MDA |

Lock & Dam #8 - Control Site

| | | | |
|----------|-------|-----------|-------------|
| 05/09/84 | H-3 | 80+/-330 | 3293 |
| 06/13/84 | H-3 | 550+/-350 | 2046 |
| 08/15/84 | H-3 | 280+/-330 | 1403 |
| 09/12/84 | Co-60 | 1+/-5 | 49.5+/-27.2 |
| 11/14/84 | Mn-54 | 0+/-4 | 16.6+/-4.2 |

Differences in gross beta reported activities were noted in January, February and March for the discharge channel site. Gross beta activities are compared by adding the two individual gross beta activities from the soluble and insoluble portions for Wisconsin and comparing that sum with the LACBWR reported gross beta activity. For Wisconsin the higher gross beta activity was in the insoluble portion. After correspondence in April 1984, it was suggested that the lower reported results by LACBWR for gross beta activities could be due to improper mixing in the sample preparation of the surface water sample or to problems associated with the calibration of the gas flow proportional counter. Thorough mixing was initiated in April 1984 and agreement in the Wisconsin and LACBWR reported results for gross beta activities has been substantially better.

Tritium (H-3) continues to be a problem for LACBWR. It is noted for LACBWR that tritium problems exist for both the indicator and the control sites. Tritium results between Wisconsin and LACBWR can not be compared until the analysis problems are resolved. It was suggested by the LACBWR Radiation Protection Engineer that a cross check program for tritium should be set up between LACBWR and Wisconsin. It is hoped that this cross check program will be initiated in 1985.

After reviewing the gamma isotopic results for both Wisconsin and LACBWR, the gamma isotopic differences noted in Table 4 could not be resolved due to possible difficulties associated with the gamma isotopic procedure. The gamma isotopic differences noted during January, February and March could be related to improper mixing during sample preparation as mentioned previously. Thorough mixing was initiated in April 1984 and agreement in the Wisconsin and LACBWR reported results for gamma isotopic

activities has been substantially better. The Co-60 detected by Wisconsin in the 06/13/84 sample from the discharge channel could be a Wisconsin problem. The Wisconsin reported gamma isotopic activity for Co-60 does not agree with the reported Wisconsin gross beta activity for the 06/13/84 sample. It is noted that LACBWR reported similar Co-60 activities for the control and the indicator samples collected on 09/12/84. Higher backgrounds experienced in the LACBWR environmental laboratory could explain the similar reported Co-60 activities for the control and indicator samples collected on 09/12/84. The other gamma isotopic differences for 11/14/84 and 11/15/84 are small and could be explained due to the low activity of the samples.

All activities reported by either Wisconsin or LACBWR are below the standards for uncontrolled areas as specified in ICRP Report No.2 or 10 CFR 20.

Fish

Both LACBWR and Wisconsin analyze the same samples with LACBWR first performing its analysis and then Wisconsin.

The Wisconsin and LACBWR gamma isotopic analysis of the fish samples detected the following radioisotopes above their respective MDC or MDA.

Table 5. Radioisotopes detected in fish samples.

WI - Section of Radiation Protection

| Isotope | # samples detected | range (pCi/kg) |
|---------|--------------------|----------------|
| K-40 | 6 | 2700 - 4100 |
| Co-60 | 1 | 120 |

LACBWR

| | | |
|--------|----|------------------|
| K-40 | NA | |
| Mn-54 | 2 | 9.5 *a - 16.4 *a |
| Co-57 | 1 | 8 *a |
| Co-60 | 3 | 49 *a - 78 *a |
| Ru-103 | 1 | 11 *a |
| Cs-137 | 4 | 14 *a - 33.7 *a |

NA - LACBWR does not report naturally occurring radioisotopes.

*a - Less than the WI respective MDC.

The reported Wisconsin activities for K-40 can not be compared since LACBWR does not report naturally occurring radioisotopes. The Wisconsin reported activity for Co-60 of 120+/-30 pCi/kg was also reported by LACBWR with an activity of 51.2+/-13.1 pCi/kg. All other reported LACBWR activities are less than the respective Wisconsin MDC and are also less than the required NRC LLD's. At

the low level of reported activities the Wisconsin and LACBWR data compare favorably.

Bottom Sediments

Both Wisconsin and LACBWR analyze the same samples with LACBWR first performing its analysis and then Wisconsin. Bottom sediments were monitored more closely in 1984 with bottom sediments collected on 03/27/84, 06/26/84 and an extended collection on 10/17/84. The Wisconsin results are presented for all three collections. Wisconsin and LACBWR reported activities are compared for only the 10/17/84 collection since previous to that collection LACBWR reported results on a wet basis and Wisconsin reported results on a dry basis.

The Wisconsin and LACBWR gamma isotopic analysis of the bottom sediment samples detected the following radioisotopes above the respective MDC or MDA and are presented in Table 6.

Table 6. Radioisotopes detected in bottom sediment samples.

WI - Section of Radiation Protection
(23 samples from 03/27/84, 06/26/84 and 10/17/84)

| Isotope | # samples detected | range (pCi/kg) |
|---------|--------------------|----------------|
| Co-58 | 2 | 160 - 180 |
| Co-60 | 11 | 60 - 32400 |
| Mn-54 | 1 | 230 |
| Cs-134 | 5 | 300 - 610 |
| Cs-137 | 13 | 130 - 13200 |
| K-40 | 23 | 5600 - 18100 |
| *a | 23 | 270 - 3200 |

LACBWR
(11 samples from 10/17/84)

| | | |
|--------|----|---------------|
| Cr-51 | 2 | 46 *b - 82 *b |
| Mn-54 | 5 | 15 *b - 182 |
| Co-57 | 1 | 16 *b |
| Co-58 | 2 | 9 *b - 21 *b |
| Co-60 | 10 | 12 *b - 7000 |
| Zn-65 | 1 | 12 *b |
| Cs-134 | 3 | 5.4 *b - 323 |
| Cs-137 | 10 | 13 *b - 7890 |
| K-40 | NA | |

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

*b - Less than the respective Wisconsin MDC.

NA - LACBWR does not report naturally occurring radioisotopes.

The comparison of Wisconsin and LACBWR results for the 10/17/84 collection was good. The disagreements between the reported Wisconsin and LACBWR results are indicated in Table 7.

Table 7. Differences in reported results for Wisconsin and LACBWR for bottom sediment samples.

| Site | Isotope | WI (pCi/kg) | LACBWR (pCi/kg) |
|------|---------|----------------|--------------------|
| BS-1 | Cs-137 | 6000+/-170 | 7890+/-53 |
| BS-4 | Co-60 | 580+/-70 | 790+/-21 |

The differences in reported results could be due to the rearrangement of the sample in the counting container during the sample preparation by Wisconsin and LACBWR. The differences would then be due to attenuation by the sample.

The samples BS-1 through BS-10 were taken starting at the discharge and proceeding downstream. The samples BS 3 - BS 4, BS 5 - BS 7 and BS 8 - BS 10 represent samples taken as a cross section of the river. The BS-11 sample is an upstream sample.

The distance & direction from the discharge point are summarized in Table 8.

Table 8. Distance and direction of sampling points from the discharge point.

| Site | Distance | Direction |
|-----------------|--------------------|------------|
| BS-1 | at discharge point | |
| BS-2 | 500 feet | downstream |
| BS-3,BS-4 | 1690 feet | downstream |
| BS-5,BS-6,BS-7 | 3220 feet | downstream |
| BS-8,BS-9,BS-10 | 6070 feet | downstream |
| BS-11 | 2630 feet | upstream |

The analysis of the BS-11 sample (upstream) by Wisconsin detected only Cs-137 at an activity of 250+/-40 pCi/kg and naturally occurring products. The highest activity was detected at the discharge point with Co-60 and Cs-137 predominating. Sample activity decreases quite rapidly with only small amounts of activity detected at sites BS-5, BS-6 and BS-7. The observed activity for Cs-137 and Co-60 from the sites BS-1 through BS-4 is attributable to the LACBWR facility operation.

Inspection of the Wisconsin data from the discharge point shows a range of activity for Co-60 and Cs-137 for the three collection dates. The range of reported activity for Co-60 was 7100 - 32400 pCi/kg and for Cs-137 was 6000 - 13200 pCi/kg with the highest reported activities for the 03/27/84 samples and the lowest

reported activities for the 10/17/84 samples. This observation would tend to indicate that the discharge point is not the best site to observe trends of accumulated radioactivity versus time. From correspondence with Dairyland Power Cooperative environmental department personnel, their observations are that the discharge point has a very small area to collect bottom sediment with larger aggregate predominating. This observation together with the fact that there is also a high scouring rate at the discharge point would support the argument that the discharge point is not a good site to study trends of accumulated radioactivity versus time.

The Wisconsin reported activities from duplicate samples collected on 03/27/84 and 06/26/84 at the discharge point illustrate the problems of obtaining representative samples. The Wisconsin reported activities for Co-60 and Cs-137 are significantly different for the duplicate samples. Representative samples from highly attenuating substances such as soil or bottom sediments are difficult to obtain.

Dose calculations from exposure to bottom sediments will be discussed later in the conclusion section.

Milk

The milk samples are obtained as grab samples on a monthly basis and are then split for analysis.

The Wisconsin and LACBWR gamma isotopic analysis of the milk samples detected the following radioisotopes listed in Table 9 above their respective minimum detectable concentration.

Table 9. Radioisotopes detected in milk samples.

| WI - Section of Radiation Protection | | |
|--------------------------------------|--------------------|-----------------|
| Radioisotope | # samples detected | range (pCi/l) |
| K-40 | 12 | 1240-1490 |
| LACBWR | | |
| Radioisotope | # samples detected | range (pCi/l) |
| K-40 | NA | |
| Cr-51 | 2 | 34.8 *a - 49 *a |
| Co-60 | 1 | 23.9 |
| Zn-65 | 1 | 17 *a |
| Nb-95 | 1 | 8.8 *a |
| I-131 | 1 | 2.9 |
| Cs-137 | 1 | 10.5 *a |
| Ce-141 | 2 | 1.5 *a - 4.8 *a |
| Ce-144 | 1 | 42 *a |

NA - Naturally occurring radioisotopes are not reported by LACBWR.

*a - Reported activities are less than the Wisconsin respective MDC.

Wisconsin detected only naturally occurring potassium-40 above its MDC in its gamma isotopic analysis of the milk samples. Activities for iodine-131 were all below its MDC of 0.40 pCi/l.

LACBWR does not report naturally occurring radioisotopes and a comparison is not possible with the Wisconsin data. All of the reported isotopes were less than the respective Wisconsin MDC's except for those differences listed in Table 10.

Table 10. Differences in reported results between Wisconsin and LACBWR for milk samples.

| Collection | Isotope | WI (pCi/l) | LACBWR (pCi/l) |
|------------|---------|---------------|-------------------|
| 1/10/84 | I-131 | -0.29+/-0.12 | 2.9+/-0.9 |
| 11/13/84 | Co-60 | \$12 | 23.9+/-1.1 |

For the 1/10/84 sample, Wisconsin reports I-131 results from a chemical separation and LACBWR's results are from a gamma isotopic analysis. The 2.9+/-0.9 pCi/l reported by LACBWR is less than its MDA of 5 pCi/l. For the 11/13/84 sample, an inspection of the Wisconsin and LACBWR analysis does not provide an explanation for the difference in the reported result for Co-60. It should be noted that Co-60 would not commonly be present in milk and the reported activity by LACBWR for the 11/13/84 sample is questionable.

The data reported by Wisconsin for 1984 is comparable to data reported for previous years. Influence by the LACBWR facility is not apparent in the milk samples analyzed by either Wisconsin or LACBWR.

Vegetation - Food Products

A split sample of food products was taken in 1984. A blended sample of mixed vegetables was collected from a local farm, 1.0 mile NE.

The Wisconsin and LACBWR gamma isotopic analysis of the blended food product sample detected the following radioisotopes above their respective MDC or MDA listed in Table 11.

Table 11. Radioisotopes detected in food product samples.

WI - Section of Radiation Protection

| Isotope | pCi/l |
|---------|------------|
| K-40 | 2800+/-300 |
| LACBWR | |
| K-40 | 3130+/-190 |
| Cs-137 | 27+/-7 *a |

*a - The reported result is less than the Wisconsin respective MDC.

Comparison of the Wisconsin and LACBWR results are favorable and influence by the LACBWR facility is not evident in food product samples.

Dose to Man from Liquid Effluent Pathways

Dose calculations from liquid effluent releases were performed according to the mathematical models illustrated in USNRC Regulatory Guide 1.109. Doses from liquid effluents according to Regulatory Guide 1.109 result from the following pathways: potable water, aquatic foods, dose from shoreline deposits and dose from foods grown on land with contaminated water. For LACBWR the pathways for potable water and dose from foods grown on land with contaminated water do not normally apply, as required by LACBWR's new technical specifications.

Total body doses were calculated for the maximum exposed individual. A minimum detectable total body dose was calculated using the Wisconsin respective MDC for isotopes that might be found in liquid effluents. For liquid effluents the Wisconsin minimum detectable total body dose was calculated to be 0.024 mrem/year from exposure to bottom sediments and 0.29 mrem/year from ingestion of fish.

Calculated total body doses from Wisconsin analysis are included in Table 12.

