

**PWR Zinc Addition Effectiveness Assessment:
Baseline Surface Activity Concentrations by Gamma
Scanning at Davis-Besse**

3002001688

PWR Zinc Addition Effectiveness Assessment: Baseline Surface Activity Concentrations by Gamma Scanning at Davis-Besse

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Abstract

Gamma spectroscopy measurements of the hot and cold leg primary loop piping were made to determine the major contributors to the piping dose rates during Refueling Outage 17. This was the second gamma scan campaign at Davis-Besse as part of a program to follow the changes in piping oxide composition with zinc addition. The initial gamma scans were performed during Maintenance Outage 17M just prior to the initiation of zinc injection to establish baseline conditions. The current data set will document conditions following the initiation of zinc addition. Performing gamma scans during future outages will enable the site and the PWR fleet worldwide to monitor the results of implemented source term reduction initiatives and prioritize future source term reduction efforts.

Keywords

Cold leg
Depleted zinc addition
Gamma spectroscopy
Hot leg

Executive Summary

Performing gamma scans is an important tool in understanding radionuclide incorporation into the piping oxide film and its effect on piping dose rates. Gamma scanning is also a tool to monitor the effectiveness of source term minimization initiatives.

Gamma scanning is being used at Davis-Besse to follow the changes in the piping radionuclide composition and concentration as depleted zinc addition is implemented. The first post-zinc addition gamma scans were performed during Refueling Outage 17. Gamma scan measurements collected during Davis-Besse's Maintenance Outage 17M serve as the baseline data. Davis-Besse began depleted zinc addition on March 12, 2012, and continued until April 28, 2012, just prior to the refueling outage.

Additional gamma scans during future outages at Davis-Besse will allow for further trending and understanding of the effects of zinc addition and steam generator replacement at existing plants. Gamma scans will also allow the plant to determine whether these strategies are beneficial to aid the plant in becoming top quartile in terms of dose rate mitigation and technologies.

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Section 1: Introduction

Introduction

Davis Besse is a two loop, Babcock and Wilcox Pressurized Water Reactor (PWR) rated at 913 MWe. Cooling water is supplied from Lake Erie and recirculated approximately 4 times in a hyperbolic cooling tower. Davis Besse is scheduled to replace their Alloy 600-tubed steam generators with Alloy 690-tubed steam generators during refueling outage, RO18. Davis Besse has been operating with constant pH of 7.2 for the last two fuel cycles.

Davis Besse started injecting depleted zinc acetate for dose rate mitigation (5 parts per billion (ppb) in the primary loop) on March 12, 2012, just prior to refueling outage RO17.

Since initial commercial operation in 1977, Davis Besse has completed seventeen fuel cycles. The current fuel cycle (seventeen) started June 29, 2010 and ended on May 6, 2012. FirstEnergy Nuclear Operating Company (FENOC), in conjunction with and funded by the EPRI Zinc Users Group, elected to perform a gamma spectroscopic assessment of the primary system to determine the isotopic composition of the piping oxide films and establish baseline conditions prior to zinc addition as well as further document changes in the piping oxide layer radionuclide composition under zinc addition.

This report presents the results of the Davis Besse gamma scanning assessment performed May 10-11, 2012, during refueling outage RO17.



Section 2: Scope

Gamma spectroscopic measurements were made on the primary system piping at Davis Besse using RSI's portable gamma spectroscopy system. RSI measured specific activity levels in the 42-inch hot leg piping for steam generators 1-1 and 1-2 and the four 33-inch reactor coolant pump suction piping for reactor coolant pumps 1-1-1, 1-1-2, 1-2-1, and 1-2-2. The reactor coolant pump suction is also referred to as crossunder piping at other PWR plants. The reactor coolant pump identification numbers are used throughout to identify cross-under and cold leg piping sections. Concurrent directional probe dose rate surveys were made at the gamma scan locations. Directional probe dose rate surveys were also made on the 1-1-1, 1-1-2, 1-2-1, and 1-2-2 cold leg piping.

The measurements made during head replacement outage 17M provides baseline isotopic activity data for interpreting and understanding dose rates observed at shutdown prior to initiating zinc addition. This data from recent measurements provides a basis for assessment following the change in piping oxide layer radionuclide composition with zinc addition and subsequent changes in out-of-core radiation level buildup.

This report presents the results of the Davis Besse gamma scanning assessment performed May 10-11, 2012, during refueling outage RO17. Historical dose rate data (by others) should be used for assessing activity buildup trends.

Section 3: Technical Approach

Gamma Scanning Methodology

Gamma scans of reactor piping are made using a portable gamma spectroscopy system that consists of a gamma detector, detector shield, and analysis system. The shielded detector is positioned adjacent to the target pipe and the remote analyzer is set up in a low radiation area. Radiation from the scanned target point reaches the detector through an aperture plug installed in the front of the shield. Stray radiation from other sources is greatly attenuated by a tungsten shield surrounding the detector. Thus, the gamma spectrum acquired by the analyzer essentially represents only the radioactivity on the scanned pipe.

Each target point is scanned twice to correct for background radiation that does penetrate the shield. The first scan is performed with a collimator (plug 2) inserted into the front of the shield. A second scan is then made at the same location using a solid plug (plug 0) to measure and quantify high energy photons that penetrate the shield. The net activity of the target point is determined by subtracting the background measurement from activity levels measured with the collimator.

Concurrent dose rate measurements are made using a Ludlum 2241 survey meter and an Eberline HP-220A shielded probe. This meter's detector is encased in a hemispherical tungsten alloy shield that provides approximately 10x attenuation of 1,332 keV gamma rays in a 2π geometry.

Description of Equipment

Detector

The portable gamma spectroscopy system is designed around a high purity, coaxial, germanium detector (Model GEM-08180-S) manufactured by EG&G Ortec. The germanium crystal's efficiency is approximately seven percent. The detector is designed to mate with a custom shield (described below) made of

sintered tungsten. In this detector, the coaxial crystal is located concentrically in a vacuum cryostat approximately 5 mm from the outer surface of the cryostat's end cap.

Detector Shield

The detector shield and collimator plugs are manufactured from sintered tungsten alloy having a density of approximately 18.4 g/cc. The main shield and collimator plugs provide a minimum equivalent shielding thickness of four inches (~10 cm) of lead in all directions (4π spherical geometry). Complete shielding is accomplished by means of the main shield and collimator plugs surrounding the cryostat, combined with a "shadow shield" located inside of the cryostat behind the germanium crystal. The external shield and collimator plug attenuate incident radiation from the front and the sides and the internal "shadow shield" attenuates radiation from the rear of the detector. The detector and shield assembly, shown attached to a pipe, is depicted in Figure 3-1.

Data Acquisition and Analysis System

The gamma spectroscopy system uses a Wilkinson analog-to-digital converter for data acquisition. Computerized peak search and analysis is performed by Canberra hardware and software (Genie 2000) interfaced to a computer system. Using efficiency calibration curves applicable to the geometry of the target, the system determines the specific activity levels (in $\mu\text{Ci}/\text{cm}^2$) of the pipe being scanned.

