NRC Docket No: 50-295

50-304

ZION NUCLEAR POWER STATION
UNITS 1 and 2

Annual Radiological
Environmental Operating Report

1 January Through 31 December 2008

Prepared By

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Appendices

I. Summary and Conclusions

This report on the Radiological Environmental Monitoring Program conducted for the Zion Nuclear Power Station (ZNPS) by Exelon covers the period 1 January 2008 through 31 December 2008. During that time period, 432 analyses were performed on 356 samples. In assessing all the data gathered for this report and comparing these results with preoperational data, it was concluded that the operation of ZNPS had no adverse radiological impact on the environment.

Public water samples were analyzed for concentrations of gross beta, tritium and gamma emitting nuclides. No fission or activation products were detected. Gross beta activities detected were consistent with those detected in previous years.

Fish (commercially and recreationally important species) and sediment samples were analyzed for concentrations of gamma emitting nuclides. No Cs-137 activity was detected in fish. No Cs-137 was detected in sediment samples. No plant produced fission or activation products were found in sediment.

Air particulate samples were analyzed for concentrations of gross beta and gamma emitting nuclides. No fission or activation products were detected.

Environmental gamma radiation measurements were performed quarterly using thermoluminescent dosimeters. Levels detected were consistent with those observed in previous years.

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II. Introduction

The Zion Nuclear Power Station (ZNPS), consisting of two 1100 MWt pressurized water reactor owned and operated by Exelon Corporation, is located in Zion, Illinois adjacent to Lake Michigan. Unit No. 1 went critical in December 1973. Unit No. 2 went critical in September 1974. The plant permanently ceased operation in January of 1998 and has been permanently defueled. The site is located in northeast Illinois on the western shore of Lake Michigan, approximately 50 miles north of Chicago, Illinois.

This report covers those analyses performed by Teledyne Brown Engineering (TBE), Global Dosimetry, and Environmental Inc. (Midwest Labs) on samples collected during the period 1 January 2008 through 31 December 2008.

A. Objective of the REMP

The objectives of the REMP are to:

1. Provide data on measurable levels of radiation and radioactive materials in the site environs.

2. Evaluate the relationship between quantities of radioactive material released from the plant and resultant radiation doses to individuals from principal pathways of exposure.

B. Implementation of the Objectives

The implementation of the objectives is accomplished by:

1. Identifying significant exposure pathways.

2. Establishing baseline radiological data of media within those pathways.

3. Continuously monitoring those media before and during Station operation to assess Station radiological effects (if any) on man and the environment.

III. Program Description

A. Sample Collection

Samples for the ZNPS REMP were collected for Exelon Nuclear by Environmental Inc. (Midwest Labs). This section describes the general

collection methods used by Environmental Inc. (Midwest Labs) to obtain environmental samples for the ZNPS REMP in 2008. Sample locations and descriptions can be found in Table B–1 and Figures B–1 and B–2, Appendix B. The sampling methods used by Environmental Inc. (Midwest Labs) are listed in Table B-2.

Aquatic Environment

The aquatic environment was evaluated by performing radiological analyses on samples of public water, fish, and sediment. Two gallon water samples were collected monthly from four public water locations (Z-14, Z-15, Z-16 and Z-18). Control locations were Z-14 and Z-18. All samples were collected in new unused plastic bottles, which were rinsed at least twice with source water prior to collection. Fish samples comprising the flesh of lake trout, burbot, salmon, bluegill, and smallmouth bass were collected semiannually at two locations, Z-26 and Z-27, both Control locations. Sediment samples composed of recently deposited substrate were collected at one location semiannually, Z-25.

Atmospheric Environment

The atmospheric environment was evaluated by performing radiological analyses on samples of air particulates. Airborne particulate samples were collected and analyzed weekly at three locations (Z-01, Z-02 and Z-03). No control location was required. Airborne particulate samples were obtained at each location, using a vacuum pump with glass fiber filters attached. The pumps were run continuously and sampled air at the rate of approximately one cubic foot per minute. The filters were replaced weekly and sent to the laboratory for analysis.

Ambient Gamma Radiation

Direct radiation measurements were made using 2 CaF 200 and 2 LiF 100 LiF 4-chip Harshaw thermoluminescent dosimeters (TLD). Each location consisted of 2 TLD sets. The TLD locations were placed on and around the ZNPS site at the following loations:

Z-101, Z-102, Z-103, Z-104, Z-105, Z-106, Z-107, Z-108, Z-110, Z-111, Z-112, Z-113, Z-114, Z-115, Z-301, Z-01, Z-02 and Z-03.

No control location was required.

The specific TLD locations were determined by the following criteria:

1. The presence of relatively dense population;

2. Site meteorological data taking into account distance and elevation for each of the sixteen–22 1/2 degree sectors around the site, where estimated annual dose from ZNPS, if any, would be most significant;

3. On hills free from local obstructions and within sight of the vents (where practical);

4. And near the closest dwelling to the vents in the prevailing downwind direction.

(Two TLDs – each comprised of two CaF_2 200 and 2 LiF 100 LiF 4-chip thermoluminescent phosphors enclosed in plastic – were placed at each location in a PVC conduit located approximately four to eight feet above ground level. The TLDs were exchanged quarterly and sent to Global Dosimetry for analysis.

B. Sample Analysis

This section describes the general analytical methodologies used by TBE and Environmental Inc. (Midwest Labs) to analyze the environmental samples for radioactivity for the ZNPS REMP in 2008. The analytical procedures used by the laboratories are listed in Table B-2.

In order to achieve the stated objectives, the current program includes the following analyses:

1. Concentrations of beta emitters in public water and air particulates.

2. Concentrations of gamma emitters in public water, air particulates, fish and sediment.

3. Concentrations of tritium in public water.

4. Ambient gamma radiation levels at various site environs.

C. Data Interpretation

The radiological and direct radiation data collected prior to Zion Nuclear Power Station becoming operational were used as a baseline with which these operational data were compared. For the purpose of this report, Zion Nuclear Power Station was considered operational at initial criticality. In addition, data were compared to previous years' operational data for consistency and trending. Several factors were important in the

interpretation of the data:

1. Lower Limit of Detection and Minimum Detectable Concentration

The lower limit of detection (LLD) was defined as the smallest concentration of radioactive material in a sample that would yield a net count (above background) that would be detected with only a 5% probability of falsely concluding that a blank observation represents a "real" signal. The LLD was intended as a before the fact estimate of a system (including instrumentation, procedure and sample type) and not as an after the fact criteria for the presence of activity. All analyses were designed to achieve the required ZNPS detection capabilities for environmental sample analysis.

The minimum detectable concentration (MDC) is defined above with the exception that the measurement is an after the fact estimate of the presence of activity.

2. Net Activity Calculation and Reporting of Results

Net activity for a sample was calculated by subtracting background activity from the sample activity. Since the REMP measures extremely small changes in radioactivity in the environment, background variations may result in sample activity being lower than the background activity effecting a negative number. An MDC was reported in all cases where positive activity was not detected.

Gamma spectroscopy results for each type of sample were grouped as follows:

For public water, sediment and air particulates 11 nuclides, Mn-54, Co-58, Fe-59, Co-60, Zn-65, Nb-95, Zr-95, Cs-134, Cs-137, Ba-140 and La-140 were reported.

Means and standard deviations of the results were calculated. The standard deviations represent the variability of measured results for different samples rather than single analysis uncertainty.

D. Program Exceptions

For 2008 the ZNPS REMP had a sample recovery rate in excess of 99%. Sample anomalies and missed samples are listed in the tables below:

Table D-1 LISTING OF SAMPLE ANOMALIES

Sample Type	Location Code	Collection Date	Reason

There were no sample anomalies in 2008.

Table D-2 LISTING OF MISSED SAMPLES

Sample Type	Location Code	Collection Date	Reason
TLD	Z-301	Second Quarter	No sample; vendor failed to complete check-off sheet for collection.
A	Z-02	12/03/08	No sample, sample pump had electrical short.

Each program exception was reviewed to understand the causes of the program exception. Sampling and maintenance errors were reviewed with the personnel involved to prevent recurrence. Occasional equipment breakdowns and power outages were unavoidable.

The overall sample recovery rate indicates that the appropriate procedures and equipment are in place to assure reliable program implementation.

E. Program Changes

There were no changes to the REMP program in 2008.

IV. Results and Discussion

A. Aquatic Environment

1. Public Water

Samples were taken weekly and composited monthly at four locations (Z-14, Z-15, Z-16 and Z-18). The following analyses were performed.

Gross Beta

Samples from all locations were analyzed for concentrations of

gross beta (Table C–I.1, Appendix C). The values ranged from 2.0 pCi/l to 8.1 pCi/l. Concentrations detected were consistent with those detected in previous years (Figures C–1 and C–2, Appendix C).

Tritium

Quarterly composites of weekly collections were analyzed for tritium activity (Table C–I.2, Appendix C). No tritium was detected and the LLD was met (Figures C–3 and C–4, Appendix C).

Gamma Spectrometry

Samples from both locations were analyzed for gamma emitting nuclides (Table C–I.3, Appendix C). No nuclides were detected and all required LLDs were met.

2. Fish

Fish samples comprised of lake trout, burbot, salmon, bluegill, and smallmouth bass were collected at two locations (Z-26 and Z-27) semiannually. The following analysis was performed:

Gamma Spectrometry

The edible portion of fish samples from both locations was analyzed for gamma emitting nuclides (Table C–II.1, Appendix C). No nuclides were detected and all required LLDs were met.

3. Sediment

Aquatic sediment samples were collected at one location (Z-25) semiannually. The following analysis was performed:

Gamma Spectrometry

Sediment samples from Z-25 were analyzed for gamma emitting nuclides (Table C–III.1, Appendix C). No nuclides were detected and all required LLDs were met.

B. Atmospheric Environment

1. Airborne

a. Air Particulates

Continuous air particulate samples were collected from three locations on a weekly basis. The three locations were within the ZNPS site boundary (Z-01, Z-02 and Z-03). The following analyses were performed:

Gross Beta

Weekly samples were analyzed for concentrations of beta emitters (Table C–IV.1 and C–IV.2, Appendix C).

Detectable gross beta activity was observed at all locations. Comparison of results among the three groups aid in determining the effects, if any, resulting from the operation of ZNPS. The results from the On-Site locations ranged from <5 E-3 pCi/m^3 to 36 E–3 pCi/m^3 with a mean of 18 E–3 pCi/m^3. Comparison of the 2008 air particulate data with previous years data indicate no effects from the operation of ZNPS. Concentrations detected were consistent with those detected in previous years.

Gamma Spectrometry

Weekly samples were composited quarterly and analyzed for gamma emitting nuclides (Table C–IV.3, Appendix C). No nuclides were detected and all required LLDs were met.

C. Ambient Gamma Radiation

Ambient gamma radiation levels were measured utilizing Harshaw (CaF and LiF) thermoluminescent dosimeters. Thirty-six TLD locations were established around the site. Results of TLD measurements are listed in Tables C–V.1 to C–V.3, Appendix C.

Most TLD measurements were below 20 mR/quarter, with a range of 16 mR/quarter to 30 mR/quarter.

D. Land Use Survey

A Land Use Survey conducted during August 2008 around the Zion Nuclear Power Station (ZNPS) was performed by Environmental Inc. (Midwest Labs) for Exelon Nuclear to comply with Chapter 3 of the Zion' Offsite Dose Calculation Manual. The purpose of the survey was to document the nearest resident, milk producing animal and garden of greater than 500 ft^2 in each of the sixteen 22 ½ degree sectors around the site. There were no changes required to the ZNPS REMP, as a result of this survey. The results of this survey are summarized below.

Distance in Miles from the ZNPS Reactor Buildings			
Sector	Residence Miles	Livestock Miles	Milk Farm Miles
A N	2.5	-	-
B NNE	-	-	-
C NE	-	-	-
D ENE	-	-	-
E E	-	-	-
F ESE	-	-	-
G SE	-	-	-
H SSE	-	-	-
J S	-	-	-
K SSW	1.9	-	-
L SW	1.1	-	-
M WSW	1.0	-	-
N W	1.1	-	-
P WNW	1.0	-	-
Q NW	1.0	-	-
R NNW	1.3	-	-

E. Summary of Results – Inter-Laboratory Comparison Program

The primary and secondary laboratories analyzed Performance Evaluation (PE) samples of air particulate, air iodine, milk, soil, vegetation and water matrices for (Appendix D). The PE samples, supplied by Analytics Inc., Environmental Resource Associates (ERA) and DOE's Mixed Analyte Performance Evaluation Program (MAPEP), were evaluated against the following pre-set acceptance criteria:

1. Analytics Evaluation Criteria

Analytics' evaluation report provides a ratio of laboratory results and Analytics' known value. Since flag values are not assigned by Analytics, TBE-ES evaluates the reported ratios based on internal

QC requirements, which are based on the DOE MAPEP criteria.

2. ERA Evaluation Criteria

   ERA's evaluation report provides an acceptance range for control and warning limits with associated flag values. ERA's acceptance limits are established per the USEPA, NELAC, state specific PT program requirements or ERA's SOP for the Generation of Performance Acceptance Limits, as applicable. The acceptance limits are either determined by a regression equation specific to each analyte or a fixed percentage limit promulgated under the appropriate regulatory document.

3. DOE Evaluation Criteria

   MAPEP's evaluation report provides an acceptance range with associated flag values.

   The MAPEP defines three levels of performance: Acceptable (flag = "A"), Acceptable with Warning (flag = "W"), and Not Acceptable (flag = "N"). Performance is considered acceptable when a mean result for the specified analyte is ± 20% of the reference value. Performance is acceptable with warning when a mean result falls in the range from ±20% to ±30% of the reference value (i.e., 20% < bias < 30%). If the bias is greater than 30%, the results are deemed not acceptable.

For the primary laboratory, 16 out of 18 analytes met the specified acceptance criteria. Two samples did not meet the specified acceptance criteria for the following reasons:

1. Teledyne Brown Engineering's Analytics December 2008 Sr-89 in milk result of 18.0 pCi/L was higher than the known value of 12.6 pCi/L, resulting in a found to known ratio of 1.43. NCR 09-02 was initiated to investigate this failure.

2. Teledyne Brown Engineering's Analytics' ERA Quik Response water sample January 2008 Sr-89 result of 37.33 pCi/L exceeded the upper acceptance limit of 25.2 pCi/L. No cause could be found for the failure. Studies bracketing these results, RAD 71 and RAD 72 had acceptable Sr-89 results. NCR 08-03

For the secondary laboratory, all of the 15 analytes met the specified acceptance criteria.

The Inter-Laboratory Comparison Program provides evidence of "in

control" counting systems and methods, and that the laboratories are producing accurate and reliable data.

APPENDIX A

RADIOLOGICAL ENVIRONMENTAL MONITORING REPORT SUMMARY

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE ZION NUCLER POWER STATION, 2008

Name of Facility: ZION **DOCKET NUMBER: 50-295 & 50-304**

Location of Facility: ZION IL **REPORTING PERIOD: ANNUAL 2008**

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPES OF ANALYSIS PERFORMED	NUMBER OF ANALYSIS PERFORMED	REQUIRED LOWER LIMIT OF DETECTION (LLD)	INDICATOR LOCATIONS MEAN(M) (F) RANGE	CONTROL LOCATION MEAN(M) (F) RANGE	LOCATION WITH HIGHEST ANNUAL MEAN (M) MEAN(M) (F) RANGE	STATION # NAME DISTANCE AND DIRECTION	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
PUBLIC WATER (PCI/LITER)	GR-B	48	4	4 (20/24) (2.0/8.1)	3.5 (18/24) (2.4/5.4)	4.2 (10/12) (2.0/8.1)	Z-16 INDICATOR WAUKEGAN WATER WORKS 6.1 MILES S OF SITE	0
	H-3	16	200	<LLD	<LLD	-		0
	GAMMA	48						
	MN-54		15	<LLD	<LLD	-		0
	CO-58		15	<LLD	<LLD	-		0
	FE-59		N/A	<LLD	<LLD	-		0
	CO-60		15	<LLD	<LLD	-		0
	ZN-65		30	<LLD	<LLD	-		0
	NB-95		15	<LLD	<LLD	-		0

* THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES
FRACTION OF DETECTABLE MEASUREMENTS AT SPECIFIED LOCATIONS IS INDICATED IN PARENTHESES (F)

TABLE A-1 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY FOR THE ZION NUCLER POWER STATION, 2008

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PUBLIC WATER (PCI/LITER)	ZR-95		15	<LLD	<LLD	-		0
	CS-134		15	<LLD	<LLD	-		0
	CS-137		18	<LLD	<LLD	-		0
	BA-140		NA	<LLD	<LLD	-		0
	LA-140		NA	<LLD	<LLD	-		0
FISH (PCI/KG WET)	GAMMA MN-54	7	130	<LLD	NA	-		0
	CO-58		130	<LLD	NA	-		0
	FE-59		N/A	<LLD	NA	-		0

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FISH (PCI/KG WET)	CO-60		130	<LLD	NA	-		0
	ZN-65		260	<LLD	NA	-		0
	NB-95		NA	<LLD	NA	-		0
	ZR-95		NA	<LLD	NA	-		0
	CS-134		100	<LLD	NA	-		0
	CS-137		100	<LLD	NA	-		0
	BA-140		NA	<LLD	NA	-		0
	LA-140		NA	<LLD	NA	-		0

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SEDIMENT (PCI/KG DRY)	GAMMA	2						
	MN-54		NA	<LLD	NA	-		0
	CO-58		NA	<LLD	NA	-		0
	FE-59		NA	<LLD	NA	-		0
	CO-60		NA	<LLD	NA	-		0
	ZN-65		NA	<LLD	NA	-		0
	NB-95		NA	<LLD	NA	-		0
	ZR-95		NA	<LLD	NA	-		0
	CS-134		150	<LLD	NA	-		0

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SEDIMENT (PCI/KG DRY)	CS-137		180	<LLD	NA	-		0
	BA-140		NA	<LLD	NA	-		0
	LA-140		NA	<LLD	NA	-		0
AIR PARTICULATE (E-3 PCI/CU.METER)	GR-B	155	10	18 (154/155) (5/36)	NA	18 (52/52) (5/33)	Z-01 INDICATOR ONSITE 1 0.3 MILES S OF SITE	0
	GAMMA	12						
	MN-54		NA	<LLD	NA	-		0
	CO-58		NA	<LLD	NA	-		0
	FE-59		NA	<LLD	NA	-		0
	CO-60		NA	<LLD	NA	-		0

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AIR PARTICULATE (E-3 PCI/CU.METER)	ZN-65		NA	<LLD	NA	-		0
	NB-95		NA	<LLD	NA	-		0
	ZR-95		NA	<LLD	NA	-		0
	CS-134		10	<LLD	NA	-		0
	CS-137		10	<LLD	NA	-		0
	BA-140		NA	<LLD	NA	-		0
	LA-140		NA	<LLD	NA	-		0
DIRECT RADIATION (MILLI-ROENTGEN/QTR.)	TLD-QUARTERLY	144	NA	20.3 (144/144) (16/30)	NA	24.5 (4/4) (20/29)	Z-301-2 INDICATOR 0.5 MILES NW	0

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APPENDIX B

LOCATION DESIGNATION, DISTANCE & DIRECTION, AND SAMPLE COLLECTION & ANALYTICAL METHODS

TABLE B-1: Radiological Environmental Monitoring Program - Sampling Locations, Distance and Direction, Zion Nuclear Power Station, 2008

Location	Location Description	Distance & Direction From Site
A. Public Water		
Z-14	Kenosha Water Works (control)	10.0 miles N
Z-15	Lake County Water Works (indicator)	1.4 miles NNW
Z-16	Waukegan Water Works (indicator)	6.1 miles S
Z-18	Lake Forest Water Works (control)	12.9 miles S
B. Air Particulates		
Z-01	Onsite 1 (indicator)	0.3 miles S
Z-02	Onsite 2 (indicator)	0.2 miles W
Z-03	Onsite 3 (indicator)	0.2 miles NNW
C. Fish		
Z-26	Lake Michigan Nearsite (indicator)	At station
Z-27	Lake Michigan Farsite (indicator)	10.1 miles N
D. Sediment		
Z-25	Lake Michigan, Illinois Beach State Park (indicator)	0.2 miles S
E. Environmental Dosimetry - TLD		
Inner Ring		
Z-101-1 and -2		0.2 miles N
Z-102-1 and -2		0.2 miles NNE
Z-103-1 and -2		0.2 miles NE
Z-104-1 and -2		0.1 miles ENE
Z-105-1 and -2		0.1 miles E
Z-106-1 and -2		0.1 miles ESE
Z-107-1 and -2		0.1 miles SE
Z-108-1 and -2		0.1 miles SSE
Z-110-1 and -2		0.2 miles SSW
Z-111-1 and -2		0.3 miles SW
Z-112-1 and -2		0.7 miles WSW
Z-113-1 and -2		0.6 miles W
Z-114-1 and -2		0.6 miles WNW
Z-115-1 and -2		0.4 miles NW
Z-301-1 and -2		0.5 miles NW
Other		
Z-01-1 and -2	Onsite 1 (indicator)	0.3 miles S
Z-02-1 and -2	Onsite 2 (indicator)	0.2 miles W
Z-03-1 and -2	Onsite 3 (indicator)	0.2 miles NNW

TABLE B-2: Radiological Environmental Monitoring Program – Summary of Sample Collection and Analytical Methods, Zion Nuclear Power Station, 2008

Sample Medium	Analysis	Sampling Method	Analytical Procedure Number
Public Water	Gamma Spectroscopy	Monthly composite from weekly grab samples.	TBE, TBE-2007 Gamma emitting radioisotope analysis Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy
Public Water	Gross Beta	Monthly composite from weekly grab samples.	TBE, TBE-2008 Gross Alpha and/or gross beta activity in various matrices Env. Inc., W(DS)-01 Determination of gross alpha and/or gross beta in water (dissolved solids or total residue)
Public Water	Tritium	Quarterly composite from weekly grab samples.	TBE, TBE-2011 Tritium analysis in drinking water by liquid scintillation Env. Inc., T-02 Determination of tritium in water (direct method)
Fish	Gamma Spectroscopy	Semi-annual samples collected via electroshocking or other techniques	TBE-2007 Gamma emitting radioisotope analysis Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy
Sediment	Gamma Spectroscopy	Semi-annual grab samples	TBE, TBE-2007 Gamma emitting radioisotope analysis Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy
Air Particulates	Gross Beta	One-week composite of continuous air sampling through glass fiber filter paper	TBE, TBE-2008 Gross Alpha and/or gross beta activity in various matrices Env. Inc., AP-02 Determination of gross alpha and/or gross beta in air particulate filters
Air Particulates	Gamma Spectroscopy	Quarterly composite of each station	TBE, TBE-2007 Gamma emitting radioisotope analysis Env. Inc., GS-01 Determination of gamma emitters by gamma spectroscopy
TLD	Thermoluminescence Dosimetry	Quarterly TLDs comprised of two CaF 200 and two LiF 100 LiF 4-chip Harshaw elements.	Global Dosimetry

