ZION STATION RESTORATION PROJECT
FINAL STATUS SURVEY RELEASE RECORD

UNIT 2 TENDON TUNNEL 547 FOOT EMBEDDED FLOOR DRAIN PIPE
SURVEY UNIT 06212

PREPARED BY / DATE: J. Graham 2019-09-01
Radiological Engineer

REVIEWED BY / DATE: P. Giza 2019-09-01
Radiological Engineer

APPROVED BY / DATE: D. Wojtkowiak 2019-09-01
C/LT Manager

TABLE OF CONTENTS

LIST OF TABLES

1. EXECUTIVE SUMMARY

This Final Status Survey (FSS) Release Record for survey unit 06212, Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe, 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 S3-06212AF 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, *"Multi-Agency Radiation Survey and Site Investigation Manual"* (MARSSIM) (Reference 4).

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. The Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe was classified as MARSSIM Class 3.

The Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe was surveyed with a Ludlum 2350-1 Data Logger paired with a 44-159 gamma detector. The survey plan required measurements to be collected at 10-foot intervals to provide for 10% survey coverage for the Class 3 survey unit. The length of this piping system was 452.99 linear feet.

For the FSS of the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe, forty-four (44) readings were obtained. All of the readings were below a Sum of Fractions (SOF) of 0.5 when compared against the Operational DCGL for embedded pipe ($OpDCGL_{EP}$), with a mean Operational SOF (OpSOF) reading of 0.014. The mean Base Case SOF (BcSOF), when compared against the Base Case DCGL for embedded pipe ($BcDCGL_{EP}$) was 0.000, which results in the dose calculated for this survey unit of 0.007 mrem/yr.

2. SURVEY UNIT DESCRIPTION

The Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe consists of a 4-inch Internal Diameter (ID) pipe that is 452.99 feet in length. The floor of the tunnel is at the 548 foot elevation, with the drain piping embedded in the concrete approximately 7-inches deep.

3. CLASSIFICATION BASIS

Survey unit 06212 was classified in accordance with Zion*Solutions* procedure ZS-LT-300-001-002, *"Survey Unit Classification"* (Reference 5).

The Tendon Tunnels were part of the Turbine Building basement FSS unit. The Turbine Building was initially classified as a Class 2 structure by the "*Zion Station Historical Site Assessment*" (HSA) (Reference 6). LTP Section 5.5.2.1.2 changed the classification of the Turbine Building basement from Class 2 to Class 3. The LTP states "The FSS units for the basements of the Turbine Building, the Crib House/Forebay, WWTF and the Circulating Water Discharge Tunnels are designated as Class 3 as defined in MARSSIM, section 2.2 in that the FSS units are expected to contain levels of residual activity at a small fraction of the DCGLs, based on site operating history and previous radiation surveys."

Although the Unit 2 Tendon Tunnels were inaccessible during site characterization in 2013, the results of environmental monitoring of radiological effluents indicated that the residual radioactivity present in this FSS unit was minimal, supporting the Class 3 classification.

4. DATA QUALITY OBJECTIVES (DQO)

Final Status Survey planning and design hinges on coherence with the 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 was to demonstrate that the level of residual radioactivity in survey unit 06212 did not exceed the release criteria specified in the LTP and that the potential dose from residual radioactivity was As Low As Reasonably Achievable (ALARA).

LTP Chapter 6, section 6.5.2 discusses the process used to derive the Radionuclides of Concern (ROC) for the decommissioning of Zion Nuclear Power Station (ZNPS), including the elimination of insignificant dose contributors (IC) from the initial suite.

Based upon the analysis of the mixture, it was determined that Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 accounted for 99.5% of all dose in the non-activated contaminated concrete mixes.

The residual radioactivity in embedded 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, *"Description of Embedded Piping, Penetrations, and Buried Pipe to Remain in Zion End State"* (Reference 7). The DCGLs for embedded piping are presented in LTP Chapter 5, sections 5.2.7 and 5.2.8.

Table 1 presents the ROC for the decommissioning at ZNPS and the normalized mixture fractions based on the radionuclide mixture.

Table 1 - Dose Significant Radionuclides and Mixture

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

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

At the start of the Data Assessment, it was determined that the isotopic mix incorporated into the Survey Design, the Containment Mix, was incorrect. The proper mix for this piping system is the mix for the Auxiliary Building. This mix was deemed appropriate because the Tendon Tunnel drains are hydraulically connected to the Turbine Building Steam Tunnel drains, and have no connection to systems in Containment. The data analysis performed for this Release Record was performed using the Auxiliary Building isotopic mix.

A FSS was conducted on the interior surfaces of embedded piping to demonstrate that the concentrations of residual activity were equal to or below DCGLs corresponding to the dose criterion in 10CFR20.1402 ($DCGL_{EP}$). $DCGL_{EP}$ were calculated for each of the remaining embedded pipe systems. The $DCGL_{EP}$ values for the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe from LTP Chapter 6, section 6.13 are referred to as $BcDCGL_{EP}$.

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/yr to an Average Member of the Critical Group (AMCG). To ensure that the summation of dose from each source term is 25 mrem/yr or less after all FSS is completed, the BcDCGLs are reduced based on an expected, or a priori, fraction of the 25 mrem/yr 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 8).

The Base Case and Operational DCGLs for the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe are listed in Tables 5-11 and 5-12 of the LTP, and are reproduced in the Table 2. The IC dose percentage of 5% was used to adjust the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe DCGLs to account for the dose from the eliminated IC radionuclides.

Table 2 - Base Case and Operational DCGLs

Radionuclide	Base Case DCGLs for Tendon Tunnel Embedded Pipe (pCi/m^2)	Operational DCGLs for Tendon Tunnel Embedded Pipe (pCi/m^2)
Co-60	1.06E+10	2.12E+08
Cs-134	2.04E+09	4.08E+07
Cs-137	2.67E+09	5.34E+07
Ni-63	2.72E+11	5.44E+09
Sr-90	9.70E+07	1.94E+06

Instrument DQOs included a verification of the ability of the survey instrument to detect the radiation(s) of interest relative to the OpDCGL. The Ludlum 44-159 gamma detector was selected as the primary instrument used to perform FSS of the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe. Response checks were required prior to issuance

and after use. Control and accountability of instrumentation used to acquire FSS data was required to assure data quality.

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 *"Final Status Survey Package Development."*

The survey design for this FSS listed the radionuclides for the Containment mixture as the ROC for survey unit 06212. This was corrected during data analysis to the isotopic mixture for the Auxiliary Building. Co-60, Ni-63, Sr-90, Cs-134 and Cs-137 are the ROC in survey unit 06212.

