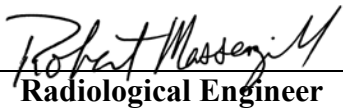
ZION SOLUTIONS LLC
An EnergySolutions Company

ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

DIESEL GENERATOR HEAT EXCHANGERS SERVICE WATER SUPPLY AND SERVICE WATER RETURN BURIED PIPE SURVEY UNIT 00101F

PREPARED BY / DATE:	R. Massengill		2019-11-23
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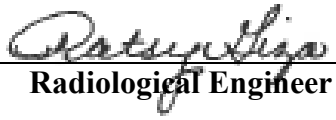
REVIEWED BY / DATE:	P. Giza		2019-11-23
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TABLE OF CONTENTS

List of Tables

LIST OF ACRONYMS AND ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
AMCG	Average Member of the Critical Group
BcDCGL	Base Case Derived Concentration Guideline Level
BcSOF	Base Case Sum of Fractions
DQO	Data Quality Objective
DCGL	Derived Concentration Guideline Level
FOV	Field of View
FSS	Final Status Survey
HTD	Hard-to-Detect
ID	Internal Diameter
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
NaI	Sodium Iodide
OpDCGL	Operational Derived Concentration Guideline Level
OpSOF	Operational Sum of Fractions
QAPP	Quality Assurance Project Plan
QC	Quality Control
ROC	Radionuclides of Concern
SOF	Sum of Fractions
TEDE	Total Effective Dose Equivalent
UCL	Upper Confidence Level
ZNPS	Zion Nuclear Power Station
ZSRP	Zion Station Restoration Project

1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for survey unit 00101F, the "Diesel Generator Heat Exchangers Service Water Supply and Service Water Return Buried Pipe" (pipe nos. AO-27, AO-28, AO-30, and AO-31) and Service Water Return buried pipe (pipe nos. TO-32 and TO-33), has been generated for the Zion Station Restoration Project (ZSRP). The release record was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-005, "Final Status Survey Data Reporting" (Reference 1) and satisfies the requirements of section 5.11 of the "Zion Station Restoration Project License Termination Plan" (LTP) (Reference 2).

FSS Sample Plan S3-00101AF Plan 6 was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001, "Final Status Survey Package Development" (Reference 3), the ZSRP LTP, and guidance from NUREG-1575, Revision 1, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM) (Reference 4).

Prior to the completion of this FSS, the survey unit numbers for the eight (8) buried pipe survey units listed in the Attachment 4, "Survey Units for Structures" from Zion*Solutions* procedure ZS-LT-300-001-002, "Survey Unit Classification" (Reference 5), were changed. The eight (8) different piping systems for survey unit 00101A were changed to 00101A through 00101H to allow for a clear distinction between these pipes in the FSS Database. The Diesel Generator Heat Exchanger Service Water Supply and Return piping was given the 00101F survey unit number.

The Diesel Generator Heat Exchanger Service Water Supply piping consisted of four (4) lengths of 12-inch internal diameter (ID) pipe that totaled approximately 304.4 feet in length (pipe nos. AO-27, AO-28, AO-30, and AO-31). The Diesel Generator Heat Exchanger Service Water Return buried piping consisted of two lengths of 15-inch ID pipe (pipe nos. TO-32 and TO-33) that traversed 367.2 linear feet under the Turbine Building basement pad.

Final Status Survey was conducted to demonstrate that the concentrations of residual radioactivity are equal to or below site-specific Derived Concentration Guideline Levels (DCGL) corresponding to the dose criterion in 10 CFR 20.1402 "Radiological Criteria for Unrestricted Use'. The Diesel Generator Heat Exchanger Service Water Supply and Return piping (pipe nos. AO-27, AO-28, AO-30, AO-31, TO-32 and TO-33) were classified as MARSSIM Class 3 as described in with Attachment F of TSD 14-016, "Description of Embedded Piping, Penetrations, and Buried Pipe to Remain in Zion End State" (Reference 6).

The Diesel Generator Heat Exchanger Service Water Supply pipes were surveyed with a Ludlum Model 2350-1 Data Logger paired with a Ludlum Model 44-10 Sodium/Iodide (NaI) gamma detector calibrated for a Cs-137 energy window. One-minute static measurements were taken to quantify the activity in the pipe. Each measurement of the 12-inch ID piping had a calculated Field of View (FOV) of 3.14 ft^2 (2,919 cm^2). The total length of the piping included

in this survey unit was 304.4 linear feet. The Service Water Return buried piping was not accessible at the time the survey was performed due to unmitigated groundwater intrusion into the pipe. However, the Service Water Return piping was part of the same system as the Service Water Supply piping and therefore, the radiological conditions in the Supply piping were considered to be radiologically representative of the entire piping system interior, including the Service Water Return buried piping.

For the FSS of the Diesel Generator Heat Exchanger Service Water Supply piping, a total of 256 measurements were obtained. All of the readings were below an Operational Sum of Fractions (OpSOF) of 0.5 when compared against the Operational DCGL for buried pipe ($OpDCGL_{BP}$) with the mean OpSOF result of 0.144. The mean Base Case SOF (BcSOF), when compared to the Base Case DCGL for buried pipe ($BcDCGL_{BP}$) was 0.037, which results in the dose calculated for this survey unit of 0.922 mrem/yr.

2. SURVEY UNIT DESCRIPTION

The Diesel Generator Heat Exchanger Service Water Supply piping consists of 12-inch ID pipe that is 304.4 linear feet in length, which equates to a surface area of 88.8 m^2. The piping consists of 4 sections: for Unit 1, AO-30 (74.5 feet) and AO-31 (77.7 feet), and for Unit 2, AO-27 (74.5 feet) and AO-28 (77.7 feet). The openings for these pipe sections are on the Diesel Generator Room floor (i.e. 567 foot elevation), and on the north and south walls of the Auxiliary Building (i.e. 553 foot and 554 foot elevation respectively).

The Diesel Generator Heat Exchanger Service Water Return buried piping consisted of two (2) sections of 15-inch ID pipe that ran 367.2 linear feet under the Turbine Building basement pad (pipe nos. TO-32 and TO-33). The pipes were cut on the floor opening thus exposing both pipes to groundwater intrusion. At the time of FSS, the Return sections of this pipe were determined to be obstructed by unmitigated groundwater intrusion. Consequently, the measurements taken in the unobstructed sections (pipe nos. AO-27, AO-28, AO-30, and AO-31) were deemed as representative of the entire pipe length in the system. The total length of piping in this survey unit was 671.6 linear feet (204.7 meters). A view of supply piping is included in Attachment 1.

3. CLASSIFICATION BASIS

Survey unit 00101F was classified as Class 3 in accordance with Attachment F of TSD 14-016 and from information taken from the Zion Station Historical Site Assessment (Reference 7).

During the FSS of the Turbine Building and Crib House basements, radiological surveys were performed in several sections of Service Water Piping associated with the Circulating Water Intake Pipe and Circulating Water Discharge Tunnels. No plant-derived radionuclides were positively identified during the performance of these surveys. Radiological surveys were also

performed to support the segmentation and removal of Condensate and Service Water pipe that was connected to the sections of end-state buried pipe. No gross radioactivity greater than background was identified during the scanning performed as part of those surveys.

The Survey Unit Classification Basis for final classification, included a review of the historical information, the results of the survey data and, completion of a final Survey Unit Classification Worksheet. It was concluded that there was a low probability for the presence of residual radioactivity in these pipes in concentrations greater than 50% of the OpDCGLs, justifying a FSS unit classification of Class 3.

4. DATA QUALITY OBJECTIVES

Final Status Survey planning and design hinges on coherence with the Data Quality Objective (DQO) process to ensure, through compliance with explicitly defined inputs and boundaries, that the primary objective of the survey is satisfied. The DQO process is described in the ZSRP LTP in accordance with MARSSIM. The appropriate design for a given survey will be developed using the DQO process as outlined in Appendix D of MARSSIM.

The DQO process incorporated hypothesis testing and probabilistic sampling distributions to control decision errors during data analysis. Hypothesis testing is a process based on the scientific method that compares a baseline condition to an alternate condition. The baseline condition is technically known as the null hypothesis. Hypothesis testing rests on the premise that the null hypothesis is true and that sufficient evidence must be provided for rejection. In designing the survey plan, the underlying assumption, or null hypothesis was that residual activity in the survey unit exceeded the release criteria. Rejection of the null hypothesis would indicate that residual activity within the survey unit does not exceed the release criteria. Therefore, the survey unit would satisfy the primary objective of the FSS sample plan.

The primary objective of the FSS sample plan is to demonstrate that the level of residual radioactivity in survey unit 00101F did not exceed the release criteria specified in the LTP and that the potential dose from residual radioactivity is As Low As Reasonably Achievable (ALARA).

The residual radioactivity in buried piping located below the 588 foot grade that will remain and be subjected to FSS is discussed in LTP Chapter 2, section 2.3.3.7 and TSD 14-016. The dose assessment methods and resulting DCGLs for buried piping are described in detail in TSD 14-015, “Buried Pipe Dose Modeling & DCGLs” (Reference 8) and LTP Chapter 6, section 6.12.

Zion*Solutions* TSD 11-001, “Technical Support Document for Potential Radionuclides of Concern During the Decommissioning of the Zion Station” (Reference 9) established the basis for an initial suite of potential radionuclides of concern (ROC) for the decommissioning of the

Zion Nuclear Power Station (ZNPS). LTP Chapter 2 provides detailed characterization data that described contamination levels in the Containments and Auxiliary Building, which were the primary source of radioactive contaminants. Zion*Solutions* TSD 14-019, "Radionuclides of Concern for Soil and Basement Fill Model Source Terms" (Reference 10) evaluates the results of the concrete core analysis data from the Containments and Auxiliary Building and refines the initial suite of potential ROC by evaluating the dose significance of each radionuclide.

The final ROC for the decommissioning of Zion are Co-60, Cs-134 and Cs-137 (as well as Eu-152 and Eu-154 for Containment), which are gamma emitters, and Ni-63, Sr-90 and H-3 (applicable only to Containment), which are Hard-to-Detect (HTD) radionuclides. LTP section 5.1 states that HTD concentrations will be inferred using a surrogate approach and the maximum ratios from LTP Chapter 5, Table 5-15 unless area-specific ratios as determined by actual survey data are used in lieu of the maximum ratios.

LTP Chapter 6, section 6.5.2 discusses the process used to derive the ROC for the decommissioning of the ZNPS, including the elimination of insignificant dose contributors from the initial suite consistent with the guidance in Section 3.3 of NUREG-1757 "Consolidated Decommissioning Guidance". Based upon the analysis of the Auxiliary Building radionuclide mixture in TSD 14-019, Table 19, it was determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 accounted for 99.5% of all dose in the contaminated concrete mixes. Table 1 presents the ROC for the decommissioning of Auxiliary Building structural surfaces and the normalized mixture fractions based on the radionuclide mixture.