Table 12. Total body dose to maximum exposed individual.

| Sample | Collection date | mrem/year |
|-----------------|---------------------|-----------|
| fish | six samples | 0.29 |
| bottom sediment | 3/27/84 upstream #1 | 0.024 |
| " " | " upstream #2 | 0.024 |
| " " | " discharge #1 | 1.63 |
| " " | " discharge #2 | 0.91 |
| " " | " downstream #1 | 0.064 |
| " " | " downstream #2 | 0.027 |
| " " | 6/26/84 upstream #1 | 0.026 |
| " " | " upstream #2 | 0.025 |
| " " | " discharge #1 | 0.61 |
| " " | " discharge #2 | 0.47 |
| " " | " downstream #1 | 0.028 |
| " " | " downstream #2 | 0.028 |
| " " | 10/17/84 BS-1 | 0.40 |
| " " | " BS-2 | 0.11 |
| " " | " BS-3 | 0.024 |
| " " | " BS-4 | 0.043 |
| " " | " BS-5 | 0.024 |
| " " | " BS-6 | 0.024 |
| " " | " BS-7 | 0.024 |
| " " | " BS-8 | 0.024 |
| " " | " BS-9 | 0.025 |
| " " | " BS-10 | 0.024 |
| " " | " BS-11 | 0.026 |

From Table 12 it is apparent that the only significant total body dose a maximum exposed individual is at the discharge point. The discharge point, however, is not readily accessible for individual use for recreational purposes including either fishing or swimming. According to the new Tech Specs for LACBWR, based upon USNRC Regulatory Guide 1.109 for liquid effluents, the worst possible pathway is from ingestion of fish. As computed from Wisconsin MDC's, the maximum total body dose of 0.29 mrem/year from ingestion of fish is well within the maximum permissible dose of 3 mrem/year, as stated in 10 CFR 50, and in accordance with LACBWR's new technical specifications.

Bottom sediments and fish will continue to be monitored in order to observe trends of accumulated radioactivity versus time.

Table 13. U.S. Environmental Protection Agency's crosscheck program, comparison of EPA and State Laboratory of Hygiene (SLH) results.

| Sample Type | Date Collected | Analysis | Concentration in pCi/sample *a | | |
|-------------|----------------|----------|--------------------------------|---------------------------|--------------------|
| | | | SLH result +/- 1 sigma | EPA result +/- 1 sigma | Deviation Known |
| Water | 01-07-83 | Sr-89 | 27.7+/-1.5 | 29.2+/-5 | -0.5 |
| | | Sr-90 | 16.3+/-1.5 | 17.2+/-1.5 | -1.1 |
| Water | 01-21-83 | Alpha | 26+/-2 | 29+/-7.25 | -0.7 |
| | | Beta | 37+/-2 | 31+/-5 | 2.0 |
| Water | 02-04-83 | Cr-51 | <144 | 45+/-5 | |
| | | Co-60 | 26+/-10 | 22+/-5 | 1.4 |
| | | Zn-65 | 27+/-8 | 21+/-5 | 0.6 |
| | | Ru-106 | <112 | 48+/-5 | |
| | | Cs-134 | 17+/-8 | 20+/-5 | -1.0 |
| | | Cs-137 | 19+/-8 | 19+/-5 | -0.1 |
| Water | 02-11-83 | H-3 | 2673+/-300 | 2560+/-353 | 0.1 |
| Milk | 02-25-83 | Sr-89 | No data provided | 37.4+/-5 | |
| | | Sr-90 | 20.3+/-1.5 | 17.8+/-1.5 | 2.9 |
| | | I-131 | 57+/-15 | 54.5+/-6 | 0.8 |
| | | Cs-137 | 25+/-10 | 25.6+/-5 | -0.1 |
| | | Ba-140 | <9 | 0.0 | |
| | | K | 1310+/-200 | 1512+/-76 | -4.6 |
| Food | 03-04-83 | Sr-89 | No data provided | 34.6+/-5 | |
| | | Sr-90 | No data provided | 27.8+/-1.5 | |
| | | I-131 | 42+/-15 | 36.9+/-6 | 1.4 |
| | | Cs-137 | 32+/-15 | 31.3+/-5 | 0.4 |
| | | Ba-140 | <12 | 0.0 | |
| | | K | 2217+/-250 | 2592+/-130 | -5.0 |
| Water | 03-11-83 | Ra-226 | 13.7+/-1.5 | 12.7+/-1.9 | 0.9 |
| | | Ra-228 | <1 | 0.0 | |
| Water | 03-18-83 | Alpha | 26+/-3 | 31+/-7.8 | -1.0 |
| | | Beta | 25+/-2 | 28+/-5 | -1.2 |
| Filter | 03-25-83 | Alpha | 36+/-3 | 26+/-6.5 | 2.8 |
| | | Beta | 68+/-5 | 68+/-5 | 0.0 |
| | | Sr-90 | 20+/-2 | 20+/-1.5 | 0.0 |
| | | Cs-137 | 27+/-8 | 27+/-5 | 0.1 |
| Water | 04-08-83 | H-3 | 3287+/-330 | 3330+/-362 | -0.2 |
| Water | 04-01-83 | I-131 | 25.7+/-5 | 26.8+/-6 | -0.3 |

Table 13 (continued)

| Sample Type | Date Collected | Analysis | Concentration in pCi/sample *a | | |
|-------------|----------------|----------|--------------------------------|---------------------------|--------------------|
| | | | SLH result +/- 1 sigma | EPA result +/- 1 sigma | Deviation Known |
| Water | 05-06-83 | Sr-89 | 53+/-2 | 57.1+/-5 | -1.5 |
| | | Sr-90 | 37.0+/-1.5 | 37.7+/-1.9 | -0.6 |
| Water | 05-09-83 | Alpha | 51+/-5 | 64+/-16 | -1.4 |
| | | Beta | 150+/-15 | 149+/-7.5 | 0.3 |
| | | Sr-89 | 21+/-1.3 | 24+/-5 | -1.2 |
| | | Sr-90 | 13+/-1.0 | 13+/-1.5 | 0.0 |
| | | Ra-226 | 6.8+/-1.5 | 8.5+/-1.3 | -2.3 |
| | | Ra-228 | 6.2+/-1.5 | 4.7+/-0.7 | 3.6 |
| | | Co-60 | 29+/-10 | 30+/-5 | -0.2 |
| | | Cs-134 | 29+/-8 | 33+/-5 | -1.3 |
| | | Cs-137 | 32+/-9 | 27+/-5 | 1.8 |
| | | U | No data provided | | 25+/-6 |
| Water | 05-20-83 | Alpha | 10+/-3 | 11+/-5 | -0.3 |
| | | Beta | 57+/-5 | 57+/-5 | 0.1 |
| Water | 06-03-83 | Cr-51 | <168 | 60+/-5 | |
| | | Co-60 | 16+/-8 | 13+/-5 | 1.0 |
| | | Zn-65 | 38+/-17 | 36+/-5 | 1.0 |
| | | Ru-106 | <120 | 40+/-5 | |
| | | Cs-134 | 48+/-12 | 47+/-5 | 0.2 |
| | | Cs-137 | 29+/-10 | 26+/-5 | 1.2 |
| Water | 06-10-83 | H-3 | 1490+/-310 | 1529+/-337 | -0.2 |
| Milk | 06-10-83 | Sr-89 | No data provided | | 25+/-5 |
| | | Sr-90 | 16+/-2 | 16+/-1.5 | 0.0 |
| | | I-131 | 30+/-10 | 30+/-6 | 0.0 |
| | | Cs-137 | 42+/-10 | 47+/-5 | -1.7 |
| | | K | 1500+/-150 | 1486+/-74 | 0.4 |
| Water | 06-17-83 | Ra-226 | 5.3+/-1.5 | 4.8+/-0.7 | 1.3 |
| | | Ra-228 | <1.0 | 0.0 | |
| Water | 07-15-83 | Alpha | 6+/-3 | 7+/-5.0 | -0.2 |
| | | Beta | 25+/-2 | 22+/-5.0 | 0.9 |
| Water | 08-05-83 | I-131 | 26+/-15 | 14+/-6 | 3.4 |
| Water | 08-12-83 | H-3 | 1970+/-450 | 1836+/-342 | 0.7 |
| Filter | 08-26-83 | Alpha | 16+/-1.8 | 13+/-5 | 0.9 |
| | | Beta | 36+/-1.8 | 36+/-5 | 0.0 |
| | | Sr-90 | 9+/-2 | 10+/-1.5 | -0.8 |
| | | Cs-137 | 21+/-6 | 15+/-5 | 2.1 |

Table 13 (continued)

| Sample Type | Date Collected | Analysis | Concentration in pCi/sample *a | | |
|-------------|----------------|----------|--------------------------------|---------------------------|--------------------|
| | | | SLH result +/- 1 sigma | EPA result +/- 1 sigma | Deviation Known |
| Water | 09-02-83 | Sr-89 | 11+/-2 | 15+/-5 | -1.4 |
| | | Sr-90 | 10+/-2 | 10+/-1.5 | -0.4 |
| Water | 09-09-83 | Ra-226 | 3.0+/-1.5 | 3.1+/-0.47 | -0.4 |
| | | Ra-228 | 4.4+/-0.8 | 2.0+/-0.30 | 13.9 |
| Water | 09-16-83 | Alpha | 5+/-1.5 | 5+/-5.0 | -0.2 |
| | | Beta | 6+/-1.4 | 9+/-5.0 | -1.0 |
| Water | 10-07-83 | Cr-51 | <80 | 51+/-5 | |
| | | Co-60 | 20+/-5 | 19+/-5 | 0.3 |
| | | Zn-65 | 45+/-10 | 40+/-5 | 1.8 |
| | | Ru-106 | <54 | 52+/-5 | |
| | | Cs-134 | 15+/-5 | 15+/-5 | 0.0 |
| | | Cs-137 | 26+/-5 | 22+/-5 | 1.4 |
| Water | 10-14-83 | H-3 | 1310+/-420 | 1210+/-329 | 0.5 |
| Milk | 10-28-83 | Sr-89 | No data provided | 15+/-5 | |
| | | Sr-90 | 15+/-1.5 | 14+/-1.5 | 1.2 |
| | | I-131 | 54+/-10 | 40+/-6 | 4.0 |
| | | Cs-137 | 36+/-6 | 33+/-5 | 1.2 |
| | | K | 1677+/-200 | 1550+/-78 | 2.8 |
| Water | 11-18-83 | Alpha | 13+/-2 | 14+/-5.0 | -0.3 |
| | | Beta | 7+/-2 | 16+/-5.0 | -3.0 |
| Water | 11-14-83 | Alpha | 19+/-3 | 22+/-5.5 | -0.9 |
| | | Ra-226 | 5.8+/-1.0 | 5.1+/-0.8 | 1.6 |
| | | Ra-228 | 4.2+/-0.5 | 2.8+/-0.4 | 6.1 |
| | | U | No data provided | 11+/-6 | |
| | | Beta | 60+/-3 | 63+/-5 | -0.9 |
| | | Sr-89 | 16+/-1.0 | 17+/-5 | -0.2 |
| | | Sr-90 | 7+/-0.8 | 8+/-1.5 | -1.2 |
| | | Co-60 | 13+/-4 | 11+/-5 | 0.8 |
| | | Cs-134 | 19+/-4 | 15+/-5 | 1.5 |
| | | Cs-137 | 16+/-5 | 15+/-5 | 0.5 |
| Filter | 11-25-83 | Alpha | 24+/-1.8 | 19+/-5 | 1.8 |
| | | Beta | 48+/-2 | 50+/-5 | -0.8 |
| | | Sr-90 | 13+/-0.9 | 15+/-1.5 | -1.9 |
| | | Cs-137 | 23+/-4 | 20+/-5 | 0.9 |
| Water | 12-09-83 | H-3 | 2280+/-400 | 2389+/-351 | -0.5 |
| Water | 12-16-83 | I-131 | 21+/-7 | 20+/-6 | 0.4 |

Table 13 (continued)

| Sample Type | Date Collected | Analysis | Concentration in pCi/sample *a | | |
|-------------|----------------|----------|--------------------------------|---------------------------|--------------------|
| | | | SLH result +/- 1 sigma | EPA result +/- 1 sigma | Deviation Known |
| Water | 12-16-83 | Ra-226 | 8.6+/-0.6 | 7.4+/-1.1 | 1.8 |
| | | Ra-228 | 4.4+/-0.4 | 3.9+/-0.56 | 1.5 |
| Water | 01-06-84 | Sr-89 | 39+/-1.5 | 36+/-5 | 0.9 |
| | | Sr-90 | 21+/-1.1 | 24+/-1.5 | -3.1 |
| Water | 01-20-84 | Alpha | 11+/-2 | 10+/-5.0 | 0.2 |
| | | Beta | 8+/-1.8 | 12+/-5.0 | -1.5 |
| Food | 01-27-84 | Sr-89 | No data provided | 34+/-5.0 | |
| | | Sr-90 | No data provided | 20+/-5.0 | |
| | | I-131 | 22+/-5 | 20+/-6.0 | 0.6 |
| | | Cs-137 | 21+/-5 | 20+/-5.0 | 0.5 |
| | | K | 2958+/-180 | 2720+/-136 | 3.0 |
| Water | 02-03-84 | Cr-51 | <60 | 40+/-5 | |
| | | Co-60 | 11+/-3 | 10+/-5 | 0.2 |
| | | Zn-65 | 54+/-8 | 50+/-5 | 1.4 |
| | | Ru-106 | <50 | 61+/-5 | |
| | | Cs-134 | 29+/-5 | 31+/-5 | -0.7 |
| | | Cs-137 | 15+/-4 | 16+/-5 | -0.2 |
| Water | 02-10-84 | H-3 | 2767+/-390 | 2383+/-351 | 1.9 |
| Milk | 03-02-84 | I-131 | 6+/-1.0 | 6+/-0.9 | 0.0 |
| Water | 03-09-84 | Ra-226 | 4.8+/-0.6 | 4.1+/-0.6 | 1.9 |
| | | Ra-228 | 2.2+/-0.3 | 2.0+/-0.3 | 1.2 |
| Water | 03-18-84 | Alpha | 5+/-2 | 5+/-5.0 | 0.2 |
| | | Beta | 18+/-2 | 20+/-5.0 | -0.6 |
| Filter | 03-23-84 | Alpha | 20+/-2 | 15+/-5 | 1.6 |
| | | Beta | 49+/-4 | 51+/-5 | -0.6 |
| | | Sr-90 | 20+/-1.5 | 21+/-1.5 | -0.8 |
| | | Cs-137 | 12+/-5 | 10+/-5 | 0.6 |
| Water | 04-06-84 | I-131 | 4+/-1.0 | 6+/-0.9 | -4.3 |
| Water | 04-13-84 | H-3 | 3330+/-400 | 3508+/-364 | -0.8 |
| Water | 05-04-84 | Sr-89 | 21+/-1.0 | 25+/-5 | -1.4 |
| | | Sr-90 | 5+/-0.7 | 5+/-1.5 | 0.0 |
| Water | 05-18-84 | Alpha | 4+/-1.3 | 3+/-5.0 | 0.3 |
| | | Beta | 8+/-1.5 | 6+/-5.0 | 0.6 |