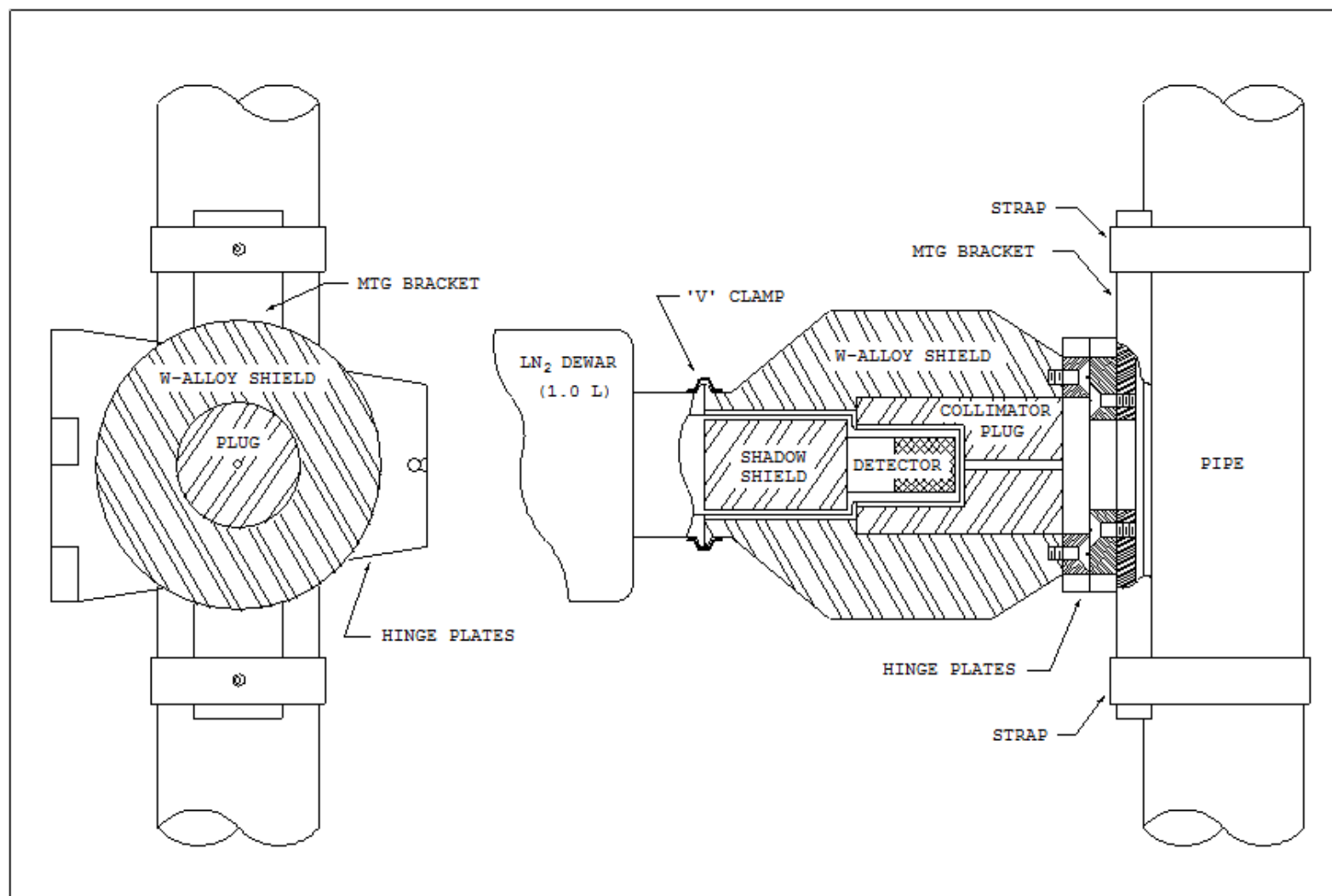


Figure 3-1
Detector and Shield Assembly

Section 4: Measurement Locations

The monitoring locations for this assessment were selected based on accessibility and potential data quality. The measurements were taken at the same locations as the data set collected during outage 17M. Dose rate measurements were made at contact with the piping full and insulation on for all locations. Figure 4-1 and Figure 4-2 summarize the piping target locations.

Gamma scan data was collected for the steam generator (SG) 1-1 and 1-2, 42-inch diameter hot leg piping and the 33-inch RCP suction piping (four locations) from

each of the reactor coolant pumps. Photographs of the target locations were documented in RSI report 4366, in November 2011, and have been omitted from this report for brevity.

RSI normally hangs the shield and detector on a bracket that mounts to the piping. This was not possible without erecting scaffolding to install the bracket straps. The shield/detector assembly was supported on a platform adjacent to the piping at the same distance from the pipe as if the bracket were installed.

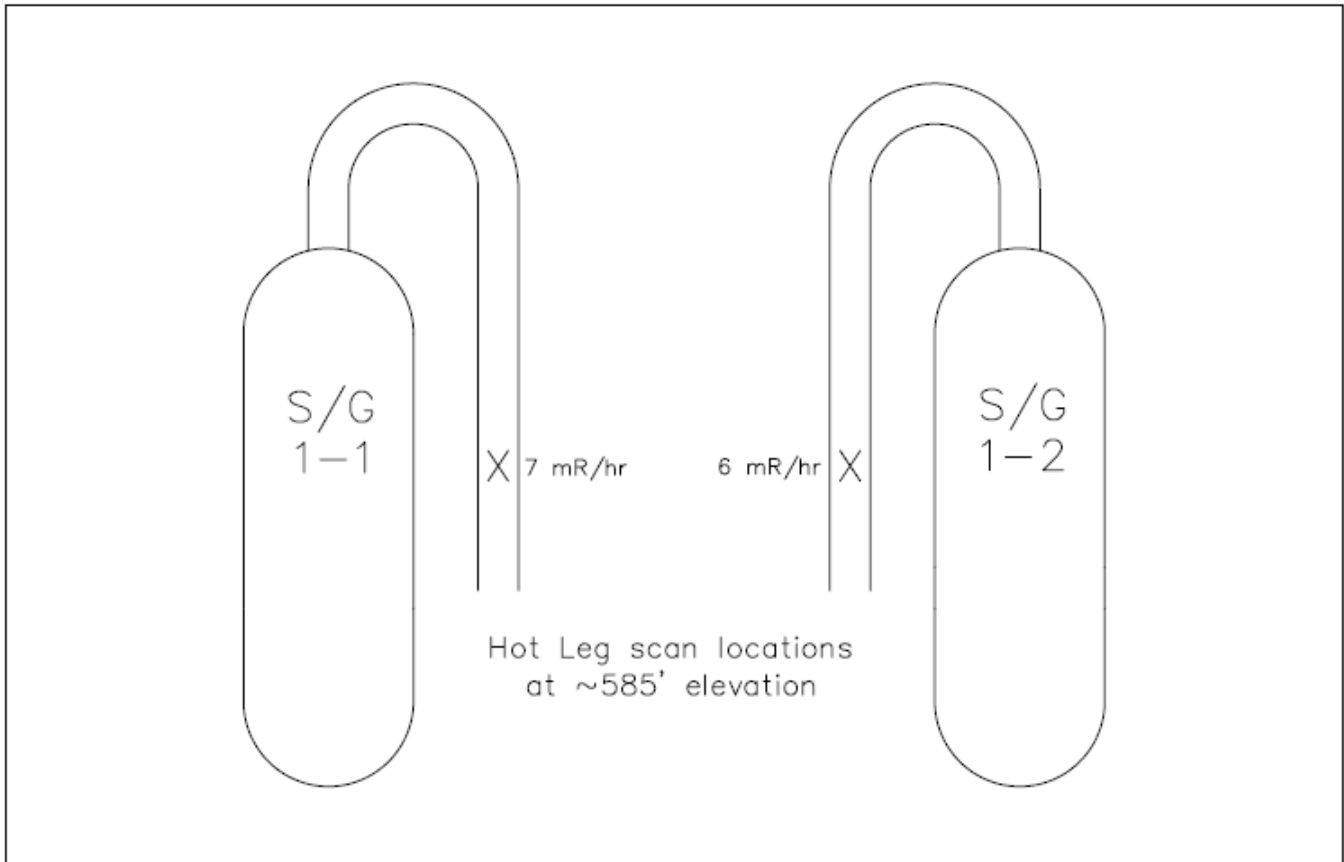


Figure 4-1
Hot Leg Piping Gamma Scan Target Locations and Contact Dose Rates, Piping Full and Insulated

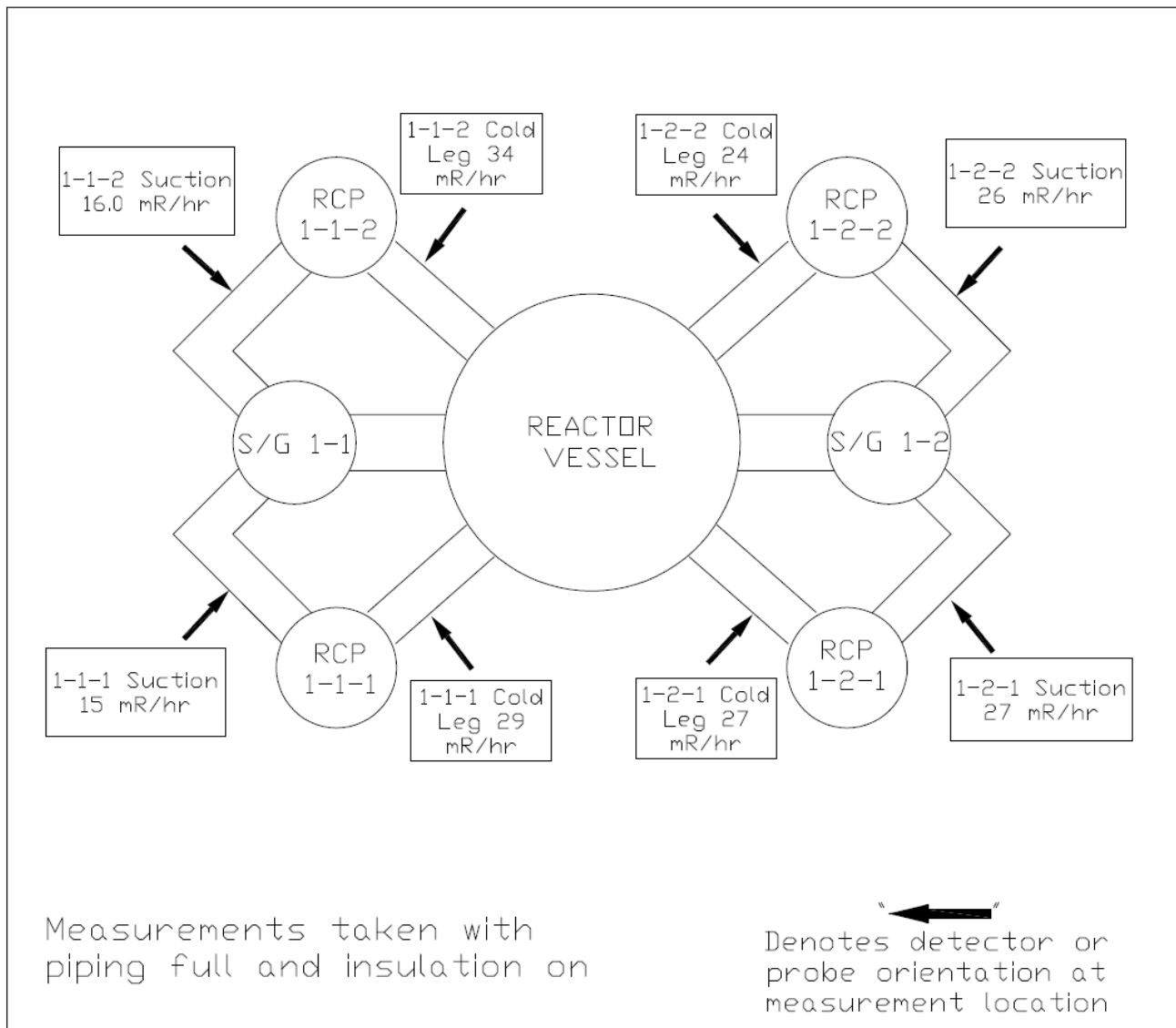


Figure 4-2

RCP - Cold Legs/Discharge and Cross-under /Suction piping Gamma Scan Target Locations and Contact Dose Rates

Section 5: Results and Discussion

The primary system piping gamma scan results are summarized in Table 5-1. These results are corrected for the actual plant pipe wall thickness compared to that of the piping used for calibration. All data is decay

corrected to the time of the shutdown. The reactor coolant pump piping and the hot leg piping were insulated and full of water.