Table 1 – Dose Significant Radionuclides and Mixture

Radionuclide	% of Total Activity (normalized)(1)
Co-60	0.92%
Cs-134	0.01%
Cs-137	75.32%
Ni-63	23.71%
Sr-90	0.05%

(1) Based on maximum percent of total activity from Table 20 of TSD 14-019, normalized to one for the dose significant radionuclides.

At ZNPS, compliance is demonstrated through the summation of dose from four distinct source terms for the end-state (basements, soils, buried pipe and groundwater). Each radionuclide-specific BcDCGL is equivalent to the level of residual radioactivity (above background levels) that could, when considered independently, result in a Total Effective Dose Equivalent (TEDE) of 25 mrem per year to an Average Member of the Critical Group (AMCG). To ensure that the summation of dose from each source term is 25 mrem/year or less after all FSS is completed,

the BcDCGLs are reduced based on an expected, or *a priori*, fraction of the 25 mrem/year dose limit from each source term. The reduced DCGLs, or "Operational" DCGLs can be related to the BcDCGLs as an expected fraction of dose based on an *a priori* assessment of what the expected dose should be based on the results of site characterization, process knowledge and the extent of planned remediation. The OpDCGL is then used as the DCGL for the FSS design of the survey unit (calculation of surrogate DCGLs, investigations levels, etc.). Details of the OpDCGLs derived for each dose component and the basis for the applied *a priori* dose fractions are provided in Zion*Solutions* TSD 17-004, "Operational Derived Concentration Guideline Levels for Final Status Survey" (Reference 11).

The Base Case and Operational DCGLs for Buried Pipe are listed in Tables 5-9 and 5-10 of the LTP, and are reproduced in Table 2.

Table 2 – Base Case and Operational DCGLs for Buried Pipe

Radionuclide	Base Case Buried Pipe DCGL dpm/100cm^2	Operational Buried Pipe DCGL dpm/100cm^2
Co-60	2.64E+04	6.76E+03
Cs-134	4.54E+04	1.16+E04
Cs-137	1.01E+05	2.59E+04
Ni-63	4.89E+07	1.25E+07
Sr-90	4.50E+04	1.15E+04

5. SURVEY DESIGN

The level of effort associated with planning a survey is based on the complexity of the survey and nature of the hazards. Guidance for preparing FSS plans is provided in procedure ZS-LT-300-001-001.

The DQO process determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 would be the ROC in survey unit 00101F. During FSS, concentrations for HTD ROC Ni-63 and Sr-90 are inferred using a surrogate approach. Cs-137 is the principle surrogate radionuclide for Sr-90 and Co-60 is the principle surrogate radionuclide for Ni-63. The mean, maximum and 95% Upper Confidence Level (UCL) of the surrogate ratios for concrete core samples taken in the Auxiliary Building basement were calculated in Zion*Solutions* TSD 14-019, and are presented in Table 3. The maximum ratios will be used in the surrogate calculations during this FSS. The results of the surrogate calculations are listed in Table 4.

Table 3 – Surrogate Ratios

Ratios	Auxiliary Building		
	Mean	Max	95%UCL
Ni-63/Co-60	44.143	180.450	154.632
Sr-90/Cs-137	0.001	0.002	0.002

Table 4 – Surrogate Base Case and Operational DCGLs

Radionuclide	Base Case Buried Pipe DCGL dpm/100cm^2	Operational Buried Pipe DCGL dpm/100cm^2
Co-60	2.41E+04	6.16E+03
Cs-134	4.54E+04	1.16E+04
Cs-137	1.01E+05	2.58E+04

An adjusted gross gamma OpDCGL was also calculated by applying the normalized gamma mixture from Table 1 to the surrogate OpDCGL for Co-60, the surrogate OpDCGL for Cs-137 and the OpDCGL for Cs-134 from Table 3. The adjusted gross gamma OpDCGL for buried pipe was 2.49E+04 dpm/100 cm^2.

The Diesel Generator Heat Exchanger Service Water Supply piping is Class 3 buried pipe. Consequently, a minimum of 1% to 10% areal surface coverage was required. For the survey of pipe internal surfaces, areal coverage is achieved by the "area of detection" for each static measurement taken. Scanning, in the traditional context, is not applicable to the survey of pipe internal surfaces. For the survey of these pipes, the pipe detector was calibrated for the specific geometry of the 12-inch ID Service Water pipes. The most likely geometry for activity in this pipe is for the activity to be collected in the bottom of the pipe. To obtain an efficiency for this geometry, a mock-up of the inner diameter of this pipe was created. The conformal source was positioned inside of the mockup covering 100% of the interior diameter of the pipe and the calibration readings obtained. For the survey of these pipes, the pipe detector was calibrated for the specific geometry of the 12-inch ID Service Water pipes. This geometry covers a FOV of 3.14 ft^2. The total internal surface area of the pipes is 956.3 ft^2 or 228.08 m^2; therefore a minimum of 31 measurements was required to meet an areal surface coverage of 10%.

The initial survey design called for the use of a Ludlum Model 44-162 NaI detector. Initially, background radiation was not subtracted from the readings. The survey commenced as designed and upon insertion of the Ludlum Model 44-162 into the pipe, the gross activity readings were greater than the Action Level calculated for this pipe. In order to minimize the effect of background on the measurements taken in the pipe, a Ludlum Model 44-10, 2 inch x

2 inch NaI detector was calibrated and "windowed" to the Cs-137 energy. An efficiency was then derived for this detector in the geometry described above. Because the initial survey of the pipe with the Ludlum Model 44-162 indicated possible measurements with results exceeding 50% of the OpDCGL, it was decided to survey 100% of the accessible area of the pipe, with a measurement taken at 1-foot intervals.

FSS investigation levels are specified in LTP Chapter 5, section 5.6.4.6, Table 5-25. If a direct measurement for a Class 3 embedded pipe exceeded 50% of the OpDCGL, then an investigation was required. The gross gamma OpDCGL calculated in survey design was 2.49E+04 dpm/100 cm^2. Since the detector used for this survey was set to detect activity for a single nuclide, Cs-137, a second surrogate calculation was performed using Cs-137 as the surrogate nuclide for Cs-134 and Co-60. This calculation resulted in a gross gamma activity of 2.45E+04 dpm/100 cm^2. Fifty percent of this value is 1.23E+04 dpm/100 cm^2. Using the efficiency derived for the Ludlum Model 44-10 detector and assuming a FOV of 3.14 ft^2, this equated to approximately 520 gross cpm for the instrument/detector combination described. This was the Action Level used for the FSS of survey unit 00101F.

In compliance with ZS-LT-01, "Quality Assurance Project Plan (for Characterization and FSS)" (Reference 12), replicate measurements were to be performed on 5% of the static measurement locations. Table 5 provides a synopsis of the survey design for FSS unit 00101F.

Table 5 – Synopsis of Survey Design

FEATURE	DESIGN CRITERIA	BASIS
Survey Unit Area	956.3 ft^2	1 ft (12-inch ID) x 304.4 feet (length) x π
Number of Static Measurements	31	10% areal coverage, Class 3
Measurement Spacing	As needed to obtain sufficient measurements for 10% areal coverage	10% areal coverage, Class 3
DCGLs	• Co-60 – 6.76E+03 dpm/100 cm^2 • Cs-134 – 1.16E+04 dpm/100 cm^2 • Cs-137 –2.59E+04 dpm/100 cm^2 • Ni-63 –1.25E+07 dpm/100 cm^2 • Sr-90 – 1.15E+04 dpm/100 cm^2	OpDCGLs for Buried Pipe, (LTP Chapter 5, Table 5-10)
HTD ROC Analysis	Gross Gamma DCGL adjusted for HTD based on the isotopic mixture	LTP 5.7.1.9
Measurement Investigation Level	>0.5 Gross Gamma OpDCGL	(LTP Chapter 5, Table 5-25)
Scan Survey Area Coverage	N/A	LTP 5.7.1.9
Quality Control (QC)	Replicate measurements were performed on 5% of the static measurement locations	Quality Assurance Project Plan (QAPP)

6. SURVEY IMPLEMENTATION

Survey instructions for this FSS were incorporated into and performed in accordance with FSS Sample Plan S300101A, Plan 6, which was developed in accordance with Zion*Solutions* procedure ZS-LT-300-001-001. The FSS unit was inspected and controlled in accordance with Zion*Solutions* procedure ZS-LT-300-001-003, "Isolation and Control for Final Status Survey" (Reference 13).

Inspections of the pipe were performed with a SeeSnake® pipe camera prior to the start of the survey. The SeeSnake was inserted into each of the pipes from the 567 foot elevation on the Diesel Generator room floor, and from the Auxiliary Building basement 542 foot elevation, through the two (2) pipe openings on the north/south walls at 553 foot and 554 foot elevations.

From the 567 foot, the SeeSnake was able to access approximately 25 feet of the pipe, and from the Auxiliary Building basement, approximately 40 feet of pipe was accessible.

A background value was determined for the detector/instrument combination to be used prior to deployment. The background value was obtained at the location where the pre-use response check of the instrument was performed. The background value was primarily used to ensure that the detector had not become cross-contaminated by any previous use. Background was not subtracted from any measurement.

Daily, prior to, and following use, each detector was subjected to an Operational Response Check in accordance with procedure ZS-LT-300-001-006, "Radiation Surveys of Pipe Interiors Using Sodium/Cesium Iodide Detectors" (Reference 14). The Daily Operational Response Check compared the background response and the response to check sources ranges established for normal background with the detector source response to ensure that the detector was working properly. After the surveys were performed on June 13 and June 14, 2018, an electronic malfunction occurred with the download function of the Ludlum Model 2350-1 which prevented the instrument from connecting with the computer and downloading the stored data. As the instrument/detector combination successfully passed the post-use operational checks, the data that was manually-recorded during the performance of the survey was used to document the survey results.

On June 13, 2018, pipe sections AO-27 and AO-28 were surveyed from the Auxiliary Building. For pipe AO-27, thirty-six (36) measurements were collected, and for pipe AO-28, thirty-eight (38) measurements were collected.

On June 14, 2018, pipe sections AO-30 and AO-31 were surveyed from the Auxiliary Building. For pipe AO-30, thirty-eight (38) measurements were collected, and for pipe AO-31, forty (40) measurements were collected.

On June 18, 2018, surveys were performed on all four (4) pipes from the Diesel Generator room floor at 567 foot elevation. Twenty-six (26) measurements were collected in each of the four (4) pipes.

7. SURVEY RESULTS

The SOF or "unity rule" is applied to the data used for the survey planning, data evaluation and statistical tests for basement surfaces since multiple radionuclide-specific measurements will be performed or the concentrations inferred based on known relationships. The application of the unity rule serves to normalize the data to allow for an accurate comparison of the various data measurements to the release criteria. When the unity rule is applied, the $DCGL_W$ (used for the nonparametric statistical test) becomes one (1). The $BcDCGL_B$ are directly analogous to the

$DCGL_W$ as defined in MARSSIM. The use and application of the unity rule was performed in accordance with section 4.3.3 of MARSSIM.