Table 13 (continued)

| Sample Type | Date Collected | Analysis | Concentration in pCi/sample *a | | |
|-------------|----------------|----------|--------------------------------|---------------------------|--------------------|
| | | | SLH result +/- 1 sigma | EPA result +/- 1 sigma | Deviation Known |
| Water | 06-08-84 | H-3 | 3007+/-400 | 3081+/-389 | -0.2 |
| Water | 06-01-84 | Cr-51 | 63+/-30 | 66+/-5 | -1.2 |
| | | Co-60 | 32+/-3 | 31+/-5 | 0.5 |
| | | Zn-65 | 68+/-7 | 63+/-5 | 1.7 |
| | | Ru-106 | <35 | 29+/-5 | |
| | | Cs-134 | 44+/-4 | 47+/-5 | -1.0 |
| | | Cs-137 | 37+/-3 | 37+/-5 | 0.0 |
| Water | 06-15-84 | Ra-226 | 4.5 | 3.5+/-0.53 | 3.4 |
| | | Ra-228 | 1.8 | 2.0+/-0.30 | -1.0 |
| Milk | 06-22-84 | Sr-89 | No data provided | 25+/-5 | |
| | | Sr-90 | 17+/-1.5 | 17+/-1.5 | 0.4 |
| | | I-131 | 44+/-8 | 43+/-6 | 0.2 |
| | | Cs-137 | 39+/-9 | 35+/-5 | 1.3 |
| | | K | 1710+/-210 | 1496+/-75 | 4.9 |
| Water | 07-20-84 | Alpha | 6+/-1.5 | 6+/-5 | -0.1 |
| | | Beta | 9+/-1.7 | 13+/-5 | -1.4 |
| Water | 08-03-84 | I-131 | 33+/-5 | 34+/-6 | -0.2 |
| Water | 08-07-84 | H-3 | 2970+/-300 | 2817+/-356 | 0.7 |
| Filter | 08-24-84 | Alpha | 19+/-1.7 | 17+/-5 | 0.6 |
| | | Beta | 47+/-2 | 51+/-5 | -1.5 |
| | | Sr-90 | 17+/-1.0 | 18+/-1.5 | -1.2 |
| | | Cs-137 | 18+/-5 | 15+/-5 | 1.2 |
| Water | 09-07-84 | Sr-89 | 31+/-1.6 | 34+/-5 | -0.9 |
| | | Sr-90 | 20+/-1.1 | 19+/-1.5 | 1.2 |
| Water | 09-14-84 | Ra-226 | 5.1+/-0.7 | 4.9+/-0.74 | 0.4 |
| | | Ra-228 | 2.1+/-0.4 | 2.3+/-0.35 | -1.2 |
| Water | 10-05-84 | Cr-51 | 48+/-16 | 40+/-5 | 2.9 |
| | | Co-60 | 19+/-3 | 20+/-5 | -0.2 |
| | | Zn-65 | 158+/-9 | 147+/-7.4 | 2.5 |
| | | Ru-106 | 47+/-16 | 47+/-5 | 0.0 |
| | | Cs-134 | 29+/-3 | 31+/-5 | -0.8 |
| | | Cs-137 | 23+/-3 | 24+/-5 | -0.2 |
| Water | 10-12-84 | H-3 | 2783+/-320 | 2810+/-356 | -0.1 |

Table 13 (continued)

| Sample Type | Date Collected | Analysis | Concentration in pCi/sample *a | | |
|-------------|----------------|----------|--------------------------------|---------------------------|--------------------|
| | | | SLH result +/- 1 sigma | EPA result +/- 1 sigma | Deviation Known |
| Water | 10-22-84 | Alpha | 13+/-2 | 14+/-5.0 | -0.2 |
| | | Beta | 69+/-5 | 64+/-5.0 | 1.7 |
| | | Ra-226 | 3.0+/-0.5 | 3.0+/-0.45 | 0.0 |
| | | Ra-228 | 3.1+/-0.3 | 2.1+/-0.32 | 5.2 |
| | | Sr-89 | 12+/-4 | 11+/-5.0 | 0.2 |
| | | Sr-90 | 13+/-1.5 | 12+/-1.5 | 1.5 |
| | | Co-60 | 15+/-5 | 14+/-5.0 | 0.5 |
| | | Cs-134 | <10 | 2+/-5.0 | |
| | | Cs-137 | 15+/-5 | 14+/-5.0 | 0.2 |
| Milk | 10-26-84 | Sr-89 | No data provided | 22+/-5 | |
| | | Sr-90 | No data provided | 16+/-1.5 | |
| | | I-131 | 41+/-9 | 42+/-6 | -0.2 |
| | | Cs-137 | 30+/-7 | 32+/-5 | -0.6 |
| | | K | 1567+/-150 | 1517+/-76 | 1.1 |
| Water | 11-16-84 | Alpha | 8+/-4 | 7+/-5 | 0.2 |
| | | Beta | 22+/-2 | 20+/-5.0 | 0.8 |
| Filter | 11-23-84 | Alpha | 18+/-5 | 15+/-5 | 1.2 |
| | | Beta | 53+/-5 | 52+/-5 | 0.2 |
| | | Sr-90 | 20+/-1.5 | 21+/-1.5 | -1.2 |
| | | Cs-137 | 11+/-4 | 10+/-5 | 0.3 |
| Water | 12-07-84 | I-131 | 41+/-8 | 36+/-6 | 1.4 |
| Water | 12-14-84 | H-3 | 2977+/-320 | 3182+/-360 | -1.0 |

Table 14 - 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 | 0.050 | | | |
| K-40 | | | | 120 |
| Sr-90 | | | | 1.2 |
| Zr,Nb-95 | 0.011 | | | |
| Ru-103 | 0.005 | | | |
| Ru-106 | 0.030 | | | |
| I-131 | | | 0.046 | 0.4 |
| Cs-134 | 0.005 | | | 12 |
| Cs-137 | 0.005 | | | 12 |
| Ba,La-140 | | | | 15 |
| Ce-141 | 0.008 | | | |
| Ce-144 | 0.025 | | | |
| | Surface Water (pCi/liter) | fish (pCi/kg) (wet) | Soil Sediment (pCi/kg) (dry) | Vegetation (pCi/kg) (wet) |
| Gross beta | 1.6 | | 740 | 740 |
| Gross alpha | 1.8 | | 900 | 900 |
| H-3 | 750 | | | |
| Sr-89 | 1.7 | | | |
| Sr-90 | 1.7 | | | |
| K-40 | | 785 | 800 | 600 |
| Mn-54 | 9 | 66 | | |
| Cr-51 | 100 | | | |
| Fe-59 | 20 | 145 | | |
| Zn-65 | 22 | 133 | | |
| Co-58 | 13 | 54 | 70 | 50 |
| Co-60 | 11 | 70 | 90 | 55 |
| Zr,Nb-95 | 15 | | | 80 |
| I-131 | 0.4 | | | 60 |
| Cs-134 | 13 | 51 | 60 | 50 |
| Cs-137 | 12 | 74 | 80 | 60 |

ATTACHMENT A - RADIO-ENVIRONMENTAL SAMPLE ANALYSES MAXIMUM LOWER LIMITS OF DETECTION VALUES (LLD)^a - (Cont'd)

(a) Calculation of Lower Limits of Detection:

The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66 s_b}{E \times V \times 2.22 \times Y \times \text{Exp}(-\lambda \Delta t)}$$

WHERE:

LLD is the a priori lower limit of detection as defined above (as picocurie 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). Typical values of E, V, Y, and Δt shall be used in the calculations.

E is the counting efficiency (as counts per transformation).

V is the sample size (in units of mass or volume).

2.22 is the number of transformations per minute per picocurie.

Y is the fraction radiochemical yield (when applicable).

λ is the radioactive decay constant for the particular radionuclide.

Δt is the elapsed time between sample collection (or end of the sample collection period) and time of counting.

(b) (2,000) LLD drinking water.

(c) LLD for gamma spectrum analyses not separation and specific isotopic analysis.

LACBWR, Health & Safety Department Procedure, LACBWR Environmental Monitoring Program.

ATTACHMENT A

RADIO-ENVIRONMENTAL SAMPLE ANALYSES MAXIMUM LOWER LIMITS OF DETECTION VALUES (LLD)^a

| Analysis | Sample Type | | | | |
|------------|-------------------------|--|-----------------------|-----------------|--------------------------|
| | Water pCi/l | Airborne Particulate or Radioiodine (pCi/m ³) | Fish (pCi/Kg, Wet) | Milk (pCi/l) | Sediment (pCi/kg Dry) |
| Gross Beta | 6 | 1×10^{-2} | | | |
| H-3 | 3500(2000) ^b | | | | |
| Mn-54 | 15 | | 130 | | |
| Fe-59 | 30 | | 260 | | |
| Co-58, 60 | 15 | | 130 | | |
| Zn-65 | 30 | | 260 | | |
| Zr-95 | 30 | | | | |
| Nb-95 | 15 | | | | |
| I-131 | 3 ^c | 7×10^{-2} | | 5 ^c | |
| Cs-134 | 15 | 5×10^{-2} | 130 | 15 | 150 |
| Cs-137 | 18 | 6×10^{-2} | 150 | 18 | 180 |
| Ba-140 | 60 | | | 60 | |
| La-140 | 20 | | | 20 | |

(See Footnotes a, b, and c on following page.)

LACBWR, Health & Safety Department Procedure, LACBWR Environmental Monitoring Program

References

La Crosse Boiling Water Reactor, LACBWR, Health & Safety Department Procedure, LACBWR Environmental Monitoring Program, HSP-03.4, Issue 5, pages 29,30.

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

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

Table 15. Air particulate gross beta and air iodine (I-131) results for January - June, 1984. Indicator site - Lock & Dam #8.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR

1984

Lock & Dam #8
0.7 miles N

Measurements in units of pCi/M³

WI - Section of Radiation Protection data

LACBWR data

| Collection date | Air Particulate | Air Iodine | Collection date | Air Particulate | Air Iodine |
|-----------------|-----------------|---------------|-----------------|-----------------|---------------|
| 01-04-84 | 0.041+/-0.004 | 0.007+/-0.03 | 01-03-84 | 0.070+/-0.005 | <MBA |
| 01-11-84 | 0.020+/-0.003 | 0.00+/-0.04 | 01-10-84 | 0.045+/-0.004 | <MBA |
| 01-18-84 | 0.023+/-0.003 | 0.00+/-0.04 | 01-17-84 | 0.055+/-0.004 | <MBA |
| 01-25-84 | 0.028+/-0.003 | 0.019+/-0.02 | 01-24-84 | 0.062+/-0.004 | <MBA |
| 02-01-84 | 0.021+/-0.003 | 0.002+/-0.04 | 01-31-84 | 0.054+/-0.004 | 0.002+/-0.001 |
| 02-08-84 | 0.028+/-0.003 | 0.00+/-0.04 | 02-07-84 | 0.046+/-0.004 | 0.002+/-0.004 |
| 02-15-84 | 0.039+/-0.004 | 0.04+/-0.04 | 02-14-84 | 0.039+/-0.004 | <MBA |
| 02-22-84 | 0.046+/-0.004 | 0.002+/-0.04 | 02-21-84 | 0.031+/-0.004 | <MBA |
| 02-29-84 | 0.020+/-0.003 | -0.003+/-0.04 | 02-28-84 | 0.036+/-0.004 | <MBA |
| 03-07-84 | 0.030+/-0.003 | 0.007+/-0.03 | 03-06-84 | 0.028+/-0.004 | <MBA |
| 03-14-84 | 0.024+/-0.003 | 0.002+/-0.03 | 03-13-84 | 0.052+/-0.004 | <MBA |
| 03-21-84 | 0.014+/-0.002 | 0.001+/-0.04 | 03-21-84 | 0.039+/-0.004 | <MBA |
| 03-28-84 | 0.022+/-0.003 | 0.004+/-0.03 | 03-27-84 | 0.046+/-0.005 | <MBA |
| 04-04-84 | 0.012+/-0.002 | 0.013+/-0.03 | 04-03-84 | 0.027+/-0.005 | <MBA |
| 04-11-84 | 0.015+/-0.003 | 0.008+/-0.03 | 04-10-84 | 0.042+/-0.004 | <MBA |
| 04-18-84 | 0.011+/-0.002 | 0.05+/-0.04 | 04-17-84 | 0.028+/-0.004 | <MBA |
| 04-25-84 | 0.010+/-0.002 | -0.03+/-0.04 | 04-25-84 | 0.024+/-0.003 | <MBA |
| 05-02-84 | 0.011+/-0.002 | -0.02+/-0.04 | 05-01-84 | 0.019+/-0.003 | <MBA |
| 05-09-84 | 0.010+/-0.002 | 0.009+/-0.03 | 05-08-84 | 0.024+/-0.004 | <MBA |
| 05-16-84 | 0.011+/-0.002 | -0.009+/-0.03 | 05-15-84 | 0.024+/-0.004 | 0.003+/-0.006 |
| 05-23-84 | 0.014+/-0.002 | -0.016+/-0.03 | 05-22-84 | 0.023+/-0.004 | <MBA |
| 05-30-84 | 0.015+/-0.003 | 0.005+/-0.03 | 05-29-84 | 0.032+/-0.004 | <MBA |
| 06-06-84 | 0.017+/-0.003 | -0.007+/-0.03 | 06-05-84 | 0.030+/-0.003 | 0.002+/-0.001 |
| 06-13-84 | 0.008+/-0.003 | 0.03+/-0.03 | 06-12-84 | 0.018+/-0.003 | <MBA |
| 06-20-84 | 0.011+/-0.002 | -0.025+/-0.03 | 06-20-84 | 0.027+/-0.003 | <MBA |
| 06-27-84 | 0.013+/-0.002 | 0.010+/-0.03 | 06-26-84 | 0.024+/-0.004 | <MBA |
| 07-04-84 | 0.009+/-0.002 | 0.010+/-0.04 | 07-03-84 | 0.028+/-0.002 | <MBA |

* a - Pump malfunction.