During FSS, concentrations for Hard-to-Detect (HTD) ROC Ni-63 and Sr-90 were 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, *"Radionuclides of Concern for Soil and Basement Fill Model Source Terms"* (Reference 9) and are presented in Table 3, which is reproduced from LTP Chapter 5, Table 5-12. The maximum ratios were 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

The equation for calculating a surrogate DCGL is as follows:

Equation 1

$$Surrogate_{DCGL} = \frac{1}{\left[\left(\frac{1}{DCGL_{Sur}}\right) + \left(\frac{R_2}{DCGL_2}\right) + \left(\frac{R_3}{DCGL_3}\right) + \cdots \left(\frac{R_n}{DCGL_n}\right)\right]}$$

Using the Base Case and Operational DCGLs presented in Table 2 and the maximum ratios from Table 3, the following surrogate calculations were performed:

Equation 2

$$Surrogate_{BcDCGL\,(Cs-137)} = \frac{1}{\left[\left(\frac{1}{2.67E09_{(Cs-137)}}\right) + \left(\frac{0.002}{9.70E07_{(Sr-90)}}\right)\right]} = 2.53E09\ pCi/m^2$$

Equation 3

$$Surrogate_{OpDCGL\,(Cs-137)} = \frac{1}{\left[\left(\frac{1}{5.34E07_{(Cs-137)}}\right) + \left(\frac{0.002}{1.94E06_{(Sr-90)}}\right)\right]} = 5.06E07\ pCi/m^2$$

Equation 4

$$Surrogate_{BcDCGL\,(Co-60)} = \frac{1}{\left[\left(\frac{1}{1.06E10_{(C0-60)}}\right) + \left(\frac{180.45}{2.72E11_{(Ni-63)}}\right)\right]} = 1.32E09\ pCi/m^2$$

Equation 5

$$Surrogate_{OpDCGL\,(Co-60)} = \frac{1}{\left[\left(\frac{1}{2.12E8_{(C0-60)}}\right) + \left(\frac{180.45}{5.44E9_{(Ni-63)}}\right)\right]} = 2.64E07\ pCi/m^2$$

Table 4 - Surrogate Base Case and Operational DCGLs

Radionuclide	Base Case Embedded Pipe DCGL pCi/m^2	Operational Embedded Pipe DCGL pCi/m^2
Co-60	1.32E+09	2.64E+07
Cs-134	2.04E+09	4.08E+07
Cs-137	2.53E+09	5.06E+07

Using the normalized gamma mixture for the Containment from LTP Chapter 5, Table 5-2, the surrogate OpDCGLs for Co-60 and Cs-137 from Table 4 plus the OpDCGLs for Cs-134, Eu-152 and Eu-154 from LTP Chapter 5, Table 5-12, a gross-gamma OpDCGL of 4.81E+07 pCi/m^2 was derived. The Action Level used for the FSS of this survey unit was 50% of that value which equates to 2.40E+07 pCi/m^2. The actual gross gamma OpDCGL using the Auxiliary Building mixture is 5.01E+07 pCi/m^2 and 50% of that value equates to 2.50E+07 pCi/m^2, which is less conservative than the Action Level that was actually used.

The Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe is a Class 3 embedded pipe. 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 4-inch diameter pipes. For a 4-inch diameter pipe, each measurement has a calculated Field-of-View (FOV) of 1.05 ft^2 (0.097 m^2).

The Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe consists of 452.99 linear feet of 4-inch diameter pipe, which equates to a surface area of forty-four (44) m^2. Procedure ZS-LT-300-001-001, *"Final Status Survey Package Development"* states that for the FSS of a Class 3 survey unit, an areal scan coverage of at least 10% is required. For this survey, 10% coverage was selected. One measurement was to be collected every 10 linear feet of piping traversed for a total of forty-six (46) distinct measurements over the entire accessible pathway of the piping system. In addition, for quality control (QC) purposes, a minimum of 5% of the measurements collected were to be replicated. This required three (3) replicated measurements to be collected throughout the length of the accessible surface of the piping system at locations selected at random.

Each static measurement represents the gamma activity in gross cpm for each specific measurement location. This gamma measurement value in cpm was then converted to dpm using an efficiency factor based on the calibration source. The total activity in dpm was adjusted for the assumed total effective surface area commensurate with the pipe diameter, resulting in measurement results in units of dpm per m^2. Unit conversion was then used to convert dpm to units of pCi. This measurement result, in units of pCi/m^2, then represented a commensurate and conservative gamma surface activity The total gamma surface activity for each FSS measurement was then converted to a gamma measurement result (in units of pCi/m^2) for each gamma ROC based on the normalized gamma mixture from Table 1. Concentrations for HTD ROC were inferred using a surrogate approach as per LTP Chapter 5. Cs-137 is the principle surrogate radionuclide for H-3 and Sr-90. Co-60 is the principle surrogate radionuclide for Ni-63. The maximum ratios from Table 3 were used in the surrogate calculations.

The "unity rule" is applied when there is more than one ROC. The measurement results for each singular ROC present in the mixture were compared against their respective OpDCGL to derive a dose fraction. The summation of the dose fractions for each ROC produces a OpSOF for the measurement.

To demonstrate that the survey unit satisfies the OpDCGL, the ROC concentration for each systematic measurement taken in the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe was divided by its applicable $OpDCGL_{EP}$ to derive a OpSOF for the ROC. The OpSOF for each ROC was then summed to determine the total OpSOF for all ROC that represents the measurement and was used as the summed value (Ws) for performing the Sign Test.

If the OpSOF for a systematic or judgmental measurement exceeded "0.5" in a Class 3 survey unit, then an investigation would be initiated in accordance with LTP Chapter 5, section 5.6.4.6 (Table 5-25). In a Class 3 FSS unit, the result of the investigation could prompt the reclassification of the survey unit (or a portion of the survey unit).

Embedded pipe survey units have a relatively small surface area, which leads to OpDCGLs that are higher than the wall/floor OpDCGLs. The reason for this fact is that the total internal surface area of the embedded pipe survey unit in a given basement is much less than the total wall/floor surface area of the basement containing them. To eliminate the potential for activity levels in embedded pipe that could lead to releases greater than surrounding walls and floors, the following remediation and grouting action levels were applied to the measurements of surface activity in embedded pipe.

- If maximum activity exceeded the $BcDCGL_{EP}$ from Table 2 (SOF >1), then remediation was performed.
- If the maximum activity in an embedded pipe exceeded the surface $OpDCGL_B$ from LTP Chapter 5, Table 5-4 (SOF>1) in the building that contains it, but was below the $BcDCGL_{EP}$ from Table 2, then the embedded pipe was remediated or grouted.
- If an embedded pipe was remediated and the maximum activity continued to exceed the surface $OpDCGL_B$ from LTP Chapter 5, Table 5-4 (SOF>1), but was less than the $OpDCGL_{EP}$ from Table 2, then the embedded pipe was grouted.
- If the maximum activity was below the surface $OpDCGL_B$ from LTP Chapter 5, Table 5-4 (SOF>1), then grouting of the pipe was not required.

The instrumentation used for the FSS of the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe was the Ludlum Model 2350-1 and the Model 44-159 detector. The instrumentation sensitivities are provided in Chapter 5 of the LTP, which is reproduced below as Table 5.