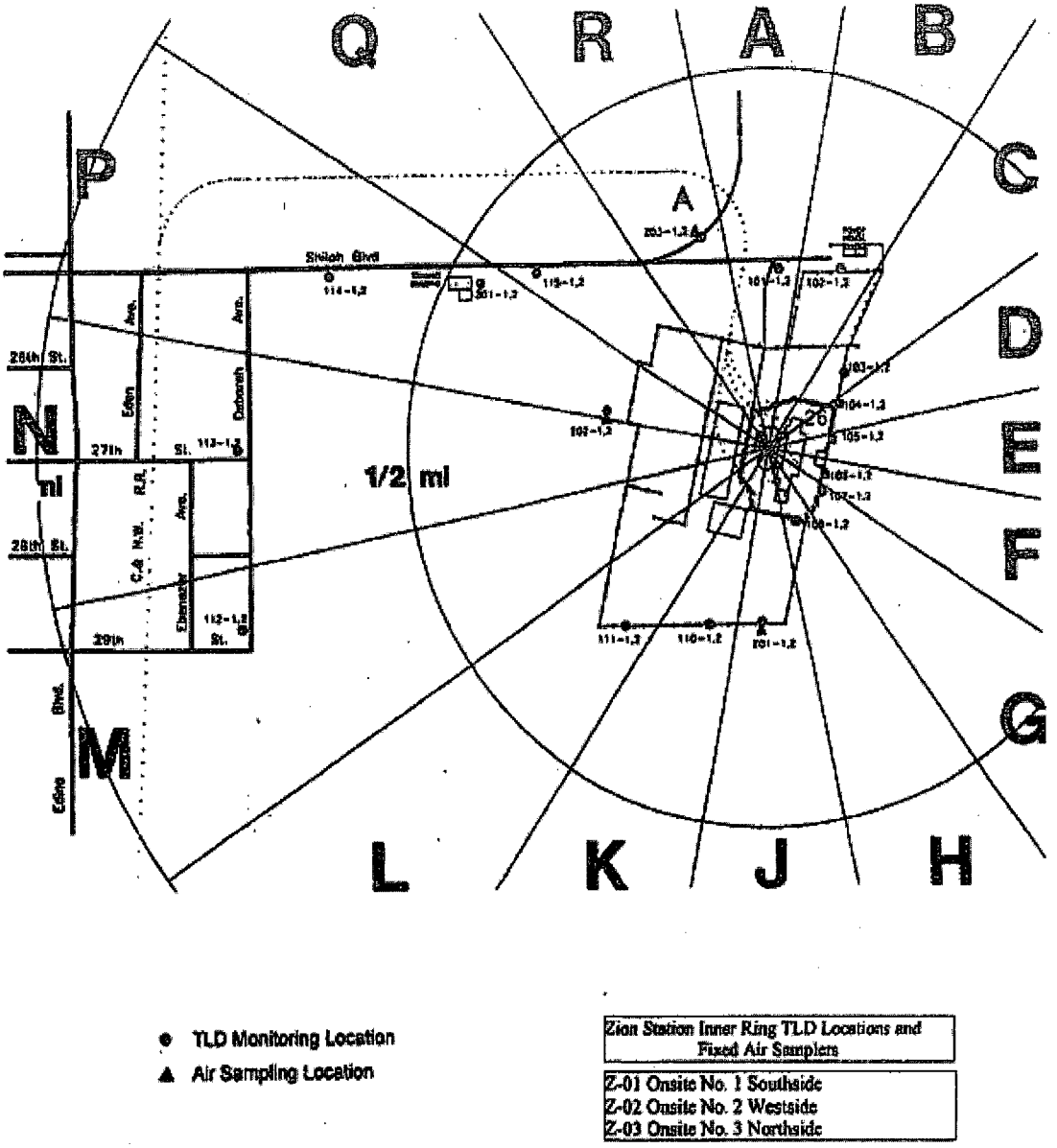


Figure B-1
Inner Ring TLD Locations and Fixed Air Samplers of the Zion Nuclear Power Station, 2008

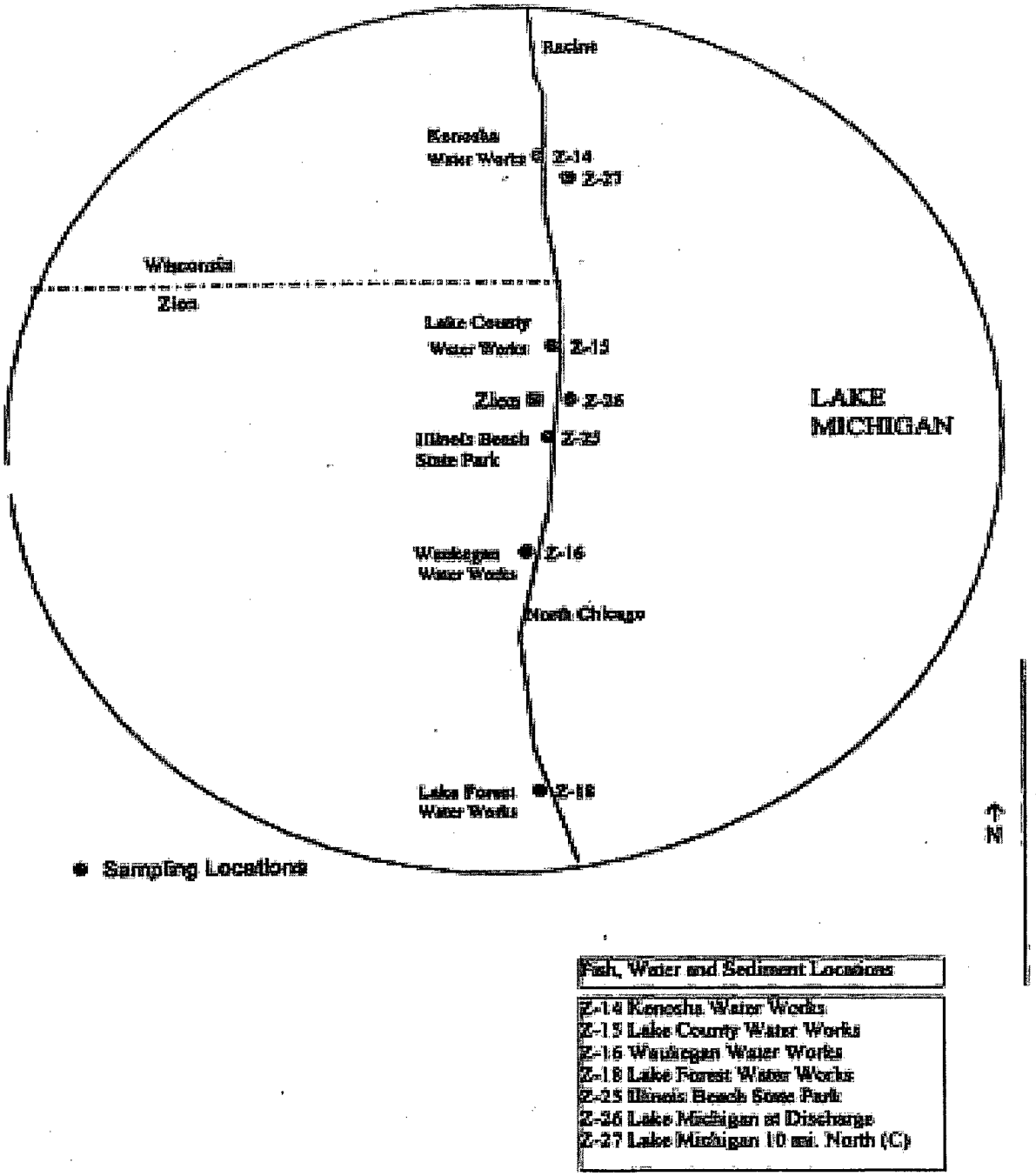


Figure B-2
Fish, Water and Sediment Locations of the Zion Nuclear Power Station, 2008

APPENDIX C

DATA TABLES
PRIMARY LABORATORY

TABLE C-I.1 **CONCENTRATIONS OF GROSS BETA IN PUBLIC WATER SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR POWER STATION, 2008**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	Z-14	Z-15	Z-16	Z-18
01/02/08 - 01/30/08	3.5 ± 1.5	4.1 ± 1.5	3.2 ± 1.4	4.3 ± 1.5
02/07/08 - 02/28/08	5.4 ± 2.7	4.4 ± 2.6	8.1 ± 2.9	4.3 ± 2.6
03/06/08 - 03/27/08	2.9 ± 1.5	3.4 ± 1.6	4.8 ± 1.7	4.7 ± 1.7
04/02/08 - 04/30/08	4.3 ± 1.5	4.3 ± 1.5	4.0 ± 1.5	2.8 ± 1.4
05/07/08 - 05/28/08	< 2.6	4.2 ± 2.3	5.3 ± 2.4	3.4 ± 2.2
06/04/08 - 06/26/08	3.1 ± 1.7	3.1 ± 1.7	3.3 ± 1.7	2.8 ± 1.7
07/02/08 - 07/30/08	< 2.4	< 2.3	2.4 ± 1.7	< 2.4
08/06/08 - 08/27/08	< 2.3	2.4 ± 1.6	< 2.2	4.5 ± 1.9
09/03/08 - 09/24/08	2.9 ± 1.4	2.0 ± 1.4	2.0 ± 1.3	2.4 ± 1.4
10/01/08 - 10/29/08	2.7 ± 1.6	4.5 ± 1.8	3.5 ± 1.7	2.4 ± 1.6
11/06/08 - 11/26/08	< 2.4	< 2.4	< 2.4	< 2.3
12/03/08 - 12/30/08	3.5 ± 1.5	5.2 ± 1.6	5.3 ± 1.6	3.3 ± 1.5
MEAN	3.5 ± 1.8	3.8 ± 2.1	4.2 ± 3.5	3.5 ± 1.8

TABLE C-I.2 **CONCENTRATIONS OF TRITIUM IN PUBLIC WATER SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR POWER STATION, 2008**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

COLLECTION PERIOD	Z-14	Z-15	Z-16	Z-18
01/02/08 - 03/27/08	< 161	< 161	< 166	< 170
04/02/08 - 06/26/08	< 187	< 190	< 193	< 194
07/02/08 - 09/24/08	< 168	< 173	< 176	< 174
10/01/08 - 12/30/08	< 180	< 182	< 181	< 186
MEAN	-	-	-	-

* THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES

TABLE C-I.3 **CONCENTRATIONS OF GAMMMA EMITTERS IN PUBLIC WATER SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR POWER STATION, 2008**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

STC	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
Z-14	01/02/08 - 01/30/08	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 1	< 1	< 16	< 6
	02/07/08 - 02/28/08	< 4	< 4	< 9	< 4	< 9	< 6	< 8	< 4	< 4	< 39	< 14
	03/06/08 - 03/27/08	< 3	< 3	< 7	< 3	< 5	< 4	< 6	< 3	< 3	< 19	< 5
	04/02/08 - 04/30/08	< 8	< 8	< 17	< 8	< 17	< 8	< 15	< 9	< 9	< 37	< 13
	05/07/08 - 05/28/08	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 2	< 2	< 12	< 4
	06/04/08 - 06/26/08	< 1	< 1	< 3	< 1	< 3	< 2	< 3	< 1	< 1	< 17	< 6
	07/02/08 - 07/30/08	< 1	< 1	< 3	< 1	< 2	< 1	< 3	< 1	< 1	< 23	< 6
	08/06/08 - 08/27/08	< 2	< 3	< 6	< 2	< 4	< 3	< 4	< 2	< 2	< 33	< 9
	09/03/08 - 09/24/08	< 1	< 2	< 4	< 1	< 2	< 2	< 3	< 1	< 1	< 23	< 9
	10/01/08 - 10/29/08	< 4	< 6	< 19	< 6	< 9	< 7	< 12	< 4	< 4	< 168	< 62
	11/06/08 - 11/26/08	< 2	< 3	< 6	< 2	< 4	< 3	< 4	< 2	< 2	< 37	< 13
	12/03/08 - 12/30/08	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 23	< 7
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Z-15	01/02/08 - 01/30/08	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 1	< 1	< 18	< 6
	02/07/08 - 02/28/08	< 5	< 7	< 14	< 6	< 13	< 8	< 10	< 6	< 6	< 53	< 19
	03/06/08 - 03/27/08	< 6	< 5	< 10	< 7	< 10	< 5	< 10	< 4	< 5	< 35	< 5
	04/02/08 - 04/30/08	< 4	< 5	< 12	< 6	< 13	< 5	< 10	< 6	< 6	< 28	< 5
	05/07/08 - 05/28/08	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 14	< 5
	06/04/08 - 06/26/08	< 2	< 2	< 4	< 2	< 3	< 2	< 3	< 1	< 2	< 21	< 7
	07/02/08 - 07/30/08	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 1	< 1	< 19	< 6
	08/06/08 - 08/27/08	< 2	< 2	< 6	< 2	< 4	< 3	< 5	< 2	< 2	< 34	< 11
	09/03/08 - 09/24/08	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 39	< 14
	10/01/08 - 10/29/08	< 5	< 5	< 18	< 4	< 10	< 6	< 11	< 4	< 5	< 182	< 72
	11/06/08 - 11/26/08	< 2	< 3	< 6	< 2	< 4	< 3	< 5	< 2	< 2	< 47	< 13
	12/03/08 - 12/30/08	< 2	< 3	< 7	< 2	< 5	< 3	< 5	< 2	< 2	< 27	< 9
	MEAN	-	-	-	-	-	-	-	-	-	-	-

TABLE C-I.3 **CONCENTRATIONS OF GAMMMA EMITTERS IN PUBLIC WATER SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR POWER STATION, 2008**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

STC	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
Z-16	01/02/08 - 01/30/08	< 1	< 1	< 3	< 1	< 2	< 1	< 3	< 1	< 1	< 17	< 6
	02/07/08 - 02/28/08	< 6	< 5	< 13	< 7	< 11	< 6	< 9	< 5	< 5	< 46	< 17
	03/06/08 - 03/27/08	< 5	< 5	< 11	< 5	< 9	< 5	< 9	< 4	< 5	< 25	< 9
	04/02/08 - 04/30/08	< 8	< 8	< 16	< 9	< 18	< 8	< 14	< 10	< 8	< 38	< 13
	05/07/08 - 05/28/08	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 16	< 4
	06/04/08 - 06/26/08	< 1	< 2	< 4	< 2	< 3	< 2	< 3	< 1	< 2	< 20	< 6
	07/02/08 - 07/30/08	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 1	< 1	< 21	< 6
	08/06/08 - 08/27/08	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 2	< 2	< 26	< 8
	09/03/08 - 09/24/08	< 2	< 3	< 6	< 2	< 4	< 3	< 5	< 2	< 2	< 46	< 15
	10/01/08 - 10/29/08	< 4	< 5	< 18	< 4	< 7	< 7	< 11	< 4	< 5	< 197	< 52
	11/06/08 - 11/26/08	< 2	< 3	< 6	< 2	< 5	< 3	< 5	< 2	< 2	< 43	< 12
	12/03/08 - 12/30/08	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 1	< 1	< 18	< 6
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Z-18	01/02/08 - 01/30/08	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 1	< 1	< 17	< 6
	02/07/08 - 02/28/08	< 6	< 8	< 18	< 4	< 12	< 8	< 13	< 7	< 8	< 54	< 14
	03/06/08 - 03/27/08	< 4	< 2	< 7	< 4	< 6	< 4	< 6	< 3	< 3	< 26	< 8
	04/02/08 - 04/30/08	< 5	< 4	< 11	< 7	< 8	< 6	< 10	< 5	< 5	< 28	< 9
	05/07/08 - 05/28/08	< 2	< 2	< 5	< 2	< 4	< 2	< 4	< 2	< 2	< 16	< 5
	06/04/08 - 06/26/08	< 2	< 2	< 4	< 2	< 3	< 2	< 4	< 1	< 2	< 22	< 7
	07/02/08 - 07/30/08	< 1	< 1	< 3	< 1	< 2	< 1	< 2	< 1	< 1	< 26	< 8
	08/06/08 - 08/27/08	< 2	< 2	< 5	< 2	< 4	< 3	< 4	< 2	< 2	< 33	< 10
	09/03/08 - 09/24/08	< 2	< 2	< 6	< 2	< 4	< 2	< 4	< 2	< 2	< 43	< 13
	10/01/08 - 10/29/08	< 4	< 5	< 15	< 4	< 9	< 6	< 11	< 4	< 3	< 160	< 47
	11/06/08 - 11/26/08	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 2	< 2	< 31	< 12
	12/03/08 - 12/30/08	< 1	< 2	< 4	< 1	< 3	< 2	< 3	< 1	< 2	< 20	< 6
	MEAN	-	-	-	-	-	-	-	-	-	-	-

TABLE C-II.1 **CONCENTRATIONS OF GAMMMA EMITTERS IN FISH SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR POWER STATION, 2008**

RESULTS IN UNITS OF PCI/KG WET ± 2 SIGMA

STC	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
Z-26												
Lake Trout	05/28/08	< 52	< 60	< 118	< 46	< 123	< 62	< 121	< 48	< 51	< 901	< 319
Salmon	06/11/08	< 46	< 58	< 149	< 56	< 127	< 63	< 106	< 51	< 61	< 456	< 147
Bluegill/Smallmouth	10/22/08	< 55	< 64	< 131	< 48	< 136	< 72	< 117	< 52	< 52	< 828	< 296
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Z-27												
Burbot	05/14/08	< 60	< 61	< 173	< 54	< 106	< 71	< 135	< 48	< 62	< 2010	< 672
Lake Trout	05/14/08	< 56	< 71	< 206	< 50	< 156	< 70	< 144	< 59	< 54	< 2110	< 845
Burbot	10/24/08	< 43	< 49	< 103	< 38	< 72	< 59	< 87	< 37	< 34	< 997	< 327
Lake Trout	10/24/08	< 36	< 49	< 116	< 32	< 87	< 54	< 78	< 34	< 43	< 956	< 299
	MEAN	-	-	-	-	-	-	-	-	-	-	-

TABLE C-III.1 CONCENTRATIONS OF GAMMMA EMITTERS IN SEDIMENT SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR POWER STATION, 2008

RESULTS IN UNITS OF PCI/KG DRY ± 2 SIGMA

STC	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
Z-25	05/28/08	< 43	< 39	< 102	< 45	< 87	< 43	< 76	< 33	< 38	< 239	< 79
	10/29/08	< 36	< 39	< 107	< 33	< 78	< 46	< 70	< 27	< 34	< 800	< 211
	MEAN	-	-	-	-	-	-	-	-	-	-	-

TABLE C-IV.1 CONCENTRATIONS OF GROSS BETA IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR POWER STATION, 2008

RESULTS IN UNITS OF E-3 PCI/CU METER ± 2 SIGMA

COLLECTION PERIOD	GROUP I		
	Z-01	Z-02	Z-03
01/02/08 - 01/09/08	22 ± 4	18 ± 4	17 ± 4
01/09/08 - 01/16/08	30 ± 5	31 ± 5	31 ± 5
01/16/08 - 01/23/08	26 ± 5	26 ± 5	23 ± 4
01/23/08 - 01/30/08	29 ± 5	31 ± 5	36 ± 5
01/30/08 - 02/07/08	17 ± 4	16 ± 4	16 ± 4
02/07/08 - 02/14/08	32 ± 5	33 ± 5	30 ± 5
02/14/08 - 02/21/08	21 ± 4	23 ± 5	23 ± 5
02/21/08 - 02/28/08	14 ± 4	16 ± 4	17 ± 4
02/28/08 - 03/06/08	22 ± 4	21 ± 4	19 ± 4
03/06/08 - 03/13/08	20 ± 4	20 ± 4	20 ± 4
03/13/08 - 03/20/08	12 ± 4	12 ± 4	13 ± 4
03/20/08 - 03/27/08	16 ± 4	15 ± 4	18 ± 4
03/27/08 - 04/02/08	19 ± 6	12 ± 4	< 5
04/02/08 - 04/09/08	15 ± 4	19 ± 4	16 ± 4
04/09/08 - 04/16/08	9 ± 3	10 ± 4	8 ± 3
04/16/08 - 04/23/08	19 ± 4	14 ± 4	14 ± 4
04/23/08 - 04/30/08	24 ± 5	16 ± 4	18 ± 4
04/30/08 - 05/07/08	20 ± 4	23 ± 5	17 ± 4
05/07/08 - 05/14/08	8 ± 3	8 ± 3	9 ± 4
05/14/08 - 05/21/08	9 ± 3	8 ± 3	13 ± 4
05/21/08 - 05/28/08	5 ± 3	5 ± 3	8 ± 3
05/28/08 - 06/04/08	12 ± 4	10 ± 4	10 ± 4
06/04/08 - 06/11/08	9 ± 4	6 ± 3	6 ± 3
06/11/08 - 06/18/08	11 ± 4	8 ± 3	9 ± 4
06/18/08 - 06/26/08	12 ± 3	11 ± 3	11 ± 3
06/26/08 - 07/02/08	19 ± 5	15 ± 4	12 ± 4
07/02/08 - 07/10/08	12 ± 3	10 ± 3	12 ± 3
07/10/08 - 07/16/08	14 ± 4	14 ± 4	16 ± 4
07/16/08 - 07/23/08	15 ± 4	19 ± 4	19 ± 4
07/23/08 - 07/30/08	15 ± 4	10 ± 4	17 ± 4
07/30/08 - 08/06/08	19 ± 4	14 ± 4	14 ± 4
08/06/08 - 08/13/08	10 ± 3	10 ± 3	12 ± 3
08/13/08 - 08/20/08	14 ± 4	17 ± 4	14 ± 4
08/20/08 - 08/27/08	17 ± 4	15 ± 4	19 ± 4
08/27/08 - 09/03/08	26 ± 5	23 ± 5	26 ± 5
09/03/08 - 09/10/08	17 ± 4	15 ± 4	14 ± 4
09/10/08 - 09/17/08	15 ± 4	11 ± 4	13 ± 4
09/17/08 - 09/24/08	33 ± 5	30 ± 5	34 ± 5
09/24/08 - 10/01/08	26 ± 5	28 ± 5	21 ± 4
10/01/08 - 10/08/08	13 ± 4	14 ± 4	15 ± 4
10/08/08 - 10/15/08	19 ± 4	21 ± 4	22 ± 4
10/15/08 - 10/22/08	13 ± 4	11 ± 4	12 ± 4
10/22/08 - 10/29/08	17 ± 4	16 ± 4	19 ± 4
10/29/08 - 11/06/08	29 ± 5	26 ± 4	29 ± 5
11/06/08 - 11/12/08	10 ± 4	9 ± 4	9 ± 4
11/12/08 - 11/19/08	17 ± 4	16 ± 4	15 ± 4
11/19/08 - 11/26/08	13 ± 4	18 ± 4	17 ± 4
11/26/08 - 12/03/08	23 ± 5	17 ± 4	20 ± 4
12/03/08 - 12/10/08	17 ± 4	(1)	19 ± 4
12/10/08 - 12/17/08	23 ± 5	23 ± 7	22 ± 5
12/17/08 - 12/23/08	33 ± 6	25 ± 5	30 ± 5
12/23/08 - 12/30/08	33 ± 5	30 ± 5	30 ± 5
MEAN	18 ± 14	17 ± 14	18 ± 14

* THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES

(1) SEE PROGRAM EXCEPTIONS SECTION FOR EXPLANATION

TABLE C-IV.3 **CONCENTRATIONS OF GAMMA EMITTERS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR POWER STATION, 2008**

