STUDENT SUMMER INTERNSHIP TECHNICAL REPORT

Enraf® & Densitometer Reference Level Updates for High-Level Nuclear Waste Tanks at Hanford Site

DOE-FIU SCIENCE & TECHNOLOGY
WORKFORCE DEVELOPMENT PROGRAM

Date submitted:

October 17, 2014

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FIU | Applied Research Center
FLORIDA INTERNATIONAL UNIVERSITY

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Subject Matter Expert	Gauck, Gregory J	10/21/2014	Greg Gauck / [signature] / 10/21/2014
Responsible Manager	Mendoza, Ruben E	10-21-14	Ruben Mendoza / [signature] 10-21-14
Other:			

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Part VI: Final Review and Approvals

11-3-14 gj

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By Janis D. Aardal at 2:47 pm, Nov 04, 2014

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	☐	☐	

Gauck, Gregory J

From: Lawrence, Hugh K
Sent: Wednesday, October 22, 2014 12:50 PM
To: Gauck, Gregory J
Cc: Aardal, Janis D; Mendoza, Ruben E; Kunz, Ashley C
Subject: RE: Enraf Photo Safety Review Completion to support ICR of Summer Intern Report

Gregory,
I have reviewed the photo contained in the document *WRPS-58302, Rev.0 entitled, "Enraf® & Densitometer Reference Level Updates for High-Level Nuclear Waste Tanks at Hanford Site"*, as requested, from an industrial safety point of view. Based on that review the photo in this document is **approved** for use. Any question or comment, please ask.

Hugh Lawrence
WRPS Safety Programs

From: Gauck, Gregory J
Sent: Wednesday, October 22, 2014 9:32 AM
To: Lawrence, Hugh K
Cc: Aardal, Janis D; Mendoza, Ruben E
Subject: Enraf Photo Safety Review Completion to support ICR of Summer Intern Report

Hugh,

See attachment of photo of installed Enraf requiring my signature on the Information Clearance Review (ICR) form being routed for releasing document WRPS-58302, Rev.0 entitled, "Enraf® & Densitometer Reference Level Updates for High-Level Nuclear Waste Tanks at Hanford Site".

Part III on form requires that I as the originator respond to the question, "If product contains pictures, safety review completed?" on any pictures being released in the document. The attachment is the only photo taken as required by this checklist item which will be released in the Summer Intern Report.

Please provide your concurrence with an e-mail response noted that the review was completed.

I can then finish completing Part III by noting "yes" to this question and then forward the completed ICR back to Janis Aardal for final release.

Thank you,

Gregory Gauck
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Washington River Protection Solutions,
Contractor to the United States Department of Energy
"Worry does not empty tomorrow of its sorrow.
It empties today of its strength" Corrie Ten Boom

WRPS-58302
Revision 0

Enraf® & Densitometer Reference Level Updates for High-Level Nuclear Waste Tanks at Hanford Site

DOE-FIU Science & Technology Workforce Development Program

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-08RV14800

washingtonriver protectionsolutions
P.O. Box 850
Richland, Washington 99352

WRPS-58302
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DOE-FIU Science & Technology Workforce Development Program

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Richland, WA

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-08RV14800

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APPROVED
By Janis D. Aardal at 2:50 pm, Nov 04, 2014

Release Approval		Date

ABSTRACT

The United States Department of Energy Hanford Site Tank Farm has implemented a system for monitoring tank waste levels in all single-shell tanks (SST), double-shell tanks (DST) and miscellaneous catch tanks using Enraf Series 854 level gauges and densitometers. To ensure an accurate computation of the tank waste levels, a precise calculation of the tank reference level must be kept up to date.

Due to an outdated document control system for Enraf and densitometer reference levels, inconsistencies were detected between field walk downs of Enraf and densitometer assemblies and the documentation containing reference levels. The development of an updated document control system for Enraf & densitometer reference levels was deemed necessary for the continuation of accurate waste level monitoring in the Hanford Tank Farms. The creation of a digital, easily updatable WHC-SD-WM-CN-078, Revision 1 ("Enraf Gauge Reference Level Summaries") document was the first step in facilitating a method for tank waste reference levels to be kept updated in future revisions.

Document WHC-SD-WM-CN-078, Revision 1, updated the Enraf and densitometer reference level summaries and the updated reference levels were used to update the PMID's (Preventive Maintenance Identification numbers) used for waste storage tank Enraf calibrations. WHC-SD-WM-CN-078, Revision 0 was originally issued in 1997.

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1. INTRODUCTION

The United States Department of Energy Hanford Site has implemented a system for monitoring tank waste levels in all single-shell tanks (SST), double-shell tanks (DST) and miscellaneous catch tanks located in the tank farms. The monitoring system uses level indicating transmitters (LIT), such as the Enraf ® Nonius Series 854 level gauge and densitometers, to read and display accurate tank waste levels to a hundredth of an inch (±0.01). To ensure an accurate computation of the tank waste levels, a precise calculation of the tank reference level must be kept up to date. A tank reference level is the measurement for which the Enraf and densitometer gauge is calibrated to the measurement being made in the tank. The term Enraf ® is a recognized and registered trademark of Honeywell International, Inc., PO Box 2245, Morristown, New Jersey, 07962-2245 USA.

The purpose of this project is to develop detailed information on current tank waste reference levels for the SSTs, DSTs and miscellaneous catch tanks whose waste levels are measured by the Enraf Series 854 and densitometer level gauges and update them in all affected documents. This project will serve to create a system where calculation summaries can be updated digitally in a uniform format, which will act as a basis for future revisions. More importantly, this project will standardize the process of updating reference levels in multiple documents, and will ensure no inconsistencies between them.

2. EXECUTIVE SUMMARY

This research work has been supported by the DOE-FIU Science & Technology Workforce Initiative, an innovative program developed by the US Department of Energy's Environmental Management (DOE-EM) and Florida International University's Applied Research Center (FIU-ARC). During the summer of 2014, a DOE Fellow intern (Anthony Fernandez) spent 10 weeks doing a summer internship at the Hanford Site in Richland, WA under the supervision and guidance of Ruben Mendoza, manager of the Waste Transfer and Storage Group at Washington River Protection Solutions. The intern's project was initiated on June 21, 2014, and continued through August 29, 2014, with the objective of updating Enraf and densitometer tank waste reference levels for all single-shell tanks, double-shell tanks and miscellaneous catch tanks.

3. RESEARCH DESCRIPTION

The deliverable for this research was to fully develop all Enraf and densitometer tank waste reference levels to create correlations between calculation documents, engineering design drawings and software used in the Hanford Tank Farms. Calculation drawings included the development of an up to date, Revision 1 of the current WHC-SD-WM-CN-078, Revision 0 ("Enraf Gauge Reference Level Calculations") document. The newly developed WHC-SD-WM-CN-078, Revision 1 document entitled "Enraf Gauge Reference Level Summaries" includes 38 Engineering Change Notices that were created for the purpose of updating Revision 0 and includes detailed information from field walk downs conducted from the months of June 2014 – August 2014.

The current document control method used for keeping Enraf and densitometer reference levels updated was proved obsolete by technological advancements. Therefore, the development of an updated document control system for Enraf and densitometer reference levels was necessary for the continuation of accurate waste level monitoring in the tank farms. The creation of a digital, easily updatable WHC-SD-WM-CN-078, Revision 1 document was the first step in facilitating a method for tank waste reference levels to be kept updated in future revisions.

A full revision of WHC-SD-WM-CN-078, Revision 0 into Revision 1 exposed inconsistencies between documents associated with tank waste reference levels. A method was created to ease the process of updating multiple documents with reference level changes. This method ensures all tank waste level documents remain updated through future revisions to comply with the State of Washington and the Department of Energy's (DOE) Office of River Protection (ORP) environmental regulations. Another method was developed for prioritizing calibration schedules for the Enraf and densitometer reference levels based on parameters given by environmental regulators to guarantee the safest, and quickest, approach towards significant updates.

All methods developed to facilitate updating Enraf and densitometer tank waste reference levels are located inside this report. For convenience, the results and analysis section is divided into sections and subsections that contain organized information.

4. RESULTS AND ANALYSIS

Section I: Enraf Nonius Series 854 Level Gauge

The Enraf's level measuring system is based on the detection of variations in the weight of a displacer that becomes suspended in the tank waste. This displacer is connected to a wire that is wound on a precision measuring drum. A change in the fluid level causes a change in the weight of the displacer which, when 15 grams is reached, will be detected by a force transducer that is located in the gauge. Electronics that are located within the Enraf gauge cause a servomotor to adjust the position of the displacer and use the reference level, which is stored in the NOVRAM (non-volatile random access memory) of the on-board computer, to determine the waste level. The gauge then displays the waste level in decimal inches on the gauge readout location. To obtain an accurate computation of the waste level inside the tank, the reference level calculation must be precise.

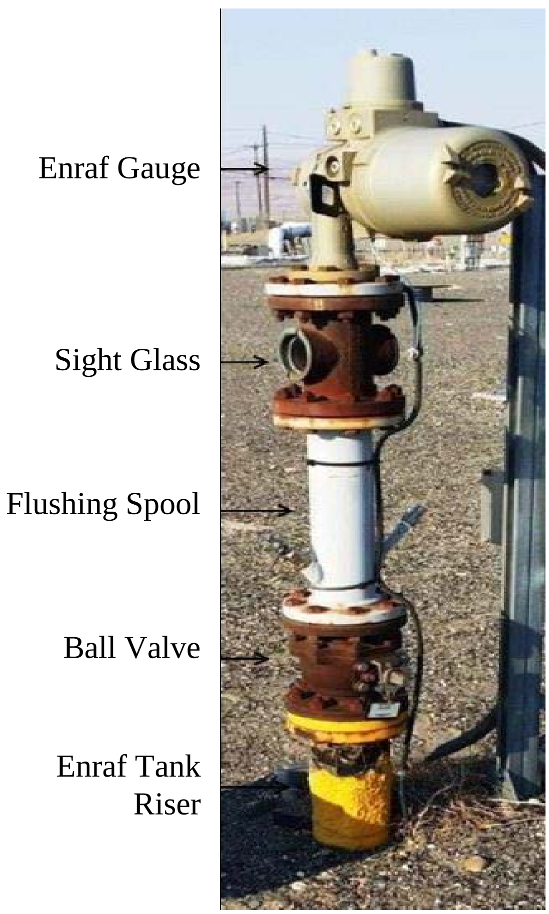


Figure 1. Typical Enraf gauge assembly.

The Enraf gauge assembly consists of a full-port isolation ball valve, a flushing spool (used to properly clean equipment before removing it from the tank), a sight-glass (for viewing and accessing the displacer) and the Enraf gauge. Figure 1 (Typical Enraf gauge assembly) shows a typical Enraf assembly as stated above. In some cases, the Enraf gauge assembly can consist of additional components (i.e., extra spool pieces, PVC liners, etc.).

Enraf level gauges are the primary LITs used to measure tank waste levels because of their accuracy, safety and ease of use. In a high level nuclear waste tank, waste level accuracy is one of the most important elements that ought to be taken into account. As stated in the Introduction, the Enraf level gauge can measure to an accuracy of one hundredth of an inch (±0.01 inches). With such a significant accuracy, the error values from the readings are minute. The Enraf level gauges are significantly safer than their waste level-measuring predecessor, the manual tape. The manual tape is an old-fashioned method of determining the waste level in a tank, which included manually lowering a measurement device into the tank that would indicate waste levels with a much larger error factor than an Enraf level gauge. The Enraf level gauge also contains a digital readout when it reads a waste level that is sent into the Hanford software called PCSACS. This software is used by the Hanford Tank Farm engineers to analyze the waste level readings without having to look at the physical Enraf.