Table 5 - Typical FSS Instrument Detection Sensitivities

Instrument /Detector	Radiation	BKGD Count Time (min.)	Typical BKGD (cpm)	Typical Instrument Efficiency (1)(2)	Count Time (min.)	Static MDC (dpm/100 cm^2)	Scan MDC (dpm/100 cm^2)
Ludlum 2350-1/ 44-159	Gamma	1	700	0.024	1	5,250	N/A

(1) Typical calibration source used is Cs-137. The efficiency is determined by counting the source with the detector in a fixed position from the source (reproducible geometry). The εt value is based on ISO-7503-1 and conditions noted for each detector.

(2) The efficiency varies for the pipe detectors depending on the pipe diameter used. The efficiency used for the table is the average efficiency value for the pipe diameters. The detectors and diameters are: Model 44-159: 2-4 in. dia., Model 44-157: 4-8 in. dia., Model 44-162: 8-12 in. diameter.

In compliance with ZS-LT-01, *"Quality Assurance Project Plan (for Characterization and FSS)"* (QAPP) (Reference 10), replicate measurements were to be performed on 5% of the static measurement locations.

Table 6 - Synopsis of Survey Design

Feature	Design Criteria	Basis
Survey Unit Area	452.99 ft^2 (44 m^2)	4 in (ID) x 452.99 ft (length) x π
Number of Static Measurements	46	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 – 2.12E+08 pCi/m^2 • Cs-134 – 4.08E+07 pCi/m^2 • Cs-137 –5.34E+07 pCi/m^2 • Ni-63 –5.44E+09 pCi/m^2 • Sr-90 –1.94E+06 pCi/m^2	Operational DCGLs for Unit 1 and Unit 2 Tendon Tunnel Embedded Pipe, (LTP Chapter 5, Table 5-12)
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 Operational DCGL	(LTP Chapter 5, Table 5-25)
Scan Survey Area Coverage	N/A	LTP 5.7.1.9
QC	replicate measurements will be performed on 5% of the static measurement locations	QAPP

6. SURVEY IMPLEMENTATION

Survey instructions for this FSS were incorporated into and performed in accordance with FSS Sample Plan 06212, 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 11).

The approach used for the radiological survey of the interior surfaces of the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe involved the insertion of a 1" x 1" CsI detector that was attached to the See Snake camera system and transported through the pipe to the maximum deployment length, or to a location of drain drop. A simple "push-pull" methodology was used, whereby the position of the detector in the piping system could be easily determined in a reproducible manner. Video footage was

tabulated on the See Snake, then measurements were obtained at 10-foot intervals while backing out of the pipe section.

A background value was also 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 use and daily 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 12). The Daily Operational Response Check compared the background response and the response to check sources ranges established for normal background and detector source response to ensure that the detector was working properly.

Surveys of the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe were performed on March 9, 2018. The survey was completed in 1 day. The piping was accessed through the floor drains located in the Tendon Tunnel, numbered M218 through M223.

Due to blockages in the piping from debris and water, only 367 feet of piping was accessible for survey. A total of forty-four (44) readings were obtained utilizing eight (8) different insertion points for the detector. The forty-four (44) readings obtained represented 9.7% of the pipe interior surface. Although the survey design called for 10% areal survey coverage of the piping system, the required scan coverage from the LTP and procedure ZS-LT-300-001-001 for a Class 3 area, is 1% to 10% coverage with judgmental selection of the areas surveyed. Since the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe was not expected to be contaminated, and this expectation was verified by the results of the survey, the areal survey coverage of 9.7% was deemed acceptable. Table 7 summarizes the data collected:

Table 7 - Survey Data Collected

Pipe Run	Length Surveyed	# of Measurements Taken	Comment
M-218 – M-219	90 feet	10 (1 QC)	None
M-219 – M-220	70 feet	8 (1 QC)	None
M-220 – Sump	20 feet	3	An obstruction was found at 20 feet
M-221 – Sump	20 feet	3	An obstruction was found at 20 feet
M-225 Cleanout - Sump	10 feet	2	This was taken to capture some of the pipe missed.
M-222 – M-221	80 feet	9	None
M-223 – M-222	77 feet	9 (1 QC)	None
Total	**367** feet	**44 (3 QC)**	

The instrument and detector used for this survey are presented in Table 8. The instrument and detector were verified to be properly calibrated prior to use.

Table 8 - Instrument and Detector

Instrument/Detector Type	Serial #	Calibration Due Date
Ludlum 2350-1	304713	04/12/18
Ludlum 44-159	PR327895	04/12/18

Daily prior to use (Pre-Test) and daily upon completion of surveys (Post-Test), response checks were performed in accordance with procedure ZS-LT-300-001-006 for each detector and data logger pairing. In addition, all instruments and detectors were physically inspected for mechanical damage as part of the response check process. During the FSS, no instances were encountered where an instrument and/or detector failed a Pre or Post response check or were found to be physically damaged during the inspection.

7. SURVEY RESULTS

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 13). Data processing included converting measurement data into reporting units, validating instrument applicability and sensitivity, calculating relevant statistical quantities, and verification that all DQO had been met. In accordance with the procedure, a preliminary Data Assessment was prepared.

The primary gamma-emitting ROC for the FSS of the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe FSS unit are Co-60, Cs-134 and Cs-137. Ni-63 and Sr-90 are also ROC for the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe. Ni-63 is inferred from the measured concentration of Co-60, while Sr-90 is inferred from the measured concentration of Cs-137.

All measurements were less than 50% of the OpDCGL, meeting the requirement for a Class 3 area. The mean of the OpSOF for all 44 samples was 0.014.

The activity in this pipe was also compared to the $OpDCGL_B$ for the building that contained it. According to Table 5-20 of the LTP, the Tendon Tunnel drains are included with both the Containment and Turbine Buildings. The results of this comparison for all measurements show that all OpSOF were less than one when compared to the $OpDCGL_B$ for both basements.

The results of the data assessment for the embedded floor drain pipe are provided in Attachment 2. A statistical summary of the data is presented in Table 9.