Table 5-1

Davis Besse Refueling Outage 17 Gamma Scan Data Summary

Nuclide	Energy (keV)	Net Activity ($\mu\text{Ci}/\text{cm}^2$)					
		1-1 HL	1-2 HL	RCP 1-1-1 SU	RCP 1-1-2 SU	RCP 1-2-1 SU	RCP 1-2-2 SU
Cr-51	320	ND	ND	ND	ND	ND	ND
Nb-95	766	0.33	0.33	ND	ND	ND	ND
Mn-54	835	0.17	0.32	ND	0.07	ND	0.28
Co-58	811	15.12	20.36	5.29	4.75	6.05	9.61
Fe-59	Average	ND	Trace	ND	ND	ND	Trace
Co-60	Average	2.43	4.11	2.73	2.48	3.14	4.86
Zn-65	1115	ND	ND	ND	ND	ND	ND
Cs-137	662	ND	ND	ND	ND	ND	ND
Total		18.05	25.11	8.02	7.30	9.20	14.76
Contact Dose Rate (mR/hr) ⁽¹⁾		7	6	15	16	27	26

- (1) Contact dose rate determined using Ludlum 2241 and HP 220A shielded probe with piping full and insulation on

SU = RCP Suction Piping

HL = Hot Leg

ND = Not Detected

Trace = Small peak in spectrum but too small for software to quantify or uncertainty was greater than the result.

Hot Leg

Co-58 and Co-60 were the predominant isotopes identified in the hot leg piping films. The Co-58 activity was 82% of the total activity and Co-60 represented 15% of the total activity for the combined hot leg piping locations. Nb-95 and Mn-54 contributed the balance of the activity. There were trace amounts of Fe-59 and La-140 identified in the spectra for the 1-1 hot leg location, but they were too small to quantify.

Although Co-60 was only 15% of the hot leg activity, it corresponds to 34% of the piping dose rate. Co-58 corresponds to approximately 64% of the piping dose rate. Nb-95 and Mn-54 each contribute less than 1% to the piping dose rate.

Table 5-2

Davis Besse RFO17 Hot Leg and Cross-under/RCP Suction Piping Percent Activity by Nuclide Summary

Nuclide	Energy (keV)	Percentage of Total Activity					
		1-1 HL	1-2 HL	RCP 1-1-1 SU	RCP 1-1-2 SU	RCP 1-2-1 SU	RCP 1-2-2 SU
Cr-51	320.1	ND	ND	ND	ND	ND	ND
Nb-95	765.8	1.83	1.33	ND	ND	ND	ND
Mn-54	834.8	0.92	1.26	ND	0.93	ND	1.93
Co-58	810.8	83.79	81.06	65.96	65.08	65.82	65.14
Fe-59	Average	ND	Trace	ND	ND	ND	Trace
Co-60	Average	13.46	16.35	34.04	33.99	34.18	32.93
Zn-65	1115.5	ND	ND	ND	ND	ND	ND
Total		100	100	100	100	100	100
Dose Rate (mR/hr)		7	6	15	16	27	26

RCP Suction Piping

Co-58 is the predominant radionuclide in the RCP suction piping corrosion film(s) accounting for approximately 65% of the total activity. Co-60 is the next largest contributor at 34%, and Mn-54 contributes the remaining 1%. Co-60, with two high energy lines with a high gamma yield, corresponds to approximately 66% of the piping dose rate, whereas Co-58's contribution is approximately at 33%.

Table 5-3 summarizes the contact dose rate data collected at the gamma scan target with a shielded probe.

The dose rate contribution data for each gamma scan location is summarized in Table 5-4 and Figure 5-1.

*Table 5-3
RCS Loop Piping Dose Rate Summary for RFO17*

Hot Leg Target	Dose Rate mR/hr	Cold Leg Target	Dose Rate mR/hr	Cross- Under/RCP Suction Pipe Target	Dose Rate mR/hr
1-1 HL	7	1-1-1 CL	29	1-1-1 SU	15
1-2 HL	6	1-1-2 CL	34	1-1-2 SU	16
		1-2-1 CL	33	1-2-1 SU	27
		1-2-2 CL	24	1-2-2 SU	26
Avg. HL	6.5	Avg. CL	30	Avg. SU	21

CL = Cold Leg

*Table 5-4
Davis Besse RFO17 Percent Contribution to RCS Loop Piping Dose Rate by Nuclide*

Nuclide	Energy keV	Percent of Dose Rate					
		1-1 HL	1-2 HL	RCP 1-1-1 SU	RCP 1-1-2 SU	RCP 1-2-1 SU	RCP 1-2-2 SU
Mn-54	834.8	0.8	1.0	ND	0.5	ND	1.0
Co-58	810.8	66.8	61.8	33.1	32.7	33.0	33.3
Fe-59	Average	ND	Trace	ND	ND	ND	Trace
Co-60	Average	31.3	36.4	66.9	66.8	67.0	65.7
Zn-65	1115.5	ND	ND	ND	ND	ND	ND
Nb-95	766	1.1	0.7	ND	ND	ND	ND
Total		100	100	100	100	100	100
Dose Rate (mR/hr)		7	6	15	16	27	26

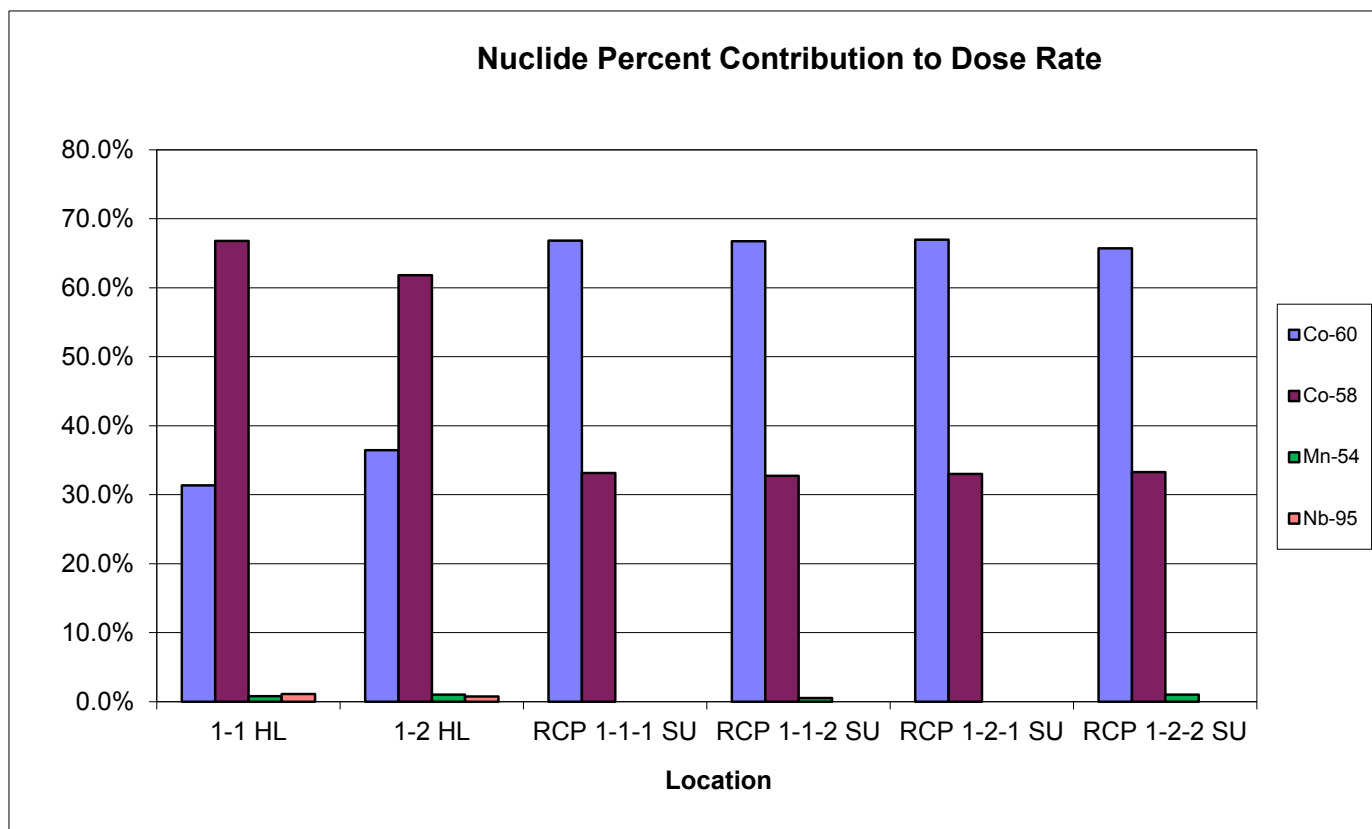


Figure 5-1

Percent Contribution to Piping Dose Rate by Nuclide (HL = Hot Leg, SU = Suction Piping)