Section II: Densitometer Level Gauge

Densitometers are LITs that share the same equipment, except for the displacer, and share the same assembly as an Enraf gauge LIT, but the densitometers serve a different purpose and operate in a different way. The densitometers are programmed on site to sense a waste level in a different method compared to the Enraf waste level sensing method. The densitometer is primarily used in double-shell tank's (DST) to monitor the amount of solid waste in the tanks. Instead of lowering a coned-bottom displacer into a waste surface (like the Enraf), the densitometer lowers a flat-bottom displacer to the inside bottom of the tank and collects a reading when it reaches a much higher displacement than the Enraf's 15 grams. Although it serves the same purpose as the Enraf and looks exactly the same, the densitometer is used to measure different kinds of waste and it is crucial to differentiate between the two.

Section III: Reference Levels

Each tank reference level (RL) is specific to each tank located in Hanford Site. The calculated reference level is the distance from the absolute tank bottom to the top of the isolation ball valve (Figure 2 – Reference Level Schematic). The elevation of the ball valve is calculated by taking the riser elevation, found in the specific tank's engineering drawing, and adding the height of the additional piping equipment located in the individual assembly. Two important factors that are used in the calculation of a tank reference level are the ball inset dimension and the immersion depth. Both factors are variable and depend on ball valve type and tank waste composition. These two variables are discussed in more detail in later sections.

The reference level associated with each individual Hanford waste tank is extremely important for the engineers working at the tank farms and for the environmental regulators who try to minimize leaks into the environment. The reference levels are important for the engineers because, with help of the Enraf detected waste levels, they show when any specific tank is approaching a full state, too much waste in the tank, or if it is empty enough to accept waste from another, more full, tank. From an environmental standpoint, the reference level is extremely important because it is the driving factor, along with the Enraf detected waste levels, to determining if a tank is leaking, and if so, how badly. Each tank reference level must be kept up to date for compliance with the State of Washington and the DOE's ORP regulations.

The Enraf reference level is determined by measuring the distance (in inches) of the following, and adding them together: the difference between the tank bottom and the riser elevation, the length of the 4" diameter ball valve (the ball valve flange-to-flange distance of 9 inches), the immersion depth (if applicable to the tank) and any associated gasket thickness and/or other miscellaneous parts (i.e., spool pieces, PVC liners, etc.). To this sum, we then subtract the ball valve inset dimension. See Section IV - B (Immersion Depth) to learn how to calculate the immersion depth of a waste tank).

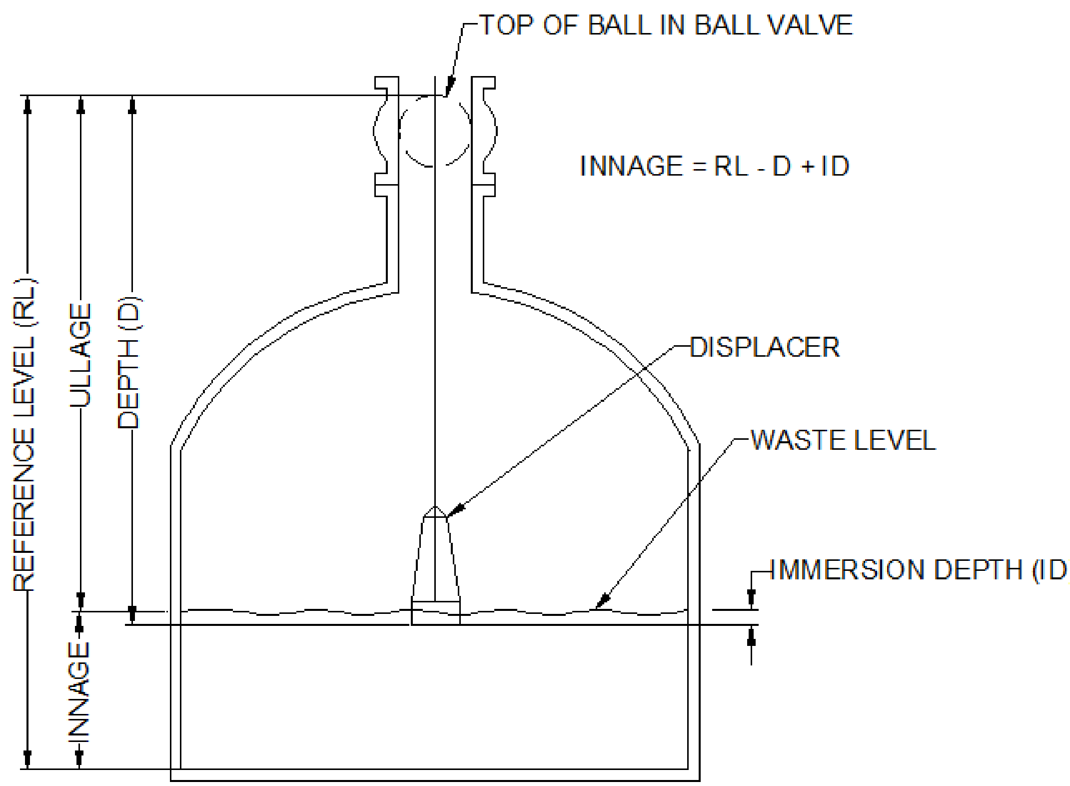


Figure 2. Reference level schematic.

Section III – A: Ball Inset Dimension

For the purpose of determining ball inset dimensions, the location of the top of the ball inside the ball valve needs be calculated. There exist two ball valves used in the Hanford Tank Farms that are symmetrical. For these, the ball inset dimension is found by dividing the ball valve length by two and adding to this value the radius of the ball located in the valve. The two ball valve types used are Flow-Tek® and Worcester®. The term Flow-Tek® is a recognized and registered trademark of Flow-Tek, Inc. 8323 N. Elderidge Parkway, 100, Houston, TX, 77041 USA. The term Worcester® is a recognized and registered trademark of Flowserve Management Company, 5215 N. O'Connor Blvd, Suite 2300, Irving, TX, 75039 USA.

These two valves are:

> Flow-Tek Ball Valve, 4", raised face, class 150, part number F15-WCB-SF-UHMW
>
> Worcester Ball Vale, 4", raised face, class 150, part number 4"8246UU150

The newest ball valve implemented at the Hanford Tank Farms is not symmetrical like the two used prior, so its ball inset dimension depends on two factors. These two factors are whether the ball valve was installed in the ball valve "up" position, or the ball valve "down" position. A report entitled "Technical Evaluation of Orientation of Enraf Ball Valve in Tank Farms," was developed to list all Worcester 818 ball valve installation positions and contains the inset dimension for each positioning, respectively.

> Worcester ball valve, 4", raised face, class 150, part number 4"818466V150N0113

Table 1. Ball Inset Dimension Values

Ball Valve Type	Ball Inset Dimension
Flow-Tek Ball Valve	1.47 inches
Worcester "824" Ball Valve	1.21 inches
Worcester "818" Ball Valve in "up"	1.09 inches
Worcester "818" Ball Valve in "down"	1.31 inches

Section III – B: Immersion Depth

The Enraf gauge reference level measurements are taken from the bottom of the displacer weight. On some occasions, usually when measuring semi-solid surfaces or supernate layers, the displacer may settle a few centimeters into the surface of the waste being measured. The distance that the displacer settles into the surface layer must be taken into account for the Enraf gauge to portray an accurate waste level. If applicable to the specific waste tank, the immersion depth is accounted for in the tank reference level measurement.

The calculation for determining the immersion depth for a specific waste tank is described in Table 2 (Immersion Depth Calculation). Figure 3 (Immersion Depth Calculation Example) shows an example of how the immersion depth calculation looks in a Reference Level Summary page in WHC-SD-CN-078, Revision 1.

However, if the waste surface is solid, like in some double-shell and many single-shell tanks, the immersion depth calculation will not be required because an immersion will not exist. The waste surface condition can be determined by reviewing documents associated with the information or by obtaining in-tank videos/photos.

***IMMERSION DEPTH CALCULATION**	
GOVERNING EQUATION FROM SECTION 5.2.1.4	
$H = (4*F_b) / (\pi * D^2 * \rho)$	
F_b = BOUYANT FORCE = SET POINT	15.0000 GRAMS
ρ = DENSITY OF LIQUID = SPECIFIC GRAVITY	1.0500 GRAMS/CM³
D = DISPLACER DIAMETER	5.0800 CM (2.0000 IN)
H = IMMERSION DEPTH (CM)	0.7049
(In.)	0.2775

Figure 3. Immersion depth calculation example

Table 2. Immersion Depth Calculation

The method for calculating immersion depth is as follows:

$F_b = \text{Buoyancy Force (difference between displacer free weight and 15g set point weight)}$

$H = \text{Immersion depth (cm)}$

$SpG = \text{Specific Gravity}$

$D = \text{Displacer Diameter, cm}$

$\pi = 3.1415$

$\rho = \text{Density } (\text{g/cm}^3)$

Then:

$$F_b = \text{Volume displaced } \times \text{Density of liquid displaced}$$

or

$$F_b = \frac{\pi D^2}{4} \times H \times \rho$$

Solving for H:

$$H = \frac{4F_b}{\pi D^2 \rho}$$

Numerically, ρ is equivalent to SpG because the SpG of water is used as follows:

The density of water is 1 gram/cm^3, and the SpG is 1 as well, so:

$$H = \frac{4F_b}{\pi D^2 SpG}$$

$$= \text{Displacer Immersion Depth, in cm, in any given liquid}$$

Section IV: Tank Input Data

Single-Shell Tanks

The primary source for determining riser and tank bottom elevations are the H-2-riser elevation drawings that are shown in Table 3 (SST Riser & Tank Bottom Elevation Drawings):

Table 3. SST Riser & Tank Bottom Elevation Drawings

Farm	Series	Drawings
241- A	----	H-2-37850
241-AX	----	H-2-37854
241-B	100 & 200	H-2-1743
241-BX	----	H-2-37852
241-BY	----	H-2-1746
241-C	100	H-2-37912
241-C	200	H-2-1744
241-S	----	H-2-37381, Sht. 1
241-SX	----	H-2-37855
241-T	100	H-2-37909
241-T	200	H-2-1741
241-TX	----	H-2-37381, Sht. 2
241-TY	----	H-2-37381, Sht. 3
241-U	100	H-2-37850
241-U	200	H-2-1742

Figure 4 (Single-shell tank configuration) provides an example of a typical Hanford single-shell tank.