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

Table 9 - Unit 2 Tendon Tunnel Embedded Floor Drain Pipe - Statistical Quantities

Individual Measurement Metrics		
Total Number of Systematic Measurements	=	44
Number of Quality Control Measurements	=	3
Number of Judgmental/Investigational Measurements	=	0
Total Number of Measurements	=	47
Mean Systematic Measurement OpSOF	=	0.014
Max Individual Systematic Measurement OpSOF	=	0.016
Number of Systematic Measurements with OpSOF >0.5	=	0

Table 9 (continued) - Unit 2 Tendon Tunnel Embedded Floor Drain Pipe - Statistical Quantities

Statistical Quantities - Systematic Measurement Population							
ROC	**MEAN (pCi/m^2)**	**MEDIAN (pCi/m^2)**	**MAX (pCi/m^2)**	**MIN (pCi/m^2)**	**ST. DEV. (pCi/m^2)**	**$BcDCGL_{EP}$ (pCi/m^2)**	**BcSOF**
Co-60	8.23E+03	8.24E+03	9.69E+03	7.05E+03	5.97E+02	1.06E+10	0.0000
Ni-63	1.49E+06	1.49E+06	1.75E+06	1.27E+06	1.08E+05	2.72E+11	0.0000
Sr-90	1.35E+03	1.35E+03	1.59E+03	1.15E+03	9.77E+01	9.70E+07	0.0000
Cs-134	8.95E+01	8.95E+01	1.05E+02	7.66E+01	6.49E+00	2.04E+09	0.0000
Cs-137	6.74E+05	6.74E+05	7.94E+05	5.77E+05	4.88E+04	2.67E+09	0.0003

The mean BcSOF for the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe FSS unit based on the mean concentration for each ROC as measured by the systematic sample population when compared against the $BcDCGL_{PN}$ is 0.0003. This value equates to a dose of 0.007 mrem/yr.

8. QUALITY CONTROL

In compliance with ZS-LT-01, replicate measurements were performed on 5% of the survey locations chosen at random. Three (3) 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 readings and the original readings. Refer to Attachment 4 for QC analysis results.

9. INVESTIGATIONS AND RESULTS

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

10. REMEDIATION AND RESULTS

No remediation was performed in this piping survey unit.

11. CHANGES FROM THE SURVEY PLAN

The access to the drain piping system was changed. The survey design called for the piping to be accessed from the Buttress Pits. Instead, an entry was made to the Tendon Tunnel, where the drain piping was accessed through the floor drains in the tunnel.

The isotopic mix for Containment was used during the design of the FSS. Following acquisition of the survey data and during the DQA process, it was determined that the correct mixture for this survey unit was the Auxiliary Building mixture instead of the Containment mixture that was used. An assessment of the difference between survey

designs using each mixture determined that the use of the Containment mixture was conservative and no additional measurements or changes were necessary.

During the pre-survey inspection of the pipe interior, it was discovered that the pipe was obstructed in several places. Consequently, only 367 feet of the pipe length of 453 feet was accessible for survey. The areal surface coverage from the measurements taken was 9.7% of the survey unit area. This was slightly less than the 10% coverage called for in the survey design. However, the coverage does meet the requirement of the LTP and procedure ZS-LT-300-001-001, which requires 1 to 10% areal surface area coverage for a Class 3 survey unit.

12. DATA QUALITY ASSESSMENT (DQA)

In accordance with procedure ZS-LT-300-001-004, the DQOs, sample design, and data were reviewed for completeness, accuracy and consistency. Documentation was complete and legible. The FSS unit was properly classified as Class 3. All measurement results were individually reviewed and validated. The instrumentation used to perform the FSS were in calibration, capable of detecting the activity with an adequate 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.

The data for Gross Gamma Activity is represented graphically through a frequency plot and a quantile plot. All graphical representations are provided in Attachment 5.

13. ANOMALIES

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

14. CONCLUSION

Forty-four (44) static measurements were taken in the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe, taken at 10-foot intervals. The length of pipe in the Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe was 453 linear feet, with the accessible length of pipe being 367 feet. This results in an areal survey coverage of 9.7%, which is acceptable for a Class 3 survey unit.

All of the measurement results were less than an OpSOF of 0.5 when compared to the $OpDCGL_{EP}$. The average OpSOF for the survey unit was 0.014. The measured radiological conditions met the conditions for a Class 3 survey unit.

The Sign Test was passed, and the Null Hypothesis was rejected.

The mean BcSOF for this survey unit is 0.000. The dose contribution from survey unit 06212, “Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain Pipe”, is 0.007 mrem/yr

TEDE, based on the average concentration of the ROC in samples used for non-parametric statistical sampling.

Survey unit 06212, "Unit 2 Tendon Tunnel 547 foot Embedded Floor Drain 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 Station Historical Site Assessment
7. Zion*Solutions* TSD 14-016, Description of Embedded Piping, Penetrations, and Buried Pipe to Remain in Zion End State
8. Zion*Solutions* TSD 17-004, Operational Derived Concentration Guideline Levels for Final Status Survey
9. Zion*Solutions* TSD 14-019, Radionuclides of Concern for Soil and Basement Fill Model Source Terms
10. Zion*Solutions* procedure ZS-LT-01, Quality Assurance Project Plan (for Characterization and FSS)
11. Zion*Solutions* procedure ZS-LT-300-001-003, Isolation and Control for Final Status Survey
12. Zion*Solutions* procedure ZS-LT-300-001-006, Radiation Surveys of Pipe Interiors Using Sodium/Cesium Iodide Detectors
13. Zion*Solutions* procedure ZS-LT-300-001-004, Final Status Survey Data Assessment