RESULTS IN UNITS OF E-3 PCI/CU METER ± 2 SIGMA

STC	COLLECTION PERIOD	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
Z-01	01/02/08 - 04/02/08	< 1	< 3	< 7	< 2	< 6	< 4	< 6	< 3	< 2	< 76	< 34
	04/02/08 - 07/02/08	< 3	< 5	< 5	< 3	< 8	< 5	< 8	< 4	< 3	< 109	< 21
	07/02/08 - 10/01/08	< 2	< 6	< 19	< 2	< 6	< 5	< 10	< 3	< 2	< 2050	< 783
	10/01/08 - 12/30/08	< 2	< 2	< 6	< 3	< 5	< 2	< 5	< 2	< 2	< 33	< 15
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Z-02	01/02/08 - 04/02/08	< 2	< 3	< 8	< 3	< 7	< 4	< 6	< 2	< 3	< 115	< 34
	04/02/08 - 07/02/08	< 3	< 3	< 6	< 2	< 6	< 3	< 5	< 3	< 2	< 60	< 23
	07/02/08 - 10/01/08	< 3	< 4	< 23	< 3	< 7	< 9	< 13	< 3	< 3	< 2170	< 1150
	10/01/08 - 12/30/08	< 4	< 3	< 11	< 4	< 10	< 5	< 6	< 4	< 3	< 55	< 25
	MEAN	-	-	-	-	-	-	-	-	-	-	-
Z-03	01/02/08 - 04/02/08	< 3	< 3	< 9	< 3	< 7	< 4	< 7	< 2	< 2	< 104	< 52
	04/02/08 - 07/02/08	< 4	< 4	< 10	< 4	< 7	< 5	< 10	< 4	< 4	< 98	< 26
	07/02/08 - 10/01/08	< 2	< 5	< 16	< 2	< 6	< 5	< 8	< 2	< 2	< 1830	< 886
	10/01/08 - 12/30/08	< 3	< 3	< 7	< 2	< 4	< 3	< 5	< 2	< 2	< 31	< 11
	MEAN	-	-	-	-	-	-	-	-	-	-	-

TABLE C-IV.2 **MONTHLY AND YEARLY MEAN VALUES OF GROSS BETA CONCENTRATIONS IN AIR PARTICULATE SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR POWER STATION, 2008**

RESULTS IN UNITS OF E-3 PCI/CU METER ± 2 SIGMA

GROUP I - ONSITE LOCATIONS

COLLECTION PERIOD	MIN	MAX	MEAN ± 2SD
01/02/08 - 01/30/08	17	36	27 ± 12
01/30/08 - 02/28/08	14	33	21 ± 14
02/28/08 - 04/02/08	< 5	22	17 ± 8
04/02/08 - 04/30/08	8	24	15 ± 9
04/30/08 - 05/28/08	5	23	11 ± 11
05/28/08 - 07/02/08	6	19	11 ± 7
07/02/08 - 07/30/08	10	19	14 ± 6
07/30/08 - 09/03/08	10	26	17 ± 11
09/03/08 - 10/01/08	11	34	21 ± 17
10/01/08 - 10/29/08	11	22	16 ± 7
10/29/08 - 12/30/08	9	33	21 ± 14
1/2/2008 - 12/30/08	< 5	36	18 ± 14

* THE MEAN AND 2 STANDARD DEVIATION VALUES ARE CALCULATED USING THE POSITIVE VALUES

TABLE C-V.1 QUARTERLY TLD RESULTS FOR ZION NUCLEAR POWER STATION, 2008

RESULTS IN UNITS OF MILLI-ROETGEN/QUARTER ± 2 STANDARD DEVIATIONS

STATION CODE	MEAN ± 2 S.D.	JAN - MAR	APR - JUN	JUL - SEP	OCT - DEC
Z-01-1	20.3 ± 6.8	25	19	20	17
Z-01-2	19.8 ± 7.2	25	18	19	17
Z-02-1	18.5 ± 8.7	25	16	17	16
Z-02-2	18.0 ± 6.7	23	16	17	16
Z-03-1	19.0 ± 7.1	24	16	19	17
Z-03-2	19.3 ± 6.8	24	16	18	19
Z-101-1	19.8 ± 7.2	25	17	19	18
Z-101-2	19.3 ± 6.6	24	17	19	17
Z-102-1	21.3 ± 9.0	28	19	19	19
Z-102-2	21.8 ± 9.7	29	19	20	19
Z-103-1	19.5 ± 7.4	25	17	18	18
Z-103-2	20.0 ± 8.0	26	18	18	18
Z-104-1	20.5 ± 8.7	27	18	18	19
Z-104-2	19.0 ± 8.0	25	17	17	17
Z-105-1	20.8 ± 8.7	27	20	19	17
Z-105-2	20.0 ± 8.0	26	18	18	18
Z-106-1	19.5 ± 7.4	24	16	17	21
Z-106-2	19.8 ± 9.7	27	17	18	17
Z-107-1	19.8 ± 6.2	24	18	20	17
Z-107-2	19.8 ± 6.0	24	17	19	19
Z-108-1	20.3 ± 9.1	27	17	19	18
Z-108-2	20.0 ± 9.4	27	17	18	18
Z-110-1	20.0 ± 9.4	27	17	18	18
Z-110-2	19.5 ± 10	27	17	17	17
Z-111-1	19.8 ± 11	28	17	18	16
Z-111-2	19.5 ± 8.7	26	17	18	17
Z-112-1	21.3 ± 6.6	26	21	19	19
Z-112-2	21.0 ± 6.7	26	19	20	19
Z-113-1	20.5 ± 6.8	25	17	19	21
Z-113-2	19.3 ± 7.7	25	17	18	17
Z-114-1	23.3 ± 7.0	27	19	25	22
Z-114-2	21.0 ± 5.7	25	19	21	19
Z-115-1	20.5 ± 8.7	27	19	18	18
Z-115-2	20.0 ± 8.0	26	18	18	18
Z-301-1	24.0 ± 11	27	30	20	19
Z-301-2	24.5 ± 9.3	28	29	21	20

TABLE C-V.2 **MEAN QUARTERLY TLD RESULTS FOR INNER RING AND OTHER LOCATIONS FOR ZION NUCLEAR POWER STATION, 2008**

RESULTS IN UNITS OF MILLI-ROENTGEN/QUARTER ± 2 STANDARD DEVIATIONS OF THE STATION DATA

COLLECTION PERIOD	INNER RING ± 2 S.D.	OTHER
JAN-MAR	26.2 ± 2.7	24.3 ± 1.6
APR-JUN	18.6 ± 6.3	16.8 ± 2.7
JUL-SEP	18.9 ± 3.1	18.3 ± 2.4
OCT-DEC	18.3 ± 2.7	17.0 ± 2.2

TABLE C-V.3 **SUMMARY OF THE AMBIENT DOSIMETRY PROGRAM FOR ZION NUCLEAR POWER STATION, 2008**

RESULTS IN UNITS OF MILLI-ROENTGEN/QUARTER

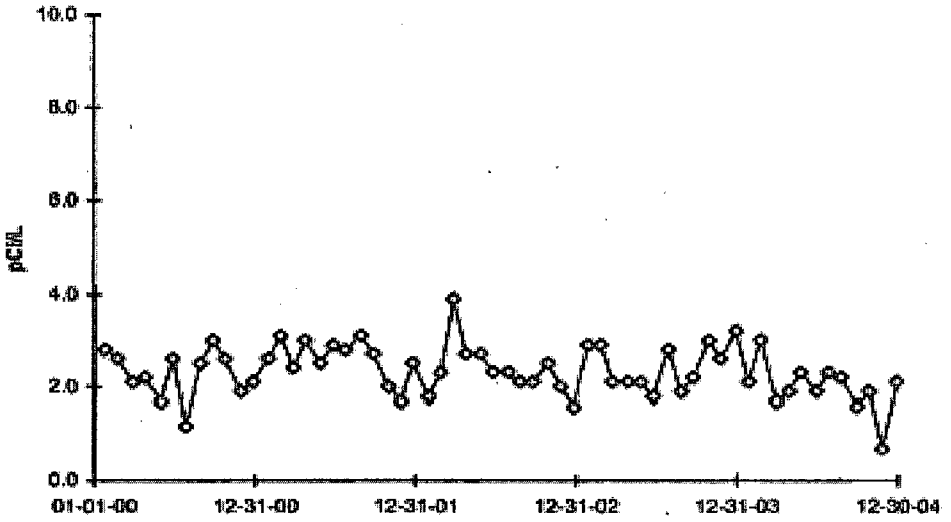
LOCATION	SAMPLES ANALYZED	PERIOD MINIMUM	PERIOD MAXIMUM	PERIOD MEAN ± 2 S.D.
INNER RING	120	16	30	20.5 ± 7.7
OTHER	24	16	25	19.1 ± 6.6

INNER RING STATIONS - Z-101-1, Z-101-2, Z-102-1, Z-102-2, Z-103-1, Z-103-2, Z-104-1, Z-104-2, Z-105-1, Z-105-2, Z-106-1, Z-106-2, Z-107-1, Z-107-2, Z-108-1, Z-108-2, Z-110-1, Z-110-2, Z-111-1, Z-111-2, Z-112-1, Z-112-2, Z-113-1, Z-113-2, Z-114-1, Z-114-2, Z-115-1, Z-115-2, Z-301-1, Z-301-2

OTHER STATIONS - Z-01-1, Z-01-2, Z-02-1, Z-02-2, Z-03-1, Z-03-2

FIGURE C-1
PUBLIC WATER - GROSS BETA - STATIONS Z-14 AND Z-15 COLLECTED IN THE VICINITY OF ZNPS, 2000-2004

Z-14 Kenosha Water Works



Z-15 Lake County Water Works

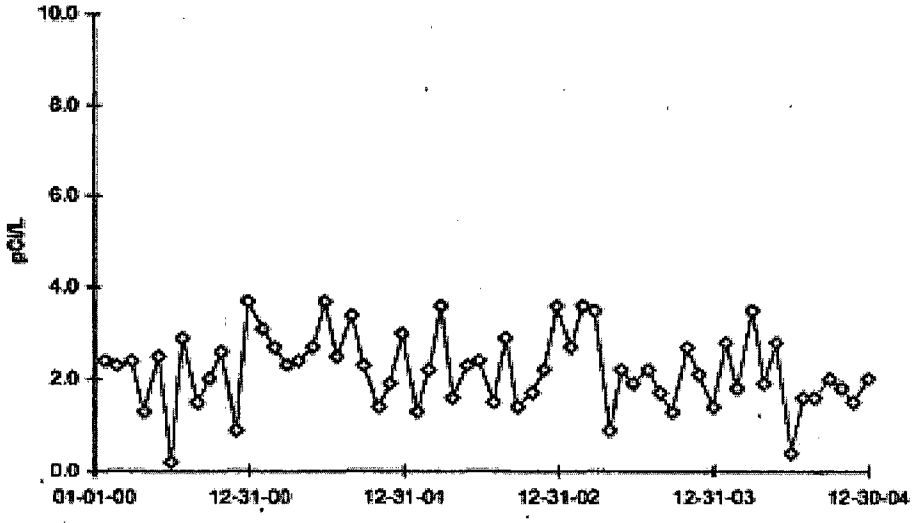
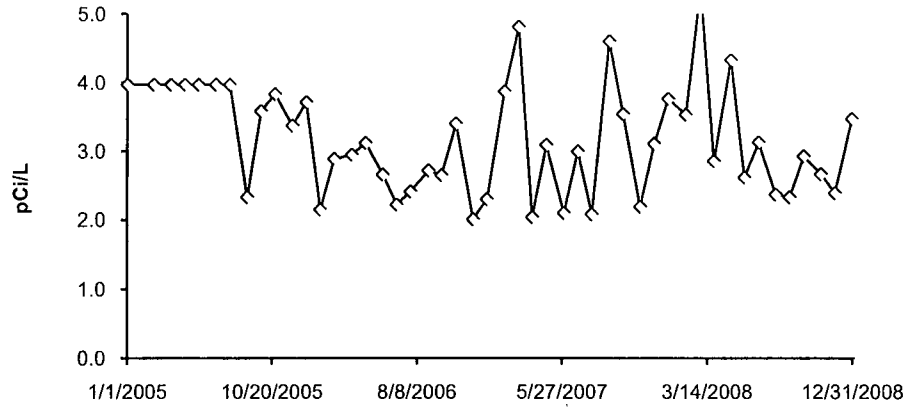
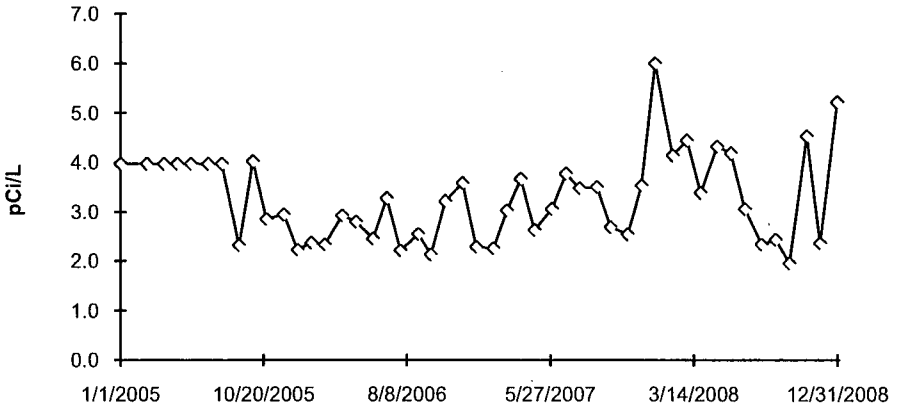


FIGURE C-1 (cont.)
PUBLIC WATER - GROSS BETA - STATIONS Z-14 AND Z-15 COLLECTED IN THE VICINITY OF ZNPS, 2005 - 2008

Z-14 (C) Kenosha Water Works



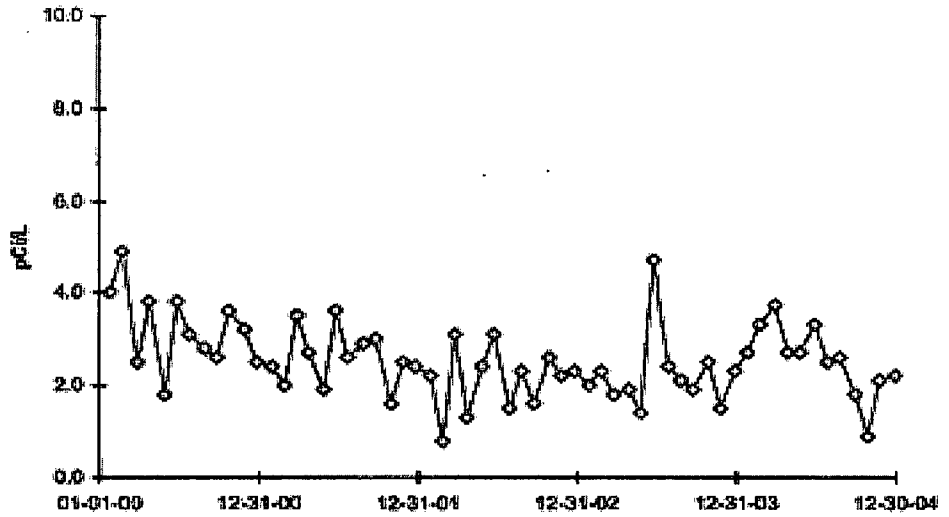
Z-15 Lake County Water Works



DUE TO VENDOR CHANGE IN 2005, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JUNE 2005

FIGURE C-2
PUBLIC WATER - GROSS BETA - STATIONS Z-16 AND Z-18 COLLECTED IN THE VICINITY OF ZNPS, 2000 - 2004

Z-16 Waukegan Water Works



Z-18 Lake Forest Water Works

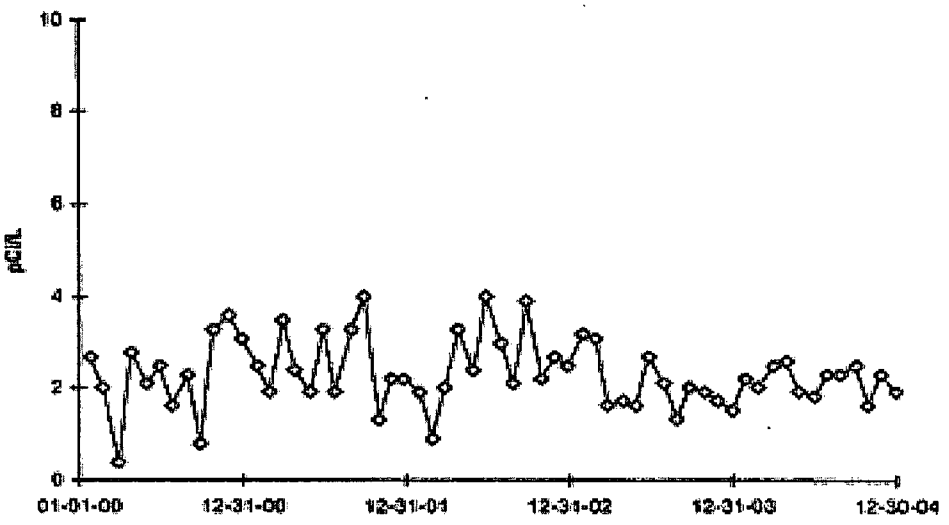
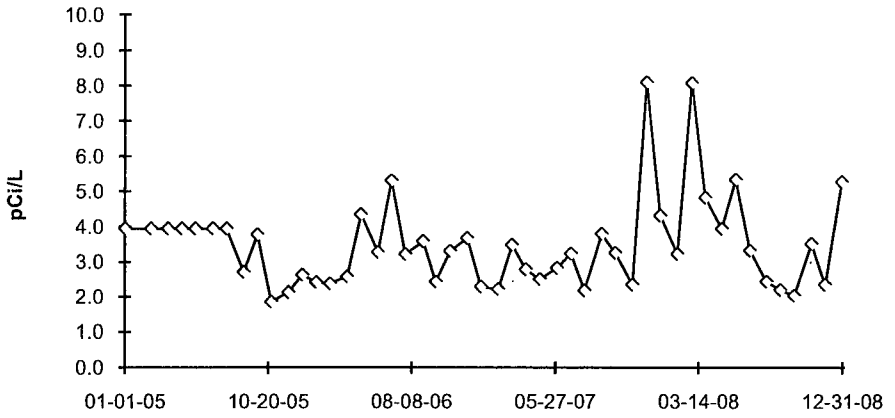
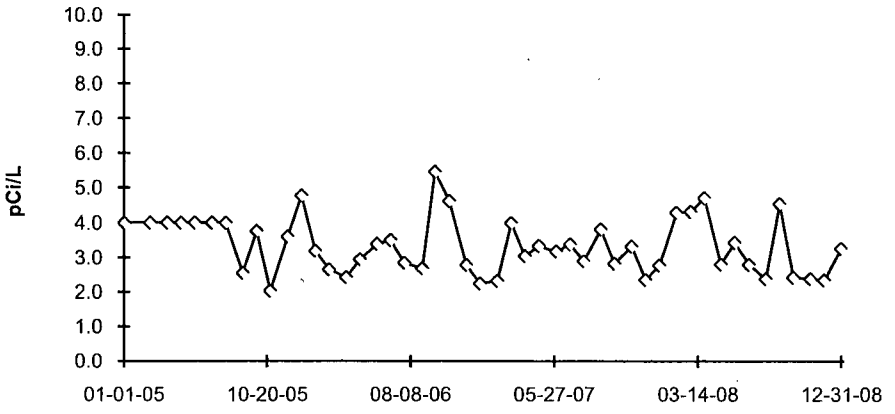


FIGURE C-2 (cont.)
PUBLIC WATER - GROSS BETA - STATIONS Z-16 AND Z-18 COLLECTED IN THE VICINITY OF ZNPS, 2005 - 2008

Z-16 Waukegan Water Works



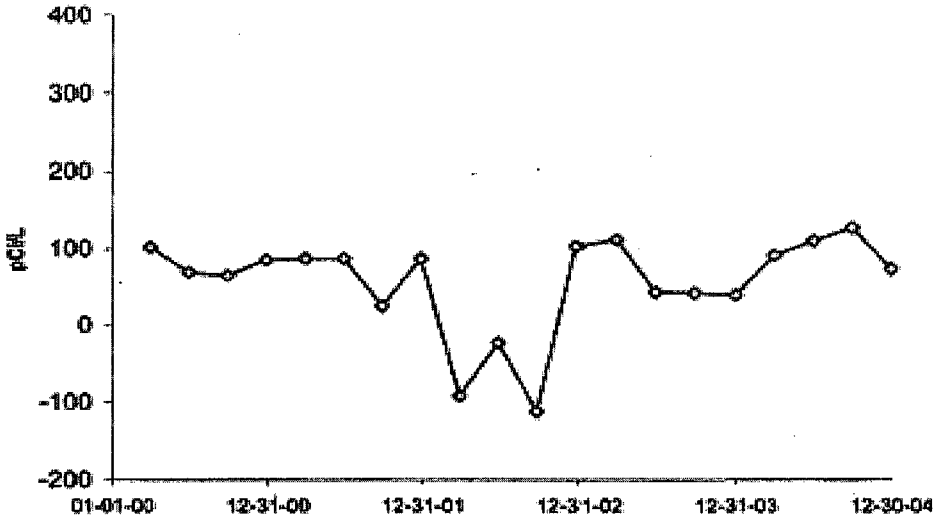
Z-18 (C) Lake Forest Water Works



DUE TO VENDOR CHANGE IN 2005, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JUNE 2005