Table 16 Air particulate gross beta and air iodine (I-131) results for July - December, 1984. Indicator site - Lock & Dam #8.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR

1984

Lock & Dam #8
0.7 miles N

Measurements in units of pCi/M³

WI - Section of Radiation Protection data

LACBWR data

| Collection date | Air Particulate | Air Iodine | Collection date | Air Particulate | Air Iodine |
|-----------------|-----------------|---------------|-----------------|-----------------|---------------|
| 07-11-84 | 0.012+/-0.002 | -0.005+/-0.03 | 07-10-84 | 0.032+/-0.004 | <MDA |
| 07-18-84 | 0.015+/-0.003 | 0.008+/-0.04 | 07-17-84 | 0.036+/-0.004 | <MDA |
| 07-25-84 | * a | * a | 07-24-84 | 0.034+/-0.004 | <MDA |
| 08-01-84 | 0.015+/-0.003 | -0.007+/-0.02 | 07-31-84 | 0.032+/-0.004 | <MDA |
| 08-08-84 | 0.026+/-0.003 | 0.019+/-0.04 | 08-07-84 | 0.041+/-0.005 | <MDA |
| 08-15-84 | 0.013+/-0.003 | -0.03+/-0.03 | 08-14-84 | 0.021+/-0.005 | <MDA |
| 08-22-84 | * a | * a | 08-21-84 | 0.040+/-0.005 | <MDA |
| 08-29-84 | 0.020+/-0.003 | -0.010+/-0.04 | 08-28-84 | 0.033+/-0.006 | <MDA |
| 09-05-84 | 0.014+/-0.003 | -0.025+/-0.03 | 09-04-84 | 0.029+/-0.004 | <MDA |
| 09-12-84 | 0.013+/-0.003 | -0.010+/-0.04 | 09-11-84 | 0.024+/-0.004 | <MDA |
| 09-19-84 | 0.015+/-0.003 | -0.009+/-0.02 | 09-18-84 | 0.032+/-0.005 | <MDA |
| 09-26-84 | 0.018+/-0.003 | -0.029+/-0.03 | 09-25-84 | 0.041+/-0.003 | <MDA |
| 10-03-84 | 0.025+/-0.003 | -0.005+/-0.04 | 10-02-84 | 0.038+/-0.004 | <MDA |
| 10-10-84 | 0.022+/-0.003 | 0.001+/-0.03 | 10-09-84 | 0.047+/-0.004 | 0.003+/-0.001 |
| 10-17-84 | 0.115+/-0.005 | -0.009+/-0.03 | 10-16-84 | 0.035+/-0.003 | 0.003+/-0.001 |
| 10-24-84 | 0.016+/-0.002 | -0.001+/-0.03 | 10-23-84 | 0.038+/-0.004 | <0.003 |
| 10-31-84 | 0.019+/-0.003 | 0.005+/-0.03 | 10-30-84 | 0.045+/-0.005 | <0.002 |
| 11-07-84 | 0.020+/-0.003 | -0.005+/-0.03 | 11-06-84 | 0.033+/-0.003 | <0.001 |
| 11-14-84 | 0.018+/-0.003 | 0.002+/-0.03 | 11-13-84 | 0.047+/-0.004 | <0.002 |
| 11-21-84 | 0.016+/-0.002 | 0.005+/-0.003 | 11-20-84 | 0.074+/-0.004 | <0.001 |
| 11-28-84 | 0.020+/-0.003 | 0.000+/-0.04 | 11-27-84 | 0.043+/-0.003 | <0.001 |
| 12-05-84 | 0.020+/-0.003 | -0.014+/-0.03 | 12-04-84 | 0.038+/-0.004 | <0.001 |
| 12-12-84 | 0.033+/-0.003 | 0.011+/-0.03 | 12-11-84 | 0.067+/-0.004 | <0.002 |
| 12-19-84 | 0.019+/-0.003 | -0.010+/-0.03 | 12-18-84 | 0.041+/-0.003 | <0.001 |
| 12-26-84 | 0.026+/-0.003 | 0.012+/-0.03 | 12-26-84 | 0.030+/-0.003 | <0.001 |
| 01-02-85 | 0.009+/-0.002 | 0.002+/-0.03 | | | |

* a - Pump malfunction.

Table 17. Air particulate gross beta and air iodine (I-131) results for January - June, 1984. Control site - LaCrosse.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR

1984

La Crosse
15.6 miles N

Measurements in units of pCi/M3

WI - Section of Radiation Protection data

LACBWR data

| Collection date | Air Particulate | Air Iodine | Collection date | Air Particulate | Air Iodine |
|-----------------|-----------------|---------------|-----------------|-----------------|----------------|
| 01-09-84 | 0.012+/-0.001 | 0.033+/-0.019 | 01-10-84 | 0.066+/-0.007 | <MDA |
| 01-16-84 | 0.021+/-0.002 | 0.02+/-0.02 | 01-17-84 | 0.064+/-0.005 | <MDA |
| 01-23-84 | 0.032+/-0.002 | 0.006+/-0.02 | 01-24-84 | 0.068+/-0.005 | <MDA |
| 01-30-84 | 0.020+/-0.002 | 0.00+/-0.02 | 01-31-84 | 0.065+/-0.005 | <MDA |
| 02-06-84 | 0.012+/-0.001 | 0.00+/-0.02 | 02-07-84 | 0.054+/-0.005 | <MDA |
| 02-13-84 | 0.029+/-0.002 | 0.00+/-0.02 | 02-14-84 | 0.059+/-0.005 | <MDA |
| 02-21-84 | 0.044+/-0.002 | 0.010+/-0.02 | 02-21-84 | 0.046+/-0.005 | <MDA |
| 02-27-84 | 0.040+/-0.002 | 0.015+/-0.03 | 02-28-84 | 0.039+/-0.004 | <MDA |
| 03-05-84 | *a | *a | 03-06-84 | 0.016+/-0.005 | <MDA |
| 03-12-84 | 0.018+/-0.001 | 0.02+/-0.02 | 03-13-84 | 0.079+/-0.008 | <MDA |
| 03-19-84 | 0.029+/-0.002 | 0.03+/-0.02 | 03-21-84 | 0.057+/-0.005 | <MDA |
| 03-26-84 | 0.029+/-0.002 | -0.008+/-0.02 | 03-27-84 | 0.041+/-0.006 | <MDA |
| 04-02-84 | 0.059+/-0.003 | -0.005+/-0.02 | 04-03-84 | 0.038+/-0.005 | <MDA |
| 04-09-84 | 0.012+/-0.001 | 0.012+/-0.03 | 04-10-84 | 0.061+/-0.005 | <MDA |
| 04-16-84 | 0.006+/-0.001 | 0.016+/-0.03 | 04-17-84 | 0.039+/-0.005 | <MDA |
| 04-23-84 | 0.010+/-0.001 | -0.002+/-0.02 | 04-25-84 | 0.039+/-0.004 | <MDA |
| 04-30-84 | 0.009+/-0.001 | 0.017+/-0.02 | 05-01-84 | 0.036+/-0.004 | <MDA |
| 05-07-84 | 0.011+/-0.001 | -0.007+/-0.02 | 05-08-84 | 0.043+/-0.005 | <MDA |
| 05-14-84 | 0.008+/-0.001 | 0.006+/-0.02 | 05-15-84 | 0.036+/-0.005 | <MDA |
| 05-21-84 | 0.011+/-0.001 | -0.007+/-0.02 | 05-22-84 | 0.037+/-0.005 | <MDA |
| 05-29-84 | 0.011+/-0.001 | 0.012+/-0.018 | 05-29-84 | 0.058+/-0.004 | <MDA |
| 06-04-84 | 0.015+/-0.002 | 0.000+/-0.02 | 06-05-84 | 0.044+/-0.005 | <MDA |
| 06-11-84 | 0.009+/-0.001 | 0.000+/-0.02 | 06-12-84 | 0.034+/-0.005 | <MDA |
| 06-18-84 | 0.009+/-0.001 | -0.007+/-0.02 | 06-20-84 | 0.034+/-0.004 | 0.0004+/-0.002 |
| 06-25-84 | 0.010+/-0.001 | -0.002+/-0.02 | 06-27-84 | 0.045+/-0.006 | 0.002+/-0.002 |
| 07-02-84 | 0.009+/-0.001 | -0.018+/-0.02 | 07-03-84 | 0.040+/-0.005 | <MDA |

* a - Pump malfunction.

Table 18. Air particulate gross beta and air iodine (I-131) results for July - December, 1984. Control site - LaCrosse.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR

1984

La Crosse
15.6 miles N

Measurements in units of pCi/M³

WI - Section of Radiation Protection data

LACBWR data

| Collection date | Air Particulate | Air Iodine | Collection date | Air Particulate | Air Iodine |
|-----------------|-----------------|----------------|-----------------|-----------------|---------------|
| 07-09-84 | 0.010+/-0.001 | -0.008+/-0.02 | 07-10-84 | 0.045+/-0.005 | <MDA |
| 07-16-84 | 0.015+/-0.001 | -0.011+/-0.02 | 07-17-84 | 0.044+/-0.005 | <MDA |
| 07-23-84 | 0.014+/-0.001 | -0.001+/-0.02 | 07-24-84 | 0.062+/-0.005 | <MDA |
| 07-30-84 | 0.013+/-0.001 | -0.006+/-0.02 | 07-31-84 | 0.054+/-0.005 | 0.003+/-0.002 |
| 08-06-84 | 0.022+/-0.002 | -0.005+/-0.013 | 08-07-84 | 0.070+/-0.005 | <MDA |
| 08-13-84 | 0.015+/-0.002 | 0.006+/-0.02 | 08-14-84 | 0.042+/-0.005 | <MDA |
| 08-20-84 | 0.020+/-0.002 | 0.008+/-0.02 | 08-21-84 | 0.067+/-0.007 | <MDA |
| 08-27-84 | 0.014+/-0.001 | -0.003+/-0.02 | 08-28-84 | 0.051+/-0.004 | <MDA |
| 09-04-84 | 0.020+/-0.002 | -0.007+/-0.013 | 09-04-84 | 0.045+/-0.005 | <MDA |
| 09-10-84 | 0.012+/-0.002 | 0.003+/-0.02 | 09-11-84 | 0.031+/-0.004 | <MDA |
| 09-17-84 | 0.014+/-0.001 | 0.006+/-0.015 | 09-18-84 | 0.045+/-0.004 | 0.002+/-0.002 |
| 09-25-84 | 0.018+/-0.001 | -0.001+/-0.012 | 09-25-84 | 0.052+/-0.005 | <MDA |
| 10-01-84 | 0.015+/-0.002 | -0.006+/-0.02 | 10-02-84 | 0.058+/-0.005 | <MDA |
| 10-08-84 | 0.024+/-0.002 | -0.010+/-0.02 | 10-09-84 | 0.066+/-0.006 | <MDA |
| 10-15-84 | 0.021+/-0.002 | -0.005+/-0.013 | 10-16-84 | 0.046+/-0.004 | <0.002 |
| 10-22-84 | 0.009+/-0.001 | 0.000+/-0.014 | 10-23-84 | 0.042+/-0.004 | <0.003 |
| 10-29-84 | 0.016+/-0.001 | 0.004+/-0.004 | 10-30-84 | 0.050+/-0.005 | <0.003 |
| 11-05-84 | 0.014+/-0.001 | -0.003+/-0.02 | 11-06-84 | 0.043+/-0.005 | <0.003 |
| 11-12-84 | 0.018+/-0.002 | 0.02+/-0.02 | 11-13-84 | 0.047+/-0.005 | <0.002 |
| 11-19-84 | 0.016+/-0.001 | -0.003+/-0.012 | 11-20-84 | 0.044+/-0.004 | <0.002 |
| 11-26-84 | 0.013+/-0.001 | -0.009+/-0.02 | 11-27-84 | 0.045+/-0.004 | <0.002 |
| 12-03-84 | 0.008+/-0.001 | -0.004+/-0.019 | 12-04-84 | 0.034+/-0.003 | <0.001 |
| 12-10-84 | 0.027+/-0.002 | -0.006+/-0.019 | 12-11-84 | 0.066+/-0.005 | <0.003 |
| 12-17-84 | 0.010+/-0.001 | -0.001+/-0.011 | 12-18-84 | 0.045+/-0.004 | <0.001 |
| 12-24-84 | 0.020+/-0.001 | -0.002+/-0.011 | 12-26-84 | 0.045+/-0.003 | <0.001 |
| 12-31-84 | 0.017+/-0.002 | 0.000+/-0.017 | | | |