16. ATTACHMENTS

Attachment 1 – Figure and Maps

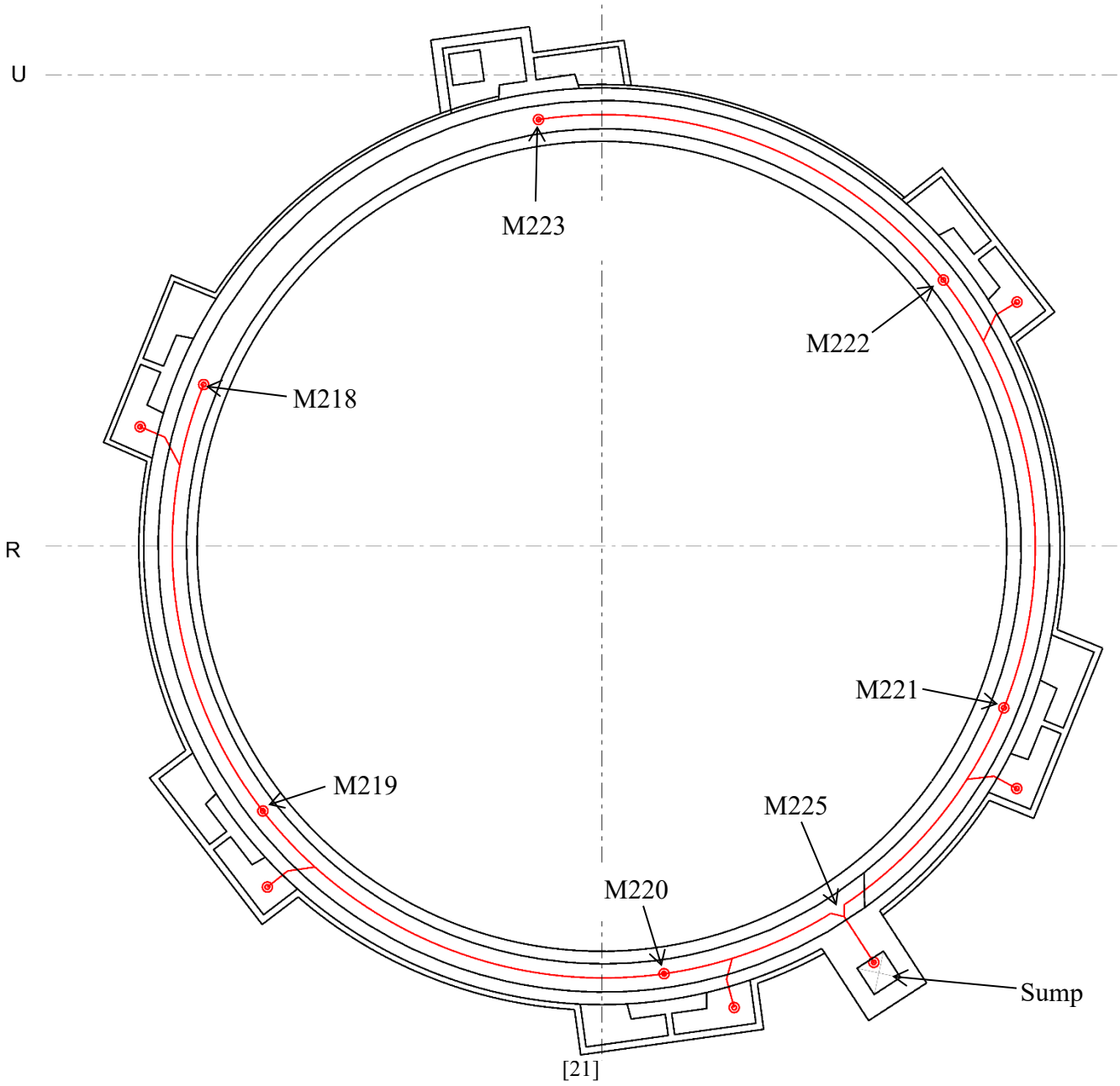
Attachment 2 – Measurement Data

Attachment 3 – Sign Test

Attachment 4 – QC Data

Attachment 5 – Graphical Presentations

ATTACHMENT 1 - FIGURE AND MAPS


U
R
M223
M222
M218
M221
M219
M225
M220
Sump
[21]

ATTACHMENT 2 - MEASUREMENT DATA

Pipe Section	Position	Gross Gamma Activity (pCi/m^2)	Co-60 Conc. (pCi/m^2)	Cs-134 Conc. (pCi/m^2)	Cs-137 Conc. (pCi/m^2)	Ni-63 Conc. (pCi/m^2)	Sr-90 Conc. (pCi/m^2)	Co-60 OpSOF	Cs-134 OpSOF	Cs-137 OpSOF	Ni-63 OpSOF	Sr-90 OpSOF	OpSOF
M223 to M222	1	6.94E+05	8.37E+03	9.10E+01	6.85E+05	1.51E+06	1.37E+03	3.95E-05	2.23E-06	1.28E-02	2.78E-04	7.07E-04	0.0139
	2	6.80E+05	8.21E+03	8.92E+01	6.72E+05	1.48E+06	1.34E+03	3.87E-05	2.19E-06	1.26E-02	2.72E-04	6.93E-04	0.0136
	3	6.97E+05	8.41E+03	9.14E+01	6.89E+05	1.52E+06	1.38E+03	3.97E-05	2.24E-06	1.29E-02	2.79E-04	7.10E-04	0.0139
	4	7.09E+05	8.56E+03	9.30E+01	7.01E+05	1.54E+06	1.40E+03	4.04E-05	2.28E-06	1.31E-02	2.84E-04	7.22E-04	0.0142
	5	7.44E+05	8.97E+03	9.75E+01	7.34E+05	1.62E+06	1.47E+03	4.23E-05	2.39E-06	1.38E-02	2.98E-04	7.57E-04	0.0149
	6	7.28E+05	8.78E+03	9.55E+01	7.19E+05	1.59E+06	1.44E+03	4.14E-05	2.34E-06	1.35E-02	2.91E-04	7.41E-04	0.0145
	7	6.89E+05	8.31E+03	9.03E+01	6.80E+05	1.50E+06	1.36E+03	3.92E-05	2.21E-06	1.27E-02	2.76E-04	7.01E-04	0.0138
	8	7.01E+05	8.45E+03	9.19E+01	6.92E+05	1.53E+06	1.38E+03	3.99E-05	2.25E-06	1.30E-02	2.80E-04	7.14E-04	0.0140
	9	6.87E+05	8.29E+03	9.01E+01	6.79E+05	1.50E+06	1.36E+03	3.91E-05	2.21E-06	1.27E-02	2.75E-04	7.00E-04	0.0137
M222 to M221	1	5.86E+05	7.07E+03	7.68E+01	5.79E+05	1.28E+06	1.16E+03	3.33E-05	1.88E-06	1.08E-02	2.34E-04	5.97E-04	0.0117
	2	6.44E+05	7.77E+03	8.45E+01	6.36E+05	1.40E+06	1.27E+03	3.67E-05	2.07E-06	1.19E-02	2.58E-04	6.56E-04	0.0129
	3	6.80E+05	8.21E+03	8.92E+01	6.72E+05	1.48E+06	1.34E+03	3.87E-05	2.19E-06	1.26E-02	2.72E-04	6.93E-04	0.0136
	4	6.66E+05	8.04E+03	8.74E+01	6.58E+05	1.45E+06	1.32E+03	3.79E-05	2.14E-06	1.23E-02	2.67E-04	6.79E-04	0.0133
	5	6.17E+05	7.44E+03	8.09E+01	6.09E+05	1.34E+06	1.22E+03	3.51E-05	1.98E-06	1.14E-02	2.47E-04	6.28E-04	0.0123
	6	6.41E+05	7.73E+03	8.40E+01	6.33E+05	1.40E+06	1.27E+03	3.65E-05	2.06E-06	1.19E-02	2.56E-04	6.52E-04	0.0128
	7	6.68E+05	8.06E+03	8.76E+01	6.60E+05	1.45E+06	1.32E+03	3.80E-05	2.15E-06	1.24E-02	2.67E-04	6.80E-04	0.0133
	8	7.11E+05	8.58E+03	9.32E+01	7.02E+05	1.55E+06	1.40E+03	4.05E-05	2.29E-06	1.32E-02	2.85E-04	7.24E-04	0.0142
	9	6.42E+05	7.75E+03	8.43E+01	6.35E+05	1.40E+06	1.27E+03	3.66E-05	2.07E-06	1.19E-02	2.57E-04	6.54E-04	0.0128
M221 to Sump	1	6.96E+05	8.39E+03	9.12E+01	6.87E+05	1.51E+06	1.37E+03	3.96E-05	2.24E-06	1.29E-02	2.78E-04	7.08E-04	0.0139
	2	6.06E+05	7.32E+03	7.95E+01	5.99E+05	1.32E+06	1.20E+03	3.45E-05	1.95E-06	1.12E-02	2.43E-04	6.18E-04	0.0121
	3	6.65E+05	8.02E+03	8.72E+01	6.57E+05	1.45E+06	1.31E+03	3.78E-05	2.14E-06	1.23E-02	2.66E-04	6.77E-04	0.0133
M218 to M219	1	7.37E+05	8.89E+03	9.66E+01	7.28E+05	1.60E+06	1.46E+03	4.19E-05	2.37E-06	1.36E-02	2.95E-04	7.50E-04	0.0147
	2	6.25E+05	7.54E+03	8.20E+01	6.18E+05	1.36E+06	1.24E+03	3.56E-05	2.01E-06	1.16E-02	2.50E-04	6.37E-04	0.0125
	3	7.02E+05	8.47E+03	9.21E+01	6.94E+05	1.53E+06	1.39E+03	4.00E-05	2.26E-06	1.30E-02	2.81E-04	7.15E-04	0.0140
	4	5.84E+05	7.05E+03	7.66E+01	5.77E+05	1.27E+06	1.15E+03	3.32E-05	1.88E-06	1.08E-02	2.34E-04	5.95E-04	0.0117
	5	7.09E+05	8.56E+03	9.30E+01	7.01E+05	1.54E+06	1.40E+03	4.04E-05	2.28E-06	1.31E-02	2.84E-04	7.22E-04	0.0142
	6	7.76E+05	9.36E+03	1.02E+02	7.67E+05	1.69E+06	1.53E+03	4.42E-05	2.49E-06	1.44E-02	3.11E-04	7.90E-04	0.0155
	7	6.82E+05	8.23E+03	8.94E+01	6.74E+05	1.48E+06	1.35E+03	3.88E-05	2.19E-06	1.26E-02	2.73E-04	6.94E-04	0.0136