FIGURE C-3
PUBLIC WATER - TRITIUM - STATION Z-14 AND Z-15 COLLECTED IN THE VICINITY OF ZNPS, 2000 - 2004

Z-14 (C) Kenosha Water Works



Z-15 Lake County Water Works

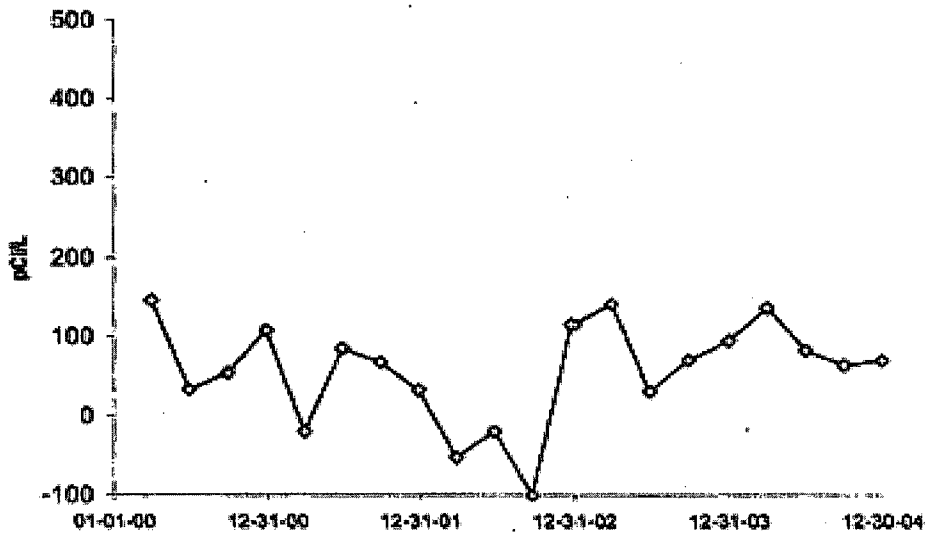
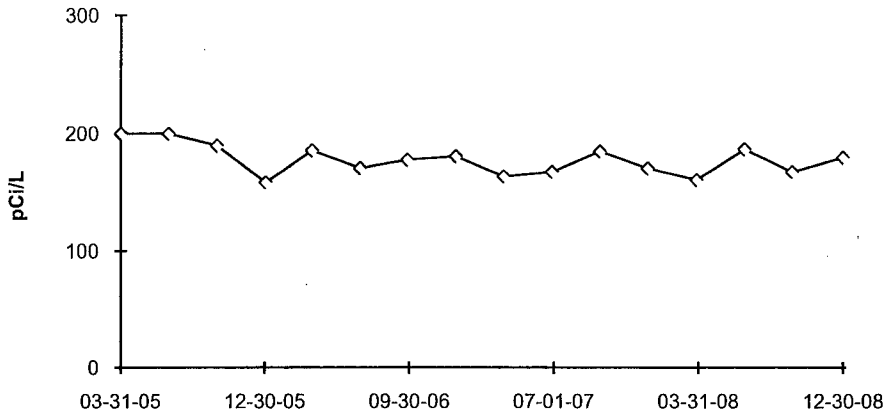
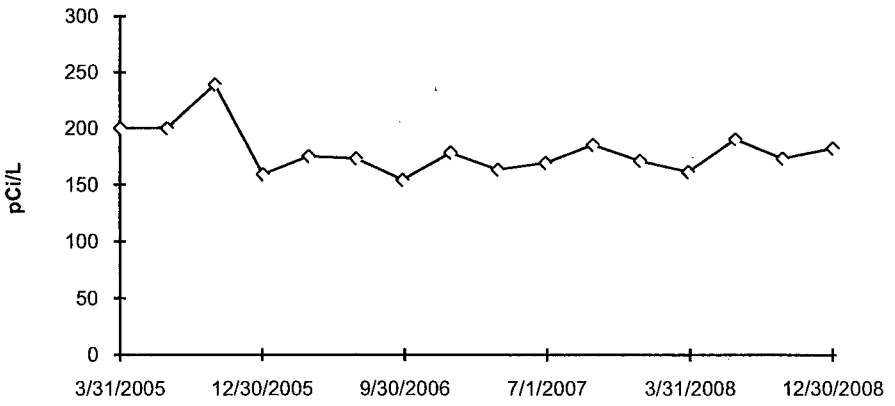


FIGURE C-3 (cont.)
PUBLIC WATER - TRITIUM - STATION Z-14 AND Z-15 COLLECTED IN THE VICINITY OF ZNPS, 2005 - 2008

Z-14 (C) Kenosha Water Works



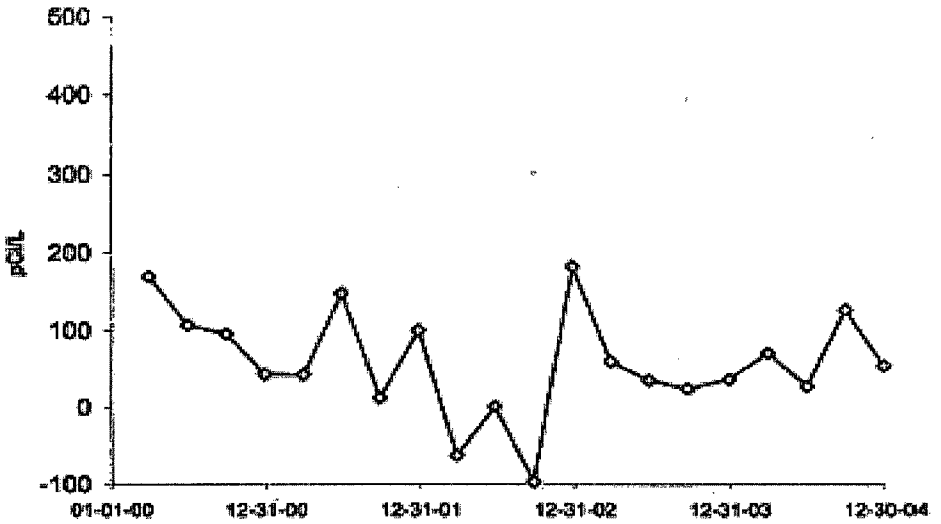
Z-15 Lake County Water Works



DUE TO VENDOR CHANGE IN 2005, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JUNE 2005

FIGURE C-4
PUBLIC WATER - TRITIUM - STATION Z-16 AND Z-18 COLLECTED IN THE VICINITY OF ZNPS, 2000 - 2004

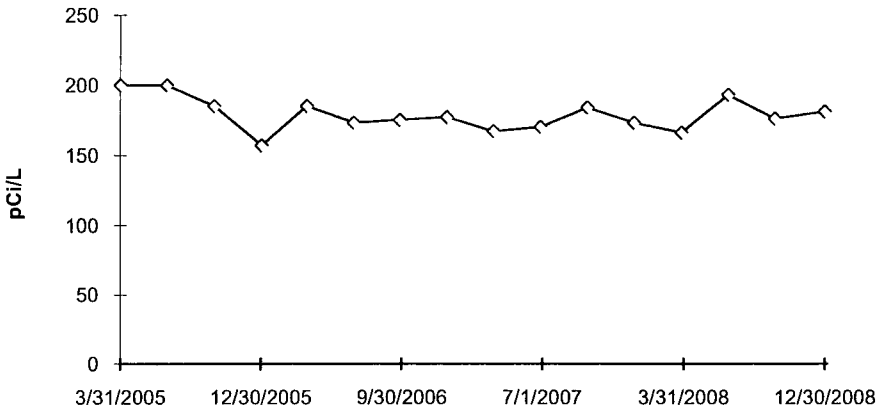
Z-16 Waukegan Water Works



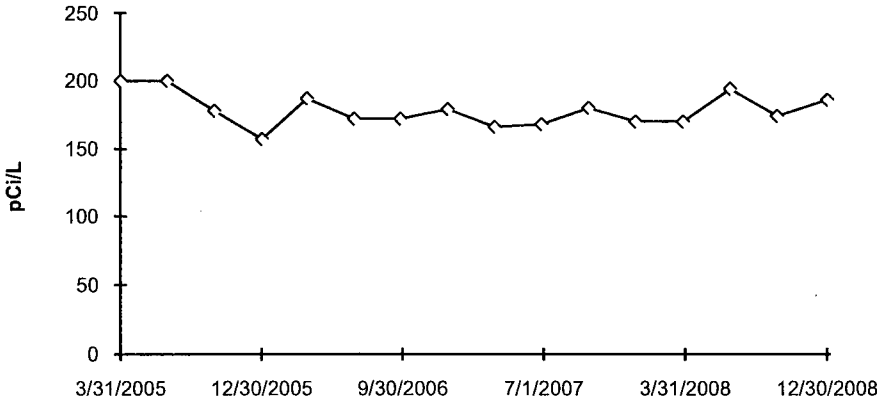
Z-18 (C) Lake Forest Water Works

FIGURE C-4 (cont.)
PUBLIC WATER - TRITIUM - STATION Z-16 AND Z-18 COLLECTED IN THE VICINITY OF ZNPS, 2005 - 2008

Z-16 Waukegan Water Works

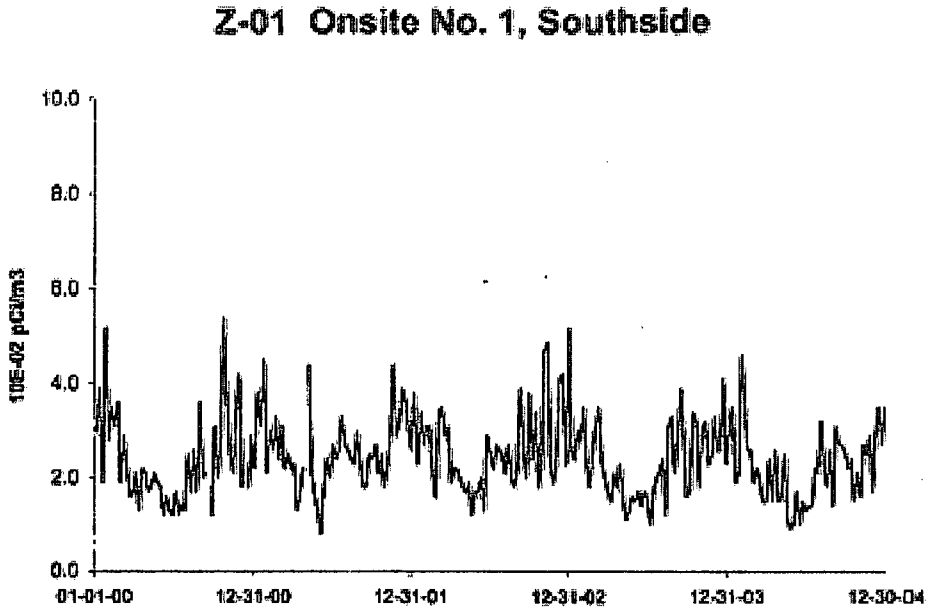


Z-18 (C) Lake Forest Water Works



DUE TO VENDOR CHANGE IN 2005, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JUNE 2005

FIGURE C-5
AIR PARTICULATES - GROSS BETA - STATIONS Z-01 AND Z-02 COLLECTED IN THE VICINITY OF ZNPS, 2000 - 2004



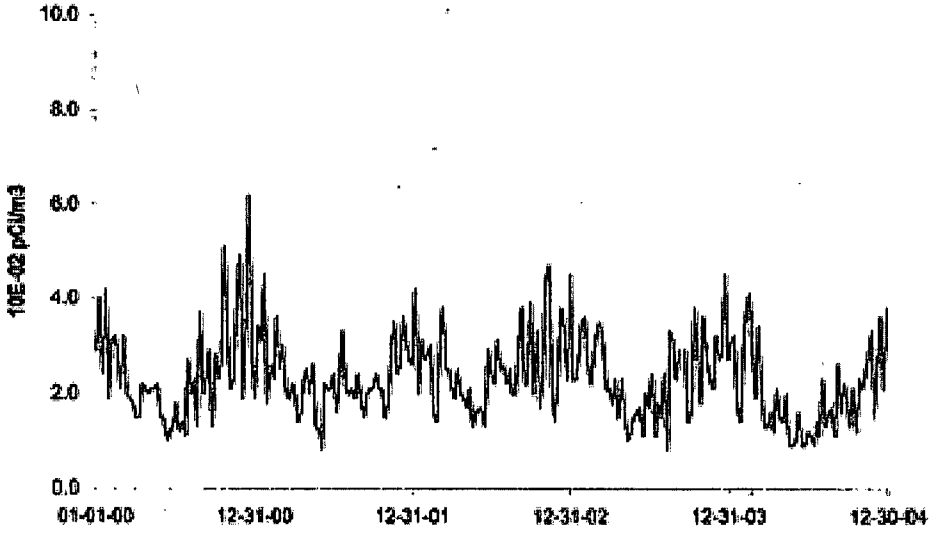
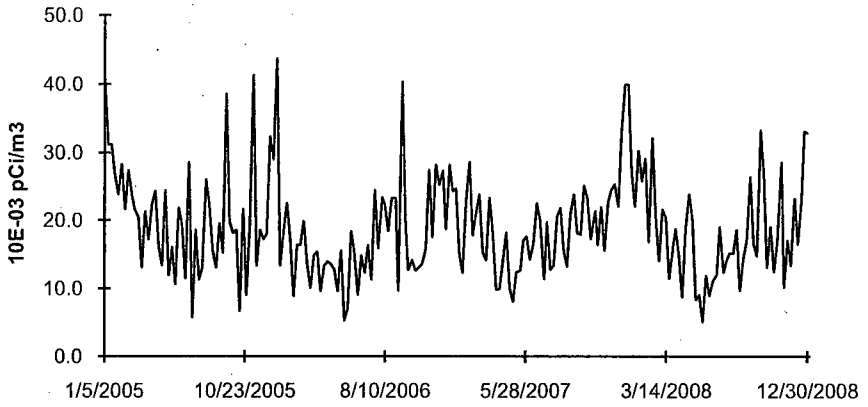
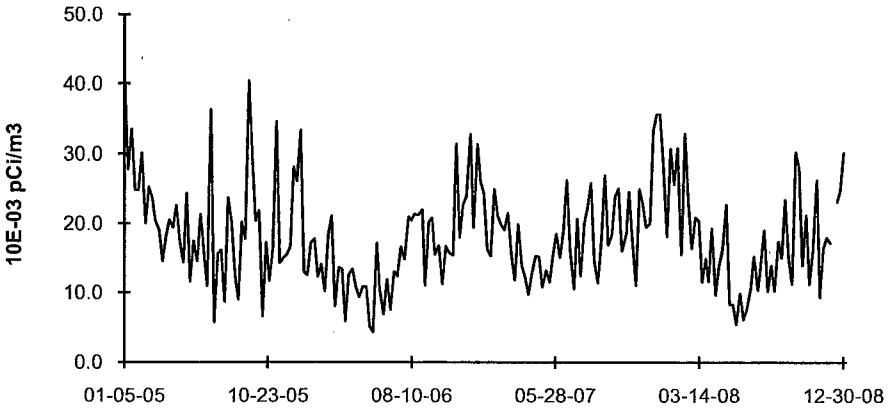


FIGURE C-5 (cont.)
AIR PARTICULATES - GROSS BETA - STATIONS Z-01 AND Z-02 COLLECTED IN THE VICINITY OF ZNPS, 2005 - 2008

Z-01 Onsite No. 1, Southside



Z-02 Onsite No. 2, Westside



DUE TO VENDOR CHANGE IN 2005, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JUNE 2005

FIGURE C-6
AIR PARTICULATES - GROSS BETA - STATIONS Z-03 COLLECTED IN THE VICINITY OF ZNPS, 2000 - 2004

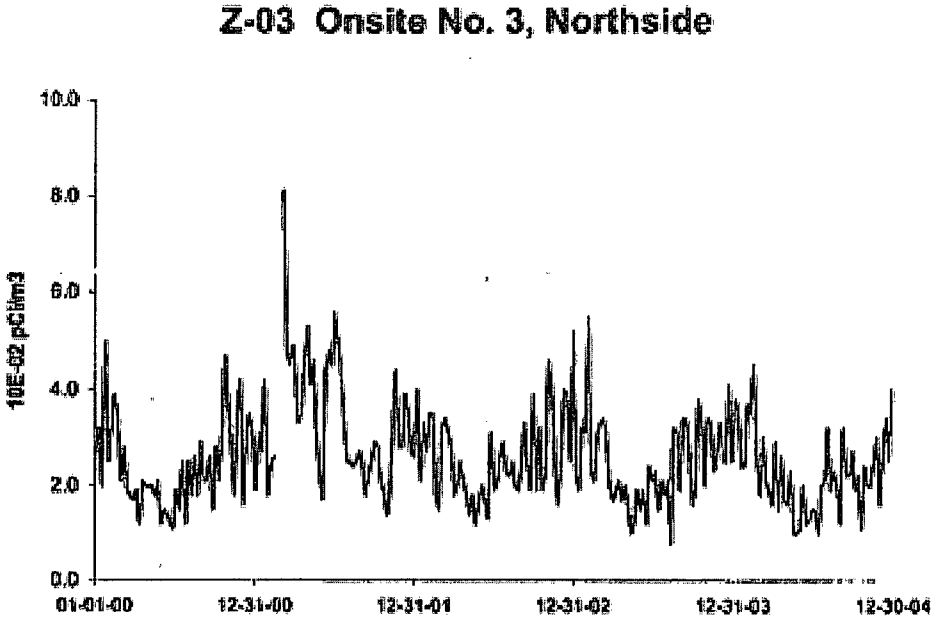
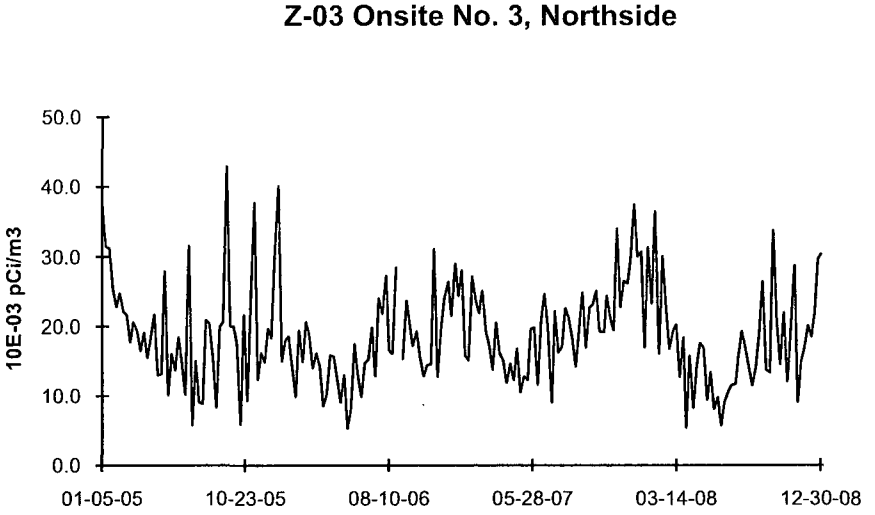


FIGURE C-6 (cont.)
AIR PARTICULATES - GROSS BETA - STATIONS Z-03 COLLECTED IN THE VICINITY OF ZNPS, 2005 - 2008



DUE TO VENDOR CHANGE IN 2005, < VALUES ARE LLD VALUES JANUARY THROUGH JUNE 2005 AND MDC VALUES AFTER JUNE 2005

APPENDIX D

INTER-LABORATORY COMPARISON PROGRAM

TABLE D-1 ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING, 2008
(PAGE 1 OF 3)

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
March 2008	E5847-396	Milk	Sr-89	pCi/L	83.5	95.8	0.87	A
			Sr-90	pCi/L	13.9	12.9	1.08	A
	E5848-396	Milk	I-131	pCi/L	57.3	60.0	0.96	A
			Ce-141	pCi/L	229	249	0.92	A
			Cr-51	pCi/L	336	359	0.94	A
			Cs-134	pCi/L	106	125	0.85	A
			Cs-137	pCi/L	141	146	0.97	A
			Co-58	pCi/L	71.8	70.8	1.01	A
			Mn-54	pCi/L	98.1	94.2	1.04	A
			Fe-59	pCi/L	102	102	1.00	A
			Zn-65	pCi/L	135	137	0.99	A
			Co-60	pCi/L	230	236	0.97	A
	E5850A-396	AP	Ce-141	pCi	163	157	1.04	A
			Cr-51	pCi	233	227	1.03	A
			Cs-134	pCi	72.6	79.0	0.92	A
			Cs-137	pCi	98.3	92.0	1.07	A
			Co-58	pCi	46.7	44.7	1.04	A
			Mn-54	pCi	69.8	59.4	1.18	A
			Fe-59	pCi	72.2	64.5	1.12	A
			Zn-65	pCi	106	86.4	1.23	W
			Co-60	pCi	156	149	1.05	A
	E5849-396	Charcoal	I-131	pCi	65.5	60.1	1.09	A
June 2008	E5971-396	Milk	Sr-89	pCi/L	83.9	85.0	0.99	A
			Sr-90	pCi/L	14.4	15.8	0.91	A
	E5972-396	Milk	I-131	pCi/L	70.9	71.4	0.99	A
			Ce-141	pCi/L	157	174	0.90	A
			Cr-51	pCi/L	159	138	1.15	A
			Cs-134	pCi/L	69.7	76.7	0.91	A
			Cs-137	pCi/L	115	116	0.99	A
			Co-58	pCi/L	59.1	61.9	0.95	A
			Mn-54	pCi/L	139	135	1.03	A
			Fe-59	pCi/L	98.4	91.7	1.07	A
			Zn-65	pCi/L	129	127	1.02	A
			Co-60	pCi/L	101	104	0.97	A
	E5974-396	AP	Ce-141	pCi	206	207	1.00	A
			Cr-51	pCi	173	164	1.05	A
			Cs-134	pCi	95.9	91.0	1.05	A
			Cs-137	pCi	142.0	138.0	1.03	A
			Co-58	pCi	72.0	73.4	0.98	A
			Mn-54	pCi	180	160.0	1.13	A
			Fe-59	pCi	108.0	109.0	0.99	A
			Zn-65	pCi	159	150	1.06	A
			Co-60	pCi	129	124	1.04	A

TABLE D-1 ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING, 2008
(PAGE 2 OF 3)

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
June 2008	E5973-396	Charcoal	I-131	pCi	73.8	84.1	0.88	A
September 2008	E6284-396	Milk	Sr-89	pCi/L	76.2	73.9	1.03	A
			Sr-90	pCi/L	12.3	11.0	1.12	A
	E6285-396	Milk	I-131	pCi/L	65.7	67.9	0.97	A
			Ce-141	pCi/L	145	161	0.90	A
			Cr-51	pCi/L	406	421	0.96	A
			Cs-134	pCi/L	196	232	0.84	A
			Cs-137	pCi/L	147	162	0.91	A
			Co-58	pCi/L	167	179	0.93	A
			Mn-54	pCi/L	165	166	0.99	A
			Fe-59	pCi/L	161	144	1.12	A
			Zn-65	pCi/L	305	319	0.96	A
			Co-60	pCi/L	218	234	0.93	A
	E6287-396	AP	Ce-141	pCi	79.5	76.3	1.04	A
			Cr-51	pCi	208	199	1.05	A
			Cs-134	pCi	106	110	0.96	A
			Cs-137	pCi	79.3	76.7	1.03	A
			Co-58	pCi	87.7	84.4	1.04	A
			Mn-54	pCi	90.3	78.6	1.15	A
			Fe-59	pCi	81.7	68.3	1.20	A
			Zn-65	pCi	144	151	0.95	A
			Co-60	pCi	111	111	1.00	A
	E6286-396	Charcoal	I-131	pCi	93.2	90.0	1.04	A
December 2008	E6415-396	Milk	Sr-89	pCi/L	98.4	91.9	1.07	A
			Sr-90	pCi/L	18.0	12.6	1.43	N (1)
	E6416-396	Milk	I-131	pCi/L	69.2	79.9	0.87	A
			Ce-141	pCi/L	177	191	0.93	A
			Cr-51	pCi/L	231	246	0.94	A
			Cs-134	pCi/L	117	134	0.87	A
			Cs-137	pCi/L	119	120	0.99	A
			Co-58	pCi/L	104	104	1.00	A
			Mn-54	pCi/L	153	152	1.01	A
			Fe-59	pCi/L	99.6	100	1.00	A
			Zn-65	pCi/L	177	183	0.97	A
			Co-60	pCi/L	133	133	1.00	A
	E6418-396	AP	Ce-141	pCi	148	146	1.01	A
			Cr-51	pCi	202	187	1.08	A
			Cs-134	pCi	103	102	1.01	A
			Cs-137	pCi	95.4	91.2	1.05	A
			Co-58	pCi	81.4	79.2	1.03	A
			Mn-54	pCi	113	116.0	0.97	A
			Fe-59	pCi	76.5	76.4	1.00	A
			Zn-65	pCi	122	139	0.88	A
			Co-60	pCi	108	101	1.07	A

TABLE D-1 ANALYTICS ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING, 2008

Month/Year	Identification Number	Matrix	Nuclide	Units	Reported Value (a)	Known Value (b)	Ratio (c) TBE/Analytics	Evaluation (d)
December 2008	E6417-396	Charcoal	I-131	pCi	65.8	74.1	0.89	A

(1) NCR 09-02 initiated to investigate the failure.

(a) Teledyne Brown Engineering reported result.

(b) The Analytics known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.

(c) Ratio of Teledyne Brown Engineering to Analytics results.