Table 19. Gamma isotopic results for January - June, 1984 from the monthly composite of air particulate samples. Indicator site - Lock & Dam #8.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR

1984

Lock & Dam #8
0.7 miles N

Measurements in unit of pCi/M³

WI - Section of Radiation Protection data

| | January | February | March | April | May | June |
|----------|----------------|----------------|----------------|----------------|----------------|----------------|
| Ce-144 | -0.001+/-0.008 | -0.016+/-0.019 | 0.003+/-0.009 | 0.004+/-0.007 | 0.009+/-0.016 | -0.002+/-0.008 |
| Ce-141 | NA | NA | 0.000+/-0.003 | 0.001+/-0.003 | 0.002+/-0.006 | 0.000+/-0.003 |
| Be-7 | 0.09+/-0.02 | 0.06+/-0.04 | 0.07+/-0.03 | 0.10+/-0.03 | 0.08+/-0.04 | 0.09+/-0.03 |
| I-131 | 0.004+/-0.015 | -0.001+/-0.015 | 0.002+/-0.012 | 0.000+/-0.012 | -0.001+/-0.02 | 0.001+/-0.014 |
| Zr,Nb-95 | 0.003+/-0.005 | 0.000+/-0.008 | -0.002+/-0.005 | 0.002+/-0.005 | -0.001+/-0.008 | 0.001+/-0.006 |
| Ru-103 | NA | NA | 0.000+/-0.003 | 0.000+/-0.002 | 0.000+/-0.005 | 0.001+/-0.003 |
| Ru-106 | 0.000+/-0.013 | -0.018+/-0.03 | -0.009+/-0.018 | -0.006+/-0.014 | -0.006+/-0.03 | 0.011+/-0.020 |
| Cs-137 | -0.001+/-0.002 | 0.000+/-0.003 | 0.001+/-0.002 | 0.000+/-0.002 | -0.001+/-0.003 | -0.001+/-0.002 |
| Cs-134 | 0.003+/-0.002 | -0.001+/-0.003 | 0.000+/-0.002 | 0.000+/-0.002 | -0.001+/-0.003 | 0.000+/-0.002 |

Isotopes other than those reported were not detected.

NA - isotope was not analyzed for.

LACBWR data

| | January | February | March | April | May | June |
|----------|-----------------|-----------------|-----------------|-----------------|-----------------|------|
| Ce-144 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ce-141 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Be-7 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| I-131 | <MDA | <MDA | 6 E-4 +/- 1 E-4 | 9 E-4 +/- 2 E-4 | <MDA | <MDA |
| Zr,Nb-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ru-103 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ru-106 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-137 | 8 E-5 +/- 3 E-5 | <MDA | <MDA | <MDA | 2 E-4 +/- 6 E-5 | <MDA |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-60 | 1 E-3 +/- 9 E-5 | 7 E-4 +/- 8 E-5 | 4 E-4 +/- 7 E-5 | 3 E-4 +/- 6 E-5 | 1 E-4 +/- 2 E-4 | <MDA |
| Mn-54 | 1 E-4 +/- 3 E-5 | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ba-140 | <MDA | <MDA | <MDA | <MDA | 1 E-3 +/- 4 E-4 | <MDA |

Table 20. Gamma isotopic results for July - December, 1984 from the monthly composite of air particulate samples. Indicator site - Lock & Dam #8.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR

1984

Lock & Dam #8
0.7 miles N

Measurements in unit of pCi/M³

WI - Section of Radiation Protection data

| | July | August | September | October | November | December |
|----------|----------------|----------------|----------------|---------------|----------------|----------------|
| Ce-144 | -0.001+/-0.014 | -0.012+/-0.03 | -0.011+/-0.019 | 0.007+/-0.02 | 0.006+/-0.02 | 0.015+/-0.02 |
| Ce-141 | 0.000+/-0.005 | 0.002+/-0.013 | 0.001+/-0.007 | 0.006+/-0.008 | 0.005+/-0.007 | 0.000+/-0.007 |
| Be-7 | 0.12+/-0.04 | 0.11+/-0.08 | 0.10+/-0.05 | 0.07+/-0.05 | 0.09+/-0.05 | 0.07+/-0.05 |
| I-131 | 0.005+/-0.019 | -0.008+/-0.05 | -0.008+/-0.02 | 0.002+/-0.03 | 0.001+/-0.02 | 0.012+/-0.02 |
| Zr,Nb-95 | 0.000+/-0.007 | -0.005+/-0.017 | -0.004+/-0.010 | 0.007+/-0.012 | -0.002+/-0.010 | 0.005+/-0.011 |
| Ru-103 | -0.001+/-0.003 | 0.000+/-0.009 | -0.002+/-0.005 | 0.001+/-0.006 | 0.000+/-0.005 | -0.002+/-0.005 |
| Ru-106 | 0.010+/-0.02 | 0.003+/-0.06 | 0.019+/-0.04 | -0.007+/-0.04 | 0.008+/-0.04 | 0.006+/-0.04 |
| Cs-137 | 0.000+/-0.003 | 0.002+/-0.007 | 0.000+/-0.004 | 0.000+/-0.005 | 0.001+/-0.005 | 0.001+/-0.005 |
| Cs-134 | 0.001+/-0.003 | -0.001+/-0.006 | 0.001+/-0.004 | 0.006+/-0.004 | 0.005+/-0.004 | -0.001+/-0.004 |

Isotopes other than those reported were not detected.

LACBWR data

| | July | August | September | October | November | December |
|----------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Ce-144 | <MDA | <MDA | <MDA | <MDA | <MDA | 5 E-4 +/- 3 E-4 |
| Ce-141 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Be-7 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| I-131 | <MDA | <MDA | <MDA | <MDA | <3.03 E-3 | 8 E-4 +/- 3 E-4 |
| Zr,Nb-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ru-103 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ru-106 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-137 | <MDA | 8 E-5 +/- 9 E-5 | 2 E-4 +/- 8 E-5 | <MDA | <7.88 E-4 | <6.50 E-5 |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <8.06 E-4 | <5.90 E-5 |
| Co-60 | 6 E-4 +/- 2 E-4 | 7 E-5 +/- 2 E-4 | <MDA | 2 E-4 +/- 2 E-4 | 6 E-4 +/- 2 E-3 | 2 E-4 +/- 2 E-4 |
| Mn-54 | <MDA | 4 E-5 +/- 9 E-5 | <MDA | 4 E-4 +/- 1 E-4 | <MDA | <MDA |

Table 21. Gamma isotopic results for January - June, 1984 from the monthly composite of air particulate samples. Control site - La Crosse.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR

1984

La Crosse
15.6 miles N

Measurements in units of pCi/M³

WI - Section of Radiation Protection data

| | January | February | March | April | May | June |
|----------|----------------|----------------|----------------|----------------|---------------|----------------|
| Ce-144 | -0.001+/-0.009 | -0.002+/-0.004 | 0.003+/-0.007 | 0.004+/-0.007 | 0.000+/-0.004 | 0.001+/-0.006 |
| Ce-141 | NA | NA | 0.001+/-0.002 | 0.001+/-0.003 | 0.001+/-0.002 | 0.000+/-0.002 |
| Be-7 | 0.06+/-0.02 | 0.040+/-0.013 | 0.078+/-0.019 | 0.07+/-0.02 | 0.093+/-0.016 | 0.065+/-0.017 |
| I-131 | 0.007+/-0.011 | 0.000+/-0.005 | 0.003+/-0.005 | -0.005+/-0.009 | 0.001+/-0.007 | 0.003+/-0.008 |
| Zr,Nb-95 | 0.001+/-0.004 | 0.001+/-0.002 | -0.002+/-0.003 | -0.001+/-0.004 | 0.001+/-0.003 | 0.000+/-0.003 |
| Ru-103 | NA | NA | 0.000+/-0.002 | 0.000+/-0.002 | 0.000+/-0.001 | 0.000+/-0.002 |
| Ru-106 | 0.008+/-0.012 | 0.000+/-0.008 | 0.003+/-0.013 | 0.012+/-0.014 | 0.001+/-0.008 | -0.002+/-0.011 |
| Cs-137 | -0.001+/-0.001 | 0.000+/-0.001 | 0.000+/-0.001 | 0.000+/-0.002 | 0.000+/-0.001 | 0.000+/-0.001 |
| Cs-134 | 0.001+/-0.001 | 0.000+/-0.001 | 0.000+/-0.001 | -0.001+/-0.001 | 0.000+/-0.001 | 0.000+/-0.001 |

Isotopes other than those reported were not detected.

NA - Isotope was not analyzed for.

LACBWR data

| | January | February | March | April | May | June |
|----------|-----------------|----------------------|-------|----------------------|-----------------|------|
| Ce-144 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ce-141 | 2 E-3 +/- 3 E-4 | <MDA | <MDA | <MDA | <MDA | <MDA |
| Be-7 | NA | NA | NA | NA | NA | NA |
| I-131 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Zr,Nb-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ru-103 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ru-106 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-137 | 9 E-4 +/- 3 E-4 | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-60 | 6 E-4 +/- 7 E-4 | <MDA | <MDA | <MDA 2 E-4 +/- 6 E-4 | 1 E-4 +/- 8 E-4 | <MDA |
| Co-58 | 2 E-3 +/- 8 E-4 | <MDA | <MDA | <MDA 6 E-5 +/- 1 E-7 | | <MDA |
| Co-57 | <MDA | <MDA 3 E-4 +/- 8 E-5 | | <MDA | <MDA | <MDA |

Table 22. Gamma isotopic results for July - December, 1984 from the monthly composite of air particulate samples. Control site - La Crosse.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR

1984

La Crosse
15.6 miles N

Measurements in units of pCi/M³

WI - Section of Radiation Protection data

| | July | August | September | October | November | December |
|----------|----------------|----------------|----------------|----------------|----------------|---------------|
| Ce-144 | 0.005+/-0.010 | -0.001+/-0.006 | 0.001+/-0.005 | 0.000+/-0.006 | 0.003+/-0.004 | 0.010+/-0.006 |
| Ce-141 | 0.002+/-0.004 | 0.000+/-0.002 | -0.001+/-0.002 | 0.001+/-0.002 | 0.000+/-0.001 | 0.001+/-0.002 |
| Be-7 | 0.08+/-0.03 | 0.10+/-0.02 | 0.079+/-0.015 | 0.062+/-0.016 | 0.057+/-0.012 | 0.062+/-0.014 |
| I-131 | -0.001+/-0.012 | 0.010+/-0.012 | 0.002+/-0.007 | 0.005+/-0.008 | 0.001+/-0.004 | 0.003+/-0.004 |
| Zr,Nb-95 | 0.003+/-0.006 | 0.000+/-0.003 | 0.000+/-0.002 | -0.001+/-0.003 | 0.001+/-0.002 | 0.001+/-0.003 |
| Ru-103 | -0.002+/-0.003 | 0.000+/-0.002 | 0.001+/-0.001 | 0.000+/-0.002 | 0.000+/-0.001 | 0.000+/-0.001 |
| Ru-106 | 0.008+/-0.019 | 0.006+/-0.011 | 0.003+/-0.008 | 0.003+/-0.010 | -0.002+/-0.007 | 0.007+/-0.009 |
| Cs-137 | 0.000+/-0.002 | 0.000+/-0.001 | 0.000+/-0.001 | 0.000+/-0.001 | 0.000+/-0.001 | 0.001+/-0.001 |
| Cs-134 | 0.001+/-0.002 | 0.000+/-0.001 | 0.000+/-0.001 | 0.000+/-0.001 | 0.000+/-0.001 | 0.000+/-0.001 |

Isotopes other than those reported were not detected.