Pipe Section	Position	Gross Gamma Activity	Co-60 Conc.	Cs-134 Conc.	Cs-137 Conc.	Ni-63 Conc.	Sr-90 Conc.	Co-60 OpSOF	Cs-134 OpSOF	Cs-137 OpSOF	Ni-63 OpSOF	Sr-90 OpSOF	OpSOF
	8	7.62E+05	9.20E+03	1.00E+02	7.53E+05	1.66E+06	1.51E+03	4.34E-05	2.45E-06	1.41E-02	3.05E-04	7.76E-04	0.0152
	9	6.51E+05	7.85E+03	8.54E+01	6.43E+05	1.42E+06	1.29E+03	3.71E-05	2.09E-06	1.20E-02	2.61E-04	6.63E-04	0.0130
	10	6.73E+05	8.12E+03	8.83E+01	6.65E+05	1.47E+06	1.33E+03	3.83E-05	2.16E-06	1.25E-02	2.69E-04	6.86E-04	0.0135
M219 to M220	1	6.84E+05	8.25E+03	8.96E+01	6.75E+05	1.49E+06	1.35E+03	3.89E-05	2.20E-06	1.26E-02	2.74E-04	6.96E-04	0.0137
	2	7.59E+05	9.16E+03	9.95E+01	7.50E+05	1.65E+06	1.50E+03	4.32E-05	2.44E-06	1.40E-02	3.04E-04	7.73E-04	0.0152
	3	6.22E+05	7.50E+03	8.16E+01	6.14E+05	1.35E+06	1.23E+03	3.54E-05	2.00E-06	1.15E-02	2.49E-04	6.33E-04	0.0124
	4	6.89E+05	8.31E+03	9.03E+01	6.80E+05	1.50E+06	1.36E+03	3.92E-05	2.21E-06	1.27E-02	2.76E-04	7.01E-04	0.0138
	5	6.72E+05	8.10E+03	8.81E+01	6.63E+05	1.46E+06	1.33E+03	3.82E-05	2.16E-06	1.24E-02	2.69E-04	6.84E-04	0.0134
	6	6.18E+05	7.46E+03	8.11E+01	6.11E+05	1.35E+06	1.22E+03	3.52E-05	1.99E-06	1.14E-02	2.48E-04	6.30E-04	0.0124
	7	7.13E+05	8.60E+03	9.35E+01	7.04E+05	1.55E+06	1.41E+03	4.06E-05	2.29E-06	1.32E-02	2.85E-04	7.26E-04	0.0142
	8	7.35E+05	8.87E+03	9.64E+01	7.26E+05	1.60E+06	1.45E+03	4.18E-05	2.36E-06	1.36E-02	2.94E-04	7.48E-04	0.0147
M220 to Sump	1	6.72E+05	8.10E+03	8.81E+01	6.63E+05	1.46E+06	1.33E+03	3.82E-05	2.16E-06	1.24E-02	2.69E-04	6.84E-04	0.0134
	2	6.53E+05	7.88E+03	8.56E+01	6.45E+05	1.42E+06	1.29E+03	3.71E-05	2.10E-06	1.21E-02	2.61E-04	6.65E-04	0.0130
	3	6.18E+05	7.46E+03	8.11E+01	6.11E+05	1.35E+06	1.22E+03	3.52E-05	1.99E-06	1.14E-02	2.48E-04	6.30E-04	0.0124
M225 to Sump	1	8.03E+05	9.69E+03	1.05E+02	7.94E+05	1.75E+06	1.59E+03	4.57E-05	2.58E-06	1.49E-02	3.22E-04	8.18E-04	0.0161
	2	7.21E+05	8.70E+03	9.46E+01	7.12E+05	1.57E+06	1.42E+03	4.10E-05	2.32E-06	1.33E-02	2.89E-04	7.34E-04	0.0144

ATTACHMENT 3 - SIGN TEST

SIGN TEST (continued)