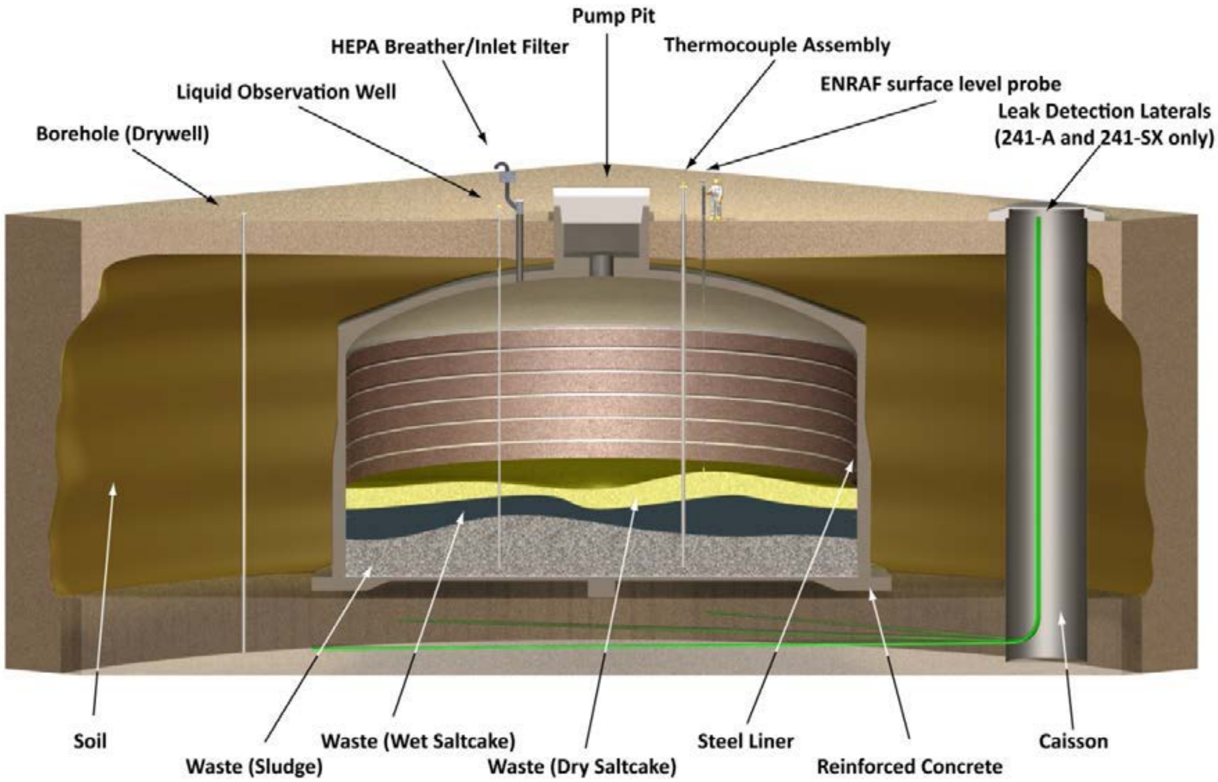


Figure 4. Single-Shell Tank or SST

Double-Shell Tanks

The tank farm Operational Test Report provides the most accurate data for determining the tank-bottom to riser dimensions. The known OTR's to exist are:

> AW-Farm: OTP-T-990-00034 Rev A-0. "Operability Test Procedure for 241-AW-1 Tank Farm."
>
> AN-Farm: OTP-T-990-00042 Rev A-0. "Operability Test Procedure for 241-AN Tank Farm (AN-1)," dated May 16, 1980.
>
> AP-Farm: SD-WM-OTR-063 Rev.0 "Operability Test Report for 241-AP Tank Farm," dated July 22, 1986.

When the OTR is not available, the drawing for the tank cross-section is used to determine the bottom-of-tank elevation and the Double-shell Underground Waste Storage Tanks Riser Survey will be used to determine the tank riser elevation. The tank cross section drawings for double-shell tanks are as follows:

Table 4. DST Cross Section Drawings

Tank	Drawing
241-AZ	H-2-67317
241-AY	H-2-64449
241-AP	H-2-90534
241-AW	H-2-70394
241-AN-101 thru 106	H-2-71975
241-AN-107	H-2-71160
241-SY-101	H-2-79556
241-SY-102	H-2-72213
241-SY-103	H-2-85104

Figure 5 (Double-shell tank configuration) provides an example of a typical Hanford double-shell tank.

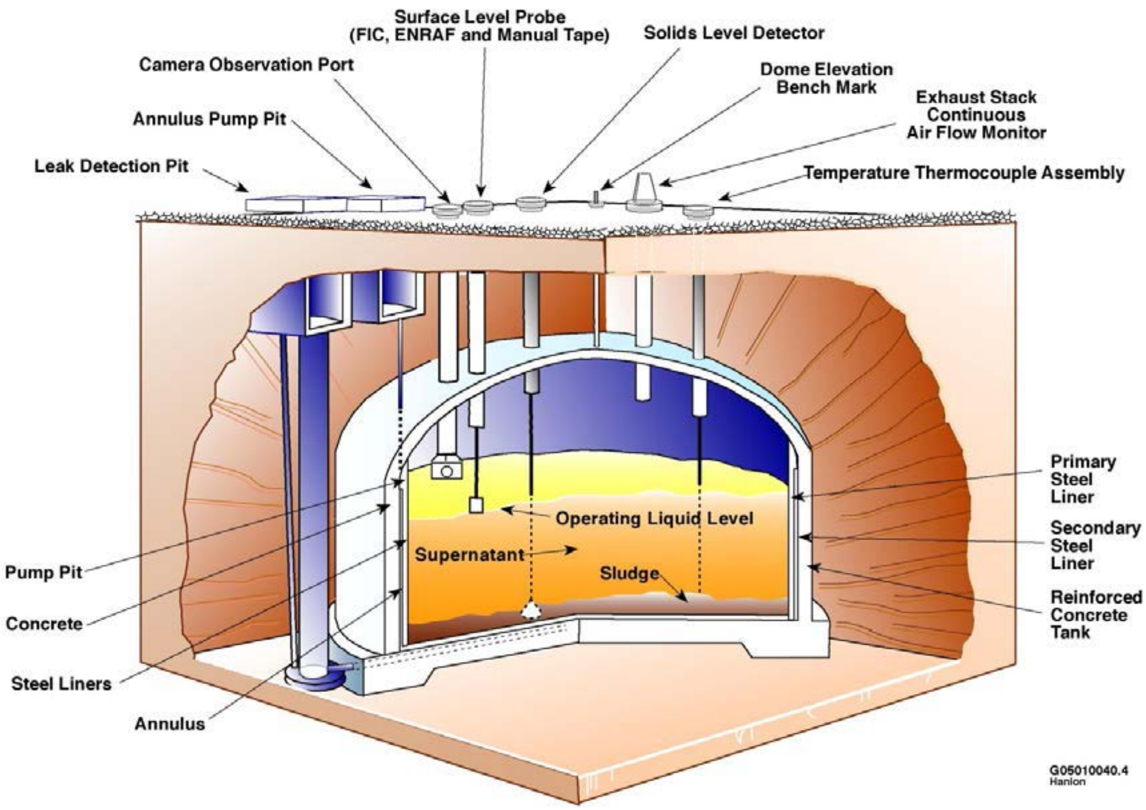


Figure 5. Double-Shell Tank or DST

Section V: WHC-SD-WM-CN-078, Revision 1

WHC-SD-WM-CN-078, entitled "Enraf Gauge Reference Level Summaries," is the primary document for Enraf and densitometer tank reference level calculation summaries. All Enrafs and densitometers (excluding annulus DST Enrafs) installed in the tank farms, and associated facilities, have their reference level calculation summary included in this document.

Also contained in this document is the process of calculating reference levels, which (from Section III) includes the ball inset dimension and the immersion depth calculations. An addition that was made to Revision 1 of the document is the document control method that facilitates the process of updating multiple documents with a reference level change, which was introduced in the Research Description. Figure 6 ("Documents Affected") shows a flow chart detailing the proper document updates needed when a reference level is changed. In Figure 6, RL means Reference Level.

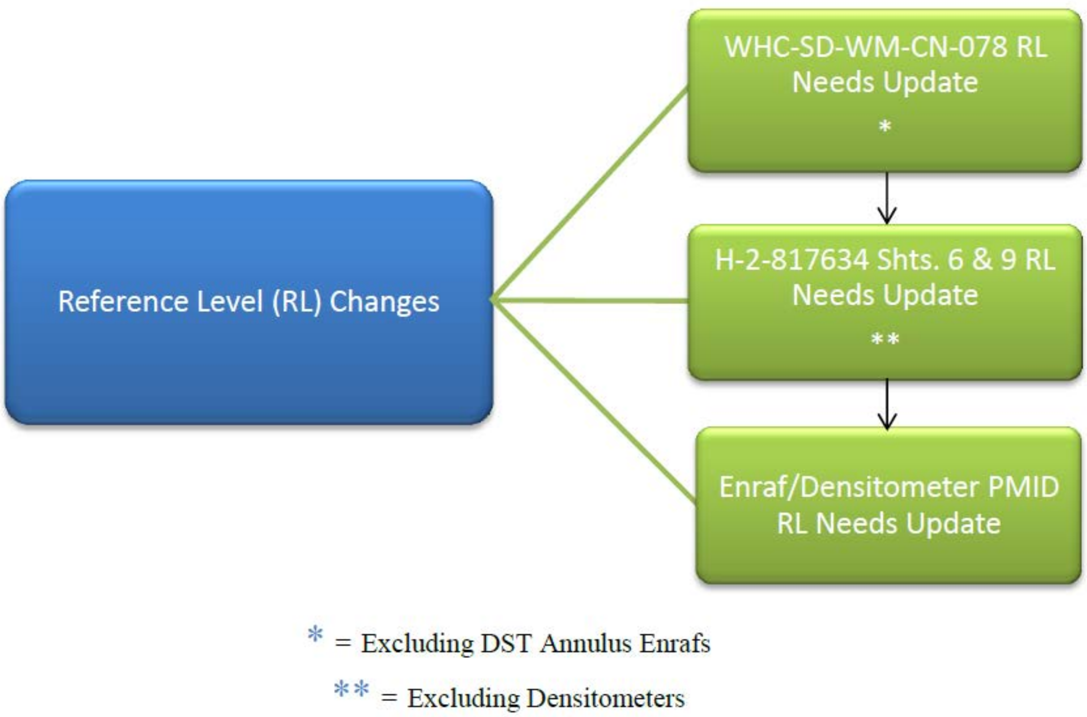


Figure 6. Documents affected by RL Revisions.

With the help of Hanford SST engineers, DST engineers, SST CSEs (cognizant system engineers), DST CSEs, all four Tank Farm Area engineers, engineers from the Waste Monitoring Group and environmental regulators from WRPS, the State of Washington and the DOE ORP, WHC-SD-WM-CN-078, Revision 1 was developed. It created a digital copy of the "Enraf Gauge Reference Level Summaries" and facilitated the updates towards future revisions, as explained in the Research Description. The purpose of the revision of this document is to incorporate 38 Engineering Change Notices that were against the Revision 0 document and to incorporate current and updated information based on field walk downs that were conducted during the months of June 2014 – August 2014, as stated in the Research Description.

Revision 1 of this document reformatted the Enraf and Densitometer Reference Level Summary pages and created a uniform and standard format for future reference level summary pages to be updated or created. Figure 7 shows an example of an Enraf Reference Level Summary from tank BX-104 from Revision 1 of WHC-SD-WM-CN-078.