(d) Analytics evaluation based on TBE internal QC limits: A= Acceptable. Reported result falls within ratio limits of 0.80-1.20. W-Acceptable with warning. Reported result falls within 0.70-0.80 or 1.20-1.30. N = Not Acceptable. Reported result falls outside the ratio limits of < 0.70 and > 1.30.

TABLE D-2 ERA ENVIRONMENTAL RADIOACTIVITY CROSS CHECK PROGRAM
TELEDYNE BROWN ENGINEERING, 2008

Month/Year	Identification Number	Media	Nuclide	Units	Reported Value (a)	Known Value (b)	Control Limits	Evaluation (c)
January 2008	Quik[tm] Response	Water	Sr-89	pCi/L	37.33	19.0	11.8 - 25.2	N (1)
			Sr-90	pCi/L	40.40	42.7	31.5 - 49.0	A
			Ba-133	pCi/L	87.8	90.5	76.2 - 99.6	A
			Cs-134	pCi/L	80.67	88.9	72.9 - 97.8	A
			Cs-137	pCi/L	222.33	231	208 - 256	A
			Co-60	pCi/L	98.9	101.0	90.9 - 113	A
			Zn-65	pCi/L	352	350	315 - 408	A
			Gr-A	pCi/L	13.0	12.7	6.02 - 18.7	A
			Gr-B	pCi/L	32.7	36.2	23.8 - 43.8	A
			H-3	pCi/L	11100	11300	9840 - 12400	A
January 2008	RAD 72	Water	Sr-89	pCi/L	69.0	65.3	53.0 - 73.4	A
			Sr-90	pCi/L	35.6	41.4	30.5 - 47.6	A
			Ba-133	pCi/L	25.9	25.7	20.0 - 29.5	A
			Cs-134	pCi/L	86.5	92.6	76.0 - 102	A
			Cs-137	pCi/L	155	158	142 - 176	A
			Co-60	pCi/L	16.0	14.4	11.4 - 18.7	A
			Zn-65	pCi/L	214	204	184 - 240	A
			Gr-A	pCi/L	13.3	14.8	7.15 - 21.2	A
			Gr-B	pCi/L	21.2	22.5	13.7 - 30.6	A
			I-131	pCi/L	22.8	23.6	19.6 - 28.0	A
			H-3	pCi/L	3390	3540	3000 - 3910	A
April 2008	Rad 73	Water	Sr-89	pCi/L	65.47	60.4	48.6 - 68.2	A
			Sr-90	pCi/L	39.80	39.2	28.8 - 45.1	A
			Ba-133	pCi/L	59.63	58.3	48.3 - 64.3	A
			Cs-134	pCi/L	45.00	46.6	37.4 - 51.3	A
			Cs-137	pCi/L	97.97	102	91.8 - 115	A
			Co-60	pCi/L	75.47	76.6	68.9 - 86.7	A
			Zn-65	pCi/L	109	106	95.4 - 126	A
			Gr-A	pCi/L	41.03	50.8	26.5 - 63.7	A
			Gr-B	pCi/L	50.20	51.4	35.0 - 58.4	A
			I-131	pCi/L	26.67	28.7	23.9 - 33.6	A
			H-3	pCi/L	11633	12000	10400 - 13200	A

(1) Could find no cause for Sr-89 failure. Sample sent to outside lab for verification, but the outside laboratory was unable to confirm our numbers or ERA numbers. Studies bracketing these results, RAD 71 and RAD 72, had acceptable Sr-89 results. NCR 08-03

(a) Teledyne Brown Engineering reported result.

(b) The ERA known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.

(c) ERA evaluation: A=acceptable. Reported result falls within the Warning Limits. NA=not acceptable. Reported result falls outside of the Control Limits. CE=check for Error. Reported result falls within the Control Limits and outside of the Warning Limit.

TABLE D-3 DOE'S MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)
TELEDYNE BROWN ENGINEERING, 2008

Month/Year	Identification Number	Media	Nuclide	Units	Reported Value (a)	Known Value (b)	Acceptance Range	Evaluation (c)
January 2008	07-MaW18	Water	Cs-134	Bq/L	-0.26		(1)	A
			Cs-137	Bq/L	0.029		(1)	A
			Co-57	Bq/L	21	22.8	16.0 - 29.6	A
			Co-60	Bq/L	8.2	8.40	5.88 - 10.92	A
			H-3	Bq/L	473	472	330 - 614	A
			Mn-54	Bq/L	12	12.1	8.5 - 15.7	A
			Sr-90	Bq/L	10.70	11.4	7.98- 14.82	A
			Zn-65	Bq/L	15.6	16.3	11.4 - 21.2	A
	07-GrW18	Water	Gr-A	Bq/L	1.4	1.399	>0.0 - 2.798	A
			Gr-B	Bq/L	3.06	2.43	1.22 - 3.65	A
	07-MaS18	Soil	Cs-134	Bq/kg	790	854.0	598 - 1110	A
			Cs-137	Bq/kg	568	545	382 - 709	A
			Co-57	Bq/kg	424	421	295 - 547	A
			Co-60	Bq/kg	2.307	2.9	(2)	A
			Mn-54	Bq/kg	611	570	399 - 741	A
			K-40	Bq/kg	6.09	571	400 - 742	A
			Sr-90	Bq/kg	454	493.0	345 - 641	A
			Zn-65	Bq/kg	0.162		(1)	A
	07-RdF18	AP	Cs-134	Bq/sample	2.73	2.5200	1.76 - 3.28	A
			Cs-137	Bq/sample	2.88	2.7	1.89 - 3.51	A
			Co-57	Bq/sample	3.493	3.55	2.49 - 4.62	A
			Co-60	Bq/sample	1.357	1.31	0.92 - 1.70	A
			Mn-54	Bq/sample	0.006		(1)	A
			Sr-90	Bq/sample	1.61	1.548	1.084 - 2.012	A
			Zn-65	Bq/sample	2.59	2.04	1.43 - 2.65	A
	07-GrF18	AP	Gr-A	Bq/sample	0.131	0.348	>0.0 - 0.696	A
			Gr-B	Bq/sample	0.261	0.286	0.143 - 0.429	A
January 2008	07-RdV18	Vegetation	Cs-134	Bq/sample	5.25	6.28	4.40 - 8.16	A
			Cs-137	Bq/sample	3.13	3.41	2.39 - 4.43	A
			Co-57	Bq/sample	6.837	6.89	4.82 - 8.96	A
			Co-60	Bq/sample	2.44	2.77	1.94 - 3.60	A
			Mn-54	Bq/sample	4.45	4.74	3.32 - 6.16	A
			K-40	Bq/sample	61.3		(1)	
			Sr-90	Bq/sample	1.33	1.273	0.891 - 1.655	A
			Zn-65	Bq/sample	0.085		(1)	A
August 2008	08-MaW19	Water	Cs-134	Bq/L	17.1	19.5	13.7 - 25.4	A
			Cs-137	Bq/L	21.4	23.6	16.5 - 30.7	A
			Co-57	Bq/L	-0.044		(1)	A
			Co-60	Bq/L	10.8	11.6	8.1 - 15.1	A
			H-3	Bq/L	334	341	239 - 443	A
			Mn-54	Bq/L	13.0	13.7	9.6 - 17.8	A
			Sr-90	Bq/L	6.55	6.45	4.52- 8.39	A
			Zn-65	Bq/L	16.5	17.1	12.0 - 22.2	A

TABLE D-3 DOE'S MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)
TELEDYNE BROWN ENGINEERING, 2008
(PAGE 2 OF 2)

Month/Year	Identification Number	Media	Nuclide	Units	Reported Value (a)	Known Value (b)	Acceptance Range	Evaluation (c)
August 2008	08-GrW19	Water	Gr-A	Bq/L	0.0612	<0.56	(3)	A
			Gr-B	Bq/L	0.222	<1.85	(3)	A
	08-MaS19	Soil	Cs-134	Bq/kg	546	581	407 - 755	A
			Cs-137	Bq/kg	2.52	2.8	(2)	A
			Co-57	Bq/kg	340	333	233 - 433	A
			Co-60	Bq/kg	157	145.0	102 - 189	A
			Mn-54	Bq/kg	460	415	291 - 540	A
			K-40	Bq/kg	650	571	399 - 741	A
			Sr-90	Bq/kg	1.40		(1)	A
			Zn-65	Bq/kg	-1.53		(1)	A
	08-RdF19	AP	Cs-134	Bq/sample	2.46	2.6300	1.84 - 3.42	A
			Cs-137	Bq/sample	0.0063		(1)	A
			Co-57	Bq/sample	1.36	1.50	1.05 - 1.95	A
			Co-60	Bq/sample	0.0143		(1)	A
			Mn-54	Bq/sample	2.70	2.64	1.85 - 3.43	A
			Sr-90	Bq/sample	1.42	1.12	0.78 - 1.46	W
			Zn-65	Bq/sample	0.975	0.94	0.66 - 1.22	A
	08-GrF19	AP	Gr-A	Bq/sample	-0.0037		(4)	A
			Gr-B	Bq/sample	0.540	0.525	0.263 - 0.788	A
	08-RdV19	Vegetation	Cs-134	Bq/sample	4.36	5.5	3.9 - 7.2	W
			Cs-137	Bq/sample	-0.03		(1)	A
			Co-57	Bq/sample	6.72	7.1	5.0 - 9.2	A
			Co-60	Bq/sample	4.04	4.70	3.3 - 6.1	A
			Mn-54	Bq/sample	5.22	5.8	4.1 - 7.5	A
			K-40	Bq/sample	64.4		(1)	
			Sr-90	Bq/sample	1.62	1.9	1.3 - 2.5	A
			Zn-65	Bq/sample	6.160	6.9	4.8 - 9.0	A

(1) Not evaluated by MAPEP.

(2) Reported a statistically zero result.

(3) Designed to test the Safe Drinking Water screening levels. Labs reporting values less than ref values were found to be acceptable.

(4) False positive test.

(a) Teledyne Brown Engineering reported result.

(b) The MAPEP known value is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation.

(c) DOE/MAPEP evaluation: A=acceptable, W=acceptable with warning, N=not acceptable.

TABLE D-4 **ERA (a) STATISTICAL SUMMARY PROFICIENCY TESTING PROGRAM**
ENVIRONMENTAL, INC., 2008

Lab Code [b]	Date	Concentration (pCi/L) Analysis	Laboratory Result [c]	ERA Result [d]	Control Limits	Acceptance
STAP-1143	03/24/08	Co-60	650.72 ± 3.00	730.0	565.0 - 912.0	Pass
STAP-1143	03/24/08	Cs-134	467.50 ± 5.53	523.0	341.0 - 647.0	Pass
STAP-1143	03/24/08	Cs-137	1375.90 ± 25.41	1450.0	1090.0 - 1900.0	Pass
STAP-1143 [e]	03/24/08	Mn-54	0.00 ± 0.00	0.0	0.0 - 10.0	Pass
STAP-1143	03/24/08	Sr-90	157.60 ± 7.70	152.0	66.9 - 236.0	Pass
STAP-1143	03/24/08	Zn-65	889.90 ± 15.90	872.0	604.0 - 1210.0	Pass
STAP-1144	03/24/08	Gr. Beta	99.90 ± 3.09	92.2	56.80 - 135.0	Pass
STSO-1145	03/24/08	Ac-228	1269.02 ± 36.81	1180.0	757.0 - 1660.0	Pass
STSO-1145	03/24/08	Bi-212	1407.10 ± 56.64	1360.0	357.0 - 2030.0	Pass
STSO-1145	03/24/08	Co-60	5219.70 ± 90.30	5130.0	3730.0 - 6890.0	Pass
STSO-1145	03/24/08	Cs-134	5427.30 ± 102.94	5640.0	3630.0 - 6790.0	Pass
STSO-1145	03/24/08	Cs-137	6346.60 ± 201.80	6010.0	4600.0 - 7810.0	Pass
STSO-1145	03/24/08	K-40	11052.70 ± 181.80	11000.0	7980.0 - 14900.0	Pass
STSO-1145 [e]	03/24/08	Mn-54	0.00 ± 0.00	0.0	0.0 - 10.0	Pass
STSO-1145	03/24/08	Pb-212	1198.20 ± 96.58	1080.0	697.0 - 1520.0	Pass
STSO-1145	03/24/08	Pb-214	2253.30 ± 291.60	2020.0	1210.0 - 3010.0	Pass
STSO-1145	03/24/08	Sr-90	6407.00 ± 277.00	5360.0	1940.0 - 8750.0	Pass
STSO-1145	03/24/08	Th-234	2421.80 ± 321.00	2030.0	644.0 - 3870.0	Pass
STSO-1145	03/24/08	Zn-65	2936.20 ± 73.50	2660.0	2110.0 - 3570.0	Pass
STVE-1146	03/24/08	Co-60	912.41 ± 13.59	888.0	600.0 - 1280.0	Pass
STVE-1146	03/24/08	Cs-134	1547.70 ± 38.81	1540.0	882.0 - 2130.0	Pass
STVE-1146	03/24/08	Cs-137	1163.80 ± 20.62	1100.0	807.0 - 1530.0	Pass
STVE-1146	03/24/08	K-40	22186.00 ± 339.40	24600.0	17700.0 - 34800.0	Pass
STVE-1146 [e]	03/24/08	Mn-54	0.00 ± 0.00	0.0	0.0 - 10.0	Pass
STVE-1146	03/24/08	Sr-90	3825.90 ± 140.66	4130.0	2310.0 - 5480.0	Pass
STVE-1146	03/24/08	Zn-65	1676.80 ± 43.00	1430.0	1030.0 - 1960.0	Pass
STW-1147	03/24/08	Co-60	1430.00 ± 33.33	1420.0	1240.0 - 1680.0	Pass
STW-1147	03/24/08	Cs-134	730.18 ± 33.39	751.0	555.0 - 862.0	Pass
STW-1147	03/24/08	Cs-137	1947.80 ± 13.80	1990.0	1690.0 - 2380.0	Pass
STW-1147 [e]	03/24/08	Mn-54	0.00 ± 0.00	0.0	0.0 - 10.0	Pass
STW-1147	03/24/08	Sr-90	512.03 ± 43.37	512.0	325.0 - 684.0	Pass
STW-1147	03/24/08	Zn-65	708.90 ± 29.00	694.0	588.0 - 865.0	Pass
STW-1120	03/19/07	Zn-65	2009.00 ± 36.40	1910.0	1600.0 - 2410.0	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the crosscheck program for proficiency testing administered by Environmental Resources Associates, serving as a replacement for studies conducted previously by the Environmental Measurements Laboratory Quality Assessment Program (EML).

[b] Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (vegetation).

[c] Unless otherwise indicated, the laboratory result is given as the mean ± standard deviation for three determinations.

[d] Results are presented as the known values, expected laboratory precision (1 sigma, 1 determination) and control limits as provided by ERA.

[e] Included in the testing series as a "false positive". No activity expected.

TABLE D-5 DOE'S MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)[a]
ENVIRONMENTAL, INC., 2008
(Page 1 of 2)

			Concentration [b]			
Lab Code[c]	Date	Analysis	Laboratory result	Known Activity	Control Limits [d]	Acceptance
STW-1137	01/01/08	Co-57	23.80 ± 0.60	22.80	16.00 - 29.60	Pass
STW-1137	01/01/08	Co-60	8.60 ± 0.50	8.40	5.88 - 10.92	Pass
STW-1137	01/01/08	Cs-134	-0.021 ± 0.10	0.00	-1.00 - 1.00	Pass
STW-1137	01/01/08	Cs-137	0.00 ± 0.10	0.00	-1.00 - 1.00	Pass
STW-1137	01/01/08	H-3	515.10 ± 12.70	472.00	330.00 - 614.00	Pass
STW-1137	01/01/08	Mn-54	12.90 ± 0.80	12.10	8.50 - 15.70	Pass
STW-1137	01/01/08	Sr-90	12.00 ± 1.50	11.40	7.98 - 14.82	Pass
STW-1137	01/01/08	Zn-65	16.90 ± 1.40	16.30	11.40 - 21.20	Pass
STW-1138	01/01/08	Gr. Beta	2.30 ± 0.15	2.43	1.22 - 3.65	Pass
STAP-1139	01/01/08	Co-57	3.90 ± 0.07	3.55	2.49 - 4.62	Pass
STAP-1139	01/01/08	Co-60	1.43 ± 0.07	1.31	0.92 - 1.70	Pass
STAP-1139	01/01/08	Cs-134	2.59 ± 0.16	2.52	1.76 - 3.28	Pass
STAP-1139	01/01/08	Cs-137	3.05 ± 0.12	2.70	1.89 - 3.51	Pass
STAP-1139	01/01/08	Mn-54	0.43 ± 0.58	0.00	0.00 - 1.00	Pass
STAP-1139	01/01/08	Sr-90	1.30 ± 0.27	1.55	1.08 - 2.01	Pass
STAP-1139	01/01/08	Zn-65	2.36 ± 0.18	2.04	1.43 - 2.65	Pass
STAP-1140	01/01/08	Gr. Beta	0.34 ± 0.04	0.29	0.14 - 0.43	Pass
STVE-1141	01/01/08	Co-57	8.30 ± 0.18	6.89	4.82 - 8.96	Pass
STVE-1141	01/01/08	Co-60	3.03 ± 0.13	2.77	1.94 - 3.60	Pass
STVE-1141	01/01/08	Cs-134	6.53 ± 0.29	6.28	4.40 - 8.16	Pass
STVE-1141	01/01/08	Cs-137	3.90 ± 0.19	3.41	2.39 - 4.43	Pass
STVE-1141	01/01/08	Mn-54	5.43 ± 0.21	4.74	3.32 - 6.16	Pass
STVE-1141	01/01/08	Zn-65	0.033 ± 0.10	0.00	0.00 - 1.00	Pass
STSO-1142	01/01/08	Co-57	483.00 ± 3.00	421.00	295.00 - 547.00	Pass
STSO-1142	01/01/08	Co-60	3.00 ± 0.80	2.90	0.00 - 5.00	Pass
STSO-1142	01/01/08	Cs-134	896.50 ± 7.40	854.00	598.00 - 1110.00	Pass
STSO-1142	01/01/08	Cs-137	624.40 ± 4.10	545.00	382.00 - 709.00	Pass
STSO-1142	01/01/08	Mn-54	667.20 ± 3.80	570.00	399.00 - 741.00	Pass
STSO-1142	01/01/08	Zn-65	0.093 ± 0.91	0.00	0.00 - 1.00	Pass
STSO-1158	08/01/08	Co-57	353.02 ± 2.01	333.00	233.00 - 433.00	Pass
STSO-1158	08/01/08	Co-60	151.99 ± 1.58	145.00	102.00 - 189.00	Pass
STSO-1158	08/01/08	Cs-134	499.72 ± 2.65	581.00	407.00 - 755.00	Pass
STSO-1158	08/01/08	Cs-137	2.54 ± 0.25	2.80	0.00 - 5.00	Pass
STSO-1158	08/01/08	K-40	643.94 ± 15.50	570.00	399.00 - 741.00	Pass
STSO-1158	08/01/08	Mn-54	452.14 ± 2.96	415.00	291.00 - 540.00	Pass
STSO-1158	08/01/08	Sr-90	1.95 ± 2.04	0.00	0.00 - 5.00	Pass
STSO-1158	08/01/08	Zn-65	0.10 ± 2.04	0.00	0.00 - 5.00	Pass

TABLE D-5 DOE'S MIXED ANALYTE PERFORMANCE EVALUATION PROGRAM (MAPEP)[a]
ENVIRONMENTAL, INC., 2008

		Concentration [b]				
Lab Code[c]	Date	Analysis	Laboratory result	Known Activity	Control Limits [d]	Acceptance
STVE-1159	08/01/08	Co-57	8.52 ± 0.23	7.10	5.00 - 9.20	Pass
STVE-1159	08/01/08	Co-60	5.08 ± 0.19	4.70	3.30 - 6.10	Pass
STVE-1159	08/01/08	Cs-134	5.26 ± 0.18	5.50	3.90 - 7.20	Pass
STVE-1159	08/01/08	Cs-137	0.01 ± 0.14	0.00	0.00 - 1.00	Pass
STVE-1159	08/01/08	Mn-54	6.39 ± 0.28	5.80	4.10 - 7.50	Pass
STVE-1159	08/01/08	Zn-65	7.73 ± 0.45	6.90	4.80 - 9.00	Pass
STW-1162	08/01/08	Co-57	0.03 ± 0.16	0.00	0.00 - 5.00	Pass
STW-1162	08/01/08	Co-60	11.27 ± 0.23	11.60	8.10 - 15.10	Pass
STW-1162	08/01/08	Cs-134	17.93 ± 0.52	19.50	13.70 - 25.40	Pass
STW-1162	08/01/08	Cs-137	23.72 ± 0.43	23.60	16.50 - 30.70	Pass
STW-1162	08/01/08	H-3	385.15 ± 8.93	341.00	239.00 - 443.00	Pass
STW-1162	08/01/08	Mn-54	13.87 ± 0.37	13.70	9.60 - 17.80	Pass
STW-1162	08/01/08	Sr-90	6.49 ± 1.12	6.45	4.52 - 8.39	Pass
STW-1162	08/01/08	Zn-65	17.64 ± 0.61	17.10	12.00 - 22.20	Pass
STW-1163	08/01/08	Gr. Beta	0.12 ± 0.05	0.00	0.00 - 1.85	Pass

[a] Results obtained by Environmental, Inc., Midwest Laboratory as a participant in the Department of Energy's Mixed Analyte Performance Evaluation Program, Idaho Operations office, Idaho Falls, Idaho

[b] Results are reported in units of Bq/kg (soil), Bq/L (water) or Bq/total sample (filters, vegetation).

[c] Laboratory codes as follows: STW (water), STAP (air filter), STSO (soil), STVE (vegetation).

[d] MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP.

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APPENDIX E

EFFLUENT DATA

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INTRODUCTION

Units 1 and 2 of the Zion Station, located in Zion, Illinois adjacent to Lake Michigan, are 1100 MWe (3520 MWt) Westinghouse pressurized water reactors. The plant permanently ceased operation in February of 1998 and has been permanently defueled.

The station was designed to keep releases to the environment at levels below those specified in the regulations. Historical data has been established that Zion, as a fully operational facility, did not contribute appreciable doses to the surrounding public. Sampling results for 2008 showed zero releases above background for a variety of monitored pathways, e.g. water, vegetation, air samples and TLIV.

Liquid effluents from Zion Station are released to Lake Michigan in controlled batches after radioassay of each batch and continuously through a monitored pathway. There are no routine noble gas releases. Due to decay, iodine is no longer present. The only noble gas that remains is Kr85 captured in the spent fuel assemblies stored in the fuel pool in the fuel building. A new ventilation system for the FB has been installed to monitor possible releases. The results of effluent analyses are summarized on a monthly basis and reported to the Nuclear Regulatory Commission as required per Technical Specifications. Airborne concentrations of noble gases and particulate radioactivity in offsite areas are calculated using effluent and meteorological data.

Environmental monitoring was conducted by sampling at indicator and control (background) locations in the vicinity of the Zion Station to measure changes in radiation or radioactivity levels that may be attributable to the station. If significant changes attributable to Zion Station are measured, these changes are correlated with effluent releases.