Pipe Section	Position	Co-60 SOF	Cs-134 SOF	Cs-137 SOF	Ni-63 SOF	Sr-90 SOF	SOF (Ws)	1-Ws	Sign
M223 to M222	1	3.95E-05	2.23E-06	1.28E-02	2.78E-04	7.07E-04	0.0139	0.99	+1
	2	3.87E-05	2.19E-06	1.26E-02	2.72E-04	6.93E-04	0.0136	0.99	+1
	3	3.97E-05	2.24E-06	1.29E-02	2.79E-04	7.10E-04	0.0139	0.99	+1
	4	4.04E-05	2.28E-06	1.31E-02	2.84E-04	7.22E-04	0.0142	0.99	+1
	5	4.23E-05	2.39E-06	1.38E-02	2.98E-04	7.57E-04	0.0149	0.99	+1
	6	4.14E-05	2.34E-06	1.35E-02	2.91E-04	7.41E-04	0.0145	0.99	+1
	7	3.92E-05	2.21E-06	1.27E-02	2.76E-04	7.01E-04	0.0138	0.99	+1
	8	3.99E-05	2.25E-06	1.30E-02	2.80E-04	7.14E-04	0.0140	0.99	+1
	9	3.91E-05	2.21E-06	1.27E-02	2.75E-04	7.00E-04	0.0137	0.99	+1
M222 to M221	1	3.33E-05	1.88E-06	1.08E-02	2.34E-04	5.97E-04	0.0117	0.99	+1
	2	3.67E-05	2.07E-06	1.19E-02	2.58E-04	6.56E-04	0.0129	0.99	+1
	3	3.87E-05	2.19E-06	1.26E-02	2.72E-04	6.93E-04	0.0136	0.99	+1
	4	3.79E-05	2.14E-06	1.23E-02	2.67E-04	6.79E-04	0.0133	0.99	+1
	5	3.51E-05	1.98E-06	1.14E-02	2.47E-04	6.28E-04	0.0123	0.99	+1
	6	3.65E-05	2.06E-06	1.19E-02	2.56E-04	6.52E-04	0.0128	0.99	+1
	7	3.80E-05	2.15E-06	1.24E-02	2.67E-04	6.80E-04	0.0133	0.99	+1
	8	4.05E-05	2.29E-06	1.32E-02	2.85E-04	7.24E-04	0.0142	0.99	+1
	9	3.66E-05	2.07E-06	1.19E-02	2.57E-04	6.54E-04	0.0128	0.99	+1
M221 to Sump	1	3.96E-05	2.24E-06	1.29E-02	2.78E-04	7.08E-04	0.0139	0.99	+1
	2	3.45E-05	1.95E-06	1.12E-02	2.43E-04	6.18E-04	0.0121	0.99	+1
	3	3.78E-05	2.14E-06	1.23E-02	2.66E-04	6.77E-04	0.0133	0.99	+1
M218 to M219	1	4.19E-05	2.37E-06	1.36E-02	2.95E-04	7.50E-04	0.0147	0.99	+1
	2	3.56E-05	2.01E-06	1.16E-02	2.50E-04	6.37E-04	0.0125	0.99	+1
	3	4.00E-05	2.26E-06	1.30E-02	2.81E-04	7.15E-04	0.0140	0.99	+1
	4	3.32E-05	1.88E-06	1.08E-02	2.34E-04	5.95E-04	0.0117	0.99	+1
	5	4.04E-05	2.28E-06	1.31E-02	2.84E-04	7.22E-04	0.0142	0.99	+1
	6	4.42E-05	2.49E-06	1.44E-02	3.11E-04	7.90E-04	0.0155	0.98	+1
	7	3.88E-05	2.19E-06	1.26E-02	2.73E-04	6.94E-04	0.0136	0.99	+1
	8	4.34E-05	2.45E-06	1.41E-02	3.05E-04	7.76E-04	0.0152	0.98	+1
	9	3.71E-05	2.09E-06	1.20E-02	2.61E-04	6.63E-04	0.0130	0.99	+1
	10	3.83E-05	2.16E-06	1.25E-02	2.69E-04	6.86E-04	0.0135	0.99	+1
M219 to M220	1	3.89E-05	2.20E-06	1.26E-02	2.74E-04	6.96E-04	0.0137	0.99	+1
	2	4.32E-05	2.44E-06	1.40E-02	3.04E-04	7.73E-04	0.0152	0.98	+1
	3	3.54E-05	2.00E-06	1.15E-02	2.49E-04	6.33E-04	0.0124	0.99	+1
	4	3.92E-05	2.21E-06	1.27E-02	2.76E-04	7.01E-04	0.0138	0.99	+1
	5	3.82E-05	2.16E-06	1.24E-02	2.69E-04	6.84E-04	0.0134	0.99	+1
	6	3.52E-05	1.99E-06	1.14E-02	2.48E-04	6.30E-04	0.0124	0.99	+1
	7	4.06E-05	2.29E-06	1.32E-02	2.85E-04	7.26E-04	0.0142	0.99	+1
	8	4.18E-05	2.36E-06	1.36E-02	2.94E-04	7.48E-04	0.0147	0.99	+1
M220 to Sump	1	3.82E-05	2.16E-06	1.24E-02	2.69E-04	6.84E-04	0.0134	0.99	+1
	2	3.71E-05	2.10E-06	1.21E-02	2.61E-04	6.65E-04	0.0130	0.99	+1
	3	3.52E-05	1.99E-06	1.14E-02	2.48E-04	6.30E-04	0.0124	0.99	+1

SIGN TEST (continued)

Pipe Section	Position	Co-60 SOF	Cs-134 SOF	Cs-137 SOF	Ni-63 SOF	Sr-90 SOF	SOF (Ws)	1-Ws	Sign
M225 to Sump	1	4.57E-05	2.58E-06	1.49E-02	3.22E-04	8.18E-04	0.0161	0.98	+1
	2	4.10E-05	2.32E-06	1.33E-02	2.89E-04	7.34E-04	0.0144	0.99	+1

Number of Measurements =	44
Type I Error =	0.05
Number of Positive Differences (S+) =	44
Critical Value =	27
Survey unit MEETS the Acceptance Criteria	YES

ATTACHMENT 4 - QC DATA

Replicate Measurement Assessment Form

Survey Unit # 06212 Survey Unit Name Unit 2 Tendon Tunnel Embedded Floor Drain

Sample Plan # S1-06212A-F

Sample Description: Comparison of replicate measurements collected from measurement locations M218 (50 ft), M219 (20 ft) and M223 (50 ft)

STANDARD				COMPARISON		
ID	Activity Value (pCi/m^2)	+20% (pCi/m^2)	-20% (pCi/m^2)	ID	Activity Value (pCi/m^2)	Acceptable (Y/N)
M218 (50 ft)	7.28E+05	8.74E+05	5.82E+05	M218 (50 ft) QC	7.38E+05	N
M219 (20 ft)	7.76E+05	9.31E+05	6.21E+05	M219 (20 ft) QC	7.16E+05	Y
M223 (50 ft)	6.22E+05	7.46E+05	4.98E+05	M223 (50 ft) QC	6.39E+05	Y

Comments/Corrective Actions: There was acceptable agreement between the standard measurement and the replicate measurement. Based on the professional judgment of the Radiological Engineer, the same conclusion was reached for each measurement. No further action is necessary.

The acceptance criteria for replicate static measurements and scan surveys are that the same conclusion is reached for each measurement. This is defined as $\pm$ 20% of the standard.