Table 5-5 Comparison Between Maintenance Outage 17M and Refueling Outage RO17 Data

Outage	Contact Dose Rate, mR/hr		RCP SU/HL Specific Activity, $\mu\text{Ci}/\text{cm}^2$											
			Co-58		Mn-54		Zn-65		Fe-59 ⁽¹⁾		Co-60 ⁽²⁾		Nb-95	
	RCP SU	HL	RCP SU	HL	RCP SU	HL	RCP SU	HL	RCP SU	HL	RCP SU	HL	RCP SU	HL
17M	17 ⁽³⁾	29	13.33	14.70	0.15	0.20	ND	ND	Trace	Trace	4.00	2.47	ND	0.16
RO17	6.5	21	6.43	17.74	0.18	0.25	ND	ND	Trace	Trace	3.30	3.27	ND	0.33

(1) Average of the 1099 and 1291 photopeaks

(2) Average of the 1173 and 1332 photopeaks

(3) Piping empty with insulation on

ND = not detected

Trace = peak identified but too small to quantify

Comparison Between 17M and RO17 Data

Hot and cold leg data are summarized in Table 5-5. The following observations are made from that data

- No Zn-65 observed in piping oxide films.
 - No Zn-65 in the oxide was expected based on short duration of zinc addition.
- There is a significant decrease in RCP suction activity, with Co-58 decreasing the most. The contribution to piping dose rate from Co-58 decreased from 50% to 33% between 17M and RO17 data sets. Co-60 increased from 50% in outage 17M to 67% in RO17
- There is a slight increase in Hot Leg activity for both Co-58 and Co-60. The contribution to piping dose rate from Co-58 decreased from 67 to 63% and Co-60 increased from 32 to 34% of for outage 17M and RO17 respectively.
- It is too early to gauge impact of zinc addition.

Davis Besse Comparison to Other Plants

Davis Besse data is compared to other plant gamma scan data in Table 5-5. Note that the majority of the data is from 4-loop Westinghouse plants. The data for original Alloy 600 steam generators and for Alloy 690 is noted as applicable.

As noted earlier, Davis Besse recently began injecting depleted zinc to mitigate radiocobalt incorporation into the primary piping oxide film. Depleted zinc acetate

was added at a rate of approximately 20 grams of zinc per day from March 12, 2012 to April 28, 2012. A total of 937 grams of zinc were added. Due to the relatively short addition period, soluble zinc levels never reached a concentration of 1 ppb in the reactor coolant. The zinc added to date has likely been tied up with and/or deposited on oxide deposits in the primary system including fuel deposits. It is expected that soluble zinc will be observed in the primary coolant with additional mass loading in the upcoming fuel cycle. As seen in Table 5-5, the radiocobalt levels in the piping oxide layer have decreased slightly yet not significantly enough between outages 17M and RFO17 to determine any causal effect of zinc addition. Continuation of zinc addition should result in decreased radiocobalt incorporation into the oxide layer and stabilize radiocobalts on primary surfaces.

The reactor coolant Co-58 and Co-60 levels have increased at many PWR's at the onset of zinc addition. The competition for sites in the oxide spinel between zinc and cobalt is believed to be the reason for the increases. Refer to Figure 5-2 for the trend data at Davis Besse. With the limited zinc exposure during this first partial cycle of zinc injection (937 grams added), detailed analysis of any increase in radiocobalt concentration would be premature, but there does seem to be a small impact of zinc injection on reactor coolant Co-58 and Co-60 concentrations.

Post 17M RCS GSA Cobalts (24-Hour Decayed Analysis)

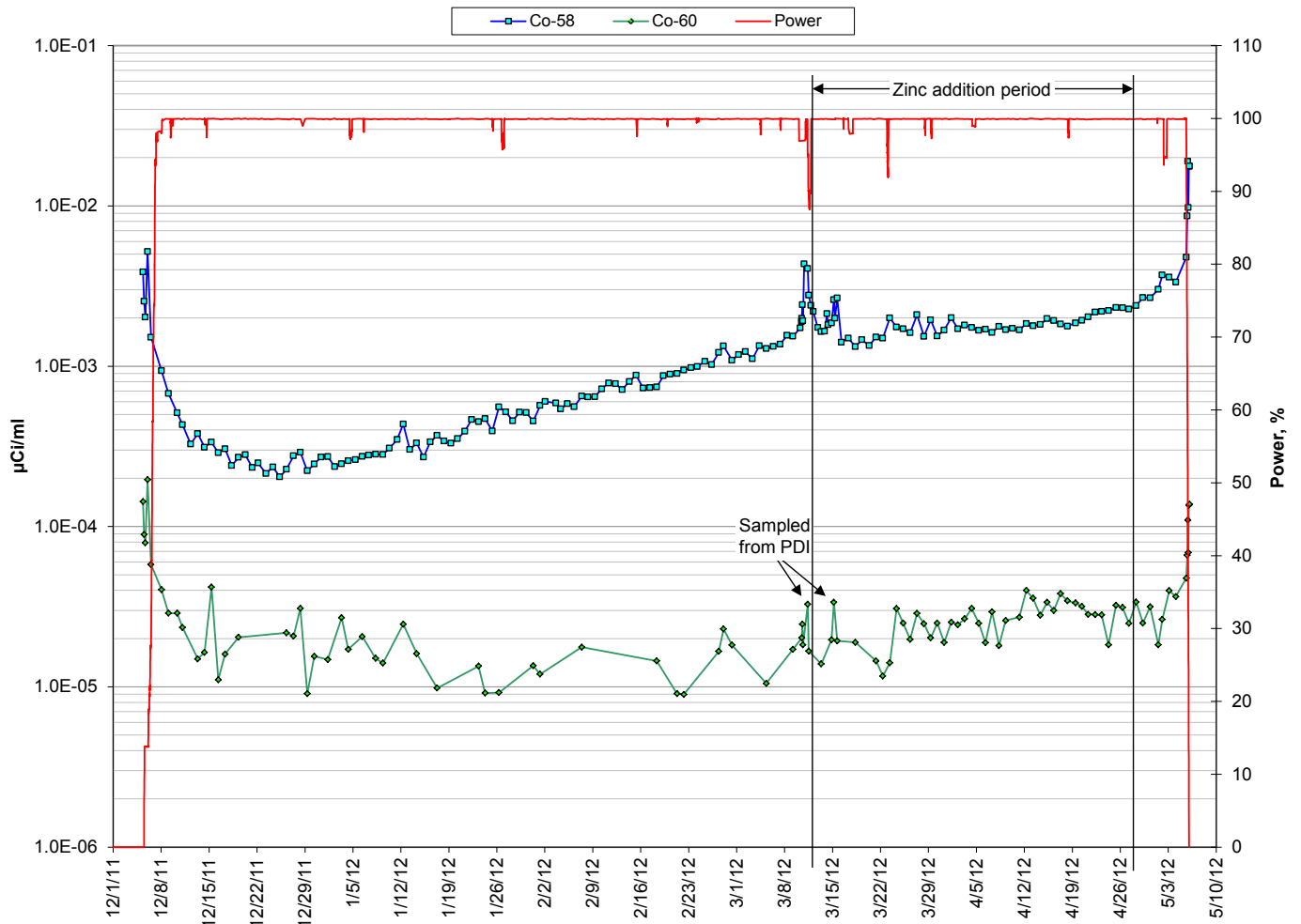


Figure 5-2: Davis Besse Reactor Coolant Radiocobalt Trends Following Zinc Addition

Table 5-6: Gamma Scan Deposited Activity and Dose Rate Comparison Data

Plant	Cycle	EFPY	Loops	SG Alloy	Zn Add	Average Dose Rate, mR/hr		Average Hot and Cold Leg Net Activity μCi/cm ²					Co-58 / Co-60
								Co-58	Fe-59 ¹	Co-60 ²	Zn-65	Nb-95	
						HL	CL						
Plant 'A' Unit-2 ³	12		4	600	No	54	51	18.81	0.43	4.50	ND	ND	4.18
Plant 'A' Unit-2 ³	13		4	600	Yes	40	25	7.01	0.39	2.59	ND	0.13	2.71
Plant 'A' Unit-1 ⁴	13		4	690	Yes	83	106	22.33	0.34	1.65	ND	0.07	13.53
Plant 'B' Unit-1 ⁴	14	17.4	4	690	No	78	85	24.49	0.10	1.50	ND	0.12	16.33
Plant 'B' Unit-1 ³	15		4	690	No	32	38	21.50	0.12	2.37	ND	0.21	9.07
Plant 'B' Unit-2 ⁸	16	21.4	4	600	Yes	47.8	45.3	5.77	0.22	1.26	0.02	0.10	4.58
Plant 'C' Unit -1	18	24.6	2	690	No	12	21	3.92	0.01	1.72	0.54	0.11	2.28
Plant 'D' Unit-3 ³	16		2	600	No	8.1	10.9	10.00	2.86	1.21	ND	0.04	8.26
Plant 'E' Unit-1 ⁵	18	24.9	2	600	Yes	10.1	8.1	5.09	ND	2.32	ND	ND	2.19
Plant 'F' Unit-1 ^{3,5}	23	22.4	4	690	No	4.1	12.5	1.20	0.04	1.18	ND	ND	1.02
Plant 'F' Unit-2 ^{3,7}	19	21.3	4	690	No	21.5	21.6	8.18	0.04	3.90	0.04	0.22	2.10
Plant 'G' Unit-1	20	23.8	3	690	Yes	12 ⁶	20 ⁶	3.83	0.09	2.41	0.25	0.10	1.59
Plant 'G' Unit-2 ⁴	15	19.5	3	600	Yes	46	27	4.53	0.12	1.39	ND	0.06	3.26
Plant 'G' Unit-1 ⁴	21	25.2	3	690	Yes	29	18	2.71	0.09	1.67	0.09	0.08	1.62
Davis Besse Unit-1 ⁹	17M	22.5	2	600	No	17	35 (SU)29	13.8	ND	3.49	ND	0.05	3.95
Davis Besse Unit-1 ⁹	17	22.54	2	600	Yes	6.5	30 (SU)21	10.20	Trace	3.29	ND	0.11	3.10