SUMMARY

Gaseous and liquid effluents for the period contributed to only a small fraction of the Station Technical Specification limits. Calculations of environmental concentrations based on effluent and meteorological data for the period indicate that consumption by the public of radionuclides attributable to the Zion Station does not exceed regulatory limits. Radiation exposure from radionuclides released to the atmosphere represented the critical pathway for the period with a maximum individual total body dose estimated to be 0.00E+00 mrem for the year, where a shielding and occupancy factor of 0.7 is assumed. The assessment of radiation doses is performed in accordance with the Exelon Offsite Dose Calculation Manual (ODCM). The results of analysis confirm that the station is operating in compliance with 10CFR50 Appendix 1, 1OCFR20 and 40CFR190.

1.0 EFFLUENTS

1.1 Gaseous Effluents to the Atmosphere

Measured concentrations and isotopic composition of noble gases and particulate radioactivity released to the atmosphere were monitored during the year. A total of 0.00E+00 microcuries of fission and activation gases was released with a maximum average release rate of 0.00E+00 µCi/sec during any one quarter period.

A total of 0.00E+00 microcuries of beta-gamma emitters was released as airborne particulate matter with a maximum average quarterly release rate of 0.00E+00 µCi/sec. quarterly only. Alpha-emitting radionuclides were not measurable. Also, 0.00E+00 curies of tritium were released with a maximum average quarterly release rate of 0.00E+00 µCi/sec.

1.2 Liquids Released to Lake Michigan

A total of 3.8E+07 liters of liquid waste containing 0.00E+00 microcuries was discharged from the station via an approved pathway after dilution with a total of 4.37E+10 liters of water. These wastes were released at a maximum quarterly average concentration of 0.00E+00 µCi/ml. A total of 0.00E-00 curies of tritium was released. Alpha activity released totaled 0.00 µCi for the year. Monthly release estimates and principal radionuclides in liquid effluents are reported in the Zion Nuclear Power Station Radioactive Effluent Report for 2008.

2.0 SOLID RADIOACTIVE WASTE

There was one solid radioactive waste shipment. For more detail, refer to Zion Station 2008 Effluent Report.

3.0 DOSE TO MAN

3.1 Gaseous Effluent Pathways

Table 3.1-1 summarizes the doses resulting from releases of airborne radioactivity via the different exposure pathways.

3.1.1 Gaseous Releases

3.1.1.1 Gamma Dose Rates

Offsite Gamma air and whole (total) body dose rates are shown in Table 3.1-1 and were calculated based on measured release rates, isotopic composition of the gases, and meteorological data for the period. Based on measured effluents and average meteorological data, the maximum total body dose to an individual would be 0.00E+00 mrem (adult) for the year (Table 3.1-1), with an occupancy or shielding factor of 0.7 included, and based on measured effluents and concurrent meteorological data would be 0.00E+00 mrem (Table 3.4-1). The maximum gamma air dose was 0.00E+00 mrad based on measured effluents and average meteorological data (Table 3.1-1), and 0.00E+00 mrad based on measured effluents and concurrent meteorological data (Table 3.4-1).

3.1.1.2 Beta Air and Skin Dose Rates

The range of beta particles in air is relatively small (on the order of a few meters or less); consequently, plumes of gaseous effluents may be considered "infinite" for purpose of calculating the dose from beta radiation incident on the skin. However, the actual dose to sensitive skin tissues is difficult to calculate due to the effect of the beta particle energies, thickness of inert skin and clothing covering sensitive tissues. For purposes of this report the skin is taken to have a thickness of 7.0 mg/cm^2 and an occupancy factor of 1.0 is used. The skin dose from beta and gamma radiation for the year was 0.00E+00 mrem based on measured effluents and average meteorological data (Table 3.1-1), and 0.00E+00 mrem based on measured effluents and concurrent meteorological data

(Table 3.4-1).
The maximum offsite beta air dose for the year was 0.00E+00 mrad based on measured effluents and average meteorological data (Table 3.1-1), and 0.00E+00 mrad based on measured effluents and concurrent meteorological data (Table 3.4-1).

3.1.2 Radioactive Iodine

The human thyroid exhibits a significant capacity to concentrate ingested or inhaled iodine. The radioiodine, 1-131, released during routine operation of the station, may be made available to man resulting in a dose to the thyroid. The principal pathway of interest for this radionuclide is ingestion of radioiodine in milk. As Zion Station is not operational and I-131 has decayed away, the maximum offsite concentration is estimated to be zero, as expected.

3.1.3 Dose to Thyroid

The hypothetical thyroid dose to a maximum exposed individual living near the station via ingestion of milk was calculated. As Zion Station is not operational and 1-131 has decayed away, the maximum offsite concentration is estimated to be zero, as expected.

3.2 Liquid Effluent Pathways

The three principal pathways through the aquatic environment for potential doses to man from liquid waste are ingestion of potable water, eating aquatic foods, and exposure while on the shoreline. Not all of these pathways are significant or applicable at a given time but a reasonable approximation of the dose can be made by adjusting the dose formula for season of the year or type and degree of use of the aquatic environment. NRC developed equations* were used to calculate the doses to the whole body, lower GI tracts, thyroid, bone, skin; specific parameters for use in the equations are given in the Exelon Offsite Dose Calculation Manual. The maximum whole body dose (total body) for the year was 0.00E+00 mrem (adult) and no organ dose exceeded 0.00E+00 mrem (teenage liver) (Table 3.2-1).

3.3 Assessment of Dose to Member of Public

During the period January to December, 2008, Zion Station did not exceed the below limits as shown in Table 3.1-1 and Table 3.2-1 (based on yearly average meteorological data), and Figure 3.1-1 (based on concurrent meteorological data):

- The RETS limits on dose or dose commitment to an individual due to radioactive materials in liquid effluents from each reactor unit (3 mrem to the whole body or 10 mrem to any organ during any calendar year).

- The RETS limits on air dose in noble gases released in gaseous effluents to a member of the public from each reactor unit (10 mrads for gamma radiation or 20 mrad for beta radiation during any calendar year).

- The RETS limits on dose to a member of the public due to iodine-131, iodine-133, tritium, and radionuclides in particulate form 'with half-lives greater than eight days in gaseous effluents released from each reactor unit (15 mrem to any organ during any calendar year).

- The 10CFR20 limit on Total Effective Dose Equivalent to individual members of the public (100 mrem).

4.0 SITE METEOROLOGY

A summary of the site meteorological measurements taken during each calendar quarter of the year is given in Appendix 11. The data are presented as cumulative joint frequency

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*Nuclear Regulatory Commission, Regulatory Guide 1.109 (Rev. 1) distributions of the wind direction for the 250' level and wind speed class by atmospheric stability class determined from the temperature difference between the 250' and 35' levels. Data recovery for these measurements was 99.2% during 2008 (Table 3.4-1).

APPENDIX E-1

DATA TABLES AND FIGURES

Table 2.0-1
Solid Radioactive Waste

Table 2.0-1 has been deliberately deleted. For details on solid waste disposal, see the Zion 2008 Annual Effluent Report

Table 3.1-1
Maximum Doses Resulting from Airborne Releases

RETDAS v3.6.3 <ZIO> VSSI

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Report for: 2008
Unit Range - From: 1 To: 2

=== I&P DOSE LIMIT ANALYSIS ========== ANNUAL 2008 =========

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2008 - Admin. Any Organ			0.00E+00	1.00E+01	0.00E+00
2008 - Admin. Total Body			0.00E+00	1.00E+01	0.00E+00
2008 - T.Spc. Any Organ			0.00E+00	1.50E+01	0.00E+00

Receptor: 0
Distance: (meters) Compass Point:
Critical Pathway:
Major Contributors (0% or greater to total)

Nuclide	Percentage

2008 - T.Spc. Total Body			0.00E+00	1.50E+01	0.00E+00

Receptor: 0
Distance: (meters) Compass Point:
Critical Pathway:
Major Contributors (0% or greater to total)

Nuclide	Percentage

Table 3.1-1 (continued)
Maximum Doses Resulting from Airborne Releases

RETDAS v3.6.3 <ZIO> VSSI

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GASEOUS DOSE SUMMARY

Report for: 2008
Unit Range - From: 1 To: 2

=== NG DOSE LIMIT ANALYSIS ========== ANNUAL 2008 =========

Annual - Limit	Dose (mrad)	Limit (mrad)	Max % of Limit
2008 - Admin. Gamma	0.00E+00	5.00E+00	0.00E+00
2008 - Admin. Beta	0.00E+00	1.00E+01	0.00E+00
2008 - T.Spc. Gamma	0.00E+00	1.00E+01	0.00E+00

Receptor: 0
Distance: (meters) Compass Point:
Nuclide Percentage

2008 - T.Spc. Beta	0.00E+00	2.00E+01	0.00E+00

Receptor: 0
Distance: (meters) Compass Point:
Nuclide Percentage

Table 3.2-1
Maximum Doses Resulting from Liquid Effluents

RETDAS v3.6.3 <ZIO> VSSI

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

LIQUID DOSE SUMMARY

Report for: 2008
Unit Range - From: 1 To: 2

Liquid Receptor

=== PERIOD DOSE BY ORGAN AND AGE GROUP (mrem) ========== ANNUAL 2008 =========

Agegrp	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	TB

=== SITE DOSE LIMIT ANALYSIS ========== ANNUAL 2008 =========

Annual - Limit	Age Group	Organ	Dose (mrem)	Limit (mrem)	Max % of Limit
2008 - Admin. Any Organ			0.00E+00	5.00E+00	0.00E+00
2008 - Admin. Total Body	ADULT	TBODY	0.00E+00	2.25E+00	0.00E+00
2008 - T.Spc. Any Organ			0.00E+00	1.00E+01	0.00E+00

Critical Pathway:
Major Contributors (0% or greater to total)

Nuclide	Percentage

2008 - T.Spc. Total Body	ADULT	TBODY	0.00E+00	3.00E+00	0.00E+00

Critical Pathway: Potable Water (PWtr)
Major Contributors (0% or greater to total)

Nuclide	Percentage

Table 3.3-1
10CFR20 Compliance Assessment

ZION STATION
2008
Unit 1
10CFR20 Compliance Assessment

1. 10CFR 20.1301 (a) (1) Compliance

Total Effective Dose Equivalent 0.00E00 mrem/year

10 CFR 20.1301 (a) (1) limit 100 mrem/year

% of the limit 0.00000000

2. Compliance Summary 10CFR20

	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr	% of Limit
TEDE	0	0	0	0	0.00000000

ZION STATION
2008
Unit 2
10CFR20 Compliance Assessment

1. 10CFR 20.1301 (a) (1) Compliance

Total Effective Dose Equivalent 0.00E00 mrem/year

10 CFR 20.1301 (a) (1) limit 100 mrem/year

% of the limit 0.00000000

2. Compliance Summary 10CFR20

	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr	% of Limit
TEDE	0	0	0	0	0.00000000

Table 3.4-1
Maximum Doses Resulting from Airborne Released Based on Concurrent Meteorological Data

Zion Station - Unit 1

MAXIMUM DOSES RESULTING FROM AIRBORNE RELEASES

2008

TYPE OF DOSE	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER	ANNUAL
GAMMA AIR (mrad)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)
BETA AIR (mrad)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)
WHOLE BODY (mrem)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)
SKIN (mrem)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)
ORGAN (mrem)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)
CRITICAL PERSON	Adult	Adult	Adult	Adult	Adult
CRITICAL ORGAN	Bone	Bone	Bone	Bone	Bone

COMPLIANCE STATUS

TYPE OF DOSE	10 CFR 50 APP. I QUARTERLY OBJECTIVE	% OF APP. I	10 CFR 50 APP.I YEARLY OBJECTIVE	% OF APP. I
GAMMA AIR (mrad)	5.0	0.00	10.0	0.00
BETA AIR (mrad)	10.0	0.00	20.0	0.00
WHOLE BODY (mrem)	2.5	0.00	5.0	0.00
SKIN (mrem)	7.5	0.00	15.0	0.00
ORGAN (mrem)	7.5	0.00	15.0	0.00
CRITICAL PERSON		Adult		Adult
CRITICAL ORGAN		Bone		Bone

Calculation used release data from the following:
Unit 1 - Ground

Date of calculation: 2/11/2009

Table 3.4-1 (continued)
Maximum Doses Resulting from Airborne Released Based on Concurrent Meteorological Data

Zion Station - Unit 2

MAXIMUM DOSES RESULTING FROM AIRBORNE RELEASES

2008

TYPE OF DOSE	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER	ANNUAL
GAMMA AIR (mrad)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)
BETA AIR (mrad)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)
WHOLE BODY (mrem)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)
SKIN (mrem)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)
ORGAN (mrem)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)	0.000E+00(N)
CRITICAL PERSON	Adult	Adult	Adult	Adult	Adult
CRITICAL ORGAN	Bone	Bone	Bone	Bone	Bone

COMPLIANCE STATUS

TYPE OF DOSE	10 CFR 50 APP. I QUARTERLY OBJECTIVE	% OF APP. I	10 CFR 50 APP.I YEARLY OBJECTIVE	% OF APP. I
GAMMA AIR (mrad)	5.0	0.00	10.0	0.00
BETA AIR (mrad)	10.0	0.00	20.0	0.00
WHOLE BODY (mrem)	2.5	0.00	5.0	0.00
SKIN (mrem)	7.5	0.00	15.0	0.00
ORGAN (mrem)	7.5	0.00	15.0	0.00
CRITICAL PERSON		Adult		Adult
CRITICAL ORGAN		Bone		Bone

Calculation used release data from the following:
Unit 2 - Ground

Date of calculation: 2/11/2009

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APPENDIX F

METEOROLOGICAL DATA

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Extremely Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	2	0	0	0	2
NE	0	0	1	0	0	0	1
ENE	0	0	0	0	0	0	0
E	0	0	1	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	1	0	0	1
WSW	0	0	2	3	0	0	5
W	0	0	8	5	0	0	13
WNW	0	0	5	0	0	0	5
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	0	19	9	0	0	28

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 2
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Moderately Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	3	0	0	0	3
NE	0	0	2	0	0	0	2
ENE	0	0	1	0	0	0	1
E	0	0	2	0	0	0	2
ESE	0	0	2	0	0	0	2
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	2	3	0	0	0	5
WSW	0	1	4	1	0	0	6
W	0	2	5	2	0	0	9
WNW	0	1	2	0	0	0	3
NW	0	0	2	0	0	0	2
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	6	26	3	0	0	35

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 1
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Slightly Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	2	0	0	2
NNE	0	1	5	3	0	0	9
NE	0	0	1	0	0	0	1
ENE	0	1	3	0	0	0	4
E	0	0	0	0	0	0	0
ESE	0	0	1	0	0	0	1
SE	0	0	0	0	0	0	0
SSE	0	0	1	0	0	0	1
S	0	1	1	0	0	0	2
SSW	0	0	7	0	0	0	7
SW	0	1	4	0	0	0	5
WSW	0	1	4	4	0	0	9
W	0	3	15	3	0	0	21
WNW	0	3	3	0	0	0	6
NW	0	0	1	1	0	0	2
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	11	46	13	0	0	70

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Neutral - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	6	35	14	0	0	55
NNE	0	14	33	13	0	0	60
NE	1	6	11	10	1	0	29
ENE	0	5	8	4	12	0	29
E	0	5	17	16	7	0	45
ESE	0	22	24	2	0	0	48
SE	1	12	20	0	0	0	33
SSE	1	7	39	16	1	0	64
S	2	34	35	11	0	0	82
SSW	6	22	49	13	1	0	91
SW	6	25	17	11	5	0	64
WSW	8	38	40	16	0	0	102
W	6	42	96	32	6	0	182
WNW	5	35	80	13	3	0	136
NW	1	15	59	0	0	0	75
NNW	0	12	13	5	0	0	30
Variable	0	0	0	0	0	0	0
Total	37	300	576	176	36	0	1125

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 39
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Slightly Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	5	8	27	6	0	0	46
NNE	6	11	21	8	0	0	46
NE	2	18	2	6	3	0	31
ENE	1	9	2	1	3	0	16
E	1	9	5	2	0	1	18
ESE	2	7	10	1	0	0	20
SE	2	13	16	0	0	0	31
SSE	1	14	14	10	2	0	41
S	5	36	19	8	0	0	68
SSW	5	16	10	6	0	0	37
SW	11	37	7	4	0	0	59
WSW	12	23	7	2	0	0	44
W	8	30	23	12	1	0	74
WNW	13	46	11	1	0	0	71
NW	9	45	17	0	0	0	71
NNW	2	33	7	0	0	0	42
Variable	0	0	0	0	0	0	0
Total	85	355	198	67	9	1	715

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 9
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Moderately Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	3	0	0	0	0	0	3
NNE	0	1	0	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	1	0	0	0	0	0	1
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	3	0	0	0	0	3
SSE	0	4	12	2	0	0	18
S	0	12	8	0	0	0	20
SSW	4	0	1	0	0	0	5
SW	6	2	0	0	0	0	8
WSW	0	6	0	1	0	0	7
W	5	7	0	0	0	0	12
WNW	9	18	0	0	0	0	27
NW	4	3	0	0	0	0	7
NNW	1	3	0	0	0	0	4
Variable	0	0	0	0	0	0	0
Total	33	59	21	3	0	0	116

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Extremely Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	4	11	0	0	0	15
S	0	1	5	0	0	0	6
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	4	0	0	0	0	4
W	0	7	0	0	0	0	7
WNW	0	4	0	0	0	0	4
NW	0	3	0	0	0	0	3
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	23	16	0	0	0	39

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Extremely Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	2	0	0	0	2
NE	0	0	0	0	0	0	0
ENE	0	0	1	0	0	0	1
E	0	0	0	0	0	0	0
ESE	0	0	1	0	0	0	1
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	3	1	0	4
W	0	0	0	7	4	0	11
WNW	0	0	1	3	5	0	9
NW	0	0	0	2	0	0	2
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	0	5	15	10	0	30

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Moderately Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	1	1	0	0	2
NE	0	0	3	0	0	0	3
ENE	0	0	1	0	0	0	1
E	0	0	1	0	0	0	1
ESE	0	0	3	0	0	0	3
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	3	4	1	0	8
W	0	0	1	2	3	0	6
WNW	0	0	4	0	4	0	8
NW	0	0	0	3	1	0	4
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	0	17	10	9	0	36

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Slightly Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	2	0	2
NNE	0	0	3	2	2	0	7
NE	0	0	2	0	1	0	3
ENE	0	0	4	0	0	0	4
E	0	0	0	0	0	0	0
ESE	0	0	1	0	0	0	1
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	1	2	0	0	3
SSW	0	0	0	2	0	0	2
SW	0	0	3	5	0	0	8
WSW	0	1	1	2	1	0	5
W	0	0	3	9	2	2	16
WNW	0	3	2	7	1	2	15
NW	0	0	0	1	1	0	2
NNW	0	0	0	1	1	0	2
Variable	0	0	0	0	0	0	0
Total	0	4	20	31	11	4	70

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Neutral - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	14	12	13	3	42
NNE	0	4	16	33	20	3	76
NE	0	8	7	6	9	4	34
ENE	0	2	3	7	3	6	21
E	0	2	7	5	11	15	40
ESE	1	3	12	15	14	2	47
SE	0	6	12	20	12	1	51
SSE	1	5	16	26	2	1	51
S	0	2	12	22	10	1	47
SSW	0	6	20	53	7	14	100
SW	1	7	18	19	17	13	75
WSW	2	10	42	26	10	5	95
W	0	19	33	55	37	11	155
WNW	0	13	26	65	31	24	159
NW	0	6	24	58	25	5	118
NNW	0	8	10	26	3	0	47
Variable	0	0	0	0	0	0	0
Total	5	101	272	448	224	108	1158

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 6
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Slightly Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	4	8	20	0	0	32
NNE	0	8	9	15	26	8	66
NE	0	7	14	5	1	9	36
ENE	1	5	9	4	0	3	22
E	1	3	9	1	1	5	20
ESE	0	0	5	10	4	1	20
SE	0	5	5	16	5	1	32
SSE	0	6	3	13	9	3	34
S	2	5	6	14	3	2	32
SSW	1	6	18	25	10	7	67
SW	1	5	29	11	5	2	53
WSW	0	9	27	14	1	0	51
W	0	0	14	22	16	7	59
WNW	1	6	15	24	7	3	56
NW	0	6	25	47	4	0	82
NNW	1	4	28	23	0	0	56
Variable	0	0	0	0	0	0	0
Total	8	79	224	264	92	51	718

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 7
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Moderately Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	2	0	0	0	2
NNE	0	2	2	1	0	0	5
NE	0	1	1	0	0	0	2
ENE	0	0	0	0	0	0	0
E	0	0	1	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	0	1	0	0	0	0	1
SSE	0	1	1	0	2	0	4
S	0	0	1	10	11	3	25
SSW	1	0	1	6	3	1	12
SW	0	2	1	2	0	0	5
WSW	0	0	8	3	0	0	11
W	0	0	3	2	1	0	6
WNW	0	3	4	6	0	0	13
NW	0	0	4	10	1	0	15
NNW	0	0	9	5	0	0	14
Variable	0	0	0	0	0	0	0
Total	1	10	38	45	18	4	116

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: January - March 2008
Stability Class - Extremely Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	3	0	0	0	3
NNE	0	0	1	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	1	0	1
S	0	0	0	3	9	3	15
SSW	0	0	2	1	2	0	5
SW	0	0	0	0	0	0	0
WSW	0	0	0	1	0	0	1
W	0	0	1	4	0	0	5
WNW	0	0	0	3	0	0	3
NW	0	0	2	1	0	0	3
NNW	0	0	2	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	0	0	11	13	12	3	39

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Extremely Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	1	0	0	1
NE	0	3	3	0	0	0	6
ENE	0	0	3	0	0	0	3
E	0	3	2	0	0	0	5
ESE	0	1	2	0	0	0	3
SE	0	0	2	0	0	0	2
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	2	0	0	2
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	7	12	3	0	0	22

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Moderately Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	1	0	1
NNE	0	0	4	1	0	0	5
NE	0	2	3	0	0	0	5
ENE	0	1	1	0	0	0	2
E	0	2	0	0	0	0	2
ESE	0	0	1	0	0	0	1
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	1	0	1
WSW	0	0	0	2	2	0	4
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	5	9	3	4	0	21

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Slightly Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	5	1	0	6
NNE	0	0	4	3	0	0	7
NE	0	5	3	0	0	0	8
ENE	0	2	3	0	0	0	5
E	0	1	2	0	0	0	3
ESE	0	1	0	0	0	0	1
SE	0	2	2	0	0	0	4
SSE	0	0	2	0	0	0	2
S	0	0	0	0	0	0	0
SSW	0	0	0	5	0	0	5
SW	0	1	2	1	1	0	5
WSW	0	1	6	2	2	0	11
W	0	1	1	4	0	0	6
WNW	0	0	2	0	0	0	2
NW	0	0	1	0	0	0	1
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	14	28	20	4	0	66

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Neutral - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	2	14	34	30	17	0	97
NNE	1	28	17	4	0	0	50
NE	1	24	5	0	0	0	30
ENE	2	9	1	6	0	0	18
E	0	9	3	0	0	0	12
ESE	2	13	1	0	0	0	16
SE	0	8	3	0	0	0	11
SSE	0	5	15	0	0	0	20
S	0	4	3	3	0	0	10
SSW	0	3	9	15	3	0	30
SW	0	5	28	11	0	0	44
WSW	0	12	39	15	1	0	67
W	0	10	30	6	1	0	47
WNW	0	10	27	3	0	0	40
NW	0	6	34	3	0	0	43
NNW	0	1	3	3	0	0	7
Variable	0	0	0	0	0	0	0
Total	8	161	252	99	22	0	542