LACBWR data

| | July | August | September | October | November | December |
|----------|-----------------|-----------------|-----------------|---------|-----------------|-----------------|
| Ce-144 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ce-141 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Be-7 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| I-131 | <MDA | <MDA | 3 E-3 +/- 1 E-3 | <MDA | 1.59 E-3 | 1.48 E-3 |
| Zr,Nb-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ru-103 | <MDA | 8 E-4 +/- 4 E-4 | <MDA | <MDA | <MDA | <MDA |
| Ru-106 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-137 | <MDA | <MDA | 1 E-3 +/- 3 E-4 | <MDA | 3.77 E-4 | 2 E-3 +/- 3 E-4 |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | 3.50 E-4 | 2.88 E-4 |
| Co-60 | 2 E-3 +/- 1 E-3 | 6 E-4 +/- 1 E-3 | <MDA | <MDA | <MDA | 1 E-3 +/- 8 E-4 |
| Mn-54 | <MDA | <MDA | <MDA | <MDA | 9 E-4 +/- 2 E-4 | <MDA |

Table 23. Analysis of surface water samples from January - June, 1984. Indicator site - discharge channel.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR

1984

Discharge channel

0.1 mile W

Measurements in units of pCi/liter

WI - Section of Radiation Protection data

| Collection Date | 01-10-84 | 02-15-84 | 03-28-84 | 04-10-84 | 05-09-84 | 06-13-84 |
|-------------------|-------------|-------------|--------------|------------|-------------|-------------|
| Gross Alpha-sol. | 2.5+/-1.4 | 1.2+/-1.0 | 2.6+/-1.3 | 1.7+/-1.3 | 2.1+/-1.3 | 2.3+/-1.5 |
| Gross Alpha-insol | 8.2+/-1.6 | 1.4+/-0.8 | 2.7+/-1.1 | 0.2+/-0.5 | 0.9+/-0.7 | 1.3+/-0.9 |
| Gross Beta-sol. | 34+/-3 | 19+/-2 | 11.0+/-1.7 | 6.5+/-1.5 | 5.9+/-1.4 | 11.0+/-1.7 |
| Gross Beta-insol. | 194+/-6 | 35+/-3 | 55+/-3 | 2.9+/-1.2 | 5.7+/-1.5 | 18+/-2 |
| H-3 | -14+/-360 | 4000+/-450 | 750+/-340 | 420+/-340 | -80+/-300 | 760+/-350 |
| Sr-89 | 0.2+/-0.4 | -0.5+/-0.6 | -0.04+/-0.6 | -0.4+/-0.5 | -0.3+/-0.6 | -0.6+/-0.7 |
| Sr-90 | 0.9+/-0.4 | 0.7+/-0.6 | 0.3+/-0.5 | 0.9+/-0.5 | 0.6+/-0.6 | 0.6+/-0.7 |
| I-131 | -0.3+/-0.17 | 0.12+/-0.17 | -0.22+/-0.18 | -0.6+/-0.6 | 0.16+/-0.18 | 0.07+/-0.18 |
| Gamma Isotopic | | | | | | |
| Mn-54 | 105+/-16 | 21+/-9 | 27+/-8 | 2+/-5 | 0+/-5 | 14+/-8 |
| Fe-59 | 30+/-30 | 0+/-16 | 20+/-12 | -1+/-8 | 1+/-8 | 11+/-14 |
| Co-58 | 30+/-10 | 7+/-8 | 9+/-7 | 2+/-5 | 1+/-5 | 12+/-8 |
| Co-60 | 230+/-20 | 68+/-12 | 74+/-13 | 3+/-6 | 6+/-7 | 96+/-15 |
| Zn-65 | 6+/-30 | 24+/-14 | 11+/-13 | 2+/-10 | 13+/-12 | 9+/-15 |
| Cs-134 | 7+/-12 | 3+/-7 | 10+/-7 | 4+/-6 | 3+/-5 | 3+/-7 |
| Cs-137 | 9+/-14 | -2+/-9 | 12+/-8 | 4+/-6 | 2+/-6 | 7+/-7 |
| Zr-95 | 6+/-30 | 13+/-13 | 9+/-15 | 2+/-11 | 4+/-12 | 2+/-15 |
| Ba,La-140 | 6+/-6 | -1+/-6 | 10+/-50 | -2+/-6 | 0+/-6 | 30+/-50 |

Isotopes other than those reported were not detected.

LACBWR data

| Collection Date | 01-10-84 | 02-15-84 | 03-28-84 | 04-10-84 | 05-09-84 | 06-13-84 |
|-----------------|-----------|------------|------------|-----------|------------|------------|
| Gross Alpha | 5.9+/-6.0 | 8.4+/-6.1 | <MDA | <MDA | <MDA | <MDA |
| Gross Beta | 148+/-4 | 35.6+/-2.7 | 34.1+/-2.3 | 9.4+/-2.3 | 11.8+/-2.4 | 24.0+/-2.6 |
| H-3 | <MDA | <MDA | <MDA | <MDA | 3951 | 3410 |
| Sr-89 | NA | NA | NA | NA | NA | NA |
| Sr-90 | NA | NA | NA | NA | NA | NA |
| Gamma Isotopic | | | | | | |
| Mn-54 | <MDA | 13+/-4 | <MDA | <MDA | <MDA | 8.7+/-8.2 |
| Fe-59 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-60 | 192+/-11 | <MDA | 33+/-7 | <MDA | <MDA | <MDA |
| Zn-65 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| I-131 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-137 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Zr-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ba,La-140 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Nb-95 | <MDA | 11+/-2 | <MDA | <MDA | <MDA | <MDA |
| Co-57 | <MDA | <MDA | <MDA | 3.9+/-0.9 | <MDA | 6.3+/-3.5 |

NA - Isotope was not analyzed for.

Table 24. Analysis of surface water samples from July - December, 1984. Indicator site - discharge channel.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION
LACBWR
1984
Discharge channel
0.1 mile W

Measurements in units of pCi/liter

WI - Section of Radiation Protection data

| Collection Date | 07-10-84 | 08-15-84 | 09-12-84 | 10-09-84 | 11-15-84 | 12-12-84 |
|-------------------|-------------|-------------|-------------|--------------|-------------|-------------|
| Gross Alpha-sol | 1.6+/-1.4 | 2.1+/-1.4 | 1.7+/-1.2 | 0.6+/-1.1 | 1.8+/-1.2 | 1.5+/-1.2 |
| Gross Alpha-insol | 0.6+/-0.6 | 0.1+/-0.6 | 0.7+/-0.7 | 0.2+/-0.6 | 0.8+/-0.7 | 0.3+/-0.7 |
| Gross Beta-sol | 6.2+/-1.5 | 8.3+/-1.8 | 6.6+/-1.4 | 6.0+/-1.6 | 24+/-2 | 7.4+/-1.5 |
| Gross Beta-insol. | 2.8+/-1.1 | 7.9+/-1.6 | 6.3+/-1.4 | 1.2+/-1.2 | 6.3+/-1.3 | 0.7+/-1.0 |
| H-3 | -40+/-330 | 2500+/-360 | -50+/-310 | 80+/-300 | 9500+/-400 | 180+/-280 |
| Sr-89 | 0.6+/-0.7 | 0.6+/-0.7 | -0.08+/-0.5 | -0.3+/-0.5 | -1.6+/-0.5 | -2.6+/-0.4 |
| Sr-90 | -0.03+/-0.8 | 0.12+/-0.7 | 0.7+/-0.4 | 0.14+/-0.5 | 1.2+/-0.4 | 1.1+/-0.4 |
| I-131 | 0.05+/-0.19 | 0.19+/-0.17 | 0.05+/-0.17 | -0.14+/-0.18 | 3.50+/-0.18 | 0.14+/-0.18 |
| Gamma Isotopic | | | | | | |
| Mn-54 | 0+/-3 | 8+/-6 | 1+/-4 | -4+/-5 | 5+/-6 | 3+/-5 |
| Fe-59 | 1+/-5 | 8+/-10 | 4+/-9 | -1+/-10 | 3+/-10 | 3+/-8 |
| Co-58 | 1+/-3 | 7+/-5 | 0+/-4 | -3+/-5 | 0+/-5 | 3+/-5 |
| Co-60 | 0+/-3 | 30+/-9 | 5+/-6 | 11+/-6 | 25+/-8 | 4+/-5 |
| Zn-65 | 2+/-6 | 8+/-11 | 4+/-10 | -10+/-11 | 4+/-10 | 1+/-9 |
| Cs-134 | 1+/-3 | 4+/-5 | 2+/-5 | -3+/-5 | 7+/-6 | 7+/-5 |
| Cs-137 | 1+/-3 | 7+/-6 | 0+/-5 | -4+/-5 | 7+/-5 | 4+/-5 |
| Zr-95 | 2+/-6 | 7+/-12 | -2+/-10 | -14+/-11 | 13+/-11 | -1+/-10 |
| Ba,La-140 | -4+/-4 | -5+/-6 | -5+/-7 | 1+/-7 | 9+/-7 | -4+/-6 |

Isotopes other than those reported were not detected.

LACBWR data

| Collection Date | 07-10-84 | 08-15-84 | 09-12-84 | 10-09-84 | 11-15-84 | 12-12-84 |
|-------------------|-------------|-------------|-------------|-------------|-------------|------------|
| Gross Alpha-Total | 6.33+/-6.16 | 7.04+/-6.10 | <7.90 | <7.79 | <17.5 | <14.6 |
| Gross Beta-Total | 8.56+/-2.28 | 22.7+/-3.81 | 8.63+/-2.27 | 4.61+/-2.14 | 43.0+/-2.67 | 25.5+/-2.3 |
| H-3 | <MDA | 3508 | 1430 | <1255 | 2197 | <1262 |
| Sr-89 | NA | NA | NA | NA | NA | NA |
| Sr-90 | NA | NA | NA | NA | NA | NA |
| Gamma Isotopic | | | | | | |
| Mn-54 | <MDA | 7.07+/-4.52 | <MDA | <MDA | <MDA | <MDA |
| Fe-59 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-60 | <MDA | 27.2+/-8.94 | 50.3+/-27.3 | <MDA | <MDA | <MDA |
| Zn-65 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| I-131 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-137 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Zr-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ba,La-140 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-57 | 5.00+/-1.95 | <MDA | <MDA | <MDA | <MDA | <MDA |
| Nb-95 | 5.67+/-2.49 | <MDA | <MDA | <MDA | 6.71+/-3.25 | <MDA |
| Ce-141 | 8.22+/-3.81 | <MDA | <MDA | <MDA | <MDA | <MDA |

NA - Isotope was not analyzed for.

Table 25. Analysis of surface water samples from January - June, 1984. Control site - Lock & Dam #8.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR
1984
Lock & Dam #8
0.7 miles W

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

| Collection Date | 01-10-84 | 02-15-84 | 03-28-84 | 04-10-84 | 05-09-84 | 06-13-84 |
|-------------------|--------------|--------------|------------|------------|--------------|-------------|
| Gross Alpha-sol. | 0.9+/-1.0 | 0.6+/-0.9 | 1.2+/-1.1 | 0.8+/-1.0 | 3+/-3 | 2.5+/-1.4 |
| Gross Alpha-insol | 0.8+/-0.7 | 0.2+/-0.5 | 1.0+/-0.9 | 0.1+/-0.5 | 0.9+/-0.7 | 0.9+/-0.8 |
| Gross Beta-sol. | 4.0+/-1.3 | 4.2+/-1.3 | 5.2+/-1.4 | 4.5+/-1.3 | 4.8+/-1.5 | 4.6+/-1.3 |
| Gross Beta-insol. | 0.5+/-0.9 | 0.7+/-1.0 | 6.5+/-1.4 | -0.1+/-0.9 | 1.1+/-1.0 | 2.4+/-1.1 |
| H-3 | -150+/-360 | -30+/-400 | -4+/-330 | 250+/-330 | 80+/-330 | 550+/-350 |
| Sr-89 | -0.2+/-0.4 | 0.4+/-0.6 | 0.15+/-0.5 | 0.4+/-0.6 | 0.9+/-0.6 | -0.2+/-0.5 |
| Sr-90 | 0.6+/-0.4 | 0.4+/-0.6 | 0.4+/-0.5 | 0.7+/-0.6 | -0.13+/-0.6 | 0.6+/-0.6 |
| I-131 | -0.48+/-0.18 | -0.13+/-0.19 | -0.2+/-0.2 | 0.04+/-0.4 | -0.20+/-0.14 | 0.01+/-0.18 |
| Gamma Isotopic | | | | | | |
| Mn-54 | -1+/-5 | 2+/-4 | -1+/-5 | -1+/-5 | -3+/-4 | -1+/-5 |
| Fe-59 | 2+/-10 | 4+/-6 | 2+/-8 | 3+/-9 | 7+/-10 | -7+/-7 |
| Co-58 | 2+/-5 | 2+/-5 | 0+/-5 | 1+/-5 | -1+/-5 | 0+/-5 |
| Co-60 | 1+/-6 | 3+/-4 | -2+/-5 | 1+/-6 | 0+/-6 | -5+/-5 |
| Zn-65 | 4+/-11 | -1+/-11 | -1+/-10 | 3+/-11 | 0+/-10 | 6+/-11 |
| Cs-134 | 0+/-6 | 1+/-6 | 3+/-5 | 0+/-5 | 4+/-5 | 1+/-5 |
| Cs-137 | 2+/-5 | -2+/-6 | 1+/-6 | -1+/-6 | 2+/-6 | 2+/-6 |
| Zr-95 | 4+/-11 | 9+/-10 | 6+/-11 | 2+/-11 | 13+/-13 | -9+/-10 |
| Ba,La-140 | -1+/-7 | 5+/-4 | 1+/-6 | 2+/-7 | -2+/-5 | -1+/-6 |

Isotopes other than those reported were not detected.