Enraf Reference Level Summary

Drawing	H-2-817634	ECN/Doc. No.	ECN-626484	Page	1 of 1
Building	241-BX	Revision	0	Job No.	2E-95-1085
Subject	BX-104 ENRAF REFERENCE LEVEL			EIN	BX104-WST-LIT-101

TANK NUMBER		BX-104
BOTTOM OF TANK TO RISER DIMENSION		
DRAWING NUMBER		(H-14-010611)
RISER NUMBER		RISER-008
RISER ELEVATION (Ft.)		657.09
TANK CL BOTTOM ELEVATION (Ft.)	-	616.00
RISER TO TANK BOTTOM ELEVATION (Ft.)		41.09
(In.)		493.08 (A)
DETERMINING REFERENCE LEVEL:		
1/16 GASKET @ 50% COMPRESSION (In.)	+	0.0313 (B)
PVC FLANGE (OPTIONAL) (In.)	+	1.0000 (C)
1/8 GASKET @ 50% COMPRESSION (In.)	+	0.0625 (D)
BALL VALVE FLANGE TO FLANGE (In.)	+	9.0000 (E)
BALL INSET DIM (FROM TOP) (In.)	-	1.4700 (F)
IMMERSION DEPTH (In.)	+	0.2775 (G)
(A + B + C + D + E – F + G)		
REFERENCE LEVEL (In.)		501.9813
(Ft.)		41.8318
***IMMERSION DEPTH CALCULATION**		
GOVERNING EQUATION FROM SECTION 5.2.1.4		
$H = (4 * F_b) / (\pi * D^2 * \rho)$		
F_b = BOUYANT FORCE = SET POINT		15.0000 GRAMS
ρ = DENSITY OF LIQUID = SPECIFIC GRAVITY		1.0500 GRAMS/CM³
D = DISPLACER DIAMETER		5.0800 CM (2.0000 IN)
H = IMMERSION DEPTH (CM)		0.7049
(In.)		0.2775

Figure 7. Enraf Reference Level Summary Sheet (BX-104).

Section VI: H-2-817634 Sheets 6 & 9

The H-2-817634 engineering design drawings, entitled "INSTM Enraf Nonius ASSY Installation & Riser Schedule," are the primary location for Enraf assembly drawings. Included in the drawings are assembly installations per tank riser, information regarding the parts used in each Enraf assembly and two sheets that contain each Enraf tank waste reference level. Therefore, Sheets 6 & 9 of the H-2-817634 drawings show Enraf reference levels in the Hanford Tank Farm East Area and Tank Farm West Area, respectively. Although additional information, such as the electric installation for each installed Enraf gauge, is listed in the document, we are primarily concerned with keeping each reference level consistent to the most updated revision of WHC-SD-WM-CN-078.

The purpose of having the reference levels in the engineering design drawings is to support the engineering groups working in the Hanford Tank Farms. Accessing a table in a drawing facilitates the process of searching for reference level information, if kept up to date.

Both sheets 6 and 9 of the H-2-817634 drawings required reference level updates for a large number of installed Enrafs. To comply with Figure 6 (also located in WHC-SD-WM-CN-078, Revision 1 under the “Documents Affected” section), the reference levels were updated to reconcile all inconsistencies between the two sheets and the WHC-SD-WM-CN-078, Revision 1 document.

Table 5 lists all reference levels that were updated in Revision 37 of Sheet 6 and includes the addition of a new East Area miscellaneous Catch Tank Table. Table 8 lists all reference levels that were updated in Revision 3 of Sheet 9 and includes the addition of a new West Area miscellaneous Catch Tank Table.

Table 6 shows H-2-817634 Sheet 6, Revision 36. Revision 37 was developed to include the updates in Table 5 to Enraf reference levels (as seen in Table 7).

Table 5. H-2-817634 Sheet 6 Revised Reference Levels per Revision 37

Tank	New RL (in)	Tank	New RL (in)	Tank	New RL (in)
241-A-102	655.87	241-B-105	486.25	241-BY-109	574.92
241-A-104	653.80	241-B-106	484.62	241-BY-111	594.77
241-A-105	646.36	241-B-107	478.22	241-BY-112	593.42
241-AN-101	677.27	241-B-109	485.87	241-C-101	478.10
241-AN-102	677.94	241-B-110	478.74	241-C-102	478.46
241-AN-103	677.60	241-B-111	484.34	241-C-103	471.86
241-AN-104	677.53	241-BX-103	501.26	241-C-104	471.98
241-AN-105	677.53	241-BX-106	500.28	241-C-105	472.44
241-AN-106	677.43	241-BX-107	501.86	241-C-106	490.49
241-AN-107	681.49	241-BX-108	501.70	241-C-107	478.78
241-AW-101	675.72	241-BX-109	501.70	241-C-108	473.76
241-AW-102	673.48	241-BX-110	507.32	241-C-109	477.98
241-AW-103	676.05	241-BX-111	507.05	241-C-110	478.46
241-AW-104	676.17	241-BX-112	502.34	241-C-111	473.42
241-AW-105	675.23	241-BY-101	591.74	241-C-112	471.86
241-AW-106	675.23	241-BY-102	588.98	241-C-201	477.50
241-AX-103	651.96	241-BY-104	588.26	241-C-202	475.70
241-AZ-102	687.92	241-BY-105	590.54	241-C-203	477.62
241-B-101	478.34	241-BY-106	589.58	244-CR-001	654.77
241-B-103	483.62	241-BY-107	577.58	----	----
241-B-104	478.50	241-BY-108	574.58	----	----

Table 6. H-2-817634 Sheet 6, Revision 36

WAS (Before Changes)

EAST AREA RISER SCHEDULE

	TANK NO.	RISER NO.	SIZE	ASSY NO.	BALL VALVE	DISPLACER	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
30	241-A-101	6	4"	1	20		657.52	-040	
30	241-A-102	-006	4"	-010	20		655.75	-140	
30	241-A-103	6	4"	1	48		654.86	-040	
30	241-A-104	6	4"	1	48		654.86	-030	
30	241-A-105	-005	4"	-010	20		646.46	-140	
30	241-A-106	6	4"	1	48		653.18	-030	
30	A-302-A	N/A	6"	78	48		342.67	-030	
	241-AN-101	-004 (2A)	4"	1	48		677.07	-360***	
	241-AN-102	-004	4"	1	20		677.06	-350	
	241-AN-103	-004 (2A)	4"	1	20		677.05	-360***	
	241-AN-104	-004 (2A)	4"	1	20		677.05	-360***	
	241-AN-105	-004 (2A)	4"	1	20		677.05	-360***	
	241-AN-106	-004	4"	1	20		677.06	-350	
	241-AN-107	-004	4"	1	20		681.02	-350	
‡‡	241-AP-101	-004 (2)	4"	1	20		676.45	-320	
‡‡	241-AP-102	-004 (2)	4"	1	20		676.21	-320	
‡‡	241-AP-103	-004 (2)	4"	1	20		676.09	-320	
‡‡	241-AP-104	-004 (2)	4"	1	20		676.45	-320	
‡‡	241-AP-105	-004 (2)	4"	1	20		676.21	-320	
‡‡	241-AP-106	-004 (2)	4"	1	20		676.45	-320	
‡‡	241-AP-107	-004 (2)	4"	1	20		676.45	-320	
‡‡	241-AP-108	-004 (2)	4"	1	20		676.45	-320	
	241-AW-101	-004 (2A)	4"	1	20		675.38	-350	
	241-AW-102	-020 (16C)	4"	63	48		673.37	-350	
	241-AW-103	-004 (2A)	4"	1	48		675.84	-360***	
	241-AW-104	-004 (2A)	4"	1	48		675.96	-360***	
	241-AW-105	-004 (2A)	4"	1	48		674.96	-360***	
	241-AW-106	-004 (2A)	4"	1	48		675.03	-360***	
30	241-AX-101	8C	4"	1	20		652.08	-040	
30	241-AX-102	9B	6"	1	20		664.44	-060	
30	241-AX-103	9C	4"	1	20		651.84	-040	
30	241-AX-104	9B	6"	1	20		663.60	-030	
	241-AY-101	039	4"	1&80	48		695.04	-150	
	241-AY-101	088	24"	114	20	89	0.15	-140	
	241-AY-101	090	12"	111	20	89	0.15	-140	
	241-AY-101	091	12"	111	20	89	0.15	-140	
	241-AY-102	039	4"	1&80	48		698.04	-150	
	241-AY-102	088	24"	114	20	89	0.15	-140	
	241-AY-102	089	24"	1&115	20	89	0.15	N/A	
	241-AY-102	091	12"	111	20	89	0.15	-140	
	241-AZ-101	068	4"	31	20		688.83	-030	
	241-AZ-101	090	24"	114	20	89	TBD	–	
	241-AZ-101	091	12"	111	20	89	TBD	–	
	241-AZ-101	092	12"	111	20	89	TBD	–	
	241-AZ-102	072	6"	80	20		687.80	-040	
	241-AZ-102	089	24"	114	20	89	TBD	–	
	241-AZ-102	091	12"	111	20	89	TBD	–	
	241-AZ-102	092	12"	111	20	89	TBD	–	

241-AW ANNULUS LEAK DETECTOR RISER SCHEDULE

TANK NO.	RISER NO.	SIZE (IN)	ASSY NO.	BALL VALVE	DISPLACER	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
241-AW-101	-062	4"	118	20	89	0.15	-350	
241-AW-101	-063	4"	118	20	89	0.15	-350	
241-AW-101	-064	4"	118	20	89	0.15	-350	
241-AW-102	-062	4"	118	20	89	0.15	-350	
241-AW-102	-063	4"	118	20	89	0.15	-350	
241-AW-102	-064	4"	118	20	89	0.15	-350	
241-AW-103	-062	4"	118	20	89	0.15	-350	
241-AW-103	-063	4"	118	20	89	0.15	-350	
241-AW-103	-064	4"	118	20	89	0.15	-350	
241-AW-104	-062	4"	118	20	89	0.15	-350	
241-AW-104	-063	4"	118	20	89	0.15	-350	
241-AW-104	-064	4"	118	20	89	0.15	-350	
241-AW-105	-062	4"	118	20	89	0.15	-350	
241-AW-105	-063	4"	118	20	89	0.15	-350	
241-AW-105	-064	4"	118	20	89	0.15	-350	
241-AW-106	-062	4"	118	20	89	0.15	-350	
241-AW-106	-063	4"	118	20	89	0.15	-350	
241-AW-106	-064	4"	118	20	89	0.15	-350	

EAST AREA RISER SCHEDULE (CONT'D)