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Slightly Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	3	44	38	13	0	0	98
NNE	10	48	17	0	0	0	75
NE	3	15	9	1	0	0	28
ENE	3	5	4	3	1	1	17
E	3	8	7	1	0	0	19
ESE	5	8	2	0	0	0	15
SE	8	21	5	0	0	0	34
SSE	2	27	42	4	0	0	75
S	6	20	24	5	0	0	55
SSW	6	22	17	25	0	0	70
SW	14	23	21	5	0	0	63
WSW	5	32	22	2	1	0	62
W	7	32	21	0	0	0	60
WNW	2	17	9	0	0	0	28
NW	2	18	1	1	0	0	22
NNW	8	10	5	1	0	0	24
Variable	0	0	0	0	0	0	0
Total	87	350	244	61	2	1	745

Hours of calm in this stability class: 3
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Moderately Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	7	15	1	0	0	0	23
NNE	5	12	2	0	0	0	19
NE	4	7	2	0	0	0	13
ENE	3	1	0	0	0	0	4
E	3	2	5	1	0	0	11
ESE	6	7	1	0	0	0	14
SE	2	11	5	1	0	0	19
SSE	4	21	32	8	1	0	66
S	11	29	11	2	0	0	53
SSW	11	10	2	0	0	0	23
SW	13	13	0	0	0	0	26
WSW	13	12	0	0	0	0	25
W	14	17	0	0	0	0	31
WNW	5	9	0	0	0	0	14
NW	7	3	1	0	0	0	11
NNW	4	1	1	0	0	0	6
Variable	0	0	0	0	0	0	0
Total	112	170	63	12	1	0	358

Hours of calm in this stability class: 2
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Extremely Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	4	0	0	0	0	5
NNE	5	3	1	0	0	0	9
NE	2	3	0	0	0	0	5
ENE	2	1	0	0	0	0	3
E	3	2	0	0	0	0	5
ESE	3	7	2	0	0	0	12
SE	0	8	3	0	0	0	11
SSE	4	12	20	3	1	0	40
S	3	26	6	0	0	0	35
SSW	11	2	0	0	0	0	13
SW	9	4	1	0	0	0	14
WSW	17	12	0	0	0	0	29
W	13	6	0	0	0	0	19
WNW	2	0	0	0	0	0	2
NW	3	0	0	0	0	0	3
NNW	2	0	0	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	80	90	33	3	1	0	207

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Extremely Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	1	0	1
NE	0	0	4	1	0	0	5
ENE	0	0	3	1	0	0	4
E	0	1	0	2	0	0	3
ESE	0	2	0	1	0	0	3
SE	0	0	2	2	0	0	4
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	2	2
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	3	9	7	1	2	22

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Moderately Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	1	2	1	1	5
NE	0	0	5	1	0	0	6
ENE	0	0	2	0	0	0	2
E	0	1	0	0	0	0	1
ESE	0	0	1	1	0	0	2
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	4	4
W	0	0	0	0	0	1	1
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	1	9	4	1	6	21

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Slightly Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	1	1
NNE	0	0	3	2	4	4	13
NE	0	0	5	0	0	0	5
ENE	0	1	2	1	0	0	4
E	0	2	2	0	0	0	4
ESE	0	0	2	0	0	0	2
SE	0	0	0	3	0	0	3
SSE	0	0	1	1	0	0	2
S	0	0	0	1	0	0	1
SSW	0	0	0	0	3	0	3
SW	0	0	0	0	3	0	3
WSW	0	0	1	3	2	4	10
W	0	0	2	2	5	0	9
WNW	0	0	0	1	3	0	4
NW	0	0	0	0	1	0	1
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	3	18	14	21	9	65

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 1
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Neutral - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	4	8	11	13	15	51
NNE	0	6	35	25	9	17	92
NE	0	6	13	3	0	0	22
ENE	0	5	12	0	3	3	23
E	1	8	3	0	0	0	12
ESE	0	5	7	0	1	0	13
SE	0	3	6	2	2	0	13
SSE	0	3	9	4	1	0	17
S	0	0	5	6	1	0	12
SSW	0	1	2	1	9	9	22
SW	0	0	6	18	6	3	33
WSW	0	0	9	32	17	12	70
W	0	2	10	21	10	4	47
WNW	0	1	11	19	16	0	47
NW	0	0	10	29	15	0	54
NNW	0	0	3	2	1	0	6
Variable	0	0	0	0	0	0	0
Total	1	44	149	173	104	63	534

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 8
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Slightly Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	5	15	21	6	3	51
NNE	0	13	41	43	10	2	109
NE	1	11	16	7	4	0	39
ENE	0	5	5	4	3	2	19
E	1	5	8	5	9	2	30
ESE	4	4	6	2	4	0	20
SE	2	10	8	10	5	0	35
SSE	0	8	20	25	15	1	69
S	0	9	8	22	9	4	52
SSW	0	4	3	5	27	10	49
SW	0	2	19	30	8	4	63
WSW	0	6	20	29	10	1	66
W	0	5	13	31	9	1	59
WNW	1	2	11	24	7	0	45
NW	0	2	7	11	0	0	20
NNW	1	1	8	9	1	1	21
Variable	0	0	0	0	0	0	0
Total	11	92	208	278	127	31	747

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 1
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Moderately Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	2	1	0	0	3
NNE	2	3	12	3	0	0	20
NE	2	11	4	3	2	1	23
ENE	0	5	6	2	1	2	16
E	0	8	1	1	1	3	14
ESE	1	3	3	1	4	0	12
SE	1	5	12	5	5	0	28
SSE	1	7	5	24	17	8	62
S	1	12	11	13	11	5	53
SSW	0	1	5	8	4	1	19
SW	0	2	7	18	3	0	30
WSW	1	1	5	8	4	0	19
W	0	1	5	7	0	0	13
WNW	0	4	4	16	0	0	24
NW	0	1	3	6	2	0	12
NNW	1	2	3	6	0	0	12
Variable	0	0	0	0	0	0	0
Total	10	66	88	122	54	20	360

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: April - June 2008
Stability Class - Extremely Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	1	3	0	0	0	5
NNE	0	2	2	0	0	0	4
NE	1	2	0	1	0	1	5
ENE	1	1	0	0	0	0	2
E	2	1	1	0	0	0	4
ESE	1	3	0	1	2	0	7
SE	0	7	2	1	3	4	17
SSE	0	2	5	7	4	1	19
S	0	5	4	25	15	5	54
SSW	0	7	12	22	4	0	45
SW	2	6	4	4	0	0	16
WSW	1	1	1	6	4	0	13
W	0	0	2	2	0	0	4
WNW	0	0	3	4	0	0	7
NW	0	3	1	0	0	0	4
NNW	0	2	0	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	9	43	40	73	32	11	208

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 217

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Extremely Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	2	20	0	0	0	22
NE	0	7	9	0	0	0	16
ENE	0	7	3	0	0	0	10
E	0	6	1	0	0	0	7
ESE	0	15	2	0	0	0	17
SE	0	5	0	0	0	0	5
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	42	35	0	0	0	77

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Moderately Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	1	0	0	1
NNE	0	4	11	0	0	0	15
NE	0	8	2	0	0	0	10
ENE	0	1	0	0	0	0	1
E	0	4	2	0	0	0	6
ESE	0	2	1	0	0	0	3
SE	0	1	1	0	0	0	2
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	2	0	0	0	2
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	20	19	1	0	0	40

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Slightly Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	1	5	2	0	0	8
NNE	0	3	9	0	0	0	12
NE	0	11	3	0	0	0	14
ENE	0	5	2	0	0	0	7
E	0	9	1	0	0	0	10
ESE	0	10	0	0	0	0	10
SE	0	1	0	0	0	0	1
SSE	0	2	0	0	0	0	2
S	0	0	0	0	0	0	0
SSW	0	1	0	0	0	0	1
SW	0	0	9	0	0	0	9
WSW	0	4	10	0	0	0	14
W	0	3	5	2	0	0	10
WNW	0	4	3	0	0	0	7
NW	0	0	1	0	0	0	1
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	54	48	4	0	0	106

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Neutral - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	22	25	1	0	0	48
NNE	1	48	19	2	0	0	70
NE	2	14	4	2	0	0	22
ENE	6	11	1	2	0	0	20
E	2	13	2	0	0	0	17
ESE	2	20	2	0	0	0	24
SE	4	35	4	0	0	0	43
SSE	0	16	38	11	0	0	65
S	0	12	2	1	0	0	15
SSW	3	9	13	0	0	0	25
SW	0	12	16	5	0	0	33
WSW	3	32	15	0	0	0	50
W	3	26	27	4	0	0	60
WNW	2	22	14	0	0	0	38
NW	1	20	15	0	0	0	36
NNW	1	12	8	0	0	0	21
Variable	0	0	0	0	0	0	0
Total	30	324	205	28	0	0	587

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Slightly Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	10	31	21	1	0	0	63
NNE	4	25	33	2	0	0	64
NE	4	16	17	5	0	0	42
ENE	5	9	3	0	0	0	17
E	6	11	7	1	0	0	25
ESE	5	11	4	0	0	0	20
SE	5	31	17	0	0	0	53
SSE	6	25	38	17	0	0	86
S	12	47	6	0	0	0	65
SSW	4	37	20	0	0	0	61
SW	14	37	15	0	0	0	66
WSW	9	58	18	0	0	0	85
W	11	59	8	0	0	0	78
WNW	8	53	3	0	0	0	64
NW	11	35	4	0	0	0	50
NNW	7	23	4	0	0	0	34
Variable	0	0	0	0	0	0	0
Total	121	508	218	26	0	0	873

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Moderately Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	7	3	1	0	0	0	11
NNE	3	1	1	0	0	0	5
NE	2	0	0	0	0	0	2
ENE	1	1	0	0	0	0	2
E	1	1	0	0	0	0	2
ESE	1	4	0	0	0	0	5
SE	1	3	1	0	0	0	5
SSE	3	9	2	0	0	0	14
S	11	23	1	0	0	0	35
SSW	26	12	0	0	0	0	38
SW	13	21	0	0	0	0	34
WSW	23	31	0	0	0	0	54
W	37	20	0	0	0	0	57
WNW	17	12	1	0	0	0	30
NW	21	23	0	0	0	0	44
NNW	12	5	0	0	0	0	17
Variable	0	0	0	0	0	0	0
Total	179	169	7	0	0	0	355

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Extremely Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	2	0	0	0	0	0	2
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	1	0	0	0	0	1
SSE	0	3	0	0	0	0	3
S	3	2	0	0	0	0	5
SSW	16	3	0	0	0	0	19
SW	8	1	0	0	0	0	9
WSW	16	3	0	0	0	0	19
W	42	21	0	0	0	0	63
WNW	24	8	0	0	0	0	32
NW	9	3	0	0	0	0	12
NNW	2	0	0	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	122	45	0	0	0	0	167

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Extremely Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	7	9	0	0	16
NE	0	0	17	4	0	0	21
ENE	0	0	6	2	0	0	8
E	0	1	5	0	0	0	6
ESE	0	0	13	1	0	0	14
SE	0	0	11	1	0	0	12
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	1	59	17	0	0	77

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Moderately Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	1	0	1
NNE	0	0	5	9	0	0	14
NE	0	0	10	0	0	0	10
ENE	0	0	2	0	0	0	2
E	0	0	0	0	0	0	0
ESE	0	1	6	1	0	0	8
SE	0	0	1	2	0	0	3
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	2	0	0	2
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	1	24	14	1	0	40

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Slightly Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	1	1	0	2
NNE	0	0	12	5	0	0	17
NE	0	4	9	1	0	0	14
ENE	0	3	1	2	0	0	6
E	0	5	3	0	0	0	8
ESE	0	3	4	0	0	0	7
SE	0	3	4	1	0	0	8
SSE	0	0	2	0	0	0	2
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	4	2	0	0	6
WSW	0	0	5	9	0	0	14
W	0	0	3	8	2	0	13
WNW	0	0	4	1	1	0	6
NW	0	0	1	2	0	0	3
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	18	52	32	4	0	106

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Neutral - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	8	13	14	3	0	38
NNE	0	14	39	15	3	0	71
NE	0	15	11	2	5	1	34
ENE	2	8	3	2	2	0	17
E	1	10	3	0	0	0	14
ESE	1	13	1	6	0	0	21
SE	0	21	22	4	0	0	47
SSE	0	8	31	12	7	0	58
S	0	6	13	7	2	1	29
SSW	0	3	4	4	1	0	12
SW	2	2	8	14	8	0	34
WSW	0	4	21	14	0	0	39
W	0	13	24	29	10	0	76
WNW	1	4	11	14	4	0	34
NW	0	7	18	18	1	0	44
NNW	0	1	11	7	0	0	19
Variable	0	0	0	0	0	0	0
Total	7	137	233	162	46	2	587

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Slightly Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	6	23	17	5	1	52
NNE	1	10	19	24	12	0	66
NE	0	8	20	22	15	3	68
ENE	2	3	8	4	3	0	20
E	3	5	4	8	3	0	23
ESE	0	4	10	7	2	0	23
SE	2	9	21	18	8	0	58
SSE	2	11	23	29	13	0	78
S	1	5	20	26	4	0	56
SSW	0	4	17	19	0	0	40
SW	0	6	20	39	5	0	70
WSW	1	4	28	43	5	0	81
W	1	4	36	39	8	1	89
WNW	0	4	14	35	0	0	53
NW	0	6	13	36	2	0	57
NNW	0	4	16	19	0	0	39
Variable	0	0	0	0	0	0	0
Total	13	93	292	385	85	5	873

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 1
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Moderately Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	6	14	7	1	0	28
NNE	1	8	12	1	1	0	23
NE	2	5	2	0	0	0	9
ENE	1	6	5	0	0	0	12
E	2	4	1	0	0	0	7
ESE	0	2	1	1	3	0	7
SE	0	1	7	2	3	0	13
SSE	2	3	8	4	0	0	17
S	2	5	14	12	0	0	33
SSW	2	1	12	10	1	0	26
SW	1	3	17	16	0	0	37
WSW	2	5	8	25	4	0	44
W	1	4	8	27	3	0	43
WNW	1	3	6	10	1	0	21
NW	0	4	5	9	0	0	18
NNW	1	2	3	10	2	0	18
Variable	0	0	0	0	0	0	0
Total	18	62	123	134	19	0	356

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: July - September 2008
Stability Class - Extremely Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	4	5	0	0	0	9
NNE	0	4	5	0	0	0	9
NE	1	7	1	0	0	0	9
ENE	6	4	3	0	0	0	13
E	2	2	1	0	0	0	5
ESE	2	3	1	0	0	0	6
SE	0	2	0	0	0	0	2
SSE	2	2	0	0	0	0	4
S	1	6	2	6	0	0	15
SSW	1	5	1	11	0	0	18
SW	2	3	5	5	0	0	15
WSW	0	2	7	3	0	0	12
W	0	4	7	4	0	0	15
WNW	0	3	5	8	1	0	17
NW	1	8	2	2	0	0	13
NNW	0	4	0	1	0	0	5
Variable	0	0	0	0	0	0	0
Total	18	63	45	40	1	0	167

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 1
Hours of missing stability measurements in all stability classes: 0

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Extremely Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	1	0	0	0	1
NE	0	0	1	0	0	0	1
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	2	0	0	0	2
SE	0	1	1	0	0	0	2
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	1	5	0	0	0	6

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Moderately Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	3	0	0	0	3
NE	0	0	1	0	0	0	1
ENE	0	1	0	0	0	0	1
E	0	1	0	0	0	0	1
ESE	0	1	1	0	0	0	2
SE	0	0	1	0	0	0	1
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	3	6	0	0	0	9

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Slightly Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	1	0	0	0	1
NNE	0	2	3	0	0	0	5
NE	0	2	0	0	0	0	2
ENE	0	2	0	0	0	0	2
E	0	3	0	2	0	0	5
ESE	0	3	2	2	0	0	7
SE	0	2	1	0	0	0	3
SSE	0	0	0	0	0	0	0
S	0	0	1	0	0	0	1
SSW	0	0	1	1	0	0	2
SW	0	0	2	0	0	0	2
WSW	0	0	1	0	0	0	1
W	0	0	2	2	0	0	4
WNW	0	0	4	0	0	0	4
NW	0	0	4	0	0	0	4
NNW	0	0	1	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	0	14	23	7	0	0	44

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Neutral - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Speed (in mph)

Wind Direction	1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	4	7	4	0	0	15
NNE	0	9	7	0	0	0	16
NE	1	11	2	3	3	0	20
ENE	0	1	1	2	4	1	9
E	0	3	7	5	3	0	18
ESE	1	1	23	14	1	0	40
SE	0	8	16	7	0	0	31
SSE	0	7	23	19	9	0	58
S	0	7	12	2	1	0	22
SSW	3	12	24	10	0	0	49
SW	1	11	25	3	0	0	40
WSW	0	14	23	20	4	0	61
W	1	28	56	27	9	0	121
WNW	1	21	66	3	0	0	91
NW	1	26	39	14	0	0	80
NNW	1	21	22	20	0	0	64
Variable	0	0	0	0	0	0	0
Total	10	184	353	153	34	1	735

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 17
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Slightly Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	6	7	8	1	0	22
NNE	1	10	9	10	3	0	33
NE	0	4	9	1	1	0	15
ENE	0	2	4	2	1	1	10
E	1	10	13	1	0	0	25
ESE	3	6	22	7	0	0	38
SE	2	18	15	7	0	0	42
SSE	0	13	29	11	4	0	57
S	7	51	20	24	1	0	103
SSW	16	58	48	39	1	0	162
SW	11	36	40	6	0	0	93
WSW	7	40	24	6	1	0	78
W	7	57	41	10	6	0	121
WNW	5	37	42	9	0	0	93
NW	5	59	58	8	0	0	130
NNW	1	22	12	3	0	0	38
Variable	0	0	0	0	0	0	0
Total	66	429	393	152	19	1	1060

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 29
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Moderately Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	3	0	0	0	0	4
NNE	0	0	0	0	0	0	0
NE	1	0	0	0	0	0	1
ENE	0	1	0	0	0	0	1
E	1	2	0	0	0	0	3
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	2	7	15	4	0	0	28
S	7	32	5	2	0	0	46
SSW	11	16	0	0	0	0	27
SW	7	4	0	0	0	0	11
WSW	16	4	4	0	0	0	24
W	7	9	0	0	0	0	16
WNW	3	3	0	0	0	0	6
NW	2	11	0	0	0	0	13
NNW	1	4	0	0	0	0	5
Variable	0	0	0	0	0	0	0
Total	59	96	24	6	0	0	185

Hours of calm in this stability class: 2
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Extremely Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 35 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	3	10	1	0	0	14
S	7	10	6	0	0	0	23
SSW	1	3	0	0	0	0	4
SW	3	2	0	0	0	0	5
WSW	6	3	0	0	0	0	9
W	21	11	0	0	0	0	32
WNW	12	7	0	0	0	0	19
NW	2	7	0	0	0	0	9
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	52	46	16	1	0	0	115

Hours of calm in this stability class: 1
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Extremely Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	2	0	0	0	2
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	1	0	1
SE	0	0	1	0	2	0	3
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	0	3	0	3	0	6

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Moderately Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	0	0	0	0
NNE	0	0	2	1	0	0	3
NE	0	0	1	0	0	0	1
ENE	0	0	0	0	0	0	0
E	0	1	1	0	0	0	2
ESE	0	0	0	0	1	0	1
SE	0	0	1	0	1	0	2
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	1	5	1	2	0	9

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Slightly Unstable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	0	1	0	0	1
NNE	0	0	6	0	0	0	6
NE	0	0	1	0	0	0	1
ENE	0	1	1	0	0	0	2
E	0	1	0	0	1	0	2
ESE	0	0	4	0	5	0	9
SE	0	1	2	1	0	0	4
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	2	1	0	3
SW	0	0	0	1	1	0	2
WSW	0	0	1	0	0	0	1
W	0	0	0	3	0	2	5
WNW	0	0	0	4	0	0	4
NW	0	0	0	2	1	0	3
NNW	0	0	1	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	0	3	16	14	9	2	44

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Neutral - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	3	7	5	0	3	18
NNE	0	3	7	5	0	0	15
NE	0	5	6	2	0	6	19
ENE	0	1	0	0	1	6	8
E	0	3	0	7	3	3	16
ESE	0	0	3	13	20	3	39
SE	0	1	10	11	16	7	45
SSE	0	3	10	14	16	2	45
S	0	3	7	9	3	3	25
SSW	0	5	9	20	14	0	48
SW	0	4	8	22	3	1	38
WSW	0	5	12	20	13	14	64
W	1	9	16	36	18	26	106
WNW	0	7	20	69	13	2	111
NW	0	5	20	34	21	3	83
NNW	0	8	15	12	20	4	59
Variable	0	0	0	0	0	0	0
Total	1	65	150	279	161	83	739

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 13
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Slightly Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	0	0	3	7	3	6	19
NNE	0	0	8	12	4	10	34
NE	1	0	3	12	1	2	19
ENE	0	1	1	4	2	2	10
E	0	0	6	11	2	0	19
ESE	2	3	3	17	8	5	38
SE	0	0	20	13	19	8	60
SSE	0	3	10	17	5	5	40
S	1	8	24	31	15	20	99
SSW	0	10	40	56	47	11	164
SW	0	3	24	47	16	3	93
WSW	0	5	29	30	9	5	78
W	0	4	29	41	17	12	103
WNW	0	8	15	40	27	6	96
NW	1	3	13	82	27	3	129
NNW	1	1	14	33	4	2	55
Variable	0	0	0	0	0	0	0
Total	6	49	242	453	206	100	1056

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 34
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Moderately Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	1	2	5	1	0	0	9
NNE	0	0	3	0	0	0	3
NE	0	0	3	0	0	0	3
ENE	0	0	0	0	0	0	0
E	1	0	2	1	0	0	4
ESE	0	1	2	0	1	0	4
SE	0	1	5	2	0	0	8
SSE	0	3	3	2	7	4	19
S	1	0	9	16	14	2	42
SSW	1	1	10	23	2	0	37
SW	1	0	2	1	0	0	4
WSW	0	1	3	3	1	0	8
W	0	1	9	7	4	0	21
WNW	0	0	5	5	0	0	10
NW	0	0	2	1	0	0	3
NNW	0	4	2	6	0	0	12
Variable	0	0	0	0	0	0	0
Total	5	14	65	68	29	6	187

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

Zion Nuclear Station

Period of Record: October - December2008
Stability Class - Extremely Stable - 250Ft-33Ft Delta-T (F)
Winds Measured at 250 Feet

Wind Direction	Wind Speed (in mph) 1-3	4-7	8-12	13-18	19-24	> 24	Total
N	5	3	7	0	0	0	15
NNE	0	2	3	0	0	0	5
NE	1	0	1	0	0	0	2
ENE	0	1	1	0	0	0	2
E	1	0	0	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	1	0	0	0	0	0	1
SSE	0	2	0	0	1	0	3
S	0	3	7	16	8	0	34
SSW	0	0	2	9	2	0	13
SW	1	3	3	1	0	0	8
WSW	1	2	0	0	0	0	3
W	1	1	0	0	0	0	2
WNW	0	0	1	3	0	0	4
NW	2	0	2	2	0	0	6
NNW	5	3	9	0	0	0	17
Variable	0	0	0	0	0	0	0
Total	18	20	36	31	11	0	116

Hours of calm in this stability class: 0
Hours of missing wind measurements in this stability class: 0
Hours of missing stability measurements in all stability classes: 4

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APPENDIX G

ANNUAL RADIOLOGICAL GROUNDWATER PROTECTION PROGRAM REPORT (ARGPPR)

Docket No: 50-295
50-304

ZION NUCLEAR POWER STATION
UNITS 1 and 2

Annual Radiological
Groundwater Protection Program Report

1 January Through 31 December 2008

Prepared By

Teledyne Brown Engineering
Environmental Services

Exelon SM
Nuclear

Zion Nuclear Power Station
Zion, IL 60099

May 2009

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Appendices

I. Summary and Conclusions

In 2006, Exelon instituted a comprehensive program to evaluate the impact of station operations on groundwater and surface water in the vicinity of Zion Nuclear Power Station. This is the second in a series of annual reports on the status of the Radiological Groundwater Protection Program (RGPP) conducted at Zion Nuclear Power Station. This report covers both groundwater and surface water samples, collected from the environment, on station property in 2008. During that time period, 32 analyses were performed on 16 samples from eight locations. Phase 1 of the monitoring was part of a comprehensive study initiated by Exelon to determine whether groundwater or surface water at and in the vicinity of Zion Nuclear Power Station had been adversely impacted by any releases of radionuclides. Phase 1 was conducted by Conestoga Rovers and Associates (CRA) and the conclusions were made available to state and federal regulators as well as the public on an Exelon web site http://www.exeloncorp.com/ourcompanies/powergen/nuclear/Tritium.htm]. Phase 2 of the RGPP was conducted by Exelon corporate and station personnel to initiate follow up of Phase 1 and begin long-term monitoring at groundwater and surface water locations selected during Phase 1. All analytical results from Phase 2 monitoring are reported herein.