LACBWR data

| Collection Date | 01-10-84 | 02-15-84 | 03-28-84 | 04-10-84 | 05-09-84 | 06-13-84 |
|-----------------|------------|-----------|-----------|-----------|-----------|-----------|
| Gross Alpha | 11.4+/-7.5 | <MDA | <MDA | <MDA | <MDA | <MDA |
| Gross Beta | 11.5+/-2.3 | 3.5+/-2.2 | 6.2+/-1.7 | 7.1+/-2.2 | 8.8+/-2.3 | 4.1+/-2.3 |
| H-3 | <MDA | <MDA | <MDA | <MDA | 3293 | 2046 |
| Sr-89 | NA | NA | NA | NA | NA | NA |
| Sr-90 | NA | NA | NA | NA | NA | NA |
| Gamma Isotopic | | | | | | |
| Mn-54 | <MDA | 4.7+/-1.5 | <MDA | <MDA | <MDA | <MDA |
| Fe-59 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-60 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Zn-65 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| I-131 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-137 | <MDA | <MDA | <MDA | <MDA | <MDA | 6.8+/-3.4 |
| Zr-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ba,La-140 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ce-141 | <MDA | <MDA | <MDA | 7.2+/-1.7 | <MDA | <MDA |
| Co-57 | <MDA | <MDA | 2.0+/-0.5 | <MDA | <MDA | <MDA |

Table 26. Analysis of surface water samples from July - December, 1984. Control site - Lock & Dam #8.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR
1984
Lock & Dam #8
0.7 miles W

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

| Collection Date | 07-10-84 | 08-15-84 | 09-12-84 | 10-09-84 | 11-14-84 | 12-12-84 |
|-------------------|------------|-------------|-------------|--------------|-------------|------------|
| Gross Alpha-sol. | 2.5+/-1.5 | 1.2+/-1.2 | 0.7+/-1.0 | 0.5+/-1.1 | 1.6+/-1.2 | 2.0+/-1.2 |
| Gross Alpha-insol | 0.0+/-0.5 | 1.0+/-0.8 | 0.3+/-0.6 | 0.9+/-0.7 | 0.0+/-0.6 | 0.3+/-0.7 |
| Gross Beta-sol. | 5.1+/-1.4 | 5.9+/-1.6 | 3.7+/-1.2 | 4.0+/-1.5 | 6.3+/-1.4 | 4.8+/-1.3 |
| Gross Beta-insol. | 0.6+/-1.0 | 3.0+/-1.3 | 2.4+/-1.1 | 1.2+/-1.2 | 0.9+/-1.0 | 0.8+/-1.0 |
| H-3 | -100+/-330 | 280+/-330 | -10+/-310 | -200+/-290 | -110+/-280 | -150+/-280 |
| Sr-89 | -0.3+/-0.5 | -0.5+/-0.6 | -0.01+/-0.4 | -1.6+/-0.6 | -0.15+/-0.5 | -1.7+/-0.4 |
| Sr-90 | 0.5+/-0.5 | 0.9+/-0.7 | 0.5+/-0.4 | 1.0+/-0.6 | 0.4+/-0.4 | 0.8+/-0.4 |
| I-131 | 0.3+/-0.8 | 0.48+/-0.18 | 0.22+/-0.18 | -0.14+/-0.18 | 0.34+/-0.16 | 0.4+/-0.2 |
| Gamma Isotopic | | | | | | |
| Mn-54 | -1+/-4 | 0+/-4 | 2+/-5 | -5+/-4 | 0+/-4 | 0+/-4 |
| Fe-59 | 4+/-9 | 1+/-8 | 3+/-9 | 1+/-8 | 4+/-9 | -2+/-7 |
| Co-58 | 3+/-5 | 0+/-4 | 3+/-5 | 1+/-4 | -1+/-4 | 1+/-4 |
| Co-60 | -2+/-5 | 2+/-5 | 1+/-5 | -2+/-4 | -1+/-5 | -2+/-5 |
| Zn-65 | 2+/-10 | 3+/-10 | 3+/-10 | 0+/-9 | -4+/-8 | 7+/-11 |
| Cs-134 | -1+/-5 | 4+/-5 | 3+/-5 | 1+/-4 | 2+/-5 | 2+/-5 |
| Cs-137 | 0+/-5 | 1+/-5 | -3+/-4 | 2+/-5 | 0+/-5 | 0+/-5 |
| Zr-95 | 5+/-12 | 1+/-11 | -1+/-11 | -4+/-9 | -1+/-11 | 3+/-11 |
| Ba,La-140 | -2+/-7 | -7+/-5 | 0+/-8 | -1+/-4 | -7+/-6 | -3+/-6 |

Isotopes other than those reported were not detected.

LACBWR data

| Collection Date | 07-10-84 | 08-15-84 | 09-12-84 | 10-09-84 | 11-14-84 | 12-12-84 |
|-------------------|-------------|-------------|--------------|-------------|------------|-------------|
| Gross Alpha-Total | 6.33+/-6.16 | <MDA | <7.90 | <7.79 | <14.7 | 16.6+/-16.2 |
| Gross Beta-Total | 6.45+/-2.42 | 7.72+/-2.27 | 7.08+/-1.98 | 5.11+/-2.10 | 3.0+/-2.2 | <2.4 |
| H-3 | <MDA | 1403 | <MDA | <1255 | <1201 | <1262 |
| Sr-89 | NA | NA | NA | NA | NA | NA |
| Sr-90 | NA | NA | NA | NA | NA | NA |
| Gamma Isotopic | | | | | | |
| Mn-54 | <MDA | 3.10+/-4.82 | 12.35+/-3.11 | <MDA | 16.6+/-4.2 | <MDA |
| Fe-59 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-60 | <MDA | 3.39+/-7.96 | 49.5+/-27.2 | <MDA | <MDA | <MDA |
| Zn-65 | <MDA | <MDA | <MDA | 22.4+/-7.3 | <MDA | <MDA |
| I-131 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-137 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Zr-95 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ba,La-140 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-57 | <MDA | <MDA | <MDA | 5.06+/-2.46 | <MDA | <MDA |
| Nb-95 | <MDA | <MDA | 7.78+/-3.41 | <MDA | <MDA | <MDA |

Table 27. Analysis of fish samples.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR

1984

Measurements in units of pCi/kg (wet)

WI - Section of Radiation Protection data

| Collection Date | 03-27-84 | 03-27-84 | 06-26-84 | 06-26-84 | 11-21-84 | 11-21-84 |
|-----------------|------------|--------------|------------|------------|------------|------------|
| Type | carp | walleye pike | sauger | carp | walleye | carp |
| Gamma Isotopic | | | | | | |
| Mn-54 | 20+/-30 | 50+/-40 | 30+/-40 | 1+/-30 | 15+/-17 | 40+/-30 |
| Fe-59 | 70+/-60 | 40+/-90 | 40+/-90 | 12+/-70 | 90+/-50 | 60+/-80 |
| Co-58 | 4+/-30 | 20+/-40 | 13+/-40 | 18+/-40 | 7+/-19 | -1+/-30 |
| Co-60 | 20+/-30 | 40+/-50 | 70+/-50 | 40+/-40 | 120+/-30 | 40+/-40 |
| Zn-65 | 30+/-70 | 0+/-100 | 40+/-90 | 40+/-70 | 70+/-50 | 70+/-70 |
| Cs-134 | 7+/-30 | 3+/-40 | 19+/-40 | 4+/-30 | 6+/-15 | 40+/-30 |
| Cs-137 | 40+/-30 | 40+/-40 | 30+/-40 | 50+/-40 | 40+/-20 | 13+/-30 |
| K-40 | 3100+/-700 | 4100+/-800 | 4000+/-900 | 3500+/-800 | 3300+/-500 | 2700+/-700 |

Isotopes other than those reported were not detected.

LACBWR data

| Collection Date | 03-27-84 | 03-27-84 | 06-26-84 | 06-26-84 | 11-21-84 | 11-21-84 |
|-----------------|----------|----------|----------|----------|-------------|-----------|
| Type | carp | walleye | sauger | carp | walleye | carp |
| Gamma Isotopic | | | | | | |
| Mn-54 | <MDA | <MDA | <MDA | <MDA | 16.4+/-4.0 | 9.5+/-3.1 |
| Fe-59 | <MDA | <MDA | <MDA | <MDA | <13.2 | <6.7 |
| Co-58 | <MDA | <MDA | <MDA | <MDA | <5.64 | <4.7 |
| Co-60 | 49+/-6 | 78+/-9 | <MDA | <MDA | 51.2+/-13.1 | <12.7 |
| Zn-65 | <MDA | <MDA | <MDA | <MDA | <11.2 | <9.5 |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <6.1 | <5.5 |
| Cs-137 | 14+/-3 | <MDA | 25+/-5 | 25+/-5 | 33.7+/-7.2 | <5.9 |
| K-40 | NA | NA | NA | NA | NA | NA |
| Co-57 | <MDA | 8+/-3 | <MDA | <MDA | <MDA | <MDA |
| Ru-103 | <MDA | 11+/-4 | <MDA | <MDA | <MDA | <MDA |

Table 28. Analysis of bottom sediment samples collected 3/27/84 and 6/26/84.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR

1984

Measurements in units of pCi/kg (dry)

WI - Section of Radiation Protection data

| Collection Date | 03-27-84 | 03-27-84 | 03-27-84 | 03-27-84 | 03-27-84 | 03-27-84 |
|-------------------|--------------|--------------|--------------|--------------|---------------|---------------|
| Type | sediment | sediment | sediment | sediment | sediment | sediment |
| Location | upstream #1 | upstream #2 | discharge #1 | discharge #2 | downstream #1 | downstream #2 |
| Analysis | | | | | | |
| Gross beta (dry) | 11000+/-3000 | 7000+/-3000 | 17000+/-3000 | 21000+/-3000 | 27000+/-4000 | 26000+/-4000 |
| Gross alpha (dry) | 1200+/-3000 | -900+/-3000 | 0+/-3000 | 700+/-3000 | 3000+/-3000 | 7000+/-4000 |
| Gamma Isotopic | | | | | | |
| Co-58 | 20+/-30 | 13+/-30 | -3+/-200 | -3+/-180 | -4+/-60 | 30+/-60 |
| Co-60 | 1+/-30 | 20+/-30 | 32400+/-400 | 16400+/-300 | 940+/-100 | 150+/-60 |
| Cs-134 | 25+/-30 | 8+/-30 | 600+/-200 | 610+/-170 | 30+/-60 | 30+/-50 |
| Cs-137 | 16+/-30 | 14+/-30 | 11600+/-300 | 13200+/-300 | 210+/-60 | 20+/-50 |
| Mn-54 | | | | | | |
| K-40 | 6500+/-700 | 5700+/-700 | 7000+/-900 | 7500+/-800 | 13600+/-1000 | 14300+/-1100 |
| Ra-226 * | 300+/-600 | 0+/-600 | 900+/-2000 | 2000+/-2000 | 700+/-900 | 1400+/-800 |
| Pb-214 * | 270+/-60 | 210+/-60 | 300+/-300 | 300+/-300 | 430+/-100 | 440+/-90 |
| Bi-214 * | 230+/-60 | 180+/-60 | 1500+/-300 | 1780+/-300 | 280+/-110 | 300+/-90 |
| Tl-208 * | 270+/-90 | 130+/-80 | 400+/-400 | 400+/-400 | 310+/-150 | 240+/-130 |
| Ac-228 * | 240+/-110 | 200+/-90 | -13+/-700 | 30+/-600 | 700+/-200 | 240+/-160 |
| Collection Date | 06-26-84 | 06-26-84 | 06-26-84 | 06-26-84 | 06-26-84 | 06-26-84 |
| Type | sediment | sediment | sediment | sediment | sediment | sediment |
| Location | upstream #1 | upstream #2 | discharge #1 | discharge #2 | downstream #1 | downstream #2 |
| Analysis | | | | | | |
| Gross beta (dry) | 17800+/-3000 | 21000+/-3000 | 18000+/-3000 | 16000+/-3000 | 26000+/-4000 | 28000+/-4000 |
| Gross alpha (dry) | 8000+/-4000 | 3000+/-4000 | -1700+/-3000 | -600+/-3000 | 11000+/-5000 | 11000+/-5000 |
| Gamma Isotopic | | | | | | |
| Co-58 | 6+/-60 | -8+/-40 | 180+/-130 | 160+/-120 | 70+/-50 | 16+/-50 |
| Co-60 | 30+/-60 | 10+/-50 | 9900+/-300 | 7400+/-200 | 40+/-60 | 10+/-60 |
| Cs-134 | 2+/-50 | 20+/-40 | 410+/-140 | 520+/-130 | 60+/-50 | 30+/-50 |
| Cs-137 | 220+/-60 | 170+/-50 | 11000+/-200 | 9700+/-200 | 370+/-70 | 380+/-60 |
| Mn-54 | | | | 230+/-100 | | |
| K-40 | 12600+/-1200 | 13400+/-1000 | 9000+/-800 | 7800+/-800 | 17000+/-1300 | 17300+/-1300 |
| Ra-226 * | 1100+/-1000 | 1500+/-700 | -120+/-1800 | 3200+/-1600 | 500+/-1000 | 1300+/-900 |
| Pb-214 * | 490+/-100 | 470+/-90 | 400+/-200 | 400+/-200 | 740+/-130 | 760+/-110 |
| Bi-214 * | 460+/-110 | 440+/-100 | 1300+/-200 | 1300+/-200 | 620+/-120 | 590+/-120 |
| Tl-208 * | 650+/-150 | 530+/-130 | 400+/-300 | 300+/-300 | 590+/-170 | 790+/-160 |
| Ac-228 * | 460+/-180 | 490+/-140 | 400+/-500 | 800+/-400 | 800+/-200 | 800+/-200 |

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

Isotopes other than those reported were not detected.