- 1 Average of the 1099 and 1292 keV photopeaks
- 2 Average of the 1173 and 1332 keV photopeaks
- 3 Contact dose rate using Ludlum 2241 meter and HP220A shielded probe with piping full and insulation on
- 4 Contact dose rate using Ludlum 2241 meter and HP220A shielded probe with piping empty and insulation on
- 5 Cs-134 and Cs-137 were also detected in the piping films at Plant 'E' Unit-1 and Plant 'F' Unit-1
- 6 'A' and 'C' loops only, insulation installed; 'B' loop was

drained

7 Cs-137 was detected in the cold leg piping at Plant 'F' Unit-2

8 Average of cold leg/suction piping only. No hot leg gamma scan data

9 Average of hot leg/suction piping only. No cold leg gamma scan data

Section 6: Conclusions

The baseline gamma scan data collected during vessel head replacement outage 17M showed that Co-58 and Co-60 were the predominant isotopes identified in the hot leg and RCP suction piping films. In RFO17, the same conclusion can be made with Co-58 and Co-60 again being the predominant isotopes.

The average Co-58 hot leg activity was 82% of the total activity and Co-60 represented 15% of the total activity in the hot leg piping. Nb-95 and Mn-54 contributed the balance of the activity. Trace amounts of Fe-59 and La-140 were identified but were too small to be quantified.

Although Co-60 was only 15% of the hot leg activity, it corresponds to 34% of the piping dose rate. Co-58 corresponds to approximately 64% of the dose rate. Nb-95 and Mn-54 each contribute less than 1% to the piping dose rate.

Co-58 is the predominant radionuclide in the RCP suction corrosion film(s) accounting for approximately 65% of the total activity. Co-60 is the next largest contributor at 34%, and Mn-54 contributes the remaining 1%. Co-60 corresponds to approximately 66% of the piping dose rate whereas Co-58's contribution is approximately at 33%. Trace amounts of Fe-59 were identified but were too small to be quantified.

Using averages for the hot leg and cross-under or RCP suction piping data, the Co-58 to Co-60 ratio in the oxide was 3.10. This is consistent with other alloy 600 steam generator tube plants in RSI's database. The nickel corrosion rate should be at a steady rate as the generator oxide film should be passive and primary pH control has been constant for several cycles. This results in Co-58 activity that can be greatly affected by the effectiveness of the forced oxidation. The Co-60 in the film is more difficult to control and because of the longer half-life it is more important not to incorporate it into the piping oxide film. Incorporation of Co-60 can be reduced by the use of zinc injection and cobalt source term removal.

Davis Besse saw small reductions in the average Co-58 and Co-60 concentrations in the piping film as well as reductions in the average dose rate and Co-58 to Co-60 ratio from outage 17M to RFO17. Since zinc injection has only been used for a short period of time prior to the most recent measurements, it is difficult to say if it was a factor in these reductions. Continued monitoring of radiocobalt in the piping films is necessary to ascertain the long term effects of zinc injection.

No Zn-65 was detected in either set of SG data due to the relatively short time period Davis Besse has been utilizing zinc addition. Continued zinc addition should cause a small amount of Zn-65 to be incorporated into the piping deposits but will also be beneficial in minimizing and mitigating the incorporation of radiocobalts into the piping films. Zinc addition is a good starting point to control existing Co-60 inventory in the primary loop. Additional reduction of source term may require elimination of cobalt bearing materials from the reactor coolant system.

Continued use of gamma scanning will allow FENOC to monitor the effectiveness of changes and optimization of the chemistry control strategy and source term reduction initiatives.



Appendix A: Original Radionuclide Data Sheets and Correction Factors

All data was corrected for the differences in pipe wall thickness for the scanned piping verses the calibration piping. The correction factors are as follows:

Nuclide	Energy (keV)	Correction Factor Hot Leg	Correction Factor Cross-under
Cr-51	320	49.282	14.702
Nb-95	766	12.144	5.592
Mn-54	835	11.003	5.227
Co-58	811	11.404	5.385
Fe-59	Average	7.446	3.990
Co-60	Average	7.081	3.855
Zn-65	1116	7.930	4.170

Eu-152 Check Source

```
*****  
*****      G A M M A      S P E C T R U M      A N A L Y S I S      *****  
*****
```

Filename: E:\Davis Besse 1205\eu152db.CNF

Report Generated On : 5/11/2012 9:02:57 AM

Sample Title : Eu-152 Source Check, Davis Besse
Sample Description :
Sample Identification : eu152db
Sample Type :
Sample Geometry : pt source

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000

Sample Taken On : 10/1/2011 12:00:00 AM
Acquisition Started : 5/10/2012 8:56:59 AM

Live Time : 3600.0 seconds
Real Time : 3608.6 seconds

Dead Time : 0.24 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 12/16/1999

Efficiency ID : Source Check

 ***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
 Sample Title: Eu-152 Source Check, Davis Besse
 Peak Analysis Performed on: 5/11/2012 9:02:57 AM
 Peak Analysis From Channel: 1
 Peak Analysis To Channel: 4096

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
	1	101-	106	103.23	51.69	0.91	6.09E+002	53.20	9.03E+002
	2	239-	247	243.58	121.93	1.12	5.49E+004	255.75	4.87E+003
	3	291-	296	293.99	147.17	0.50	-1.30E+001	58.75	1.96E+003
	4	484-	493	488.93	244.74	1.13	1.11E+004	129.58	2.55E+003
	5	586-	596	591.24	295.95	1.24	5.95E+002	79.31	2.39E+003
	6	682-	692	687.66	344.21	1.27	2.84E+004	183.26	2.16E+003
	7	731-	739	734.58	367.69	1.44	8.57E+002	64.27	1.53E+003
M	8	817-	835	821.14	411.02	1.21	2.05E+003	56.07	1.32E+003
m	9	817-	835	831.07	415.99	1.22	1.50E+002	29.80	1.30E+003
	10	881-	890	886.79	443.88	1.31	2.49E+003	79.15	1.67E+003
	11	972-	981	976.11	488.58	1.76	2.89E+002	63.50	1.65E+003
	12	1120-	1131	1126.28	563.75	1.51	4.22E+002	73.33	1.97E+003
	13	1168-	1176	1170.84	586.05	1.60	3.52E+002	59.38	1.48E+003
	14	1351-	1361	1355.51	678.49	1.46	2.69E+002	64.06	1.60E+003
	15	1369-	1381	1375.60	688.54	1.78	6.20E+002	72.27	1.75E+003
	16	1431-	1440	1437.11	719.33	1.05	1.94E+002	58.73	1.44E+003
	17	1549-	1561	1555.88	778.78	1.55	7.03E+003	105.65	1.57E+003
	18	1615-	1624	1618.82	810.28	1.07	1.45E+002	52.85	1.17E+003
	19	1726-	1737	1732.51	867.18	1.64	2.07E+003	74.88	1.41E+003
	20	1834-	1842	1836.90	919.43	1.01	1.47E+002	41.11	7.19E+002
	21	1919-	1932	1925.76	963.91	1.68	6.72E+003	95.87	8.96E+002
	22	2004-	2014	2007.76	1004.96	1.50	3.66E+002	40.61	5.32E+002
M	23	2162-	2183	2169.16	1085.74	1.61	4.05E+003	67.20	5.18E+002
m	24	2162-	2183	2176.92	1089.63	1.61	7.13E+002	32.46	4.77E+002
	25	2214-	2228	2221.58	1111.98	1.74	5.52E+003	85.61	6.30E+002
	26	2417-	2429	2423.24	1212.91	1.53	4.95E+002	36.92	3.30E+002
	27	2490-	2502	2497.06	1249.87	1.17	7.07E+001	27.53	2.61E+002
	28	2538-	2552	2545.91	1274.31	1.89	1.41E+002	25.14	1.71E+002
	29	2590-	2602	2595.57	1299.17	1.96	5.77E+002	30.89	1.43E+002
	30	2806-	2820	2813.30	1408.15	1.85	6.58E+003	81.82	4.20E+001
	31	2907-	2918	2912.51	1457.81	1.82	1.48E+002	12.67	5.39E+000
	32	3047-	3059	3053.35	1528.30	1.24	7.36E+001	9.52	6.45E+000