As described in LTP Chapter 5, section 5.10.3.2, the Sign Test was used to evaluate the measured residual radioactivity against the dose criterion. The OpSOF for each measurement was used as the sum value for the Sign Test. The Sign Test then demonstrated that the mean activity for each ROC was less than the $OpDCGL_B$ at a Type I decision error of 0.05.

For buried pipe, areas of elevated activity were defined as any area identified by measurement (systematic or judgmental) that exceeded the OpDCGL but was less than the BcDCGL. Any area that exceeded the BcDCGL would have required remediation. The OpSOF for a systematic or a judgmental measurement/sample(s) could exceed one without remediation as long as the survey unit passed the Sign Test and, the mean OpSOF for the survey unit did not exceed one. Once the survey data set passed the Sign Test (using OpDCGLs), then the mean radionuclide activity (dpm/100 cm^2) for each ROC from systematic measurements along with any identified elevated areas from systematic and judgmental samples was used with the BcDCGLs to perform a mean BcSOF calculation. The dose from residual radioactivity assigned to the FSS unit is the mean BcSOF multiplied by 25 mrem/yr.

After completion of the FSS measurements in the pipe, the sample plan was reviewed to confirm the completeness of the survey and the survey data was validated in accordance with procedure ZS-LT-300-001-004, “Final Status Survey Data Assessment” (Reference 15). Data processing includes converting measurement data into reporting units, validating instrument applicability and sensitivity, calculating relevant statistical quantities, and verification that all DQO have been met. In accordance with the procedure, a preliminary Data Assessment was prepared.

Since the survey was performed with a Ludlum Model 44-10 set to the Cs-137 window, the calculated gross gamma value was applied to Cs-137, and the Co-60 and Cs-134 values were inferred based on the isotopic mix from Table 1 normalized to the gamma emitting ROC. The normalized mix includes Cs-137 98.78%, Co-60 1.21%, and Cs-134 0.01%. The surrogate ratios for the HTD nuclides listed in Table 5-15 of the LTP (i.e. 180.45 for Ni-63/Co-60; and 0.002 for Sr-90/Cs-137) were then used to infer representative concentrations for HTD ROC.

The results of the data assessment for the Diesel Generator Heat Exchanger Service Water Supply piping are provided in Attachment 2. A statistical summary of the data is presented in Table 6. No observed individual measurement exceeded an OpSOF of 0.5.

The data collected passed the Sign Test. The result of the Sign Test is provided in Attachment 3.

Table 6 – Diesel Generator Service Water Supply – Statistical Quantities
Systematic Measurement Population Individual Measurement Metrics

Total Number of Systematic Measurements	=	256
Number of Quality Control Measurements	=	17
Number of Judgmental/Investigational Measurements	=	0
Total Number of Measurements	=	273
Mean Systematic Measurement OpSOF	=	0.144
Max Individual Systematic Measurement OpSOF	=	0.488
Number of Systematic Measurements with OpSOF >0.5	=	0

Statistical Quantities - Systematic Measurement Population

ROC	MEAN (dpm/100cm^2)	MEDIAN (dpm/100cm^2)	MAX (dpm/100cm^2)	MIN (dpm/100cm^2)	STD. DEV. (dpm/100cm^2)	BcDCGL (dpm/100cm^2)	BcSOF	Avg Dose per ROC
Gross Gamma	3.53E+03	2.99E+03	1.20E+04	1.33E+03	1.73E+03	N/A	N/A	N/A
Co-60	4.31E+01	3.66E+01	1.46E+02	1.63E+01	2.12E+01	2.64E+04	0.002	0.041
Ni-63 (1)	7.77E+03	6.60E+03	2.64E+04	2.94E+03	3.82E+03	4.89E+07	0.000	0.004
Sr-90 (1)	7.05E+00	5.98E+00	2.39E+01	2.66E+00	3.47E+00	4.50E+04	0.000	0.004
Cs-134	4.68E-01	3.97E-01	1.59E+00	1.77E-01	2.30E-01	4.54E+04	0.000	0.000
Cs-137	3.53E+03	2.99E+03	1.20E+04	1.33E+03	1.73E+03	1.01E+05	0.035	0.873

(1) Concentrations for Ni-63 and Sr-90 are inferred

MEAN BcSOF ASSIGNED TO SURVEY UNIT (SYSTEMATIC AVG.)	=	0.037
DOSE ASSIGNED TO SURVEY UNIT (SYSTEMATIC AVG.)	=	0.922 mrem/yr.

8. QUALITY CONTROL

In compliance with ZS-LT-01, replicate measurements were performed on 5% of the survey locations chosen at random. Seventeen (17) replicate measurements were taken. Using the acceptance criteria specified in section 4.1.2 of ZS-LT-01, there was acceptable agreement between the replicate measurements and the original measurements in 15 of the 17 comparisons. Two (2) QC measurements did not fall within 20% of the original measurement. For pipe AO-30, the 19 ft. measurement was approximately 40% less than the original measurement. For pipe AO-30, the 13 ft. measurement was 20.3% greater than the original measurement. All measurements were well below 50% of the DCGL and the instrument and detector passed the post use response check, therefore no further action was deemed necessary. Refer to Attachment 4 for quality control analysis results.

9. INVESTIGATIONS AND RESULTS

As all measurements in the accessible pipe interior surface area were below an OpSOF of 0.5, no investigations were required or performed.

10. REMEDIATION AND RESULTS

No remediation was performed in this survey unit.

11. CHANGES FROM THE SURVEY PLAN

The detector selected for the survey during the survey design (Ludlum Model 44-162) was unable to obtain satisfactory results due to high background readings. A Ludlum Model 44-10 detector was subsequently calibrated for the Cs-137 energy window operating mode and was used to successfully collect the measurements required.

12. DATA QUALITY ASSESSMENT

In accordance with procedure ZS-LT-300-001-004, the DQOs, sample design, and data were reviewed for completeness, accuracy, and consistency. Documentation was determined to be complete and legible. The FSS unit was properly classified as Class 3. All measurement results were individually reviewed and validated. The number of measurements was sufficient to meet 10% areal surface coverage of accessible surfaces. The instrumentation used to perform the FSS was in calibration, capable of detecting the activity with an adequate minimum detectable concentration (MDC) and successfully response checked prior to and following use. An adequate number of replicate measurements were taken and the results meet the acceptance criteria as specified in the QAPP.

13. ANOMALIES

No anomalies were observed during the performance or analyses of the survey.

14. CONCLUSION

Two hundred fifty-six (256) static measurements were taken in the Diesel Generator Service Water Supply Header buried piping (pipe nos. AO-27, AO-28, AO-30 and AO-31). These pipes also represented the Diesel Generator Heat Exchanger Service Water Return buried piping that consisted of two (2) sections of 15-inch ID pipe that ran 367.2 linear feet under the Turbine Building basement pad (pipe nos. TO-32 and TO-33) and were determined to be obstructed by unmitigated groundwater intrusion at the time the FSS was performed. The measurements taken in the unobstructed sections (pipe nos. AO-27, AO-28, AO-30, and AO-31) were deemed as representative of the radiological conditions that would be found in the entire pipe length. The total length of the piping of this survey unit was 671.6 linear feet (204.7 meters). The 256 readings comprised approximately 38% of the total area of the buried piping, therefore the 10% areal surface coverage requirement for a Class 3 buried pipe was achieved.

All of the measurements taken inside the buried pipe were below an OpSOF of 0.5 when compared to the $OpDCGL_{BP}$. The average OpSOF for the survey unit was 0.144. The Sign Test was passed, and the Null Hypothesis was rejected. The requirements for a Class 3 survey unit have been met.

The mean BcSOF for this survey unit is 0.037. The dose contribution from survey unit 00101F, "Diesel Generator Heat Exchangers Service Water Supply and Service Water Return Buried Pipe," is 0.922 mrem/yr. TEDE, based on the average concentration of the ROC in samples used for non-parametric statistical sampling.

Survey unit 00101F, "Diesel Generator Heat Exchangers Service Water Supply and Service Water Return Buried Pipe" is acceptable for unrestricted release.

15. REFERENCES

1. Zion*Solutions* procedure ZS-LT-300-001-005, Final Status Survey Data Reporting
2. Zion Station Restoration Project License Termination Plan
3. Zion*Solutions* procedure ZS-LT-300-001-001, Final Status Survey Package Development
4. NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual
5. Zion*Solutions* procedure ZS-LT-300-001-002, Survey Unit Classification
6. Zion*Solutions* TSD 14-016, Description of Embedded Piping, Penetrations, and Buried Pipe to Remain in Zion End State

7. Zion Station Historical Site Assessment
8. Zion*Solutions* TSD 14-015, Buried Pipe Dose Modeling & DCGLs
9. Zion*Solutions* TSD 11-001, Technical Support Document for Potential Radionuclides of Concern During the Decommissioning of the Zion Station
10. Zion*Solutions* TSD 14-019, Radionuclides of Concern for Soil and Basement Fill Model Source Terms
11. Zion*Solutions* TSD 17-004, Operational Derived Concentration Guideline Levels for Final Status Survey
12. Zion*Solutions* procedure ZS-LT-01, Quality Assurance Project Plan (for Characterization and FSS)
13. Zion*Solutions* procedure ZS-LT-300-001-003, Isolation and Control for Final Status Survey
14. Zion*Solutions* procedure ZS-LT-300-001-006, Radiation Surveys of Pipe Interiors Using Sodium/Cesium Iodide Detectors
15. Zion*Solutions* procedure ZS-LT-300-001-004, Final Status Survey Data Assessment