Table 29. Analysis of bottom sediment samples collected 10/17/84.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTIONLACBWR
1984Measurements in units of pCi/kg (dry)
WI - Section of Radiation Protection data

| Collection Date | 10-17-84 | 10-17-84 | 10-17-84 | 10-17-84 | 10-17-84 | 10-17-84 |
|-------------------|--------------|-------------|--------------|--------------|--------------|-------------|
| Type | sediment | sediment | sediment | sediment | sediment | sediment |
| Location | BS-1 | BS-2 | BS-3 | BS-4 | BS-5 | BS-6 |
| Analysis | | | | | | |
| Gross beta (dry) | 14200+/-4000 | 9800+/-4000 | 12000+/-4000 | 15000+/-4000 | 23000+/-5000 | 7500+/-4000 |
| Gross alpha (dry) | 1700+/-4000 | 2000+/-5000 | -600+/-4000 | 6000+/-6000 | 10000+/-6000 | -600+/-4000 |
| Gamma isotopic | | | | | | |
| Co-58 | -2+/-110 | -4+/-50 | 30+/-30 | -2+/-50 | 30+/-30 | 30+/-30 |
| Co-60 | 7100+/-200 | 2100+/-100 | 40+/-50 | 580+/-70 | 60+/-40 | 50+/-40 |
| Cs-134 | 150+/-120 | 40+/-50 | 16+/-30 | 0+/-40 | 10+/-30 | 40+/-30 |
| Cs-137 | 6000+/-170 | 570+/-50 | 50+/-30 | 130+/-50 | 50+/-30 | 50+/-30 |
| Mn-54 | | | | | | |
| K-40 | 6800+/-700 | 5900+/-500 | 8400+/-800 | 7200+/-800 | 12900+/-800 | 5600+/-700 |
| Ra-226 * | 1800+/-1300 | 400+/-600 | -44+/-600 | 500+/-700 | 1100+/-500 | 500+/-500 |
| Pb-214 * | 150+/-150 | 230+/-70 | 160+/-60 | 200+/-70 | 330+/-50 | 160+/-50 |
| Bi-214 * | 520+/-180 | 270+/-80 | 190+/-70 | 150+/-90 | 290+/-60 | 220+/-50 |
| Tl-208 * | 230+/-200 | 170+/-90 | 210+/-60 | 230+/-100 | 350+/-80 | 190+/-70 |
| Ac-228 * | 260+/-400 | 140+/-160 | 270+/-120 | 230+/-150 | 320+/-110 | 170+/-110 |

LACBWR data

| Collection Date | 10-17-84 | 10-17-84 | 10-17-84 | 10-17-84 | 10-17-84 | 10-17-84 |
|-------------------|-----------|-----------|----------|----------|----------|----------|
| Type | sediment | sediment | sediment | sediment | sediment | sediment |
| Location | BS-1 | BS-2 | BS-3 | BS-4 | BS-5 | BS-6 |
| Analysis | | | | | | |
| Gross beta (dry) | NA | NA | NA | NA | NA | NA |
| Gross alpha (dry) | NA | NA | NA | NA | NA | NA |
| Gamma isotopic | | | | | | |
| Co-58 | <MDA | 21+/-9 | <MDA | <MDA | <MDA | <MDA |
| Co-60 | 7000+/-89 | 2230+/-40 | <MDA | 790+/-21 | 112+/-15 | 30+/-9 |
| Cs-134 | 323+/-14 | 40+/-8 | <MDA | <MDA | <MDA | <MDA |
| Cs-137 | 7890+/-53 | 512+/-17 | 17+/-5 | 183+/-10 | 23+/-7 | 172+/-4 |
| Mn-54 | 182+/-18 | 74+/-12 | <MDA | 41+/-9 | <MDA | 21+/-4 |
| Zn-65 | 12+/-32 | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cr-51 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Co-57 | 16+/-7 | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ru-106 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| K-40 | NA | NA | NA | NA | NA | NA |
| Ra-226 * | NA | NA | NA | NA | NA | NA |
| Pb-214 * | NA | NA | NA | NA | NA | NA |
| Bi-214 * | NA | NA | NA | NA | NA | NA |
| Tl-208 * | NA | NA | NA | NA | NA | NA |
| Ac-228 * | NA | NA | NA | NA | NA | NA |

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

Isotopes other than those reported were not detected.

Table 30. Analysis of bottom sediment samples collected 10/17/84.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTIONLACBWR
1984Measurements in units of pCi/kg (dry)
WI - Section of Radiation Protection data

| | | | | | |
|-------------------|--------------|--------------|-------------|-------------|--------------|
| Collection Date | 10-17-84 | 10-17-84 | 10-17-84 | 10-17-84 | 10-17-84 |
| Type | sediment | sediment | sediment | sediment | sediment |
| Location | BS-7 | BS-8 | BS-9 | BS-10 | BS-11 |
| Analysis | | | | | |
| Gross beta (dry) | 29700+/-5000 | 10000+/-4000 | 9800+/-4000 | 8700+/-4000 | 25700+/-5000 |
| Gross alpha (dry) | 4000+/-5000 | 0+/-4000 | 1700+/-5000 | 0+/-4000 | 9000+/-6000 |
| Gamma Isotopic | | | | | |
| Co-58 | -2+/-40 | 10+/-16 | 11+/-30 | 16+/-20 | -6+/-40 |
| Co-60 | 40+/-40 | 0+/-20 | 110+/-40 | 20+/-30 | 15+/-40 |
| Cs-134 | 20+/-40 | 18+/-20 | 40+/-30 | 20+/-20 | 30+/-40 |
| Cs-137 | 20+/-30 | 20+/-17 | 40+/-30 | 40+/-20 | 250+/-40 |
| Mn-54 | | | | | |
| K-40 | 11200+/-900 | 7400+/-500 | 5900+/-600 | 6400+/-500 | 18100+/-1000 |
| Ra-226 * | 400+/-700 | 100+/-400 | 600+/-500 | 600+/-400 | 1600+/-800 |
| Pb-214 * | 180+/-60 | 170+/-40 | 120+/-60 | 150+/-40 | 710+/-80 |
| Bi-214 * | 260+/-70 | 190+/-40 | 230+/-60 | 250+/-40 | 650+/-90 |
| Tl-208 * | 130+/-100 | 190+/-50 | 150+/-80 | 300+/-60 | 770+/-120 |
| Ac-228 * | 280+/-130 | 250+/-70 | 130+/-120 | 240+/-80 | 680+/-140 |

LACBWR data

| | | | | | |
|-------------------|-----------|----------|----------|----------|----------|
| Collection Date | 10-17-84 | 10-17-84 | 10-17-84 | 10-17-84 | 10-17-84 |
| Type | sediment | sediment | sediment | sediment | sediment |
| Location | BS-7 | BS-8 | BS-9 | BS-10 | BS-11 |
| Analysis | | | | | |
| Gross beta (dry) | NA | NA | NA | NA | NA |
| Gross alpha (dry) | NA | NA | NA | NA | NA |
| Gamma Isotopic | | | | | |
| Co-58 | <MDA | <MDA | 9+/-4 | <MDA | <MDA |
| Co-60 | 12+/-9 | 33+/-5 | 84+/-10 | 15+/-9 | 19+/-15 |
| Cs-134 | 5.4+/-2.5 | <MDA | <MDA | <MDA | <MDA |
| Cs-137 | 13+/-4 | <MDA | 47+/-6 | 14+/-5 | 236+/-15 |
| Mn-54 | <MDA | <MDA | 15+/-4 | <MDA | <MDA |
| Zn-65 | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cr-51 | <MDA | <MDA | 46+/-30 | 82+/-28 | <MDA |
| Co-57 | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ru-106 | <MDA | <MDA | <MDA | <MDA | <MDA |
| K-40 | NA | NA | NA | NA | NA |
| Ra-226 * | NA | NA | NA | NA | NA |
| Pb-214 * | NA | NA | NA | NA | NA |
| Bi-214 * | NA | NA | NA | NA | NA |
| Tl-208 * | NA | NA | NA | NA | NA |
| Ac-228 * | NA | NA | NA | NA | NA |

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

Isotopes other than those reported were not detected.

Table 31. Analysis of milk samples for January - June, 1984.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Milk

LACBWR

1984

Measurements in units of pCi/liter

WI - Section of Radiation Protection data

| Collection date | 01-10-84 | 02-14-84 | 03-27-84 | 04-10-84 | 05-08-84 | 06-12-84 |
|-----------------|--------------|------------|------------|------------|--------------|-------------|
| Location | Pedretti | P. Malin | P. Malin | A. Malin | A. Malin | Pedretti |
| Isotope: | | | | | | |
| I-131 | -0.29+/-0.12 | 0.09+/-0.3 | -0.3+/-0.2 | -0.2+/-0.3 | -0.17+/-0.17 | -0.09+/-0.2 |
| Ba,La-140 | -1+/-6 | 6+/-5 | 5+/-4 | 3+/-4 | 5+/-5 | 4+/-4 |
| Cs-134 | 0+/-7 | 8+/-6 | 0+/-6 | 4+/-6 | 0+/-7 | 3+/-6 |
| Cs-137 | 5+/-7 | 5+/-7 | 4+/-6 | -1+/-7 | 6+/-7 | 4+/-7 |
| K-40 | 1334+/-170 | 1410+/-180 | 1300+/-180 | 1440+/-180 | 1420+/-180 | 1470+/-190 |
| Sr-90 | 2.8+/-1.0 | 4.3+/-0.8 | 3.8+/-1.0 | 3.3+/-0.8 | 4.6+/-1.0 | 6.0+/-1.3 |

Pedretti - 1.4 miles SE

A. Malin - 2.1 miles NE

P. Malin - 1.0 miles NE

Isotopes other than those reported were not detected.

LACBWR data

| Collection date | 01-10-84 | 02-14-84 | 03-27-84 | 04-10-84 | 05-08-84 | 06-12-84 |
|-----------------|-----------|----------|-----------|-----------|------------|----------|
| Location | Pedretti | P. Malin | P. Malin | A. Malin | A. Malin | Pedretti |
| Isotope: | | | | | | |
| I-131 | 2.9+/-0.9 | <MDA | <MDA | <MDA | <MDA | <MDA |
| Ba,La-140 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <MDA | <MDA |
| Cs-137 | <MDA | <MDA | <MDA | <MDA | 10.5+/-2.1 | <MDA |
| Nb-95 | <MDA | <MDA | <MDA | 8.8+/-2.4 | <MDA | <MDA |
| Ce-141 | 1.5+/-1.2 | <MDA | 4.8+/-2.3 | <MDA | <MDA | <MDA |
| K-40 | NA | NA | NA | NA | NA | NA |
| Sr-90 | NA | NA | NA | NA | NA | NA |

Table 32. Analysis of milk samples for July - December, 1984.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

Milk

LACBWR

1984

Measurements in units of pCi/liter

WI - Section of Radiation Protection data

| Collection date | 07-10-84 | 08-14-84 | 09-11-84 | 10-09-84 | 11-13-84 | 12-12-84 |
|-----------------|-------------|------------|--------------|------------|--------------|-------------|
| Location | Pedretti | P. Malin | A. Malin | P. Malin | PF | A. Malin |
| Isotope: | | | | | | |
| I-131 | -0.01+/-0.2 | 0.5+/-0.5 | -0.06+/-0.19 | 0.0+/-0.2 | -0.04+/-0.13 | 0.27+/-0.15 |
| Ba,La-140 | 1+/-5 | 9+/-7 | 3+/-6 | 2+/-5 | 1+/-5 | 2+/-5 |
| Cs-134 | 3+/-6 | 2+/-6 | 6+/-5 | 0+/-6 | 11+/-5 | 3+/-5 |
| Cs-137 | 3+/-7 | -1+/-7 | 3+/-7 | -1+/-7 | 2+/-7 | 1+/-6 |
| K-40 | 1410+/-190 | 1420+/-180 | 1480+/-180 | 1240+/-160 | 1490+/-180 | 1380+/-170 |
| Sr-90 | 4.3+/-0.9 | 5.0+/-1.0 | 2.1+/-0.8 | 3.8+/-1.1 | 4.3+/-0.8 | 2.7+/-1.4 |

Pedretti - 1.4 miles SE

A. Malin - 2.1 miles NE

P. Malin - 1.0 miles NE

Isotopes other than those reported were not detected.

LACBWR data

| Collection date | 07-10-84 | 08-14-84 | 09-11-84 | 10-09-84 | 11-13-84 | 12-12-84 |
|-----------------|----------|------------|----------|----------|------------|-----------|
| Location | Pedretti | P. Malin | A. Malin | P. Malin | PF | A. Malin |
| Isotope: | | | | | | |
| I-131 | <MDA | <MDA | <MDA | <MDA | <5.10 | 6.8+/-3.2 |
| Ba,La-140 | <MDA | <MDA | <MDA | <MDA | <8.8 | <5.41 |
| Cs-134 | <MDA | <MDA | <MDA | <MDA | <5.17 | <5.9 |
| Cs-137 | <MDA | <MDA | <MDA | <MDA | <MDA | <17 |
| K-40 | NA | NA | NA | NA | <MDA | <MDA |
| Sr-90 | NA | NA | NA | NA | <MDA | <MDA |
| Cr-51 | 49+/-29 | <MDA | <MDA | <MDA | 34.8+/-2.8 | <MDA |
| Zn-65 | <MDA | 17.0+/-5.7 | <MDA | <MDA | <MDA | <MDA |
| Ce-144 | <MDA | <MDA | <MDA | 42+/-22 | <MDA | <MDA |
| Co-60 | <MDA | <MDA | <MDA | <MDA | 23.9+/-1.1 | <MDA |
| Mn-54 | <MDA | <MDA | <MDA | <MDA | <MDA | 27.72 |

NA - Isotope was not analyzed for.

Table 33. Analysis of food products.

WISCONSIN DIVISION OF HEALTH
SECTION OF RADIATION PROTECTION

LACBWR

1984

Measurements in units of pCi/kg (wet)

WI - Section of Radiation Protection data

| | |
|-------------------|--------------------|
| Collection Date | 09-08-84 |
| Type | mixed food product |
| Location | 1.0 mile E |
| Analysis | |
| Gross beta (wet) | 2700+/-500 |
| Gross alpha (wet) | -100+/-500 |
| Gamma Isotopic | |
| I-131 | 0+/-20 |
| Be-7 | 0+/-130 |
| Zr-95 | 20+/-30 |
| Co-58 | -12+/-15 |
| Co-60 | 10+/-19 |
| Cs-134 | 2+/-13 |
| Cs-137 | -9+/-16 |
| K-40 | 2800+/-300 |

Isotopes other than those reported were not detected.

LACBWR data

| | |
|-------------------|--------------------|
| Collection Date | 09-08-84 |
| Type | mixed food product |
| Location | 1.0 mile E |
| Analysis | |
| Gross beta (wet) | NA |
| Gross alpha (wet) | NA |
| Gamma Isotopic | |
| I-131 | <MDA |
| Be-7 | NA |
| Zr-95 | <MDA |
| Co-58 | <MDA |
| Co-60 | <MDA |
| Cs-134 | <MDA |
| Cs-137 | 27+/-7 |
| K-40 | 3130+/-190 |

NA - Analysis was not performed.