	TANK NO.	RISER NO.	SIZE	ASSY NO.	BALL VALVE	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
	241-AZ-151	NONE	4"	1	20	359.01	-140	
	241-B-101	8	4"	1	20	478.34	-140	
	241-B-102	1	4"	31	20	485.20	-030	
	241-B-103	1	4"	1	20	483.50	-140	
	241-B-104	8	4"	1	20	478.38	-140	
23	241-B-105	14	4"	102	20	486.13	-140	
	241-B-106	1	4"	1	20	484.86	-140	
	241-B-107	8	4"	1	20	477.98	-140	
	241-B-108	8	4"	1	20	477.38	-140	
	241-B-109	3	12"	50	20	485.75	-140	
	241-B-110	5	4"	1	20	478.50	-140	
	241-B-111	1	4"	1	20	483.98	-140	
	241-B-112	4	4"	1	20	484.84	-140	
	241-B-201	8	4"	1	20	468.66	-140	
	241-B-202	5	4"	1	20	469.38	-140	
	241-B-203	8	4"	1	20	469.38	-140	
	241-B-204	8	4"	1	20	469.50	-140	
	241-BX-101	8	4"	1	48	501.02	-030	
	241-BX-102	7	12"	50	48	524.45	-030	
	241-BX-103	8	4"	1	48	501.38	-030	
	241-BX-104	8	4"	1	48	501.98	-030	
	241-BX-105	1	4"	1	48	506.26	-030	
	241-BX-106	8	4"	1	20	500.04	-010	
	241-BX-107	8	4"	1	48	501.86	-040	
	241-BX-108	8	4"	1	48	500.64	-030	
	241-BX-109	8	4"	1	48	501.70	-030	
	241-BX-110	2	4"	2	48	507.32	-030	
	241-BX-111	2	4"	1	48	506.52	-030	
	241-BX-112	8	4"	1	48	502.34	-030	
	241-BY-102	5	4"	1	20	588.72	-140	
◆	241-BY-103	12A	4"	1	20	604.73	-140	
	241-BY-109	4	4"	1	20	574.80	-140	
	241-BY-110	4	4"	1	48	573.96	-350	
	241-BY-111	15	6"	78	20	594.05	-350	
	241-BY-101	10C	4"	1	20	588.77	-350	
	241-BY-104	5	4"	1	20	588.29	-350	
	241-BY-105	5	4"	1	20	590.57	-350	
	241-BY-106	5	4"	1	20	589.61	-350	
	241-BY-107	4	4"	1	20	577.61	-350	
	241-BY-108	4	4"	1	20	574.61	-350	
	241-BY-112	19	4"	1	20	593.45	-350	
	241-C-101	8	4"	31	20	489.99	-140	
	241-C-102							
21	241-C-103	8	4"	1	20	472.78	-350	
◆◆	241-C-104	8	4"	1	20	473.04	-140	
◆◆◆	241-C-105	8	4"			473.51	-030	
	241-C-106	1	4"	64	48	490.78	-050	
	241-C-107	8	4"	1	48	479.04	-030	
	241-C-108	8	4"	1	20	473.64	-140	
	241-C-109	1	4"	1	20	477.86	-140	
	241-C-110	4	4"	1	20	478.34	-140	
	241-C-111	8	4"	1	20	473.30	-140	
	241-C-112	5	4"	1	20	472.22	-030	
	241-C-203	8	4"	1	20	477.50	-280	
	241-C-202	8	4"	1	20	475.58	-280	
	241-C-201	8	4"	1	20	477.38	-280	
◇◇	241-C-204	5	4"	1	20	491.09	-280	
	244-CR-001	8724	6"	125	20	654.64	-280	
	244-CR-003	8757	6"	1	20	527.53	-280	

241-AN ANNULUS LEAK DETECTOR RISER SCHEDULE

TANK NO.	RISER NO.	SIZE (IN)	ASSY NO.	BALL VALVE	DISPLACER	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
241-AN-101	-059	4"	1	20	89	0.15	-350	
241-AN-101	-060	4"	1	20	89	0.15	-350	
241-AN-101	-061	4"	1	20	89	0.15	-350	
241-AN-102	-059	4"	1	20	89	0.15	-350	
241-AN-102	-060	4"	1	20	89	0.15	-350	
241-AN-102	-061	4"	1	20	89	0.15	-350	
241-AN-103	-059	4"	1	20	89	0.15	-350	
241-AN-103	-060	4"	1	20	89	0.15	-350	
241-AN-103	-061	4"	1	20	89	0.15	-350	
241-AN-104	-059	4"	1	20	89	0.15	-350	
241-AN-104	-060	4"	1	20	89	0.15	-350	
241-AN-104	-061	4"	1	20	89	0.15	-350	
241-AN-105	-059	4"	1	20	89	0.15	-350	
241-AN-105	-060	4"	1	20	89	0.15	-350	
241-AN-105	-061	4"	1	20	89	0.15	-350	
241-AN-106	-059	4"	1	20	89	0.15	-350	
241-AN-106	-060	4"	1	20	89	0.15	-350	
241-AN-106	-061	4"	1	20	89	0.15	-350	
241-AN-107	-059	4"	1	20	89	0.15	-350	
241-AN-107	-060	4"	1	20	89	0.15	-350	
241-AN-107	-061	4"	1	20	89	0.15	-350	

241-AP ANNULUS LEAK DETECTOR RISER SCHEDULE

TANK NO.	RISER NO.	SIZE (IN)	ASSY NO.	BALL VALVE	DISPLACER	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
241-AP-101	-069	4"	1	20	89	0.15	-350	
241-AP-101	-070	4"	1	20	89	0.15	-350	
241-AP-101	-071	4"	1	20	89	0.15	-350	
241-AP-102	-069	4"	1	20	89	0.15	-350	
241-AP-102	-070	4"	1	20	89	0.15	-350	
241-AP-102	-071	4"	1	20	89	0.15	-350	
241-AP-103	-069	4"	1	20	89	0.15	-350	
241-AP-103	-070	4"	1	20	89	0.15	-350	
241-AP-103	-071	4"	1	20	89	0.15	-350	
241-AP-104	-069	4"	1	20	89	0.15	-350	
241-AP-104	-070	4"	1	20	89	0.15	-350	
241-AP-104	-071	4"	1	20	89	0.15	-350	
241-AP-105	-069	4"	1	20	89	0.15	-350	
241-AP-105	-070	4"	1	20	89	0.15	-350	
241-AP-105	-071	4"	1	20	89	0.15	-350	
241-AP-106	-069	4"	1	20	89	0.15	-350	
241-AP-106	-070	4"	1	20	89	0.15	-350	
241-AP-106	-071	4"	1	20	89	0.15	-350	
241-AP-107	-069	4"	1	20	89	0.15	-350	
241-AP-107	-070	4"	1	20	89	0.15	-350	
241-AP-107	-071	4"	1	20	89	0.15	-350	
241-AP-108	-069	4"	1	20	89	0.15	-350	
241-AP-108	-070	4"	1	20	89	0.15	-350	
241-AP-108	-071	4"	1	20	89	0.15	-350	

LEGEND

- ‡‡ NO PVC RISER LINER
- *** CIU (SMARTLINK) MOD 1 AND MOD 2 COMMUNICATION IS FED THRU EXISTING TERMINAL BOX AS SHOWN IN DWG H-2-815467 INSTALLATION 165 (-360).
- ◇◇ ENRAF ON 241-C-204 IS INSTALLED ON BREATHER FILTER ASSEMBLY H-14-105284. IN LIEU OF BALL VALVE ITEM 20, USE OF BALL VALVE ON H-14-105284, ITEM 3 IS ACCEPTABLE.
- ◇◇◇ SEE DRAWING H-2-815467.
- ◆ BREATHER FILTER WITH "Y" SPOOL PER H-2-85337.
- ◆◆ ENRAF MECHANICAL INSTALLATION REMOVED FOR PUMPING OF 244CR VAULT CELLS.
- ◆◆◆ ENRAF MECHANICAL INSTALLATION REMOVED FOR 241-C-105 RETRIEVAL.

IN PRACTICE ALL ENRAFS USED AS ANNULUS LEAK DETECTORS HAVE THE SAME REFERENCE ELEVATION (RL). WHICH IS 0.15". THE DISPLACER IS SET ON THE BOTTOM OF THE ANNULUS. THE RL IS CODED IN AS 0.15", AND THE REFERENCE IS ACCEPTED. UNLIKE THE STANDARD ENRAFS THE DISPLACER IS NOT CALIBRATED TO THE BALL VALVE ELEVATION, BUT TO THE BOTTON OF THE ANNULUS INSTEAD. THE DISPLACER WILL BEGIN TO FLOAT AT A LIQUID LEVEL OF 0.15". WHICH IS WHY THAT WAS CHOSEN AS THE RL VALUE. WHEN IT REACHES 0.25" THE ALARM IS TRIGGERED.

30 ELECTRICAL INSTALLATION HAS BEEN MODIFIED BY ECN-727108-R0 TO ASSEMBLY 280. HARDWARE FROM PREVIOUS ELECTRICAL INSTALLATION TO REMAIN IN PLACE FOR FUTURE RECONNECTION.

PARTS LIST MOVED TO SH 7
FOR NOTES SEE SH 1 & 5
SCHEDULES CONTINUED ON H-2-817634-9

MAY - 8 2014 58

36 DIRECT REV PER ECN-13-001300

REVISIONS

DWG NUMBER | TITLE | DRAWING TRACEABILITY LIST

REF NUMBER | TITLE | REFERENCES | NEXT USED ON

BLDG NO. 241G

INDEX NO. 5901

CAUTION
NOT COMPLETE WITHOUT CURRENT CHANGE DOCUMENTS FROM DATABASE

[redacted]

NAME
JE DAVIS 03/14
RE DUNBAR
JC TURKNETT

U.S. DEPARTMENT OF ENERGY
Office of River Protection

INST
ENRAF NONIUS ASSY
INSTALLATION & RISER

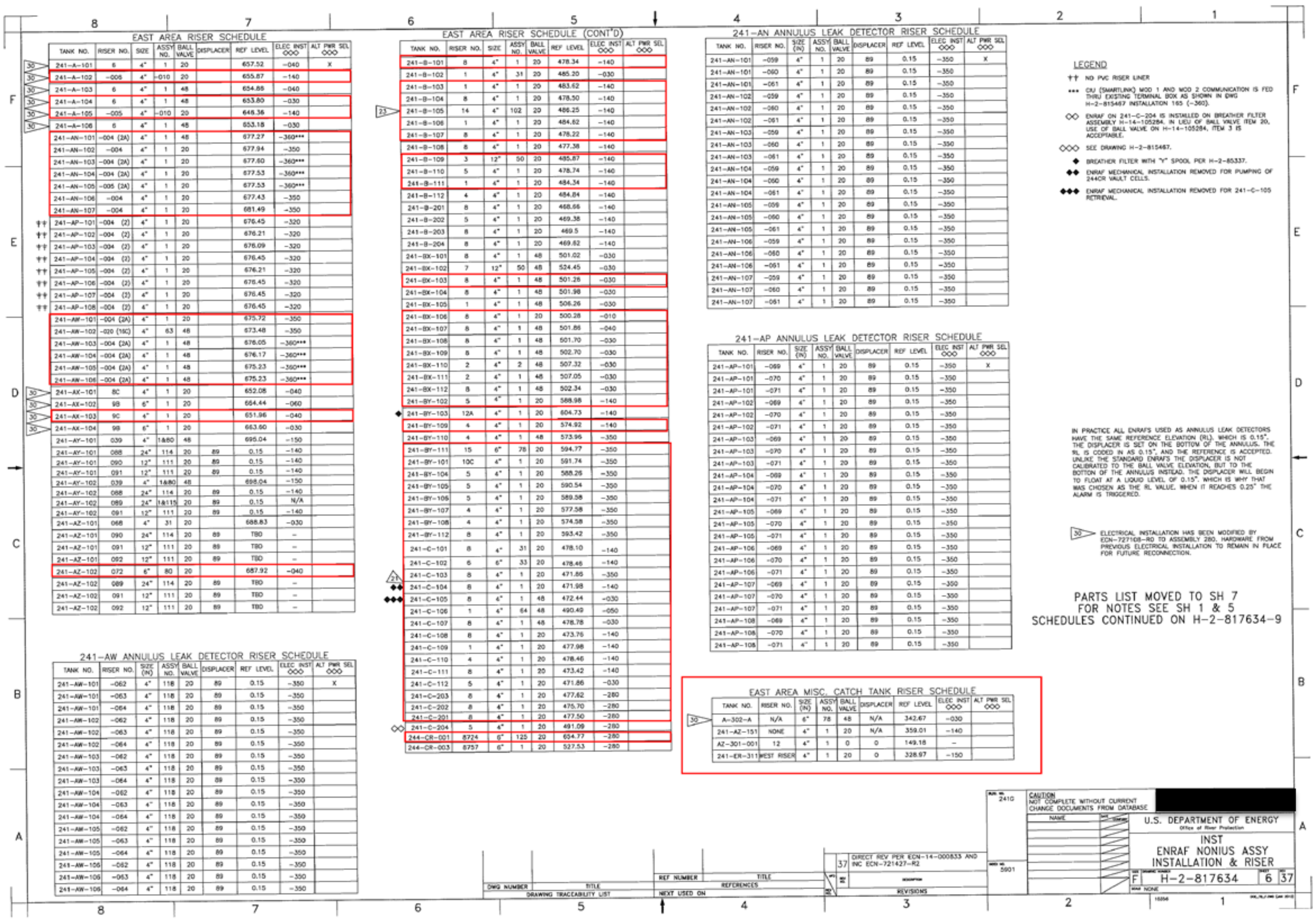
SIZE F | DRAWING NUMBER H-2-817634 | SHEET 6 | REV 36