16. ATTACHMENTS

Attachment 1 – 12 Inch Service Water Supply Headers

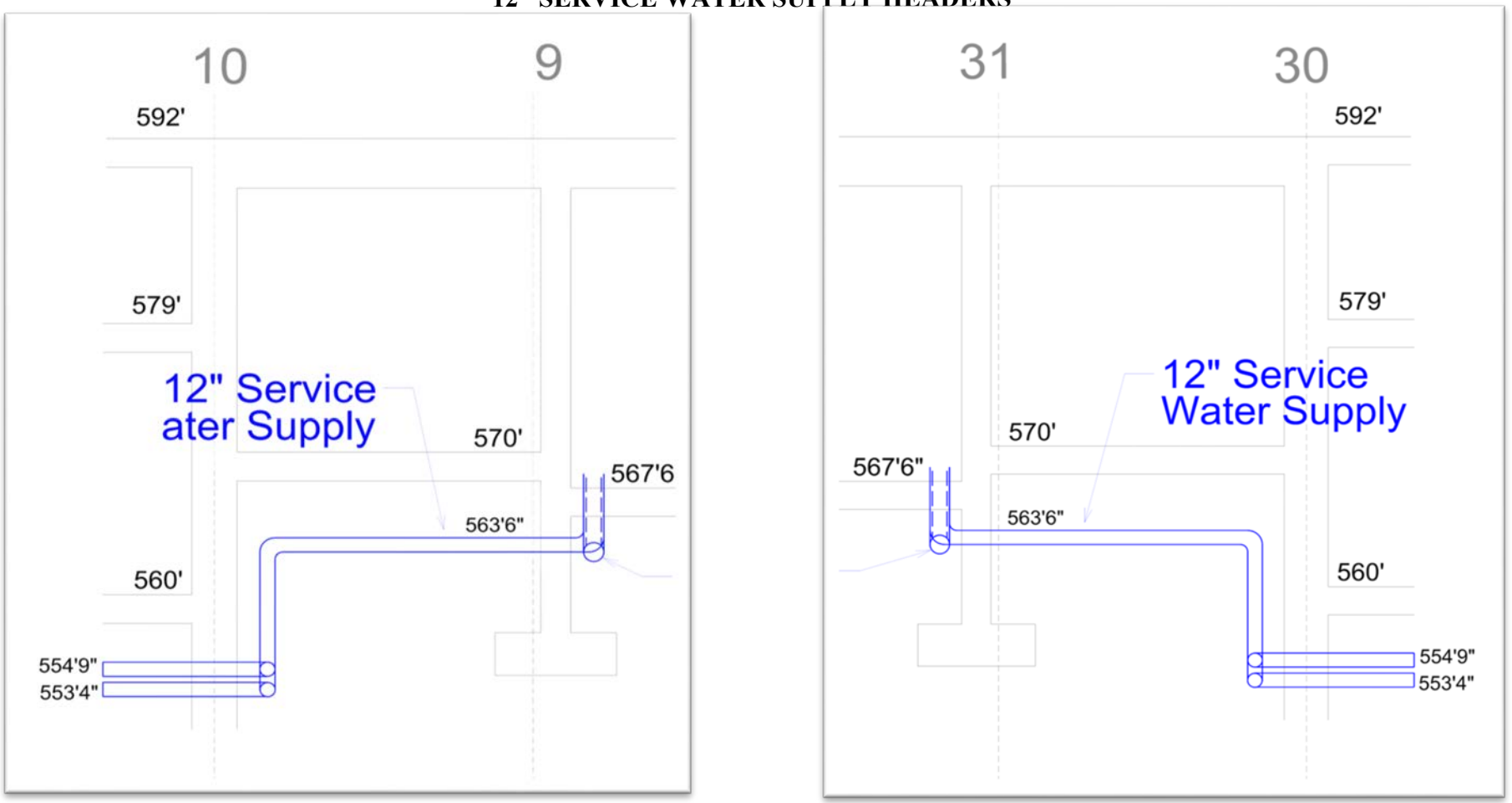
Attachment 2 – Sample Data

Attachment 3 – Sign Test

Attachment 4 – QC Data

ATTACHMENT 1
12 INCH SERVICE WATER SUPPLY HEADERS

12" SERVICE WATER SUPPLY HEADERS



Unit 2

Note: Refer to Plant Design Drawing M-106

Unit 1

ATTACHMENT 2
SAMPLE DATA

Pipes AO-27, AO-28, AO-30 and AO-31 Data Reporting

Pipe	Position	Feet into Pipe	Gamma Result (dpm/100cm^2)	Co-60 (dpm/100cm^2)	Ni-63 (dpm/100cm^2)	Sr-90 (dpm/100cm^2)	Cs-134 (dpm/100cm^2)	Cs-137 (dpm/100cm^2)	OpSOF
AO-27	Zero	36	2.74E+03	3.35E+01	6.05E+03	5.49E+00	3.64E-01	2.74E+03	0.112
AO-27	1	35	2.44E+03	2.98E+01	5.38E+03	4.88E+00	3.24E-01	2.44E+03	0.099
AO-27	2	34	5.70E+03	6.96E+01	1.26E+04	1.14E+01	7.57E-01	5.70E+03	0.232
AO-27	3	33	1.05E+04	1.28E+02	2.31E+04	2.10E+01	1.39E+00	1.05E+04	0.428
AO-27	4	32	1.02E+04	1.24E+02	2.24E+04	2.04E+01	1.35E+00	1.02E+04	0.415
AO-27	5	31	1.20E+04	1.46E+02	2.64E+04	2.39E+01	1.59E+00	1.20E+04	0.488
AO-27	6	30	9.31E+03	1.14E+02	2.05E+04	1.86E+01	1.24E+00	9.31E+03	0.380
AO-27	7	29	9.31E+03	1.14E+02	2.05E+04	1.86E+01	1.24E+00	9.31E+03	0.380
AO-27	8	28	9.36E+03	1.14E+02	2.06E+04	1.87E+01	1.24E+00	9.36E+03	0.382
AO-27	9	27	7.88E+03	9.63E+01	1.74E+04	1.58E+01	1.05E+00	7.88E+03	0.321
AO-27	10	26	7.65E+03	9.34E+01	1.69E+04	1.53E+01	1.02E+00	7.65E+03	0.312
AO-27	11	25	6.97E+03	8.51E+01	1.54E+04	1.39E+01	9.25E-01	6.97E+03	0.284
AO-27	12	24	6.71E+03	8.19E+01	1.48E+04	1.34E+01	8.91E-01	6.71E+03	0.274
AO-27	13	23	6.61E+03	8.08E+01	1.46E+04	1.32E+01	8.78E-01	6.61E+03	0.270
AO-27	14	22	6.15E+03	7.51E+01	1.35E+04	1.23E+01	8.16E-01	6.15E+03	0.251
AO-27	15	21	6.17E+03	7.54E+01	1.36E+04	1.23E+01	8.19E-01	6.17E+03	0.252
AO-27	16	20	5.11E+03	6.25E+01	1.13E+04	1.02E+01	6.79E-01	5.11E+03	0.209
AO-27	17	19	5.23E+03	6.39E+01	1.15E+04	1.05E+01	6.95E-01	5.23E+03	0.213
AO-27	18	18	5.02E+03	6.13E+01	1.11E+04	1.00E+01	6.66E-01	5.02E+03	0.205
AO-27	19	17	5.40E+03	6.59E+01	1.19E+04	1.08E+01	7.16E-01	5.40E+03	0.220
AO-27	20	16	5.56E+03	6.79E+01	1.23E+04	1.11E+01	7.38E-01	5.56E+03	0.227
AO-27	21	15	4.32E+03	5.27E+01	9.51E+03	8.63E+00	5.73E-01	4.32E+03	0.176
AO-27	22	14	4.15E+03	5.07E+01	9.15E+03	8.30E+00	5.51E-01	4.15E+03	0.169
AO-27	23	13	3.87E+03	4.73E+01	8.53E+03	7.74E+00	5.14E-01	3.87E+03	0.158
AO-27	24	12	3.99E+03	4.87E+01	8.79E+03	7.98E+00	5.29E-01	3.99E+03	0.163
AO-27	25	11	3.07E+03	3.75E+01	6.77E+03	6.15E+00	4.08E-01	3.07E+03	0.125
AO-27	26	10	2.91E+03	3.55E+01	6.41E+03	5.82E+00	3.86E-01	2.91E+03	0.119
AO-27	27	9	3.19E+03	3.90E+01	7.03E+03	6.38E+00	4.24E-01	3.19E+03	0.130
AO-27	28	8	2.70E+03	3.30E+01	5.95E+03	5.40E+00	3.58E-01	2.70E+03	0.110
AO-27	29	7	2.67E+03	3.27E+01	5.89E+03	5.35E+00	3.55E-01	2.67E+03	0.109
AO-27	30	6	2.23E+03	2.72E+01	4.91E+03	4.46E+00	2.96E-01	2.23E+03	0.091
AO-27	31	5	2.28E+03	2.78E+01	5.02E+03	4.55E+00	3.02E-01	2.28E+03	0.093
AO-27	32	4	2.18E+03	2.66E+01	4.81E+03	4.36E+00	2.90E-01	2.18E+03	0.089
AO-27	33	3	2.28E+03	2.78E+01	5.02E+03	4.55E+00	3.02E-01	2.28E+03	0.093
AO-27	34	2	2.13E+03	2.61E+01	4.70E+03	4.27E+00	2.83E-01	2.13E+03	0.087
AO-27	35	1	2.58E+03	3.15E+01	5.69E+03	5.16E+00	3.43E-01	2.58E+03	0.105
AO-27	Zero	25	2.10E+03	2.56E+01	4.62E+03	4.19E+00	2.78E-01	2.10E+03	0.086
AO-27	1	24	2.88E+03	3.52E+01	6.36E+03	5.77E+00	3.83E-01	2.88E+03	0.118
AO-27	2	23	2.32E+03	2.83E+01	5.10E+03	4.63E+00	3.07E-01	2.32E+03	0.094
AO-27	3	22	2.23E+03	2.72E+01	4.91E+03	4.46E+00	2.96E-01	2.23E+03	0.091
AO-27	4	21	2.97E+03	3.63E+01	6.55E+03	5.94E+00	3.94E-01	2.97E+03	0.121

Pipes AO-27, AO-28, AO-30 and AO-31 Data Reporting (continued)