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: Eu-152 Source Check, Davis Besse
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/)	Activity Uncertainty
EU-152	0.998	121.78*	28.40	1.05670E+000	1.05252E+000
		244.69*	7.49	1.03550E+000	9.91874E-001
		344.27*	26.50	1.07693E+000	9.66514E-001
		411.11*	2.21	1.11594E+000	1.27812E+000
		443.98*	3.11	1.03982E+000	1.25522E+000
		778.89*	12.74	1.09380E+000	7.95013E-001
		867.32*	4.16	1.04941E+000	6.81463E-001
		964.01*	14.40	1.04443E+000	6.63251E-001
		1085.78*	10.00	9.69936E-001	6.21127E-001
		1112.02*	13.30	1.00783E+000	6.43874E-001
		1407.95*	20.70	9.10912E-001	8.83752E-001

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

1-1 Hot Leg Piping Plug 2

***** G A M M A S P E C T R U M A N A L Y S I S *****

Filename: E:\Davis Besse 1205\1-1 HLP2.CNF

Report Generated On : 5/11/2012 9:04:28 AM

Sample Title : 1-1 Hot Leg, p2, P2 7 mR/hr
Sample Description :
Sample Identification : 1-1HLP2
Sample Type :
Sample Geometry : pipe

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000 cm2

Sample Taken On : 5/6/2012 12:01:00 AM
Acquisition Started : 5/10/2012 4:13:06 PM

Live Time : 1800.0 seconds
Real Time : 1826.8 seconds

Dead Time : 1.47 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 8/24/2011
Efficiency ID : D1P2FUIN42 Pipe

***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
Sample Title: 1-1 Hot Leg, p2, P2 7 mR/hr
Peak Analysis Performed on: 5/11/2012 9:04:28 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 4096

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	101-	106	103.33	51.74	0.96	2.45E+003	115.41	4.31E+003
2	358-	363	360.08	180.25	0.50	-1.18E+002	140.28	1.12E+004
3	753-	762	758.71	379.77	0.52	-2.50E+001	156.47	1.08E+004
4	972-	978	974.32	487.69	0.70	-1.44E+002	104.85	5.89E+003
5	1015-	1026	1020.94	511.02	2.52	2.66E+003	161.40	9.33E+003
6	1526-	1536	1530.20	765.92	1.65	3.83E+002	92.92	3.46E+003
7	1613-	1626	1619.97	810.86	1.62	2.02E+004	171.42	3.34E+003
8	1665-	1674	1667.97	834.88	1.86	2.39E+002	67.79	1.92E+003
9	1699-	1708	1703.69	852.76	0.96	3.90E+001	64.92	1.85E+003
10	1722-	1732	1726.54	864.20	1.29	1.87E+002	69.86	1.97E+003
11	1918-	1924	1920.74	961.40	0.78	2.12E+001	45.23	1.07E+003
12	2339-	2351	2344.52	1173.51	1.83	6.53E+003	91.13	6.81E+002
13	2656-	2670	2663.07	1332.96	1.92	7.47E+003	89.51	1.93E+002
14	3187-	3197	3190.39	1596.89	1.71	4.97E+001	8.76	1.13E+001
15	3340-	3354	3347.59	1675.58	1.60	2.55E+002	16.48	5.63E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 1-1 Hot Leg, p2, P2 7 mR/hr
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/cm2)	Activity Uncertainty
MN-54	1.000	834.83*	99.97	1.50937E-002	4.28087E-003
CO-58	0.998	810.76*	99.40	1.34305E+000	1.20974E-002
CO-60	0.975	1173.22*	100.00	3.62611E-001	5.06415E-003
		1332.49*	100.00	3.97413E-001	4.76394E-003
NB-95	0.997	765.79*	99.81	2.71415E-002	6.57986E-003
LA-140	0.492	328.77	20.50		
		432.53	2.94		
		487.03*	45.50	-3.09390E-002	2.24656E-002
		751.79	4.40		
		815.85	23.50		
		867.82	5.63		
		919.63	2.88		
		925.24	7.09		
		1596.49*	95.49	3.36210E-003	5.92036E-004

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

1-1 Hot Leg Piping Plug 0

***** G A M M A S P E C T R U M A N A L Y S I S *****

Filename: E:\Davis Besse 1205\1-1 HLP0.CNF

Report Generated On : 5/11/2012 9:05:48 AM

Sample Title : 1-1 Hot Leg, P0, 7 mR/hr
Sample Description :
Sample Identification : 1-1HLP0
Sample Type :
Sample Geometry : pipe

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000 cm2

Sample Taken On : 5/6/2012 12:01:00 AM
Acquisition Started : 5/10/2012 4:47:29 PM

Live Time : 1800.0 seconds
Real Time : 1801.8 seconds

Dead Time : 0.10 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 8/24/2011
Efficiency ID : D1P2FUIN42 Pipe

***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
Sample Title: 1-1 Hot Leg, P0, 7 mR/hr
Peak Analysis Performed on: 5/11/2012 9:05:48 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 4096

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	1091-	1096	1093.00	547.09	0.50	-1.52E+001	21.90	2.72E+002
2	1613-	1626	1620.00	810.87	1.08	2.57E+002	38.25	4.37E+002
3	2338-	2351	2344.39	1173.45	1.44	4.98E+002	28.70	1.19E+002
4	2655-	2669	2662.84	1332.84	1.88	8.77E+002	31.27	3.45E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 1-1 Hot Leg, P0, 7 mR/hr
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/cm2)	Activity Uncertainty
CO-58	0.998	810.76*	99.40	1.70767E-002	2.54444E-003
CO-60	0.986	1173.22*	100.00	2.76992E-002	1.59496E-003
		1332.49*	100.00	4.66530E-002	1.66425E-003

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

1-1-1 RCP Suction Piping Plug 2

***** G A M M A S P E C T R U M A N A L Y S I S *****

Filename: E:\Davis Besse 1205\1-1-1 sucP2.CNF

Report Generated On : 5/11/2012 9:06:33 AM

Sample Title : 1-1-1 RCP Suction P2 15 mR/hr
Sample Description :
Sample Identification : 1-1-1 SucP2
Sample Type :
Sample Geometry : pipe

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000 cm2

Sample Taken On : 5/6/2012 12:01:00 AM
Acquisition Started : 5/10/2012 3:19:46 PM

Live Time : 900.0 seconds
Real Time : 932.4 seconds

Dead Time : 3.47 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 11/3/2011
Efficiency ID : D1P2FUIN33 Pipe

***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
Sample Title: 1-1-1 RCP Suction P2 15 mR/hr
Peak Analysis Performed on: 5/11/2012 9:06:33 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 4096

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	131-	138	134.96	68.05	0.98	5.48E+002	170.17	1.41E+004
2	1015-	1025	1020.57	511.12	2.64	1.80E+003	161.18	1.01E+004
3	1361-	1367	1363.64	682.75	0.70	-1.10E+002	86.27	3.99E+003
4	1613-	1625	1619.57	810.79	1.62	1.38E+004	164.61	5.07E+003
5	2139-	2145	2142.26	1072.29	0.57	-4.41E+001	51.97	1.45E+003
6	2339-	2350	2344.01	1173.23	1.73	1.14E+004	119.17	1.11E+003
7	2655-	2669	2662.43	1332.53	1.88	1.38E+004	120.97	2.88E+002
8	3340-	3353	3346.89	1674.96	1.98	2.44E+002	16.63	1.19E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 1-1-1 RCP Suction P2 15 mR/hr
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/cm2)	Activity Uncertainty
CO-58	1.000	810.76*	99.40	9.98580E-001	1.22992E-002
CO-60	1.000	1173.22*	100.00	7.29286E-001	7.60515E-003
		1332.49*	100.00	8.56757E-001	7.50534E-003

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

1-1-1 RCP Suction Piping Plug 0

***** G A M M A S P E C T R U M A N A L Y S I S *****

Filename: E:\Davis Besse 1205\1-1-1 sucP0.CNF

Report Generated On : 5/11/2012 9:07:20 AM

Sample Title : 1-1-1 RCP Suction P0 15 mR/hr
Sample Description :
Sample Identification : 1-1-1 SucP0
Sample Type :
Sample Geometry : pipe

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000 cm2

Sample Taken On : 5/6/2012 12:01:00 AM
Acquisition Started : 5/10/2012 3:40:18 PM

Live Time : 900.0 seconds
Real Time : 902.9 seconds

Dead Time : 0.32 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 11/3/2011
Efficiency ID : D1P2FUIN33 Pipe

***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
Sample Title: 1-1-1 RCP Suction P0 15 mR/hr
Peak Analysis Performed on: 5/11/2012 9:07:20 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 4096

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	1615-	1625	1619.38	810.70	1.39	2.14E+002	41.68	6.35E+002
2	2337-	2350	2344.25	1173.35	1.90	1.02E+003	39.67	2.01E+002
3	2655-	2669	2662.60	1332.62	1.62	1.68E+003	43.12	6.14E+001
4	3343-	3353	3346.81	1674.92	2.02	4.00E+001	6.32	0.00E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 1-1-1 RCP Suction P0 15 mR/hr
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/cm2)	Activity Uncertainty
CO-58	0.999	810.76*	99.40	1.54815E-002	3.02002E-003
CO-60	0.997	1173.22*	100.00	6.51494E-002	2.53171E-003
		1332.49*	100.00	1.04329E-001	2.67512E-003

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

1-1-2 RCP Suction Piping Plug 2

***** G A M M A S P E C T R U M A N A L Y S I S *****

Filename: E:\Davis Besse 1205\1-1-2 sucP2.CNF

Report Generated On : 5/11/2012 9:08:01 AM

Sample Title : 1-1-2 RCP Suction P2 16 mR/hr
Sample Description :
Sample Identification : 1-1-2 SucP2
Sample Type :
Sample Geometry : pipe