ATTACHMENT 5 - GRAPHICAL PRESENTATIONS

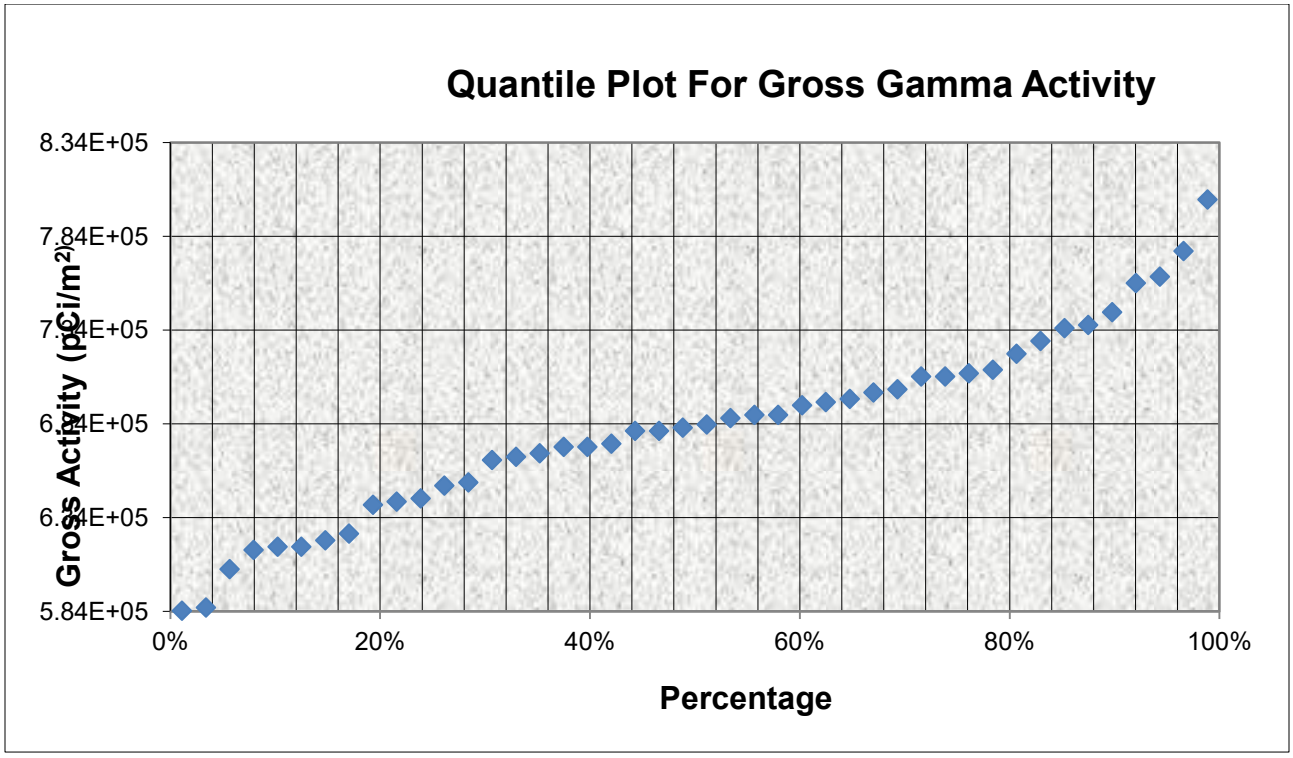
QUANTILE PLOT for Gross Gamma Activity

Survey Unit: 06212

Unit 2 Tendon Tunnel Drains

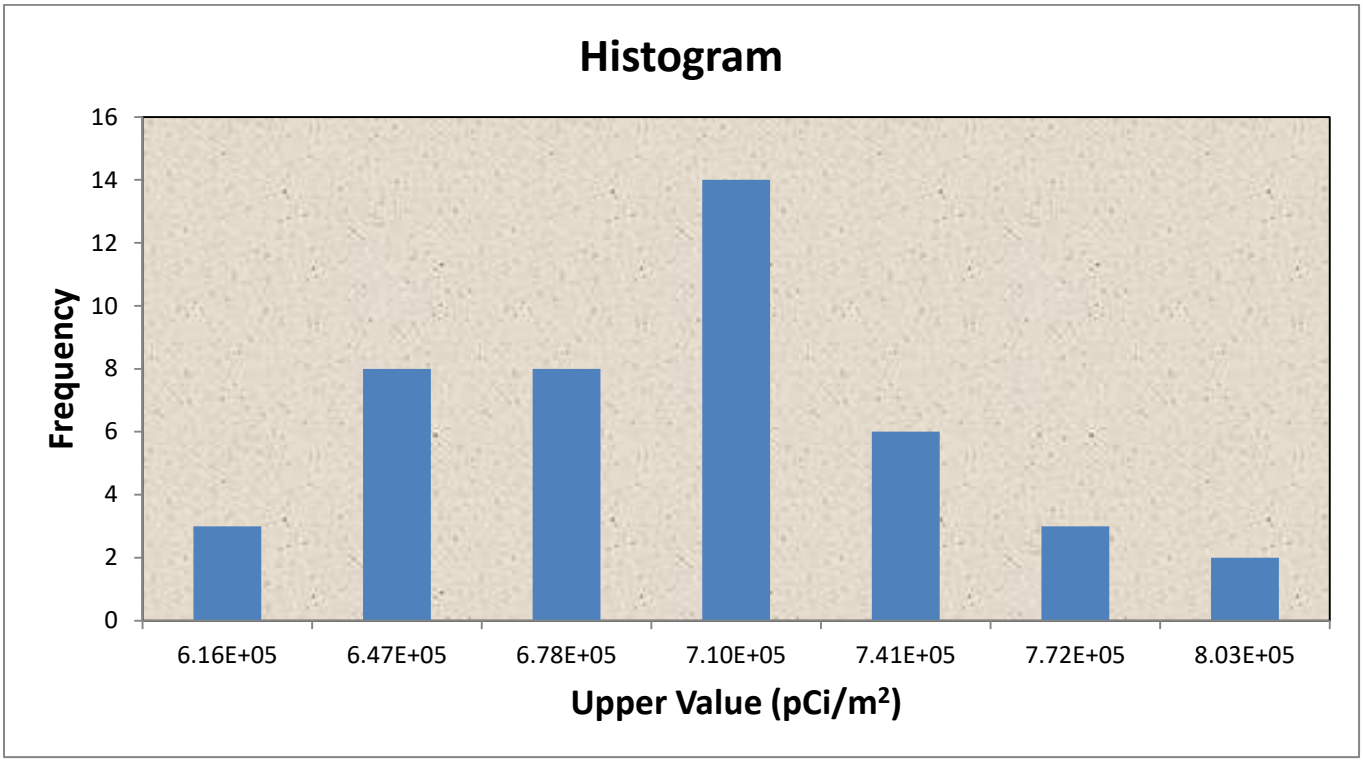
Survey Unit Name: Embedded Pipe

Mean: 6.82E+05 pCi/m^2



Histogram for Gross Gamma Activity

Survey Unit: 06212
Survey Unit Name: Unit 2 Tendon Tunnel Floor Drains
Mean: 6.82E+05 pCi/g
Median: 6.83E+05 pCi/g
ST DEV: 4.95E+04
Skew: 0.140



Upper Value	Observation Frequency	Observation %
6.16E+05	3	7%
6.47E+05	8	18%
6.78E+05	8	18%
7.10E+05	14	32%
7.41E+05	6	14%
7.72E+05	3	7%
8.03E+05	2	5%
TOTAL	**44**	**100%**

Retrospective Power Curve for Survey Unit 06212