In assessing all the data gathered for this report, it was concluded that the operation of Zion Nuclear Power Station had no adverse radiological impact on the environment, and there are no known active releases into the groundwater at Zion Nuclear Power Station.

Gamma-emitting radionuclides were not detected at concentrations greater than their respective Lower Limits of Detection (LLDs) in any of the groundwater or surface water samples.

Strontium-89/90 was not detected at a concentration greater than the LLD of 2.0 picoCuries per liter (pCi/L) in any of the groundwater or surface water samples tested.

Tritium was not detected in any of the surface water samples analyzed. Low levels of tritium were detected at a concentration greater than the LLD of 200 pCi/L in one groundwater sample analyzed. In the case of tritium, Exelon specified that it's laboratories achieve a lower limit of detection 10 times lower than that required by federal regulation.

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II. Introduction

The Zion Nuclear Power Station (ZNPS), consisting of two 1100 MWt pressurized water reactor owned and operated by Exelon Corporation, is located in Zion, Illinois adjacent to Lake Michigan. Unit No. 1 went critical in December 1973. Unit No. 2 went critical in September 1974. The plant permanently ceased operation in January of 1998 and has been permanently defueled. The site is located in northeast Illinois on the western shore of Lake Michigan, approximately 50 miles north of Chicago, Illinois.

This report covers those analyses performed by Teledyne Brown Engineering (TBE) and Environmental Inc. (Midwest Labs) on samples collected in 2006.

A. Objective of the RGPP

The long-term objectives of the RGPP are as follows:

1. Identify suitable locations to monitor and evaluate potential impacts from station operations before significant radiological impact to the environment and potential drinking water sources.

2. Understand the local hydrogeologic regime in the vicinity of the station and maintain up-to-date knowledge of flow patterns on the surface and shallow subsurface.

3. Perform routine water sampling and radiological analysis of water from selected locations.

4. Report new leaks, spills, or other detections with potential radiological significance to stakeholders in a timely manner.

5. Regularly assess analytical results to identify adverse trends.

6. Take necessary corrective actions to protect groundwater resources.

B. Implementation of the Objectives

The objectives identified have been implemented at Zion Nuclear Power Station as discussed below:

1. Exelon and its consultant identified locations as described in the Phase 1 study. Phase 1 studies were conducted by Conestoga Rovers and Associates (CRA) and the results and conclusions were made available to state and federal regulators as well as the public on an Exelon web site in station specific reports.

http://www.exeloncorp.com/ourcompanies/powergen/nuclear/Tritium.htm

2. The Zion Nuclear Power Station reports describe the local hydrogeologic regime. Periodically, the flow patterns on the surface and shallow subsurface are updated based on ongoing measurements.

3. Zion Nuclear Power Station will continue to perform routine sampling and radiological analysis of water from selected locations.

4. Zion Nuclear Power Station has implemented new procedures to identify and report new leaks, spills, or other detections with potential radiological significance in a timely manner.

5. Zion Nuclear Power Station staff and consulting hydrogeologist assess analytical results on an ongoing basis to identify adverse trends.

C. Program Description

1. Sample Collection

Sample locations can be found in Table A—1 and Figures A–1 and A–2, Appendix A.

Groundwater and Surface Water

Samples of water are collected, managed, transported and analyzed in accordance with approved procedures following EPA methods. Groundwater samples were collected. Sample locations, sample collection frequencies and analytical frequencies are controlled in accordance with approved station procedures. Contractor and/or station personnel are trained in the collection, preservation management, and shipment of samples, as well as in documentation of sampling events. Analytical laboratories are subject to internal quality assurance programs, industry cross-check programs, as well as nuclear industry audits. Station personnel review and evaluate all analytical data deliverables as data are received.

Analytical data results are reviewed by both station personnel and an independent hydrogeologist for adverse trends or changes to hydrogeologic conditions.

D. Characteristics of Tritium (H-3)

Tritium (chemical symbol H-3) is a radioactive isotope of hydrogen. The most common form of tritium is tritium oxide, which is also called "tritiated water." The chemical properties of tritium are essentially those of ordinary hydrogen.

Tritiated water behaves the same as ordinary water in both the environment and the body. Tritium can be taken into the body by drinking water, breathing air, eating food, or absorption through skin. Once tritium enters the body, it disperses quickly and is uniformly distributed throughout the body. Tritium is excreted primarily through urine with a clearance rate characterized by an effective biological half-life of about 14 days. Within one month or so after ingestion, essentially all tritium is cleared. Organically bound tritium (tritium that is incorporated in organic compounds) can remain in the body for a longer period.

Tritium is produced naturally in the upper atmosphere when cosmic rays strike air molecules. Tritium is also produced during nuclear weapons explosions, as a by-product in reactors producing electricity, and in special production reactors, where the isotopes lithium-7 and/or boron-10 are activated to produce tritium. Like normal water, tritiated water is colorless and odorless. Tritiated water behaves chemically and physically like non-tritiated water in the subsurface, and therefore tritiated water will travel at the same velocity as the average groundwater velocity.

Tritium has a half-life of approximately 12.3 years. It decays spontaneously to helium-3 (3He). This radioactive decay releases a beta particle (low-energy electron). The radioactive decay of tritium is the source of the health risk from exposure to tritium. Tritium is one of the least dangerous radionuclides because it emits very weak radiation and leaves the body relatively quickly. Since tritium is almost always found as water, it goes directly into soft tissues and organs. The associated dose to these tissues is generally uniform and is dependent on the water content of the specific tissue.

III. Program Description

A. Sample Analysis

This section describes the general analytical methodologies used by TBE to analyze the environmental samples for radioactivity for the Zion Nuclear Power Station RGPP in 2008.

In order to achieve the stated objectives, the current program includes the following analyses:

1. Concentrations of gamma emitters in groundwater and surface water.

2. Concentrations of strontium in groundwater and surface water.

3. Concentrations of tritium in groundwater and surface water.

B. Data Interpretation

The radiological data collected prior to Zion Nuclear Power Station becoming operational were used as a baseline with which these operational data were compared. For the purpose of this report, Zion Nuclear Power Station was considered operational at initial criticality. Several factors were important in the interpretation of the data:

1. Lower Limit of Detection and Minimum Detectable Concentration

The lower limit of detection (LLD) is specified by federal regulation as a minimum sensitivity value that must be achieved routinely by the analytical parameter.

2. Laboratory Measurements Uncertainty

The estimated uncertainty in measurement of tritium in environmental samples is frequently on the order of 50% of the measurement value.

Statistically, the exact value of a measurement is expressed as a range with a stated level of confidence. The convention is to report results with a 95% level of confidence. The uncertainty comes from calibration standards, sample volume or weight measurements, sampling uncertainty and other factors. Exelon reports the uncertainty of a measurement created by statistical process (counting error) as well as all sources of error (Total Propagated Uncertainty or TPU). Each result has two values calculated. Exelon reports the TPU by following the result with plus or minus ± the estimated sample standard deviation, as TPU, that is obtained by propagating all sources of analytical uncertainty in measurements.

Analytical uncertainties are reported at the 95% confidence level in this report for reporting consistency with the AREOR.

C. Background Analysis

A pre-operational radiological environmental monitoring program (pre-operational REMP) was conducted to establish background radioactivity levels prior to operation of the Station. The environmental media sampled and analyzed during the pre-operational REMP were atmospheric radiation, fall-out, domestic water, surface water, marine life, and foodstuffs. The results of the monitoring were detailed in the report entitled, Environmental Radiological Monitoring for Zion Nuclear Power Nuclear Power Station, Commonwealth Edison Company, Annual Report 1973, May 1974.

The pre-operational REMP contained analytical results from samples collected from the surface water and groundwater.

Tritium levels in Lake Michigan water were studied in the vicinity of Zion Station throughout 1970. The concentration of tritium in the surface water samples from the Lake at Zion ranged from approximately 311 ± 20 pCi/L to 374 ± 34 pCi/L and averaged 340 pCi/L. There was no statistical difference in average tritium concentrations among the stations (eight stations from Kenosha to Waukegan).

Prior to 1998, surface water samples were collected at the following six locations along Lake Michigan:

- Kenosha, Wisconsin (intake located 10 miles north of the station)
- Lake County Public Water District (intake located 1.1 miles north of the Station)
- Waukegan, Illinois (intake located 6 miles south of the Station)
- North Chicago, Illinois (intake located 10 miles south of the Station)
- Great Lakes NTS (intake located 13 miles south of the Station)
- Lake Forest, Illinois (intake located 16.5 miles south of the Station)

After 1998, surface water samples were collected at the following four locations along Lake Michigan:

- Kenosha, Wisconsin (intake located 10 miles north of the station)
- Lake County Public Water District (intake located 1.1 miles north of the Station)
- Waukegan, Illinois (intake located 6 miles south of the Station)
- Lake Forest, Illinois (intake located 16.5 miles south of the Station)

Lake Michigan surface water data are collected as part of the REMP. Tritium concentrations in surface water samples from Lake Michigan ranged from non-detect to 660 pCi/L.

Groundwater was collected from one off-site well on a quarterly basis. Gamma isotopic, radiostrontium and tritium analyses were performed on all samples. Strontium-89, strontium-90, tritium and gamma emitters were below their respective LLDs.

1. Background Concentrations of Tritium

The purpose of the following discussion is to summarize background measurements of tritium in various media performed by others. Additional detail may be found by consulting references (CRA 2006).

a. Tritium Production

Tritium is created in the environment from naturally occurring processes both cosmic and subterranean, as well as from anthropogenic (i.e., man-made) sources. In the upper atmosphere, "Cosmogenic" tritium is produced from the bombardment of stable nuclides and combines with oxygen to form tritiated water, which will then enter the hydrologic cycle. Below ground, "lithogenic" tritium is produced by the bombardment of natural lithium present in crystalline rocks by neutrons produced by the radioactive decay of naturally abundant uranium and thorium. Lithogenic production of tritium is usually negligible compared to other sources due to the limited abundance of lithium in rock. The lithogenic tritium is introduced directly to groundwater.

A major anthropogenic source of tritium and strontium-90 comes from the former atmospheric testing of thermonuclear weapons. Levels of tritium in precipitation increased significantly during the 1950s and early 1960s, and later with additional testing, resulting in the release of significant amounts of tritium to the atmosphere. The Canadian heavy water nuclear power reactors, other commercial power reactors, nuclear research and weapons production continue to influence tritium concentrations in the environment.

b. Precipitation Data

Precipitation samples are routinely collected at stations around the world for the analysis of tritium and other radionuclides. Two publicly available databases that provide tritium concentrations in precipitation are Global Network of Isotopes in Precipitation (GNIP) and USEPA's RadNet

database. GNIP provides tritium precipitation concentration data for samples collected world wide from 1960 to 2006. RadNet provides tritium precipitation concentration data for samples collected at stations through out the U.S. from 1960 up to and including 2006. Based on GNIP data for sample stations located in the U.S. Midwest, tritium concentrations peaked around 1963. This peak, which approached 10,000 pCi/L for some stations, coincided with the atmospheric testing of thermonuclear weapons. Tritium concentrations in surface water showed a sharp decline up until 1975 followed by a gradual decline since that time. Tritium concentrations in Midwest precipitation have typically been below 100 pCi/L since around 1980. Tritium concentrations in wells may still be above the 200 pCi/L detection limit from the external causes described above. Water from previous years and decades is naturally captured in groundwater, so some well water sources today are affected by the surface water from the 1960s that were elevated in tritium.

c. Surface Water Data

Tritium concentrations are routinely measured in large surface water bodies, including Lake Michigan and the Mississippi River. Illinois surface water data were typically less than 100 pCi/L.

The USEPA RadNet surface water data typically has a reported 'Combined Standard Uncertainty' of 35 to 50 pCi/L. According to USEPA, this corresponds to a ± 70 to 100 pCi/L 95% confidence bound on each given measurement. Therefore, the typical background data provided may be subject to measurement uncertainty of approximately ± 70 to 100 pCi/L.

The radio-analytical laboratory is counting tritium results to an Exelon specified LLD of 200 pCi/L. Typically, the lowest positive measurement will be reported within a range of 40 – 240 pCi/L or 140 ± 100 pCi/L. Clearly, these sample results cannot be distinguished as different from background at this concentration.

IV. Results and Discussion

A. Groundwater and Surface Water Results

Groundwater and Surface Water

Samples were collected from on -site wells throughout the year in accordance with the station radiological groundwater protection program. Analytical results and anomalies are discussed below.

Tritium

Samples from all locations were analyzed for tritium activity (Table B–I.1, Appendix B) (Table B–II.1, Appendix B). Tritium was detected in one of the groundwater samples analyzed. The tritium concentration was 168 ± 100 pCi/L. Zion Nuclear Power Station does not have any off-site wells and therefore there is no risk to off-site users.

Strontium

Strontium-90 was not detected in any of the samples and the required LLD of 2.0 pCi/liter was met. (Table B–I.1, Appendix B) (Table B–II.1, Appendix B)

Gamma Emitters

No gamma-emitting radionuclides were detected in 2008. (Table B–I.2, Appendix B) (Table B–II.1, Appendix B)

B. Drinking Water Well Survey

A drinking water well survey was conducted during the summer 2006 by CRA (CRA 2006) around the Zion Nuclear Power Station.

C. Summary of Results – Inter-Laboratory Comparison Program

Inter-Laboratory Comparison Program results for TBE and Environmental Inc. (Midwest Labs) are presented in the AREOR.

D. Leaks, Spills, and Releases

There were no leaks, spills or releases.

E. Trends

There are no previously identified plumes therefore there are no trends.

F. Investigations

Conclusions from the Phase 1 report have been made available to state and federal regulators as well as the public on an Exelon web site: http://www.exeloncorp.com/ourcompanies/powergen/nuclear/Tritium.htm.

G. Actions Taken

1. Compensatory Actions

   There have been no station events requiring compensatory actions at the Zion Nuclear Power Station.

2. Installation of Monitoring Wells

   No new wells were required to be installed.

3. Actions to Recover/Reverse Plumes

   There have been no station events requiring actions to recover/reverse any plumes.

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APPENDIX A

LOCATION & DIRECTION

ATTACHMENT 1: Sampling Locations for the Radiological Groundwater Protection Program, Zion Station, 2008.

Site	Site Type	Temporary/Permanent	Distance
MW-ZN-01S	Monitoring Well	Permanent	On-Site
MW-ZN-02S	Monitoring Well	Permanent	On-Site
MW-ZN-03S	Monitoring Well	Permanent	On-Site
MW-ZN-04S	Monitoring Well	Permanent	On-Site
MW-ZN-05S	Monitoring Well	Permanent	On-Site
MW-ZN-06S	Monitoring Well	Permanent	On-Site
MW-ZN-07S	Monitoring Well	Permanent	On-Site
MW-ZN-08S	Monitoring Well	Permanent	On-Site
MW-ZN-09S	Monitoring Well	Permanent	On-Site
MW-ZN-10S	Monitoring Well	Permanent	On-Site
MW-ZN-11S	Monitoring Well	Permanent	On-Site
SW-ZN-1	Surface Water	Lake Michigan	On-Site

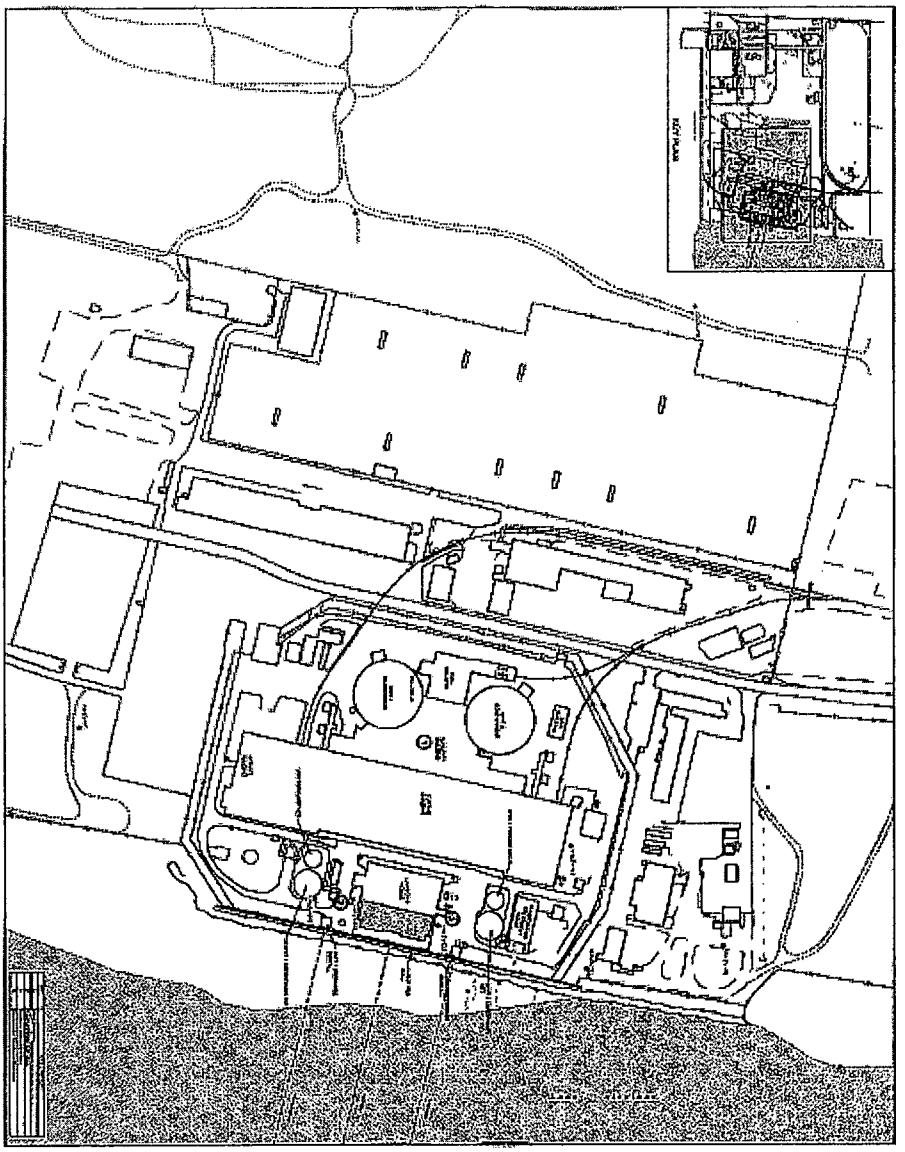

Figure A-1

Radiological Ground Water Protection Program
Groundwater and Surface Water Locations of the Zion Station, 2008

APPENDIX B

DATA TABLES

TABLE B-I.1 CONCENTRATIONS OF TRITIUM AND STRONIUM IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR POWER STATION, 2008

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3	SR-90
MW-ZN-01S	09/23/08	168 ± 100	< 1
MW-ZN-01S	04/21/08	< 188	
MW-ZN-02S	09/23/08	< 139	< 1
MW-ZN-02S	04/21/08	< 197	
MW-ZN-03S	09/24/08	< 140	< 1
MW-ZN-03S	04/21/08	< 193	
MW-ZN-04S	09/24/08	< 144	< 1
MW-ZN-04S	04/21/08	< 193	
MW-ZN-09S	09/23/08	< 141	< 1
MW-ZN-09S	04/21/08	< 198	
MW-ZN-10S	09/23/08	< 137	< 1
MW-ZN-10S	04/22/08	< 195	
MW-ZN-11S	09/23/08	< 143	< 1
MW-ZN-11S	04/22/08	< 192	

TABLE B-I.2 **CONCENTRATIONS OF GAMMA EMITTERS IN GROUNDWATER SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR STATION, 2008**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

STC	COLLECTION PERIOD	Be-7	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
MW-ZN-01S	09/23/08	< 39	< 73	< 4	< 5	< 10	< 4	< 9	< 5	< 7	< 4	< 4	< 38	< 12
MW-ZN-10S	09/23/08	< 40	< 89	< 4	< 5	< 11	< 4	< 11	< 5	< 8	< 4	< 4	< 36	< 14
MW-ZN-11S	09/23/08	< 37	< 74	< 4	< 4	< 10	< 3	< 7	< 4	< 7	< 3	< 3	< 35	< 12
MW-ZN-02S	09/23/08	< 50	< 44	< 6	< 6	< 10	< 5	< 12	< 6	< 9	< 5	< 5	< 38	< 14
MW-ZN-03S	09/24/08	< 45	< 47	< 4	< 4	< 11	< 4	< 8	< 5	< 8	< 4	< 4	< 35	< 9
MW-ZN-04S	09/24/08	< 43	< 93	< 4	< 5	< 8	< 4	< 7	< 4	< 8	< 4	< 5	< 36	< 10
MW-ZN-09S	09/23/08	< 49	< 84	< 5	< 6	< 12	< 5	< 12	< 5	< 7	< 5	< 5	< 45	< 15

TABLE B-II.1 CONCENTRATIONS OF TRITIUM AND STRONIUM IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR STATION, 2008

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

SITE	COLLECTION DATE	H-3	SR-90
SW-ZN-01	04/21/08	< 188	
SW-ZN-01	09/23/08	< 146	< 2

TABLE B-II.2 **CONCENTRATIONS OF GAMMA EMITTERS IN SURFACE WATER SAMPLES COLLECTED IN THE VICINITY OF ZION NUCLEAR STATION, 2008**

RESULTS IN UNITS OF PCI/LITER ± 2 SIGMA

STC	COLLECTION PERIOD	Be-7	K-40	Mn-54	Co-58	Fe-59	Co-60	Zn-65	Nb-95	Zr-95	Cs-134	Cs-137	Ba-140	La-140
SW-ZN-01	09/23/08	< 49	< 40	< 4	< 5	< 12	< 5	< 9	< 5	< 10	< 4	< 4	< 44	< 13