Pipe	Position	Feet into Pipe	Gamma Result (dpm/100cm^2)	Co-60 (dpm/100cm^2)	Ni-63 (dpm/100cm^2)	Sr-90 (dpm/100cm^2)	Cs-134 (dpm/100cm^2)	Cs-137 (dpm/100cm^2)	OpSOF
AO-27	5	20	3.19E+03	3.90E+01	7.03E+03	6.38E+00	4.23E-01	3.19E+03	0.130
AO-27	6	19	2.93E+03	3.58E+01	6.45E+03	5.85E+00	3.89E-01	2.93E+03	0.119
AO-27	7	18	2.66E+03	3.25E+01	5.87E+03	5.33E+00	3.54E-01	2.66E+03	0.109
AO-27	8	17	2.99E+03	3.66E+01	6.60E+03	5.98E+00	3.97E-01	2.99E+03	0.122
AO-27	9	16	3.15E+03	3.84E+01	6.93E+03	6.29E+00	4.18E-01	3.15E+03	0.128
AO-27	10	15	2.99E+03	3.66E+01	6.60E+03	5.98E+00	3.97E-01	2.99E+03	0.122
AO-27	11	14	3.54E+03	4.32E+01	7.80E+03	7.08E+00	4.70E-01	3.54E+03	0.144
AO-27	12	13	2.66E+03	3.25E+01	5.87E+03	5.33E+00	3.54E-01	2.66E+03	0.109
AO-27	13	12	2.47E+03	3.01E+01	5.44E+03	4.94E+00	3.28E-01	2.47E+03	0.101
AO-27	14	11	2.47E+03	3.01E+01	5.44E+03	4.94E+00	3.28E-01	2.47E+03	0.101
AO-27	15	10	2.12E+03	2.59E+01	4.67E+03	4.24E+00	2.81E-01	2.12E+03	0.086
AO-27	16	9	2.18E+03	2.67E+01	4.81E+03	4.37E+00	2.90E-01	2.18E+03	0.089
AO-27	17	8	2.12E+03	2.59E+01	4.67E+03	4.24E+00	2.81E-01	2.12E+03	0.086
AO-27	18	7	1.92E+03	2.35E+01	4.24E+03	3.84E+00	2.55E-01	1.92E+03	0.078
AO-27	19	6	2.10E+03	2.56E+01	4.62E+03	4.19E+00	2.78E-01	2.10E+03	0.086
AO-27	20	5	2.16E+03	2.64E+01	4.77E+03	4.32E+00	2.87E-01	2.16E+03	0.088
AO-27	21	4	2.38E+03	2.91E+01	5.25E+03	4.76E+00	3.16E-01	2.38E+03	0.097
AO-27	22	3	2.36E+03	2.88E+01	5.20E+03	4.72E+00	3.13E-01	2.36E+03	0.096
AO-27	23	2	2.82E+03	3.44E+01	6.21E+03	5.64E+00	3.74E-01	2.82E+03	0.115
AO-27	24	1	1.90E+03	2.32E+01	4.19E+03	3.80E+00	2.52E-01	1.90E+03	0.077
AO-27	25	0	2.05E+03	2.51E+01	4.53E+03	4.11E+00	2.73E-01	2.05E+03	0.084
AO-28	Zero	38	2.04E+03	2.49E+01	4.50E+03	4.08E+00	2.71E-01	2.04E+03	0.083
AO-28	1	37	2.20E+03	2.69E+01	4.86E+03	4.41E+00	2.93E-01	2.20E+03	0.090
AO-28	2	36	2.91E+03	3.55E+01	6.41E+03	5.82E+00	3.86E-01	2.91E+03	0.119
AO-28	3	35	2.72E+03	3.32E+01	6.00E+03	5.44E+00	3.61E-01	2.72E+03	0.111
AO-28	4	34	4.53E+03	5.53E+01	9.98E+03	9.05E+00	6.01E-01	4.53E+03	0.185
AO-28	5	33	4.97E+03	6.07E+01	1.10E+04	9.95E+00	6.60E-01	4.97E+03	0.203
AO-28	6	32	6.50E+03	7.94E+01	1.43E+04	1.30E+01	8.63E-01	6.50E+03	0.265
AO-28	7	31	8.33E+03	1.02E+02	1.84E+04	1.67E+01	1.11E+00	8.33E+03	0.340
AO-28	8	30	9.92E+03	1.21E+02	2.19E+04	1.98E+01	1.32E+00	9.92E+03	0.405
AO-28	9	29	7.98E+03	9.74E+01	1.76E+04	1.60E+01	1.06E+00	7.98E+03	0.325
AO-28	10	28	8.35E+03	1.02E+02	1.84E+04	1.67E+01	1.11E+00	8.35E+03	0.341
AO-28	11	27	7.37E+03	9.00E+01	1.62E+04	1.47E+01	9.78E-01	7.37E+03	0.300
AO-28	12	26	5.56E+03	6.79E+01	1.23E+04	1.11E+01	7.38E-01	5.56E+03	0.227
AO-28	13	25	6.36E+03	7.76E+01	1.40E+04	1.27E+01	8.44E-01	6.36E+03	0.259
AO-28	14	24	4.86E+03	5.93E+01	1.07E+04	9.71E+00	6.45E-01	4.86E+03	0.198
AO-28	15	23	6.29E+03	7.68E+01	1.39E+04	1.26E+01	8.35E-01	6.29E+03	0.256
AO-28	16	22	4.60E+03	5.62E+01	1.01E+04	9.20E+00	6.10E-01	4.60E+03	0.187
AO-28	17	21	4.39E+03	5.36E+01	9.67E+03	8.77E+00	5.82E-01	4.39E+03	0.179
AO-28	18	20	4.01E+03	4.90E+01	8.84E+03	8.02E+00	5.33E-01	4.01E+03	0.164
AO-28	19	19	4.32E+03	5.27E+01	9.51E+03	8.63E+00	5.73E-01	4.32E+03	0.176

Pipes AO-27, AO-28, AO-30 and AO-31 Data Reporting (continued)

Pipe	Position	Feet into Pipe	Gamma Result (dpm/100cm^2)	Co-60 (dpm/100cm^2)	Ni-63 (dpm/100cm^2)	Sr-90 (dpm/100cm^2)	Cs-134 (dpm/100cm^2)	Cs-137 (dpm/100cm^2)	OpSOF
AO-28	20	18	3.75E+03	4.58E+01	8.27E+03	7.51E+00	4.98E-01	3.75E+03	0.153
AO-28	21	17	4.13E+03	5.04E+01	9.10E+03	8.26E+00	5.48E-01	4.13E+03	0.168
AO-28	22	16	3.78E+03	4.61E+01	8.32E+03	7.55E+00	5.01E-01	3.78E+03	0.154
AO-28	23	15	3.21E+03	3.93E+01	7.08E+03	6.43E+00	4.27E-01	3.21E+03	0.131
AO-28	24	14	3.50E+03	4.27E+01	7.70E+03	6.99E+00	4.64E-01	3.50E+03	0.143
AO-28	25	13	3.57E+03	4.36E+01	7.86E+03	7.13E+00	4.73E-01	3.57E+03	0.145
AO-28	26	12	3.57E+03	4.36E+01	7.86E+03	7.13E+00	4.73E-01	3.57E+03	0.145
AO-28	27	11	3.12E+03	3.81E+01	6.88E+03	6.24E+00	4.14E-01	3.12E+03	0.127
AO-28	28	10	3.21E+03	3.93E+01	7.08E+03	6.43E+00	4.27E-01	3.21E+03	0.131
AO-28	29	9	2.93E+03	3.58E+01	6.46E+03	5.86E+00	3.89E-01	2.93E+03	0.120
AO-28	30	8	2.23E+03	2.72E+01	4.91E+03	4.46E+00	2.96E-01	2.23E+03	0.091
AO-28	31	7	2.60E+03	3.18E+01	5.74E+03	5.21E+00	3.46E-01	2.60E+03	0.106
AO-28	32	6	2.28E+03	2.78E+01	5.02E+03	4.55E+00	3.02E-01	2.28E+03	0.093
AO-28	33	5	2.28E+03	2.78E+01	5.02E+03	4.55E+00	3.02E-01	2.28E+03	0.093
AO-28	34	4	2.28E+03	2.78E+01	5.02E+03	4.55E+00	3.02E-01	2.28E+03	0.093
AO-28	35	3	2.11E+03	2.58E+01	4.65E+03	4.22E+00	2.80E-01	2.11E+03	0.086
AO-28	36	2	2.16E+03	2.64E+01	4.76E+03	4.32E+00	2.87E-01	2.16E+03	0.088
AO-28	37	1	2.28E+03	2.78E+01	5.02E+03	4.55E+00	3.02E-01	2.28E+03	0.093
AO-28	Zero	25	2.08E+03	2.53E+01	4.57E+03	4.15E+00	2.76E-01	2.08E+03	0.085
AO-28	1	24	2.60E+03	3.17E+01	5.73E+03	5.20E+00	3.45E-01	2.60E+03	0.106
AO-28	2	23	2.18E+03	2.67E+01	4.81E+03	4.37E+00	2.90E-01	2.18E+03	0.089
AO-28	3	22	2.05E+03	2.51E+01	4.53E+03	4.11E+00	2.73E-01	2.05E+03	0.084
AO-28	4	21	2.08E+03	2.53E+01	4.57E+03	4.15E+00	2.76E-01	2.08E+03	0.085
AO-28	5	20	2.36E+03	2.88E+01	5.20E+03	4.72E+00	3.13E-01	2.36E+03	0.096
AO-28	6	19	3.10E+03	3.79E+01	6.84E+03	6.20E+00	4.12E-01	3.10E+03	0.126
AO-28	7	18	2.84E+03	3.47E+01	6.26E+03	5.68E+00	3.77E-01	2.84E+03	0.116
AO-28	8	17	2.95E+03	3.60E+01	6.50E+03	5.90E+00	3.92E-01	2.95E+03	0.120
AO-28	9	16	3.93E+03	4.80E+01	8.67E+03	7.86E+00	5.22E-01	3.93E+03	0.160
AO-28	10	15	3.65E+03	4.46E+01	8.04E+03	7.30E+00	4.84E-01	3.65E+03	0.149
AO-28	11	14	3.82E+03	4.67E+01	8.43E+03	7.65E+00	5.08E-01	3.82E+03	0.156
AO-28	12	13	4.57E+03	5.58E+01	1.01E+04	9.13E+00	6.06E-01	4.57E+03	0.186
AO-28	13	12	4.19E+03	5.12E+01	9.24E+03	8.39E+00	5.57E-01	4.19E+03	0.171
AO-28	14	11	4.24E+03	5.18E+01	9.34E+03	8.48E+00	5.63E-01	4.24E+03	0.173
AO-28	15	10	3.67E+03	4.48E+01	8.09E+03	7.34E+00	4.87E-01	3.67E+03	0.150
AO-28	16	9	3.30E+03	4.03E+01	7.27E+03	6.60E+00	4.38E-01	3.30E+03	0.134
AO-28	17	8	3.89E+03	4.75E+01	8.57E+03	7.78E+00	5.16E-01	3.89E+03	0.159
AO-28	18	7	2.82E+03	3.44E+01	6.21E+03	5.64E+00	3.74E-01	2.82E+03	0.115
AO-28	19	6	1.57E+03	1.92E+01	3.47E+03	3.15E+00	2.09E-01	1.57E+03	0.064
AO-28	20	5	2.12E+03	2.59E+01	4.67E+03	4.24E+00	2.81E-01	2.12E+03	0.086
AO-28	21	4	1.83E+03	2.24E+01	4.04E+03	3.67E+00	2.44E-01	1.83E+03	0.075
AO-28	22	3	1.77E+03	2.16E+01	3.90E+03	3.54E+00	2.35E-01	1.77E+03	0.072

Pipes AO-27, AO-28, AO-30 and AO-31 Data Reporting (continued)