SCALE NONE

16045

Table 7. H-2-817634 Sheet 6, Revision 37

IS (After Changes)



EAST AREA RISER SCHEDULE

TANK NO.	RISER NO.	SIZE	ASSY NO.	BALL VALVE	DISPLACER	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
241-A-101	6	4"	1	20		657.52	-040	X
241-A-102	-006	4"	-010	20		655.87	-140	
241-A-103	6	4"	1	48		654.88	-040	
241-A-104	6	4"	1	48		653.80	-030	
241-A-105	-005	4"	-010	20		648.36	-140	
241-A-106	6	4"	1	48		653.18	-030	
241-AN-101	-004 (2A)	4"	1	48		677.27	-360***	
241-AN-102	-004	4"	1	20		677.94	-350	
241-AN-103	-004 (2A)	4"	1	20		677.60	-360***	
241-AN-104	-004 (2A)	4"	1	20		677.53	-360***	
241-AN-105	-005 (2A)	4"	1	20		677.53	-360***	
241-AN-106	-004	4"	1	20		677.43	-350	
241-AN-107	-004	4"	1	20		681.49	-350	
†† 241-AP-101	-004 (2)	4"	1	20		676.45	-320	
†† 241-AP-102	-004 (2)	4"	1	20		676.21	-320	
†† 241-AP-103	-004 (2)	4"	1	20		676.09	-320	
†† 241-AP-104	-004 (2)	4"	1	20		676.45	-320	
†† 241-AP-105	-004 (2)	4"	1	20		676.21	-320	
†† 241-AP-106	-004 (2)	4"	1	20		676.45	-320	
†† 241-AP-107	-004 (2)	4"	1	20		676.45	-320	
†† 241-AP-108	-004 (2)	4"	1	20		676.45	-320	
241-AW-101	-004 (2A)	4"	1	20		675.72	-350	
241-AW-102	-020 (15C)	4"	63	48		673.48	-350	
241-AW-103	-004 (2A)	4"	1	48		676.05	-360***	
241-AW-104	-004 (2A)	4"	1	48		676.17	-360***	
241-AW-105	-004 (2A)	4"	1	48		675.23	-360***	
241-AW-106	-004 (2A)	4"	1	48		675.23	-360***	
241-AX-101	8C	4"	1	20		652.08	-040	
241-AX-102	9B	6"	1	20		664.44	-060	
241-AX-103	9C	4"	1	20		651.96	-040	
241-AX-104	9B	6"	1	20		663.60	-030	
241-AY-101	039	4"	1&80	48		695.04	-150	
241-AY-101	088	24"	114	20	89	0.15	-140	
241-AY-101	090	12"	111	20	89	0.15	-140	
241-AY-101	091	12"	111	20	89	0.15	-140	
241-AY-102	039	4"	1&80	48		698.04	-150	
241-AY-102	088	24"	114	20	89	0.15	-140	
241-AY-102	089	24"	1&115	20	89	0.15	N/A	
241-AY-102	091	12"	111	20	89	0.15	-140	
241-AZ-101	068	4"	31	20		688.83	-030	
241-AZ-101	090	24"	114	20	89	TBD	–	
241-AZ-101	091	12"	111	20	89	TBD	–	
241-AZ-101	092	12"	111	20	89	TBD	–	
241-AZ-102	072	6"	80	20		687.92	-040	
241-AZ-102	089	24"	114	20	89	TBD	–	
241-AZ-102	091	12"	111	20	89	TBD	–	
241-AZ-102	092	12"	111	20	89	TBD	–	

241-AW ANNULUS LEAK DETECTOR RISER SCHEDULE

TANK NO.	RISER NO.	SIZE (IN)	ASSY NO.	BALL VALVE	DISPLACER	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
241-AW-101	-062	4"	118	20	89	0.15	-350	X
241-AW-101	-063	4"	118	20	89	0.15	-350	
241-AW-101	-064	4"	118	20	89	0.15	-350	
241-AW-102	-062	4"	118	20	89	0.15	-350	
241-AW-102	-063	4"	118	20	89	0.15	-350	
241-AW-102	-064	4"	118	20	89	0.15	-350	
241-AW-103	-062	4"	118	20	89	0.15	-350	
241-AW-103	-063	4"	118	20	89	0.15	-350	
241-AW-103	-064	4"	118	20	89	0.15	-350	
241-AW-104	-062	4"	118	20	89	0.15	-350	
241-AW-104	-063	4"	118	20	89	0.15	-350	
241-AW-104	-064	4"	118	20	89	0.15	-350	
241-AW-105	-062	4"	118	20	89	0.15	-350	
241-AW-105	-063	4"	118	20	89	0.15	-350	
241-AW-105	-064	4"	118	20	89	0.15	-350	
241-AW-106	-062	4"	118	20	89	0.15	-350	
241-AW-106	-063	4"	118	20	89	0.15	-350	
241-AW-106	-064	4"	118	20	89	0.15	-350	

EAST AREA RISER SCHEDULE (CONT'D)

TANK NO.	RISER NO.	SIZE	ASSY NO.	BALL VALVE	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
241-B-101	8	4"	1	20	478.34	-140	
241-B-102	1	4"	31	20	485.20	-030	
241-B-103	1	4"	1	20	483.62	-140	
241-B-104	8	4"	1	20	478.50	-140	
241-B-105	14	4"	102	20	486.25	-140	
241-B-106	1	4"	1	20	484.62	-140	
241-B-107	8	4"	1	20	478.22	-140	
241-B-108	8	4"	1	20	477.38	-140	
241-B-109	3	12"	50	20	485.87	-140	
241-B-110	5	4"	1	20	478.74	-140	
241-B-111	1	4"	1	20	484.34	-140	
241-B-112	4	4"	1	20	484.84	-140	
241-B-201	8	4"	1	20	468.66	-140	
241-B-202	5	4"	1	20	469.38	-140	
241-B-203	8	4"	1	20	469.5	-140	
241-B-204	8	4"	1	20	469.62	-140	
241-BX-101	8	4"	1	48	501.02	-030	
241-BX-102	7	12"	50	48	524.45	-030	
241-BX-103	8	4"	1	48	501.26	-030	
241-BX-104	8	4"	1	48	501.98	-030	
241-BX-105	1	4"	1	48	506.26	-030	
241-BX-106	8	4"	1	20	500.28	-010	
241-BX-107	8	4"	1	48	501.86	-040	
241-BX-108	8	4"	1	48	501.70	-030	
241-BX-109	8	4"	1	48	502.70	-030	
241-BX-110	2	4"	2	48	507.32	-030	
241-BX-111	2	4"	1	48	507.05	-030	
241-BX-112	8	4"	1	48	502.34	-030	
241-BY-102	5	4"	1	20	588.98	-140	
◆ 241-BY-103	12A	4"	1	20	604.73	-140	
241-BY-109	4	4"	1	20	574.92	-140	
241-BY-110	4	4"	1	48	573.96	-350	
241-BY-111	15	6"	78	20	594.77	-350	
241-BY-101	10C	4"	1	20	591.74	-350	
241-BY-104	5	4"	1	20	588.26	-350	
241-BY-105	5	4"	1	20	590.54	-300	
241-BY-106	5	4"	1	20	589.58	-350	
241-BY-107	4	4"	1	20	577.58	-350	
241-BY-108	4	4"	1	20	574.58	-350	
241-BY-112	8	4"	1	20	593.42	-350	
241-C-101	8	4"	31	20	478.10	-140	
241-C-102	6	6"	33	20	478.46	-140	
241-C-103	8	4"	1	20	471.86	-350	
◆◆ 241-C-104	8	4"	1	20	471.98	-140	
◆◆◆ 241-C-105	8	4"	1	48	472.44	-030	
241-C-106	1	4"	64	48	490.49	-050	
241-C-107	8	4"	1	48	478.78	-030	
241-C-108	8	4"	1	20	473.76	-140	
241-C-109	1	4"	1	20	477.98	-140	
241-C-110	4	4"	1	20	478.46	-140	
241-C-111	8	4"	1	20	473.42	-140	
241-C-112	5	4"	1	20	471.86	-030	
241-C-203	8	6"	1	20	477.62	-280	
241-C-202	8	4"	1	20	475.70	-280	
241-C-201	8	4"	1	20	477.50	-280	
◇◇ 241-C-204	5	4"	1	20	491.09	-280	
244-CR-001	8724	6"	125	20	654.77	-280	
244-CR-003	8757	6"	1	20	527.53	-280	

241-AN ANNULUS LEAK DETECTOR RISER SCHEDULE

TANK NO.	RISER NO.	SIZE (IN)	ASSY NO.	BALL VALVE	DISPLACER	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
241-AN-101	-059	4"	1	20	89	0.15	-350	X
241-AN-101	-060	4"	1	20	89	0.15	-350	
241-AN-101	-061	4"	1	20	89	0.15	-350	
241-AN-102	-059	4"	1	20	89	0.15	-350	
241-AN-102	-060	4"	1	20	89	0.15	-350	
241-AN-102	-061	4"	1	20	89	0.15	-350	
241-AN-103	-059	4"	1	20	89	0.15	-350	
241-AN-103	-060	4"	1	20	89	0.15	-350	
241-AN-103	-061	4"	1	20	89	0.15	-350	
241-AN-104	-059	4"	1	20	89	0.15	-350	
241-AN-104	-060	4"	1	20	89	0.15	-350	
241-AN-104	-061	4"	1	20	89	0.15	-350	
241-AN-105	-059	4"	1	20	89	0.15	-350	
241-AN-105	-060	4"	1	20	89	0.15	-350	
241-AN-105	-061	4"	1	20	89	0.15	-350	
241-AN-106	-059	4"	1	20	89	0.15	-350	
241-AN-106	-060	4"	1	20	89	0.15	-350	
241-AN-106	-061	4"	1	20	89	0.15	-350	
241-AN-107	-059	4"	1	20	89	0.15	-350	
241-AN-107	-060	4"	1	20	89	0.15	-350	
241-AN-107	-061	4"	1	20	89	0.15	-350	