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000 cm2

Sample Taken On : 5/6/2012 12:01:00 AM
Acquisition Started : 5/10/2012 5:38:15 PM

Live Time : 900.0 seconds
Real Time : 929.7 seconds

Dead Time : 3.19 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 11/3/2011
Efficiency ID : D1P2FUIN33 Pipe

***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
Sample Title: 1-1-2 RCP Suction P2 16 mR/hr
Peak Analysis Performed on: 5/11/2012 9:08:01 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 4096

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	101-	107	103.47	51.80	1.27	3.49E+003	127.21	5.01E+003
2	132-	138	134.68	67.43	0.93	1.88E+002	147.76	1.14E+004
3	1015-	1026	1020.81	510.96	2.88	1.55E+003	165.03	1.02E+004
4	1545-	1552	1547.71	774.69	0.68	-5.97E+001	84.20	3.54E+003
5	1613-	1625	1619.78	810.76	1.57	1.23E+004	156.30	4.62E+003
M 6	1663-	1682	1667.87	834.83	1.12	1.89E+002	43.51	2.58E+003
m 7	1663-	1682	1676.11	838.96	1.12	1.17E+002	39.04	2.52E+003
8	2280-	2287	2284.18	1143.31	0.86	-3.58E+001	41.97	8.94E+002
9	2337-	2351	2344.28	1173.39	1.75	1.02E+004	116.32	1.16E+003
10	2655-	2669	2662.67	1332.76	1.88	1.18E+004	112.52	2.83E+002
11	3339-	3354	3347.22	1675.39	1.67	1.82E+002	14.17	6.14E+000

M = First peak in a multiplet region

m = Other peak in a multiplet region

F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 1-1-2 RCP Suction P2 16 mR/hr
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/cm2)	Activity Uncertainty
MN-54	1.000	834.83*	99.97	1.30490E-002	3.00849E-003
CO-58	1.000	810.76*	99.40	8.91273E-001	1.16481E-002
CO-60	0.992	1173.22*	100.00	6.51943E-001	7.42323E-003
		1332.49*	100.00	7.34418E-001	6.98121E-003

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

1-1-2 RCP Suction Piping Plug 0

***** G A M M A S P E C T R U M A N A L Y S I S *****

Filename: E:\Davis Besse 1205\1-1-2 sucP0.CNF

Report Generated On : 5/11/2012 9:09:46 AM

Sample Title : 1-1-2 RCP Suction P0 16 mR/hr
Sample Description :
Sample Identification : 1-1-2 SucP0
Sample Type :
Sample Geometry : pipe

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000 cm2

Sample Taken On : 5/6/2012 12:01:00 AM
Acquisition Started : 5/10/2012 5:56:47 PM

Live Time : 900.0 seconds
Real Time : 902.1 seconds

Dead Time : 0.23 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 11/3/2011
Efficiency ID : D1P2FUIN33 Pipe

 ***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
 Sample Title: 1-1-2 RCP Suction P0 16 mR/hr
 Peak Analysis Performed on: 5/11/2012 9:09:47 AM
 Peak Analysis From Channel: 1
 Peak Analysis To Channel: 4096

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
	1	101-	106	103.21	51.67	0.78	1.45E+002	27.81	2.50E+002
	2	115-	121	118.80	59.48	0.69	5.58E+001	37.49	7.12E+002
	3	1394-	1400	1397.01	699.26	0.50	-2.12E+001	25.36	3.49E+002
	4	1614-	1626	1620.30	811.02	1.12	1.33E+002	38.64	5.17E+002
	5	1735-	1740	1737.32	869.59	0.77	1.47E+001	19.55	2.06E+002
M	6	1824-	1835	1826.48	914.22	0.40	4.25E+000	18.12	1.02E+002
m	7	1824-	1835	1830.62	916.29	0.40	3.24E+000	13.80	1.00E+002
	8	2026-	2035	2030.90	1016.54	0.77	3.89E+001	24.26	2.43E+002
	9	2298-	2304	2301.27	1151.86	1.00	-8.48E-001	13.28	9.28E+001
	10	2338-	2351	2344.34	1173.42	1.59	5.37E+002	31.39	1.62E+002
	11	2655-	2670	2663.01	1332.93	1.79	1.05E+003	33.50	2.36E+001
	12	3342-	3353	3348.15	1675.86	0.70	3.60E+001	6.00	0.00E+000

M = First peak in a multiplet region
 m = Other peak in a multiplet region
 F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 1-1-2 RCP Suction P0 16 mR/hr
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/cm2)	Activity Uncertainty
CO-58	0.989	810.76*	99.40	9.64769E-003	2.80205E-003
CO-60	0.981	1173.22*	100.00	3.42577E-002	2.00306E-003
		1332.49*	100.00	6.52295E-002	2.07811E-003

* = Energy line found in the spectrum.
 @ = Energy line not used for Weighted Mean Activity
 Energy Tolerance : 1.000 keV
 Nuclide confidence index threshold = 0.30
 Errors quoted at 1.000 sigma

1-2 Hot Leg Piping Plug 2

***** G A M M A S P E C T R U M A N A L Y S I S *****

Filename: E:\Davis Besse 1205\1-2 HLP2.CNF

Report Generated On : 5/11/2012 9:11:17 AM

Sample Title : 1-2 Hot Leg P2 6 mR/hr
Sample Description :
Sample Identification : 1-2 HLP2
Sample Type :
Sample Geometry : pipe

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000 cm2

Sample Taken On : 5/6/2012 12:01:00 AM
Acquisition Started : 5/10/2012 12:55:30 PM

Live Time : 1800.0 seconds
Real Time : 1839.3 seconds

Dead Time : 2.14 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 8/24/2011
Efficiency ID : D1P2FUIN42 Pipe

***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
Sample Title: 1-2 Hot Leg P2 6 mR/hr
Peak Analysis Performed on: 5/11/2012 9:11:17 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 4096

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	257-	262	259.88	130.09	0.56	9.47E+001	165.68	1.54E+004
2	1015-	1026	1020.84	510.97	3.06	3.85E+003	195.78	1.37E+004
3	1316-	1323	1319.41	660.42	0.51	1.22E+002	104.92	5.40E+003
4	1526-	1535	1529.90	765.77	1.22	3.90E+002	108.94	5.07E+003
5	1613-	1625	1619.76	810.75	1.57	2.70E+004	200.52	5.02E+003
6	1663-	1674	1667.95	834.87	1.14	4.55E+002	100.75	3.87E+003
7	1720-	1731	1726.37	864.11	1.74	3.25E+002	95.71	3.52E+003
8	2190-	2200	2196.47	1099.41	1.05	1.10E+002	67.03	1.84E+003
9	2337-	2351	2344.27	1173.39	1.73	1.08E+004	119.12	1.20E+003
10	2574-	2587	2581.63	1292.19	1.30	1.18E+002	37.76	4.72E+002
11	2655-	2669	2662.65	1332.75	1.81	1.19E+004	112.83	3.01E+002
12	3185-	3195	3190.18	1596.79	2.06	9.67E+001	11.22	1.23E+001
13	3340-	3353	3347.01	1675.29	2.14	3.08E+002	18.34	1.05E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 1-2 Hot Leg P2 6 mR/hr
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/cm2)	Activity Uncertainty
MN-54	1.000	834.83*	99.97	2.86941E-002	6.36001E-003
CO-58	1.000	810.76*	99.40	1.79225E+000	1.43726E-002
		1291.56*	43.20	1.56773E-002	5.04923E-003
CO-60	0.992	1173.22*	100.00	5.97615E-001	6.61968E-003
		1332.49*	100.00	6.31074E-001	6.00532E-003
NB-95	1.000	765.79*	99.81	2.75445E-002	7.69381E-003

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

1-2 Hot Leg Piping Plug 0

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*****  
*****      G A M M A      S P E C T R U M      A N A L Y S I S      *****  
*****
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Filename: E:\Davis Besse 1205\1-2 HLP0.CNF

Report Generated On : 5/11/2012 9:11:54 AM

Sample Title : 1-2 Hot Leg P0 6 mR/hr
Sample Description :
Sample Identification : 1-2 HLP0
Sample Type :
Sample Geometry : pipe

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000 cm2

Sample Taken On : 5/6/2012 12:01:00 AM
Acquisition Started : 5/10/2012 1:28:59 PM

Live Time : 1800.0 seconds
Real Time : 1802.0 seconds

Dead Time : 0.11 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 8/24/2011
Efficiency ID : D1P2FUIN42 Pipe

***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
Sample Title: 1-2 Hot Leg P0 6 mR/hr
Peak Analysis Performed on: 5/11/2012 9:11:54 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 4096

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	101-	106	103.22	51.68	0.63	9.96E+001	25.02	2.04E+002
2	1614-	1625	1619.23	810.49	1.71	1.04E+002	33.34	3.96E+002
3	2310-	2319	2312.78	1157.63	0.95	1.35E+001	15.07	9.45E+001
4	2337-	2351	2344.25	1173.38	1.90	4.82E+002	27.32	9.18E+001
5	2655-	2669	2662.70	1332.77	1.82	8.07E+002	30.40	4.01E+001
6	3342-	3352	3347.71	1675.64	1.85	2.77E+001	5.55	1.31E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 1-2 Hot Leg P0 6 mR/hr
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/cm2)	Activity Uncertainty
CO-58	0.988	810.76*	99.40	6.92191E-003	2.21517E-003
CO-60	0.991	1173.22*	100.00	2.67968E-002	1.51813E-003
		1332.49*	100.00	4.29471E-002	1.61812E-003