Pipe	Position	Feet into Pipe	Gamma Result (dpm/100cm^2)	Co-60 (dpm/100cm^2)	Ni-63 (dpm/100cm^2)	Sr-90 (dpm/100cm^2)	Cs-134 (dpm/100cm^2)	Cs-137 (dpm/100cm^2)	OpSOF
AO-28	23	2	1.62E+03	1.97E+01	3.56E+03	3.23E+00	2.15E-01	1.62E+03	0.066
AO-28	24	1	1.77E+03	2.16E+01	3.90E+03	3.54E+00	2.35E-01	1.77E+03	0.072
AO-28	25	0	2.01E+03	2.45E+01	4.43E+03	4.02E+00	2.67E-01	2.01E+03	0.082
AO-30	Zero	38	2.51E+03	3.07E+01	5.53E+03	5.02E+00	3.33E-01	2.51E+03	0.102
AO-30	1	37	2.81E+03	3.44E+01	6.20E+03	5.63E+00	3.74E-01	2.81E+03	0.115
AO-30	2	36	3.10E+03	3.78E+01	6.82E+03	6.19E+00	4.11E-01	3.10E+03	0.126
AO-30	3	35	3.40E+03	4.15E+01	7.50E+03	6.80E+00	4.52E-01	3.40E+03	0.139
AO-30	4	34	3.05E+03	3.72E+01	6.72E+03	6.10E+00	4.05E-01	3.05E+03	0.124
AO-30	5	33	2.98E+03	3.64E+01	6.57E+03	5.96E+00	3.96E-01	2.98E+03	0.121
AO-30	6	32	2.98E+03	3.64E+01	6.57E+03	5.96E+00	3.96E-01	2.98E+03	0.121
AO-30	7	31	3.40E+03	4.15E+01	7.50E+03	6.80E+00	4.52E-01	3.40E+03	0.139
AO-30	8	30	3.31E+03	4.04E+01	7.29E+03	6.61E+00	4.39E-01	3.31E+03	0.135
AO-30	9	29	3.64E+03	4.44E+01	8.01E+03	7.27E+00	4.83E-01	3.64E+03	0.148
AO-30	10	28	3.38E+03	4.13E+01	7.45E+03	6.76E+00	4.48E-01	3.38E+03	0.138
AO-30	11	27	3.61E+03	4.41E+01	7.96E+03	7.22E+00	4.80E-01	3.61E+03	0.147
AO-30	12	26	3.26E+03	3.98E+01	7.19E+03	6.52E+00	4.33E-01	3.26E+03	0.133
AO-30	13	25	2.86E+03	3.50E+01	6.31E+03	5.72E+00	3.80E-01	2.86E+03	0.117
AO-30	14	24	3.26E+03	3.98E+01	7.19E+03	6.52E+00	4.33E-01	3.26E+03	0.133
AO-30	15	23	2.96E+03	3.61E+01	6.51E+03	5.91E+00	3.92E-01	2.96E+03	0.121
AO-30	16	22	2.56E+03	3.12E+01	5.64E+03	5.11E+00	3.39E-01	2.56E+03	0.104
AO-30	17	21	3.45E+03	4.21E+01	7.60E+03	6.90E+00	4.58E-01	3.45E+03	0.141
AO-30	18	20	3.38E+03	4.13E+01	7.45E+03	6.76E+00	4.48E-01	3.38E+03	0.138
AO-30	19	19	2.98E+03	3.64E+01	6.57E+03	5.96E+00	3.96E-01	2.98E+03	0.121
AO-30	20	18	3.24E+03	3.95E+01	7.13E+03	6.47E+00	4.30E-01	3.24E+03	0.132
AO-30	21	17	3.17E+03	3.87E+01	6.98E+03	6.33E+00	4.20E-01	3.17E+03	0.129
AO-30	22	16	2.91E+03	3.55E+01	6.41E+03	5.82E+00	3.86E-01	2.91E+03	0.119
AO-30	23	15	2.58E+03	3.15E+01	5.69E+03	5.16E+00	3.43E-01	2.58E+03	0.105
AO-30	24	14	2.51E+03	3.07E+01	5.53E+03	5.02E+00	3.33E-01	2.51E+03	0.102
AO-30	25	13	3.00E+03	3.67E+01	6.62E+03	6.01E+00	3.99E-01	3.00E+03	0.122
AO-30	26	12	2.60E+03	3.18E+01	5.74E+03	5.21E+00	3.46E-01	2.60E+03	0.106
AO-30	27	11	2.63E+03	3.21E+01	5.79E+03	5.25E+00	3.49E-01	2.63E+03	0.107
AO-30	28	10	2.72E+03	3.32E+01	6.00E+03	5.44E+00	3.61E-01	2.72E+03	0.111
AO-30	29	9	2.72E+03	3.32E+01	6.00E+03	5.44E+00	3.61E-01	2.72E+03	0.111
AO-30	30	8	2.35E+03	2.87E+01	5.17E+03	4.69E+00	3.11E-01	2.35E+03	0.096
AO-30	31	7	2.37E+03	2.89E+01	5.22E+03	4.74E+00	3.15E-01	2.37E+03	0.097
AO-30	32	6	2.86E+03	3.50E+01	6.31E+03	5.72E+00	3.80E-01	2.86E+03	0.117
AO-30	33	5	2.44E+03	2.98E+01	5.38E+03	4.88E+00	3.24E-01	2.44E+03	0.099
AO-30	34	4	1.99E+03	2.44E+01	4.39E+03	3.99E+00	2.65E-01	1.99E+03	0.081
AO-30	35	3	1.74E+03	2.12E+01	3.83E+03	3.47E+00	2.30E-01	1.74E+03	0.071
AO-30	36	2	2.06E+03	2.52E+01	4.55E+03	4.13E+00	2.74E-01	2.06E+03	0.084
AO-30	37	1	2.84E+03	3.47E+01	6.26E+03	5.68E+00	3.77E-01	2.84E+03	0.116

Pipes AO-27, AO-28, AO-30 and AO-31 Data Reporting (continued)

Pipe	Position	Feet into Pipe	Gamma Result (dpm/100cm^2)	Co-60 (dpm/100cm^2)	Ni-63 (dpm/100cm^2)	Sr-90 (dpm/100cm^2)	Cs-134 (dpm/100cm^2)	Cs-137 (dpm/100cm^2)	OpSOF
AO-30	Zero	25	1.92E+03	2.35E+01	4.24E+03	3.84E+00	2.55E-01	1.92E+03	0.078
AO-30	1	24	2.14E+03	2.61E+01	4.72E+03	4.28E+00	2.84E-01	2.14E+03	0.087
AO-30	2	23	1.64E+03	2.00E+01	3.61E+03	3.28E+00	2.18E-01	1.64E+03	0.067
AO-30	3	22	2.34E+03	2.85E+01	5.15E+03	4.67E+00	3.10E-01	2.34E+03	0.095
AO-30	4	21	2.45E+03	2.99E+01	5.39E+03	4.89E+00	3.25E-01	2.45E+03	0.100
AO-30	5	20	2.56E+03	3.12E+01	5.63E+03	5.11E+00	3.39E-01	2.56E+03	0.104
AO-30	6	19	2.29E+03	2.80E+01	5.06E+03	4.59E+00	3.05E-01	2.29E+03	0.094
AO-30	7	18	2.99E+03	3.66E+01	6.60E+03	5.98E+00	3.97E-01	2.99E+03	0.122
AO-30	8	17	2.82E+03	3.44E+01	6.21E+03	5.64E+00	3.74E-01	2.82E+03	0.115
AO-30	9	16	2.45E+03	2.99E+01	5.39E+03	4.89E+00	3.25E-01	2.45E+03	0.100
AO-30	10	15	3.04E+03	3.71E+01	6.69E+03	6.07E+00	4.03E-01	3.04E+03	0.124
AO-30	11	14	2.73E+03	3.34E+01	6.02E+03	5.46E+00	3.63E-01	2.73E+03	0.111
AO-30	12	13	4.76E+03	5.82E+01	1.05E+04	9.52E+00	6.32E-01	4.76E+03	0.194
AO-30	13	12	5.11E+03	6.24E+01	1.13E+04	1.02E+01	6.79E-01	5.11E+03	0.208
AO-30	14	11	4.59E+03	5.60E+01	1.01E+04	9.17E+00	6.09E-01	4.59E+03	0.187
AO-30	15	10	5.00E+03	6.11E+01	1.10E+04	1.00E+01	6.64E-01	5.00E+03	0.204
AO-30	16	9	3.71E+03	4.54E+01	8.18E+03	7.43E+00	4.93E-01	3.71E+03	0.151
AO-30	17	8	3.49E+03	4.27E+01	7.70E+03	6.99E+00	4.64E-01	3.49E+03	0.143
AO-30	18	7	2.77E+03	3.39E+01	6.11E+03	5.55E+00	3.68E-01	2.77E+03	0.113
AO-30	19	6	2.58E+03	3.15E+01	5.68E+03	5.15E+00	3.42E-01	2.58E+03	0.105
AO-30	20	5	2.27E+03	2.77E+01	5.01E+03	4.54E+00	3.02E-01	2.27E+03	0.093
AO-30	21	4	1.81E+03	2.21E+01	4.00E+03	3.63E+00	2.41E-01	1.81E+03	0.074
AO-30	22	3	1.33E+03	1.63E+01	2.94E+03	2.66E+00	1.77E-01	1.33E+03	0.054
AO-30	23	2	1.83E+03	2.24E+01	4.04E+03	3.67E+00	2.44E-01	1.83E+03	0.075
AO-30	24	1	1.81E+03	2.21E+01	4.00E+03	3.63E+00	2.41E-01	1.81E+03	0.074
AO-30	25	0	1.42E+03	1.73E+01	3.13E+03	2.84E+00	1.89E-01	1.42E+03	0.058
AO-31	Zero	40	2.70E+03	3.30E+01	5.95E+03	5.40E+00	3.58E-01	2.70E+03	0.110
AO-31	1	39	2.23E+03	2.72E+01	4.91E+03	4.46E+00	2.96E-01	2.23E+03	0.091
AO-31	2	38	3.26E+03	3.98E+01	7.19E+03	6.52E+00	4.33E-01	3.26E+03	0.133
AO-31	3	37	2.96E+03	3.61E+01	6.51E+03	5.91E+00	3.92E-01	2.96E+03	0.121
AO-31	4	36	3.73E+03	4.56E+01	8.22E+03	7.46E+00	4.95E-01	3.73E+03	0.152
AO-31	5	35	4.67E+03	5.70E+01	1.03E+04	9.34E+00	6.20E-01	4.67E+03	0.190
AO-31	6	34	4.76E+03	5.82E+01	1.05E+04	9.52E+00	6.32E-01	4.76E+03	0.194
AO-31	7	33	4.36E+03	5.33E+01	9.62E+03	8.73E+00	5.79E-01	4.36E+03	0.178
AO-31	8	32	5.02E+03	6.13E+01	1.11E+04	1.00E+01	6.66E-01	5.02E+03	0.205
AO-31	9	31	5.28E+03	6.45E+01	1.16E+04	1.06E+01	7.01E-01	5.28E+03	0.215
AO-31	10	30	5.04E+03	6.16E+01	1.11E+04	1.01E+01	6.70E-01	5.04E+03	0.206
AO-31	11	29	5.14E+03	6.27E+01	1.13E+04	1.03E+01	6.82E-01	5.14E+03	0.209
AO-31	12	28	4.50E+03	5.50E+01	9.93E+03	9.01E+00	5.98E-01	4.50E+03	0.184
AO-31	13	27	4.57E+03	5.59E+01	1.01E+04	9.15E+00	6.07E-01	4.57E+03	0.187
AO-31	14	26	4.36E+03	5.33E+01	9.62E+03	8.73E+00	5.79E-01	4.36E+03	0.178

Pipes AO-27, AO-28, AO-30 and AO-31 Data Reporting (continued)