241-AP ANNULUS LEAK DETECTOR RISER SCHEDULE

TANK NO.	RISER NO.	SIZE (IN)	ASSY NO.	BALL VALVE	DISPLACER	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
241-AP-101	-069	4"	1	20	89	0.15	-350	X
241-AP-101	-070	4"	1	20	89	0.15	-350	
241-AP-101	-071	4"	1	20	89	0.15	-350	
241-AP-102	-069	4"	1	20	89	0.15	-350	
241-AP-102	-070	4"	1	20	89	0.15	-350	
241-AP-102	-071	4"	1	20	89	0.15	-350	
241-AP-103	-069	4"	1	20	89	0.15	-350	
241-AP-103	-070	4"	1	20	89	0.15	-350	
241-AP-103	-071	4"	1	20	89	0.15	-350	
241-AP-104	-069	4"	1	20	89	0.15	-350	
241-AP-104	-070	4"	1	20	89	0.15	-350	
241-AP-104	-071	4"	1	20	89	0.15	-350	
241-AP-105	-069	4"	1	20	89	0.15	-350	
241-AP-105	-070	4"	1	20	89	0.15	-350	
241-AP-105	-071	4"	1	20	89	0.15	-350	
241-AP-106	-069	4"	1	20	89	0.15	-350	
241-AP-106	-070	4"	1	20	89	0.15	-350	
241-AP-106	-071	4"	1	20	89	0.15	-350	
241-AP-107	-069	4"	1	20	89	0.15	-350	
241-AP-107	-070	4"	1	20	89	0.15	-350	
241-AP-107	-071	4"	1	20	89	0.15	-350	
241-AP-108	-069	4"	1	20	89	0.15	-350	
241-AP-108	-070	4"	1	20	89	0.15	-350	
241-AP-108	-071	4"	1	20	89	0.15	-350	

EAST AREA MISC. CATCH TANK RISER SCHEDULE

TANK NO.	RISER NO.	SIZE (IN)	ASSY NO.	BALL VALVE	DISPLACER	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
A-302-A	N/A	6"	78	48	N/A	342.67	-030	
241-AZ-151	NONE	4"	1	20	N/A	359.01	-140	
AZ-301-001	12	4"	1	0	0	149.18	–	
241-ER-311	WEST RISER	4"	1	20	0	328.97	-150	

LEGEND

†† NO PVC RISER LINER

*** CIU (SMARTLINK) MOD 1 AND MOD 2 COMMUNICATION IS FED THRU EXISTING TERMINAL BOX AS SHOWN IN DWG H-2-815467 INSTALLATION 165 (-360).

◇◇ ENRAF ON 241-C-204 IS INSTALLED ON BREATHER FILTER ASSEMBLY H-14-105284. IN LIEU OF BALL VALVE ITEM 20, USE OF BALL VALVE ON H-14-105284, ITEM 3 IS ACCEPTABLE.

◇◇◇ SEE DRAWING H-2-815467.

◆ BREATHER FILTER WITH "Y" SPOOL PER H-2-85337.

◆◆ ENRAF MECHANICAL INSTALLATION REMOVED FOR PUMPING OF 244CR VAULT CELLS.

◆◆◆ ENRAF MECHANICAL INSTALLATION REMOVED FOR 241-C-105 RETRIEVAL.

IN PRACTICE ALL ENRAFS USED AS ANNULUS LEAK DETECTORS HAVE THE SAME REFERENCE ELEVATION (RL), WHICH IS 0.15". THE DISPLACER IS SET ON THE BOTTOM OF THE ANNULUS. THE RL IS CODED IN AS 0.15", AND THE REFERENCE IS ACCEPTED. UNLIKE THE STANDARD ENRAFS THE DISPLACER IS NOT CALIBRATED TO THE BALL VALVE ELEVATION, BUT TO THE BOTTOM OF THE ANNULUS INSTEAD. THE DISPLACER WILL BEGIN TO FLOAT AT A LIQUID LEVEL OF 0.15". WHICH IS WHY THAT WAS CHOSEN AS THE RL VALUE. WHEN IT REACHES 0.25" THE ALARM IS TRIGGERED.

30 ELECTRICAL INSTALLATION HAS BEEN MODIFIED BY ECN-727108-RO TO ASSEMBLY 280. HARDWARE FROM PREVIOUS ELECTRICAL INSTALLATION TO REMAIN IN PLACE FOR FUTURE RECONNECTION.

PARTS LIST MOVED TO SH 7
FOR NOTES SEE SH 1 & 5
SCHEDULES CONTINUED ON H-2-817634-9

2410

CAUTION
NOT COMPLETE WITHOUT CURRENT CHANGE DOCUMENTS FROM DATABASE

[redacted]

U.S. DEPARTMENT OF ENERGY

INST
ENRAF NONIUS ASSY
INSTALLATION & RISER

F H-2-817634 6 37

37 DIRECT REV PER ECN-14-000833 AND INC ECN-721427-R2

REVISIONS

DWG NUMBER TITLE DRAWING TRACEABILITY LIST

REF NUMBER TITLE REFERENCES

NEXT USED ON

Table 9 shows H-2-817634 Sheet 9, Revision 2. Revision 3 was developed to include the updates in Table 8 to Enraf reference levels (as seen in Table 10):

Table 8. H-2-817634 Sheet 9 Revised Reference Levels per Revision 3

Tank	New RL	Tank	New RL	Tank	New RL
241-S-108	556.56	241-SY-103	672.65	241-TX-115	576.60
241-SX-105	637.68	241-T-101	472.06	241-TX-116	575.16
241-SX-109	635.57	241-T-104	473.28	241-TY-101	556.68
241-SY-101 1A	672.83	241-TX-108	599.69	241-U-112	474.90
241-SY-101 1C	671.51	241-TX-113	574.44	241-U-201	469.02
241-SY-102	669.62	241-TX-114	576.48	241-U-202	469.74

Table 9. H-2-817634 Sheet 9, Revision 2

WEST AREA RISER SCHEDULE

	TANK NO.	RISER NO.	SIZE	ASSY NO.	BALL VALVE	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
	241-S-101	3	4"	1	20	555.00	-030	
	241-S-102	5	12"	50	20	556.27	-280	
	241-S-103	3	4"	1	20	556.72	-010	
	241-S-104	5	12"	50	20	555.25	-140	
	241-S-105	3	4"	1	48	557.02	-030	
	241-S-106	3	4"	1	20	556.60	-010	
	241-S-107	3	4"	1	20	556.36	-010	
	241-S-108	3	4"	1	20	556.34	-030	
	241-S-109	3	4"	1	20	556.80	-030	
	241-S-110	3	4"	1	48	559.54	-030	
	241-S-111	3	4"	1	20	557.92	-020	
†	241-S-112	3	4"	113	48	555.70	-040	
††	241-SX-101	4	4"	1	48	636.36	-040	
	241-SX-102	4	4"	1	48	635.28	-040	
	241-SX-103	3	4"	1	48	636.58	-040	
	241-SX-104	4	4"	1	20	636.86	-040	
	241-SX-105	4	4"	1	20	637.56	-030	
††	241-SX-106	3	4"	1	20	636.14	-020	
	241-SX-107	2	4"	1	20	636.02	-140	
	241-SX-108	2	4"	1	20	633.98	-140	
	241-SX-109	2	4"	1	48	635.31	-040	
	241-SX-110	2	4"	1	20	633.74	-140	
	241-SX-111	2	4"	1	20	633.74	-140	
	241-SX-112	2	4"	1	20	634.82	-140	
	241-SX-113	2	4"	1	20	634.94	-140	
	241-SX-114	2	4"	1	20	633.38	-140	
	241-SX-115	2	4"	1	20	633.50	-140	
	241-SY-101	1A	4"	1	20	672.95	-020	
	241-SY-101	1C	4"	1	48	670.87	-040	
	241-SY-102	2A	4"	1	20	672.41	-010	
	241-SY-103	2A	4"	1	20	672.65	-020	
	241-T-101	1	4"	1	20	472.32	-030	
	241-T-102	8	4"	1	20	474.30	-010	
	241-T-103	1	4"	1	20	475.241	-030	
	241-T-104	5	4"	1	20	473.54	-030	
	241-T-105	1	4"	1	48	474.34	-030	
	241-T-106	1	4"	1	48	473.16	-030	
	241-T-107	1	4"	1	20	474.88	-010	
	241-T-108	13A	4"	50	48	494.64	-030	
	241-T-109	1	4"	1	20	474.48	-010	
	241-T-110	1	4"	1	48	474.22	-040	
	241-T-111	4	4"	1	48	474.46	-030	
	241-T-112	13A	4"	50	48	494.76	-030	
	241-T-201	4	4"	1	20	476.92	-140	
	241-T-202	4	4"	1	20	476.64	-140	
	241-T-203	4	4"	1	20	476.52	-140	
	241-T-204	4	4"	1	20	476.52	-140	

(CONTINUED)

* ENRAF INSTALLED ON UPPER FLANGE

WEST AREA RISER SCHEDULE (CONT'D)

	TANK NO.	RISER NO.	SIZE	ASSY NO.	BALL VALVE	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
	241-TX-101	4	4"	65	48	589.76	-030	
	241-TX-102	9A	4"	1	48	600.12	-040	
	241-TX-103	8	4"	1	48	588.62	-030	
	241-TX-104	8	4"	65	48	599.84	-030	
	241-TX-105	8	4"	65	48	598.85	-040	
	241-TX-106	8	4"	65	48	599.45	-030	
	241-TX-107	8	4"	65	48	599.21	-030	
	241-TX-108	8	4"	65	48	599.67	-030	
	241-TX-109	4	4"	1	48	577.42	-030	
	241-TX-110	7	12"	*50	48	593.05	-030	
	241-TX-111	1	4"	65	48	589.61	-040	
	241-TX-112	1	4"	66	48	614.09	-040	
	241-TX-113	1	4"	1	48	575.50	-040	
	241-TX-114	8	4"	1	48	577.54	-030	
	241-TX-115	1	4"	1	48	577.66	-040	
	241-TX-116	1	4"	1	48	576.22	-030	
	241-TX-117	11A (SEE NOTE 14)	4"	65	48	580.37	-030	
	241-TX-118	4	4"	1	48	578.66	-040	
	241-TX-302B	3	4"	1	20	340.98		
	241-TY-101	1	4"	1	20	556.56	-030	
	241-TY-102	1	4"	1	48	556.58	-040	
	241-TY-103	1	4"	1	48	555.70	-030	
	241-TY-104	1	4"	1	48	556.58	-040	
	241-TY-105	4	4"	1	48	555.00	-030	
	241-TY-106	4	4"	1	48	555.12	-030	
	241-U-101	8	4"	1	20	475.62	-140	
	241-U-102	8	4"	1	20	475.10	-040	
	241-U-103	8	4"	1	20	475.96	-020	
	241-U-104	7	4"	1	20	489.53	-140	
††	241-U-105	8	4"	1	20	476.56	-020	
	241-U-106	8	4"	1	20	476.32	-020	
	241-U-107	8	4"	1	20	476.08	-020	
	241-U-108	8	4"	1	48	476.30	-040	
	241-U-109	8	4"	1	20	475.74	-020	
	241-U-110	8	4"	1	48	475.66	-030	
	241-U-111	8	4"	1	48	476.50	-040	
	241-U-112	8	4"	1	20	474.78	-350	
	241-U-201	1	4"	1	20	468.90	-350	
	241-U-202	1	4"	1	20	469.62	-350	
	241-U-203	1	4"	1	48	468.72	-030	
	241-U-204	1	4"	1	48	469.48	-030	

241-SY ANNULUS LEAK DETECTOR RISER SCHEDULE

TANK NO.	RISER NO.	SIZE	ASSY NO.	BALL VALVE	REF LEVEL	ELEC INST ◇◇◇◇	ALT PWR SEL ◇◇◇
241-SY-101	-033	6"	80	20	SEE NOTE BELOW	-010	
241-SY-101	-034	6"	80	20	SEE NOTE BELOW	-010	
241-SY-101	-039	8"	94	20	SEE NOTE BELOW	-010	
241-SY-102	-032	6"	95	20	SEE NOTE BELOW	-010	
241-SY-102	-033	6"	80	20	SEE NOTE BELOW	-010	
241-SY-102	-038	8"	91	20	SEE NOTE BELOW	-010	
241-SY-103	-032	6"	80	20	SEE NOTE BELOW	-010	
241-SY-103	-033	6"	80	20	SEE NOTE BELOW	-030	
241-SY-103	-038	8"	91	20	SEE NOTE BELOW	-010	

NOTE: REFERENCE LEVEL TO BE DETERMINED AT TIME OF INSTALLATION.