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

1-2-1 RCP Suction Piping Plug 2

***** G A M M A S P E C T R U M A N A L Y S I S *****

Filename: E:\Davis Besse 1205\1-2-1 sucP2.CNF

Report Generated On : 5/11/2012 9:12:33 AM

Sample Title : 1-2-1 RCP Suction P2 27 mR/hr
Sample Description :
Sample Identification : 1-2-1 SucP2
Sample Type :
Sample Geometry : pipe

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000 cm2

Sample Taken On : 5/6/2012 12:01:00 AM
Acquisition Started : 5/10/2012 2:17:31 PM

Live Time : 900.0 seconds
Real Time : 941.1 seconds

Dead Time : 4.37 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 11/3/2011
Efficiency ID : D1P2FUIN33 Pipe

***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
Sample Title: 1-2-1 RCP Suction P2 27 mR/hr
Peak Analysis Performed on: 5/11/2012 9:12:33 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 4096

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	367-	372	369.63	185.02	0.52	-3.13E+002	170.47	1.66E+004
2	705-	712	708.24	354.51	0.93	-8.45E+001	165.81	1.37E+004
3	1014-	1025	1019.95	510.53	2.60	2.14E+003	192.35	1.39E+004
4	1369-	1375	1371.60	686.54	0.84	2.37E+001	94.68	4.73E+003
5	1613-	1625	1619.39	810.56	1.61	1.57E+004	181.33	6.55E+003
6	2071-	2077	2074.26	1038.24	0.63	-4.72E+001	57.36	1.77E+003
7	2337-	2350	2343.80	1173.15	1.69	1.29E+004	129.53	1.43E+003
8	2655-	2669	2662.27	1332.56	1.83	1.51E+004	126.67	3.31E+002
9	3339-	3353	3346.41	1674.99	2.26	2.44E+002	16.27	7.39E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 1-2-1 RCP Suction P2 27 mR/hr
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/cm2)	Activity Uncertainty
CO-58	0.994	810.76*	99.40	1.13678E+000	1.35711E-002
CO-60	0.999	1173.22*	100.00	8.20313E-001	8.26632E-003
		1332.49*	100.00	9.37427E-001	7.85900E-003

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

1-2-1 RCP Suction Piping Plug 0

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*****  
*****      G A M M A      S P E C T R U M      A N A L Y S I S      *****  
*****
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Filename: E:\Davis Besse 1205\1-2-1 sucP0.CNF

Report Generated On : 5/11/2012 9:13:08 AM

Sample Title : 1-2-1 RCP Suction P0 27 mR/hr
Sample Description :
Sample Identification : 1-2-1 SucP0
Sample Type :
Sample Geometry : pipe

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000 cm2

Sample Taken On : 5/6/2012 12:01:00 AM
Acquisition Started : 5/10/2012 2:37:10 PM

Live Time : 900.0 seconds
Real Time : 902.9 seconds

Dead Time : 0.33 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 11/3/2011
Efficiency ID : D1P2FUIN33 Pipe

***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
Sample Title: 1-2-1 RCP Suction P0 27 mR/hr
Peak Analysis Performed on: 5/11/2012 9:13:08 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 4096

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	398-	403	400.82	200.64	0.50	-1.19E+001	33.81	6.51E+002
2	1490-	1499	1496.07	748.84	0.54	-1.09E+001	37.83	6.37E+002
3	1615-	1625	1619.55	810.65	1.84	1.73E+002	40.07	6.01E+002
4	1827-	1834	1829.69	915.83	1.08	1.70E+001	27.26	3.58E+002
5	2339-	2350	2343.99	1173.25	1.77	6.85E+002	33.32	1.69E+002
6	2657-	2669	2662.46	1332.65	1.78	1.32E+003	38.06	5.06E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 1-2-1 RCP Suction P0 27 mR/hr
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/cm2)	Activity Uncertainty
CO-58	0.998	810.76*	99.40	1.25459E-002	2.90198E-003
CO-60	0.998	1173.22*	100.00	4.36837E-002	2.12620E-003
		1332.49*	100.00	8.21064E-002	2.36132E-003

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

1-2-2 RCP Suction Piping Plug 2

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*****  
*****      G A M M A      S P E C T R U M      A N A L Y S I S      *****  
*****
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Filename: E:\Davis Besse 1205\1-2-2 sucP2.CNF

Report Generated On : 5/11/2012 9:13:48 AM

Sample Title : 1-2-2 RCP Suction P2 26 mR/hr
Sample Description :
Sample Identification : 1-2-2 SucP2
Sample Type :
Sample Geometry : pipe

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000 cm2

Sample Taken On : 5/6/2012 12:01:00 AM
Acquisition Started : 5/10/2012 12:01:21 PM

Live Time : 900.0 seconds
Real Time : 957.6 seconds

Dead Time : 6.02 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 11/3/2011
Efficiency ID : D1P2FUIN33 Pipe

***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
Sample Title: 1-2-2 RCP Suction P2 26 mR/hr
Peak Analysis Performed on: 5/11/2012 9:13:48 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 4096

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	101-	107	103.42	51.78	1.26	6.38E+003	178.81	9.97E+003
2	1014-	1025	1020.31	510.71	3.39	4.47E+003	232.33	1.98E+004
3	1613-	1625	1619.44	810.59	1.69	2.85E+004	227.31	8.82E+003
4	1662-	1673	1667.54	834.66	1.66	7.30E+002	135.32	7.01E+003
5	1744-	1751	1748.12	875.00	0.77	-1.34E+002	95.95	4.63E+003
6	2194-	2200	2196.81	1099.58	0.99	6.43E+001	66.11	2.27E+003
7	2337-	2350	2343.78	1173.14	1.79	2.00E+004	160.48	2.10E+003
8	2655-	2669	2662.31	1332.58	1.86	2.25E+004	154.87	5.20E+002
9	3183-	3195	3189.45	1596.43	1.04	5.32E+001	10.00	1.78E+001
10	3340-	3354	3346.55	1675.06	2.23	3.51E+002	19.44	9.92E+000

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 1-2-2 RCP Suction P2 26 mR/hr
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/cm2)	Activity Uncertainty
MN-54	0.996	834.83*	99.97	5.04449E-002	9.35146E-003
CO-58	0.995	810.76*	99.40	2.06314E+000	1.75845E-002
CO-60	0.999	1173.22*	100.00	1.27600E+000	1.02409E-002
		1332.49*	100.00	1.39658E+000	9.60828E-003

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

1-2-2 RCP Suction Piping Plug 0

```
*****  
*****      G A M M A      S P E C T R U M      A N A L Y S I S      *****  
*****
```

Filename: E:\Davis Besse 1205\1-2-2 sucP0.CNF

Report Generated On : 5/11/2012 9:14:25 AM

Sample Title : 1-2-2 RCP Suction P0 26 mR/hr
Sample Description :
Sample Identification : 1-2-2 SucP0
Sample Type :
Sample Geometry : pipe

Peak Locate Threshold : 3.00
Peak Locate Range (in channels) : 1 - 65535
Peak Area Range (in channels) : 1 - 65535
Identification Energy Tolerance : 1.000 keV

Sample Size : 1.000E+000 cm2

Sample Taken On : 5/6/2012 12:01:00 AM
Acquisition Started : 5/10/2012 12:21:05 PM

Live Time : 900.0 seconds
Real Time : 903.2 seconds

Dead Time : 0.35 %

Energy Calibration Used Done On : 5/10/2012
Efficiency Calibration Used Done On : 11/3/2011
Efficiency ID : D1P2FUIN33 Pipe

***** P E A K A N A L Y S I S R E P O R T *****

Detector Name: RSI02_1
Sample Title: 1-2-2 RCP Suction P0 26 mR/hr
Peak Analysis Performed on: 5/11/2012 9:14:25 AM
Peak Analysis From Channel: 1
Peak Analysis To Channel: 4096

Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	FWHM (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
1	877-	884	879.38	440.17	0.91	1.64E+001	37.75	6.99E+002
2	1615-	1625	1619.30	810.52	1.12	2.95E+002	43.16	6.56E+002
3	2215-	2220	2217.23	1109.80	0.54	2.08E+000	17.62	1.70E+002
4	2337-	2350	2343.95	1173.23	1.64	8.68E+002	37.55	1.97E+002
5	2655-	2669	2662.42	1332.63	1.87	1.46E+003	39.84	4.42E+001

M = First peak in a multiplet region
m = Other peak in a multiplet region
F = Fitted singlet

Errors quoted at 1.000 sigma

 ***** N U C L I D E I D E N T I F I C A T I O N R E P O R T *****

Sample Title: 1-2-2 RCP Suction P0 26 mR/hr
 Nuclide Library Used: C:\GENIE2K\CAMFILES\STDLIB.NLB

..... IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (uCi/cm2)	Activity Uncertainty
CO-58	0.991	810.76*	99.40	2.13786E-002	3.12317E-003
CO-60	0.998	1173.22*	100.00	5.53618E-002	2.39651E-003
		1332.49*	100.00	9.06261E-002	2.47148E-003

* = Energy line found in the spectrum.

@ = Energy line not used for Weighted Mean Activity

Energy Tolerance : 1.000 keV

Nuclide confidence index threshold = 0.30

Errors quoted at 1.000 sigma

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