Pipe	Position	Feet into Pipe	Gamma Result (dpm/100cm^2)	Co-60 (dpm/100cm^2)	Ni-63 (dpm/100cm^2)	Sr-90 (dpm/100cm^2)	Cs-134 (dpm/100cm^2)	Cs-137 (dpm/100cm^2)	OpSOF
AO-31	15	25	4.53E+03	5.53E+01	9.98E+03	9.05E+00	6.01E-01	4.53E+03	0.185
AO-31	16	24	3.78E+03	4.61E+01	8.32E+03	7.55E+00	5.01E-01	3.78E+03	0.154
AO-31	17	23	4.15E+03	5.07E+01	9.15E+03	8.30E+00	5.51E-01	4.15E+03	0.169
AO-31	18	22	4.67E+03	5.70E+01	1.03E+04	9.34E+00	6.20E-01	4.67E+03	0.190
AO-31	19	21	4.32E+03	5.27E+01	9.51E+03	8.63E+00	5.73E-01	4.32E+03	0.176
AO-31	20	20	5.09E+03	6.22E+01	1.12E+04	1.02E+01	6.76E-01	5.09E+03	0.208
AO-31	21	19	4.18E+03	5.10E+01	9.20E+03	8.35E+00	5.54E-01	4.18E+03	0.170
AO-31	22	18	3.89E+03	4.76E+01	8.58E+03	7.79E+00	5.17E-01	3.89E+03	0.159
AO-31	23	17	4.29E+03	5.24E+01	9.46E+03	8.59E+00	5.70E-01	4.29E+03	0.175
AO-31	24	16	5.16E+03	6.30E+01	1.14E+04	1.03E+01	6.85E-01	5.16E+03	0.210
AO-31	25	15	4.11E+03	5.01E+01	9.05E+03	8.21E+00	5.45E-01	4.11E+03	0.167
AO-31	26	14	4.27E+03	5.21E+01	9.41E+03	8.54E+00	5.67E-01	4.27E+03	0.174
AO-31	27	13	4.13E+03	5.04E+01	9.10E+03	8.26E+00	5.48E-01	4.13E+03	0.168
AO-31	28	12	3.68E+03	4.50E+01	8.12E+03	7.37E+00	4.89E-01	3.68E+03	0.150
AO-31	29	11	3.40E+03	4.15E+01	7.50E+03	6.80E+00	4.52E-01	3.40E+03	0.139
AO-31	30	10	3.28E+03	4.01E+01	7.24E+03	6.57E+00	4.36E-01	3.28E+03	0.134
AO-31	31	9	3.73E+03	4.56E+01	8.22E+03	7.46E+00	4.95E-01	3.73E+03	0.152
AO-31	32	8	3.33E+03	4.07E+01	7.34E+03	6.66E+00	4.42E-01	3.33E+03	0.136
AO-31	33	7	3.26E+03	3.98E+01	7.19E+03	6.52E+00	4.33E-01	3.26E+03	0.133
AO-31	34	6	2.79E+03	3.41E+01	6.15E+03	5.58E+00	3.71E-01	2.79E+03	0.114
AO-31	35	5	1.95E+03	2.38E+01	4.29E+03	3.89E+00	2.58E-01	1.95E+03	0.079
AO-31	36	4	1.97E+03	2.41E+01	4.34E+03	3.94E+00	2.62E-01	1.97E+03	0.080
AO-31	37	3	2.02E+03	2.46E+01	4.45E+03	4.03E+00	2.68E-01	2.02E+03	0.082
AO-31	38	2	2.42E+03	2.95E+01	5.33E+03	4.83E+00	3.21E-01	2.42E+03	0.099
AO-31	39	1	1.95E+03	2.38E+01	4.29E+03	3.89E+00	2.58E-01	1.95E+03	0.079
AO-31	Zero	26	2.40E+03	2.93E+01	5.30E+03	4.81E+00	3.19E-01	2.40E+03	0.098
AO-31	1	25	2.53E+03	3.09E+01	5.58E+03	5.07E+00	3.36E-01	2.53E+03	0.103
AO-31	2	24	2.38E+03	2.91E+01	5.25E+03	4.76E+00	3.16E-01	2.38E+03	0.097
AO-31	3	23	2.95E+03	3.60E+01	6.50E+03	5.90E+00	3.92E-01	2.95E+03	0.120
AO-31	4	22	2.73E+03	3.34E+01	6.02E+03	5.46E+00	3.63E-01	2.73E+03	0.111
AO-31	5	21	3.08E+03	3.76E+01	6.79E+03	6.16E+00	4.09E-01	3.08E+03	0.126
AO-31	6	20	2.97E+03	3.63E+01	6.55E+03	5.94E+00	3.94E-01	2.97E+03	0.121
AO-31	7	19	2.93E+03	3.58E+01	6.45E+03	5.85E+00	3.89E-01	2.93E+03	0.119
AO-31	8	18	3.47E+03	4.24E+01	7.65E+03	6.95E+00	4.61E-01	3.47E+03	0.142
AO-31	9	17	4.46E+03	5.44E+01	9.82E+03	8.91E+00	5.92E-01	4.46E+03	0.182
AO-31	10	16	4.35E+03	5.31E+01	9.58E+03	8.69E+00	5.77E-01	4.35E+03	0.177
AO-31	11	15	4.39E+03	5.36E+01	9.68E+03	8.78E+00	5.83E-01	4.39E+03	0.179
AO-31	12	14	4.50E+03	5.50E+01	9.92E+03	9.00E+00	5.97E-01	4.50E+03	0.183
AO-31	13	13	4.61E+03	5.63E+01	1.02E+04	9.22E+00	6.12E-01	4.61E+03	0.188
AO-31	14	12	4.96E+03	6.06E+01	1.09E+04	9.92E+00	6.58E-01	4.96E+03	0.202
AO-31	15	11	3.54E+03	4.32E+01	7.80E+03	7.08E+00	4.70E-01	3.54E+03	0.144

Pipes AO-27, AO-28, AO-30 and AO-31 Data Reporting (continued)

Pipe	Position	Feet into Pipe	Gamma Result (dpm/100cm^2)	Co-60 (dpm/100cm^2)	Ni-63 (dpm/100cm^2)	Sr-90 (dpm/100cm^2)	Cs-134 (dpm/100cm^2)	Cs-137 (dpm/100cm^2)	OpSOF
AO-31	16	10	3.39E+03	4.14E+01	7.46E+03	6.77E+00	4.50E-01	3.39E+03	0.138
AO-31	17	9	2.82E+03	3.44E+01	6.21E+03	5.64E+00	3.74E-01	2.82E+03	0.115
AO-31	18	8	1.73E+03	2.11E+01	3.80E+03	3.45E+00	2.29E-01	1.73E+03	0.070
AO-31	19	7	2.14E+03	2.61E+01	4.72E+03	4.28E+00	2.84E-01	2.14E+03	0.087
AO-31	20	6	1.83E+03	2.24E+01	4.04E+03	3.67E+00	2.44E-01	1.83E+03	0.075
AO-31	21	5	2.45E+03	2.99E+01	5.39E+03	4.89E+00	3.25E-01	2.45E+03	0.100
AO-31	22	4	1.66E+03	2.03E+01	3.66E+03	3.32E+00	2.20E-01	1.66E+03	0.068
AO-31	23	3	1.59E+03	1.95E+01	3.51E+03	3.19E+00	2.12E-01	1.59E+03	0.065
AO-31	24	2	1.86E+03	2.27E+01	4.09E+03	3.71E+00	2.47E-01	1.86E+03	0.076
AO-31	25	1	2.14E+03	2.61E+01	4.72E+03	4.28E+00	2.84E-01	2.14E+03	0.087
AO-31	14	12	4.96E+03	6.06E+01	1.09E+04	9.92E+00	6.58E-01	4.96E+03	0.202
AO-31	15	11	3.54E+03	4.32E+01	7.80E+03	7.08E+00	4.70E-01	3.54E+03	0.144
AO-31	16	10	3.39E+03	4.14E+01	7.46E+03	6.77E+00	4.50E-01	3.39E+03	0.138
AO-31	17	9	2.82E+03	3.44E+01	6.21E+03	5.64E+00	3.74E-01	2.82E+03	0.115
AO-31	18	8	1.73E+03	2.11E+01	3.80E+03	3.45E+00	2.29E-01	1.73E+03	0.070
AO-31	19	7	2.14E+03	2.61E+01	4.72E+03	4.28E+00	2.84E-01	2.14E+03	0.087
AO-31	20	6	1.83E+03	2.24E+01	4.04E+03	3.67E+00	2.44E-01	1.83E+03	0.075
AO-31	21	5	2.45E+03	2.99E+01	5.39E+03	4.89E+00	3.25E-01	2.45E+03	0.100
AO-31	22	4	1.66E+03	2.03E+01	3.66E+03	3.32E+00	2.20E-01	1.66E+03	0.068
AO-31	23	3	1.59E+03	1.95E+01	3.51E+03	3.19E+00	2.12E-01	1.59E+03	0.065
AO-31	24	2	1.86E+03	2.27E+01	4.09E+03	3.71E+00	2.47E-01	1.86E+03	0.076
AO-31	25	1	2.14E+03	2.61E+01	4.72E+03	4.28E+00	2.84E-01	2.14E+03	0.087

ATTACHMENT 3
SIGN TEST

Sign Test – Diesel Generator Service Water Supply Pipe

Survey Area	00101	Survey Area	Service Water Supply Header
Survey Unit	00101F	Survey Unit	Buried Pipe AO-27, AO-28, AO-30 and AO-31
Classification	3	Type I Error	0.05
Number of Measurements	256		

#	SOF (Ws)	1-Ws	Sign
1	0.112	0.888	+1
2	0.099	0.901	+1
3	0.232	0.768	+1
4	0.428	0.572	+1
5	0.415	0.585	+1
6	0.488	0.512	+1
7	0.380	0.620	+1
8	0.380	0.620	+1
9	0.382	0.618	+1
10	0.321	0.679	+1
11	0.312	0.688	+1
12	0.284	0.716	+1
13	0.274	0.726	+1
14	0.270	0.730	+1
15	0.251	0.749	+1
16	0.252	0.748	+1
17	0.209	0.791	+1
18	0.213	0.787	+1
19	0.205	0.795	+1
20	0.220	0.780	+1
21	0.227	0.773	+1
22	0.176	0.824	+1
23	0.169	0.831	+1
24	0.158	0.842	+1
25	0.163	0.837	+1
26	0.125	0.875	+1
27	0.119	0.881	+1
28	0.130	0.870	+1
29	0.110	0.890	+1
30	0.109	0.891	+1
31	0.091	0.909	+1
32	0.093	0.907	+1
33	0.089	0.911	+1

#	SOF (Ws)	1-Ws	Sign
129	0.126	0.874	+1
130	0.139	0.861	+1
131	0.124	0.876	+1
132	0.121	0.879	+1
133	0.121	0.879	+1
134	0.139	0.861	+1
135	0.135	0.865	+1
136	0.148	0.852	+1
137	0.138	0.862	+1
138	0.147	0.853	+1
139	0.133	0.867	+1
140	0.117	0.883	+1
141	0.133	0.867	+1
142	0.121	0.879	+1
143	0.104	0.896	+1
144	0.141	0.859	+1
145	0.138	0.862	+1
146	0.121	0.879	+1
147	0.132	0.868	+1
148	0.129	0.871	+1
149	0.119	0.881	+1
150	0.105	0.895	+1
151	0.102	0.898	+1
152	0.122	0.878	+1
153	0.106	0.894	+1
154	0.107	0.893	+1
155	0.111	0.889	+1
156	0.111	0.889	+1
157	0.096	0.904	+1
158	0.097	0.903	+1
159	0.117	0.883	+1
160	0.099	0.901	+1
161	0.081	0.919	+1

Sign Test – Diesel Generator Service Water Supply Pipe (continued)

#	SOF (Ws)	1-Ws	Sign
34	0.093	0.907	+1
35	0.087	0.913	+1
36	0.105	0.895	+1
37	0.086	0.914	+1
38	0.118	0.882	+1
39	0.094	0.906	+1
40	0.091	0.909	+1
41	0.121	0.879	+1
42	0.130	0.870	+1
43	0.119	0.881	+1
44	0.109	0.891	+1
45	0.122	0.878	+1
46	0.128	0.872	+1
47	0.122	0.878	+1
48	0.144	0.856	+1
49	0.109	0.891	+1
50	0.101	0.899	+1
51	0.101	0.899	+1
52	0.086	0.914	+1
53	0.089	0.911	+1
54	0.086	0.914	+1
55	0.078	0.922	+1
56	0.086	0.914	+1
57	0.088	0.912	+1
58	0.097	0.903	+1
59	0.096	0.904	+1
60	0.115	0.885	+1
61	0.077	0.923	+1
62	0.084	0.916	+1
63	0.083	0.917	+1
64	0.090	0.910	+1
65	0.119	0.881	+1
66	0.111	0.889	+1
67	0.185	0.815	+1
68	0.203	0.797	+1
69	0.265	0.735	+1
70	0.340	0.660	+1
71	0.405	0.595	+1

#	SOF (Ws)	1-Ws	Sign
162	0.071	0.929	+1
163	0.084	0.916	+1
164	0.116	0.884	+1
165	0.078	0.922	+1
166	0.087	0.913	+1
167	0.067	0.933	+1
168	0.095	0.905	+1
169	0.100	0.900	+1
170	0.104	0.896	+1
171	0.094	0.906	+1
172	0.122	0.878	+1
173	0.115	0.885	+1
174	0.100	0.900	+1
175	0.124	0.876	+1
176	0.111	0.889	+1
177	0.194	0.806	+1
178	0.208	0.792	+1
179	0.187	0.813	+1
180	0.204	0.796	+1
181	0.151	0.849	+1
182	0.143	0.857	+1
183	0.113	0.887	+1
184	0.105	0.895	+1
185	0.093	0.907	+1
186	0.074	0.926	+1
187	0.054	0.946	+1
188	0.075	0.925	+1
189	0.074	0.926	+1
190	0.058	0.942	+1
191	0.110	0.890	+1
192	0.091	0.909	+1
193	0.133	0.867	+1
194	0.121	0.879	+1
195	0.152	0.848	+1
196	0.190	0.810	+1
197	0.194	0.806	+1
198	0.178	0.822	+1
199	0.205	0.795	+1

Sign Test – Diesel Generator Service Water Supply Pipe (continued)

#	SOF (Ws)	1-Ws	Sign
72	0.325	0.675	+1
73	0.341	0.659	+1
74	0.300	0.700	+1
75	0.227	0.773	+1
76	0.259	0.741	+1
77	0.198	0.802	+1
78	0.256	0.744	+1
79	0.187	0.813	+1
80	0.179	0.821	+1
81	0.164	0.836	+1
82	0.176	0.824	+1
83	0.153	0.847	+1
84	0.168	0.832	+1
85	0.154	0.846	+1
86	0.131	0.869	+1
87	0.143	0.857	+1
88	0.145	0.855	+1
89	0.145	0.855	+1
90	0.127	0.873	+1
91	0.131	0.869	+1
92	0.120	0.880	+1
93	0.091	0.909	+1
94	0.106	0.894	+1
95	0.093	0.907	+1
96	0.093	0.907	+1
97	0.093	0.907	+1
98	0.086	0.914	+1
99	0.088	0.912	+1
100	0.093	0.907	+1
101	0.085	0.915	+1
102	0.106	0.894	+1
103	0.089	0.911	+1
104	0.084	0.916	+1
105	0.085	0.915	+1
106	0.096	0.904	+1
107	0.126	0.874	+1
108	0.116	0.884	+1
109	0.120	0.880	+1

#	SOF (Ws)	1-Ws	Sign
200	0.215	0.785	+1
201	0.206	0.794	+1
202	0.209	0.791	+1
203	0.184	0.816	+1
204	0.187	0.813	+1
205	0.178	0.822	+1
206	0.185	0.815	+1
207	0.154	0.846	+1
208	0.169	0.831	+1
209	0.190	0.810	+1
210	0.176	0.824	+1
211	0.208	0.792	+1
212	0.170	0.830	+1
213	0.159	0.841	+1
214	0.175	0.825	+1
215	0.210	0.790	+1
216	0.167	0.833	+1
217	0.174	0.826	+1
218	0.168	0.832	+1
219	0.150	0.850	+1
220	0.139	0.861	+1
221	0.134	0.866	+1
222	0.152	0.848	+1
223	0.136	0.864	+1
224	0.133	0.867	+1
225	0.114	0.886	+1
226	0.079	0.921	+1
227	0.080	0.920	+1
228	0.082	0.918	+1
229	0.099	0.901	+1
230	0.079	0.921	+1
231	0.098	0.902	+1
232	0.103	0.897	+1
233	0.097	0.903	+1
234	0.120	0.880	+1
235	0.111	0.889	+1
236	0.126	0.874	+1
237	0.121	0.879	+1

Sign Test – Diesel Generator Service Water Supply Pipe (continued)

#	SOF (Ws)	1-Ws	Sign
110	0.160	0.840	+1
111	0.149	0.851	+1
112	0.156	0.844	+1
113	0.186	0.814	+1
114	0.171	0.829	+1
115	0.173	0.827	+1
116	0.150	0.850	+1
117	0.134	0.866	+1
118	0.159	0.841	+1
119	0.115	0.885	+1
120	0.064	0.936	+1
121	0.086	0.914	+1
122	0.075	0.925	+1
123	0.072	0.928	+1
124	0.066	0.934	+1
125	0.072	0.928	+1
126	0.082	0.918	+1
127	0.102	0.898	+1
128	0.115	0.885	+1

#	SOF (Ws)	1-Ws	Sign
238	0.119	0.881	+1
239	0.142	0.858	+1
240	0.182	0.818	+1
241	0.177	0.823	+1
242	0.179	0.821	+1
243	0.183	0.817	+1
244	0.188	0.812	+1
245	0.202	0.798	+1
246	0.144	0.856	+1
247	0.138	0.862	+1
248	0.115	0.885	+1
249	0.070	0.930	+1
250	0.087	0.913	+1
251	0.075	0.925	+1
252	0.100	0.900	+1
253	0.068	0.932	+1
254	0.065	0.935	+1
255	0.076	0.924	+1
256	0.087	0.913	+1

Number of positive differences (S+) 256

Critical Value 141

The Survey Unit MEETS the Acceptance Criteria

ATTACHMENT 4
QC DATA

DIESEL GENERATOR SERVICE WATER SUPPLY – QC AGREEMENT

Survey Unit # 00101F Survey Unit Name Diesel Generator Service Water Supply Buried Pipe

Sample Plan # S3-00101A

Sample Description: Comparison of replicate gross-gamma measurements for QC from Pipe AO-27 – positions 12, 30, 19 and 6, Pipe AO-28 – positions 15, 31, 20 and 8, Pipe AO-30 – positions 8, 13, 30, 20 and 7 and from Pipe AO-31 – positions 15, 31, 21 and 4.

STANDARD				DUPLICATE		
ID	ACTIVITY (dpm/100cm^2)	+20% (dpm/100cm^2)	-20% (dpm/100cm^2)	ID	ACTIVITY (dpm/100cm^2)	ACCEPTABLE (Y/N)
Pipe AO-27, 12 ft	3.99E+03	4.79E+03	3.19E+03	Pipe AO-27, 12 QC	3.38E+03	Y
Pipe AO-27, 30 ft	9.31E+03	1.12E+04	7.45E+03	Pipe AO-27, 30 QC	9.99E+03	Y
Pipe AO-27, 19 ft	5.23E+03	6.28E+03	4.18E+03	Pipe AO-27, 19 QC	3.15E+03	N
Pipe AO-27, 6 ft	2.10E+03	2.52E+03	1.68E+03	Pipe AO-27, 6 QC	2.14E+03	Y
Pipe AO-28, 15 ft	3.21E+03	3.86 E+03	2.57E+03	Pipe AO-28, 15 QC	3.75E+03	Y
Pipe AO-28, 31 ft	8.33E+03	9.99E+03	6.66E+03	Pipe AO-28, 31 QC	8.07E+03	Y
Pipe AO-28, 20 ft	2.36E+03	2.83E+03	1.89E+03	Pipe AO-28, 20 QC	2.53E+03	Y
Pipe AO-28, 8 ft	3.89E+03	4.67E+03	3.11E+03	Pipe AO-28, 8 QC	3.52E+03	Y
Pipe AO-30, 8 ft	2.35E+03	2.81E+03	1.88E+03	Pipe AO-30, 8 QC	2.56E+03	Y
Pipe AO-30, 13 ft	3.00E+03	3.60E+03	2.40E+03	Pipe AO-30, 13 QC	3.61E+03	Y
Pipe AO-30, 30 ft	3.31E+03	3.97E+03	2.65E+03	Pipe AO-30, 30 QC	3.64E+03	Y
Pipe AO-30, 20 ft	2.56E+03	3.07E+03	2.04E+03	Pipe AO-30, 20 QC	2.32E+03	Y
Pipe AO-30, 7 ft	2.77E+03	3.33E+03	2.22E+03	Pipe AO-30, 7 QC	3.08E+03	Y
Pipe AO-31, 15 ft	4.53E+03	5.43E+03	3.62E+03	Pipe AO-31, 15 QC	4.36E+03	Y
Pipe AO-31, 31 ft	4.53E+03	5.43E+03	3.62E+03	Pipe AO-31, 31 QC	4.88E+03	Y
Pipe AO-31, 21 ft	3.08E+03	3.70E+03	2.46E+03	Pipe AO-31, 21 QC	3.19E+03	Y
Pipe AO-31, 4 ft	1.66E+03	1.99E+03	1.33E+03	Pipe AO-31, 4 QC	1.64E+03	Y

Comments/Corrective Actions: Using the acceptance criteria specified in section 4.1.2 of ZS-LT-01, there was acceptable agreement between the replicate measurements and the original measurement in 15 of the 17 comparisons. Two (2) QC measurements did not fall within 20% of the original measurement. For pipe AO-30, the 19 ft. measurement was approximately 40% less than the original measurement. For pipe AO-30, the 13 ft. measurement was 20.3% greater than the original measurement. All measurements were well below 50% of the DCGL and the instrument and detector passed the post use response check. No further action was deemed necessary.

The acceptance criteria for replicate static measurements and scan surveys is that the same conclusion is reached for each measurement. That is defined as + 20% of the standard.