LEGEND

◇◇◇◇ SEE DRAWING H-14-103761.

◇◇◇ SEE DRAWING H-2-815467.

† ENRAF INSTALLED IN STILLING WELL FOR S-112 WASTE RETRIEVAL PROJECT

†† NO PVC RISER LINER

IN PRACTICE ALL ENRAFS USED AS ANNULUS LEAK DETECTORS HAVE THE SAME REFERENCE ELEVATION (RL), WHICH IS 0.15". THE DISPLACER IS SET ON THE BOTTOM OF THE ANNULUS. THE RL IS CODED IN AS 0.15", AND THE REFERENCE IS ACCEPTED. UNLIKE THE STANDARD ENRAFS THE DISPLACER IS NOT CALIBRATED TO THE BALL VALVE ELEVATION, BUT TO THE BOTTON OF THE ANNULUS INSTEAD. THE DISPLACER WILL BEGIN TO FLOAT AT A LIQUID LEVEL OF 0.15" WHICH IS WHY THAT WAS CHOSEN AS THE RL VALUE. WHEN IT REACHES 0.25" THE ALARM IS TRIGGERED.

PARTS LIST MOVED TO SH 7
FOR NOTES SEE SH 1 & 5

MAY - 5 2014

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2410

CAUTION
NOT COMPLETE WITHOUT CURRENT CHANGE DOCUMENTS FROM DATABASE

[redacted]

NAME

JC DAVIS

2 DIRECT REV PER ECN-13-001300, INC ECN-12-001185 & ECN-13-000419

REVISIONS

5901

JC TURKNETT

U.S. DEPARTMENT OF ENERGY
Office of River Protection

INST
ENRAF NONIUS ASSY
INSTALLATION & RISER

F H-2-817634 9 2

SCALE NONE

DWG NUMBER | TITLE
DRAWING TRACEABILITY LIST

REF NUMBER | TITLE
REFERENCES

NEXT USED ON

Table 10. H-2-817634 Sheet 9, Revision 3

WEST AREA RISER SCHEDULE

	TANK NO.	RISER NO.	SIZE	ASSY NO.	BALL VALVE	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
	241-S-101	3	4"	1	20	555.00	-030	X
	241-S-102	5	12"	50	20	556.27	-280	
	241-S-103	3	4"	1	20	556.72	-010	
	241-S-104	5	12"	50	20	555.25	-140	
	241-S-105	3	4"	1	48	557.02	-030	
	241-S-106	3	4"	1	20	556.60	-010	
	241-S-107	3	4"	1	20	556.36	-010	
	241-S-108	3	4"	1	20	556.56	-030	
	241-S-109	3	4"	1	20	556.80	-030	
	241-S-110	3	4"	1	48	559.54	-030	
	241-S-111	3	4"	1	20	557.92	-020	
†	241-S-112	3	4"	113	48	555.70	-040	
††	241-SX-101	4	4"	1	48	636.36	-040	
	241-SX-102	4	4"	1	48	635.28	-040	
	241-SX-103	3	4"	1	48	636.58	-040	
	241-SX-104	4	4"	1	20	636.86	-040	
	241-SX-105	4	4"	1	20	637.68	-030	
††	241-SX-106	3	4"	1	20	636.14	-020	
	241-SX-107	2	4"	1	20	636.02	-140	
	241-SX-108	2	4"	1	20	633.98	-140	
	241-SX-109	2	4"	1	48	635.57	-040	
	241-SX-110	2	4"	1	20	633.74	-140	
	241-SX-111	2	4"	1	20	633.74	-140	
	241-SX-112	2	4"	1	20	634.82	-140	
	241-SX-113	2	4"	1	20	634.94	-140	
	241-SX-114	2	4"	1	20	633.38	-140	
	241-SX-115	2	4"	1	20	633.50	-140	
	241-SY-101	1A	4"	1	20	672.83	-020	
	241-SY-101	1C	4"	1	20	671.51	-040	
	241-SY-102	2A	4"	1	20	668.68	-010	
	241-SY-103	2A	4"	1	20	672.65	-020	
	241-T-101	1	4"	1	20	472.06	-030	
	241-T-102	8	4"	1	20	474.30	-010	
	241-T-103	1	4"	1	20	475.241	-030	
	241-T-104	5	4"	1	20	473.28	-030	
	241-T-105	1	4"	1	48	474.34	-030	
	241-T-106	1	4"	1	48	473.16	-030	
	241-T-107	1	4"	1	20	474.88	-010	
	241-T-108	13A	4"	50	48	494.64	-030	
	241-T-109	1	4"	1	20	474.48	-010	
	241-T-110	1	4"	1	48	474.22	-040	
	241-T-111	4	4"	1	48	474.46	-030	
	241-T-112	13A	4"	50	48	494.76	-030	
	241-T-201	4	4"	1	20	476.92	-140	
	241-T-202	4	4"	1	20	476.64	-140	
	241-T-203	4	4"	1	20	476.52	-140	
	241-T-204	4	4"	1	20	476.52	-140	

(CONTINUED)

* ENRAF INSTALLED ON UPPER FLANGE

WEST AREA RISER SCHEDULE (CONT'D)

	TANK NO.	RISER NO.	SIZE	ASSY NO.	BALL VALVE	REF LEVEL	ELEC INST ◇◇◇	ALT PWR SEL ◇◇◇
	241-TX-101	4	4"	65	48	589.76	-030	X
	241-TX-102	9A	4"	1	48	600.12	-040	
	241-TX-103	8	4"	1	48	588.62	-030	
	241-TX-104	8	4"	65	48	599.84	-030	
	241-TX-105	8	4"	65	48	598.85	-040	
	241-TX-106	8	4"	65	48	598.38	-030	
	241-TX-107	8	4"	65	48	599.21	-030	
	241-TX-108	8	4"	65	48	599.69	-030	
	241-TX-109	4	4"	1	48	577.42	-030	
	241-TX-110	7	12"	*50	48	593.65	-030	
	241-TX-111	1	4"	65	48	589.61	-040	
	241-TX-112	1	4"	66	48	614.09	-040	
	241-TX-113	1	4"	1	48	574.44	-040	
	241-TX-114	8	4"	1	48	576.48	-030	
	241-TX-115	1	4"	1	48	576.60	-040	
	241-TX-116	1	4"	1	48	575.16	-030	
	241-TX-117	11A (SEE NOTE 14)	4"	65	48	580.37	-030	
	241-TX-118	4	4"	1	48	578.66	-040	
	241-TY-101	1	4"	1	20	556.68	-030	
	241-TY-102	1	4"	1	48	556.58	-040	
	241-TY-103	1	4"	1	48	555.70	-030	
	241-TY-104	1	4"	1	48	556.58	-040	
	241-TY-105	4	4"	1	48	555.00	-030	
	241-TY-106	4	4"	1	48	555.12	-030	
	241-U-101	8	4"	1	20	475.74	-140	
	241-U-102	8	4"	1	20	475.10	-040	
	241-U-103	8	4"	1	20	475.96	-020	
	241-U-104	7	4"	1	20	489.65	-140	
††	241-U-105	8	4"	1	20	476.58	-020	
	241-U-106	8	4"	1	20	476.32	-020	
	241-U-107	8	4"	1	20	476.08	-020	
	241-U-108	8	4"	1	48	476.30	-040	
	241-U-109	8	4"	1	20	475.74	-020	
	241-U-110	8	4"	1	48	475.66	-030	
	241-U-111	8	4"	1	48	476.50	-040	
	241-U-112	8	4"	1	20	474.90	-350	
	241-U-201	1	4"	1	20	469.02	-350	
	241-U-202	1	4"	1	20	469.74	-350	
	241-U-203	1	4"	1	48	468.72	-030	
	241-U-204	1	4"	1	48	469.48	-030	

241-SY ANNULUS LEAK DETECTOR RISER SCHEDULE

TANK NO.	RISER NO.	SIZE	ASSY NO.	BALL VALVE	REF LEVEL	ELEC INST ◇◇◇◇	ALT PWR SEL ◇◇◇
241-SY-101	-01A	4"	1	20	SEE NOTE BELOW	N/A	
241-SY-101	-033	6"	80	20	SEE NOTE BELOW	-010	X
241-SY-101	-034	6"	80	20	SEE NOTE BELOW	-010	
241-SY-101	-039	8"	94	20	SEE NOTE BELOW	-010	
241-SY-102	-032	6"	95	20	SEE NOTE BELOW	-010	
241-SY-102	-033	6"	80	20	SEE NOTE BELOW	-010	
241-SY-102	-038	8"	91	20	SEE NOTE BELOW	-010	
241-SY-103	-032	6"	80	20	SEE NOTE BELOW	-010	
241-SY-103	-033	6"	80	20	SEE NOTE BELOW	-030	
241-SY-103	-038	8"	91	20	SEE NOTE BELOW	-010	

NOTE: REFERENCE LEVEL TO BE DETERMINED AT TIME OF INSTALLATION.

WEST AREA MISC. CATCH TANK RISER SCHEDULE

TANK NO.	RISER NO.	SIZE	ASSY NO.	BALL VALVE	REF LEVEL	ELEC INST ◇◇◇◇	ALT PWR SEL ◇◇◇
240-S-302	N/A	4"	1	48	394.32	-030	
241-S-304	-0	0	0	0	467.21	-010	
241-TX-302B	3	4"	1	20	340.98	-	
241-TX-302C	N/A	4"	1	48	440.88	-030	
241-U-301	N/A	4"	1	48	378.24	-030	
241-UX-302A	0	0	0	0	358.7	-010	

LEGEND

◇◇◇◇ SEE DRAWING H-14-103761.

◇◇◇ SEE DRAWING H-2-815467.

† ENRAF INSTALLED IN STILLING WELL FOR S-112 WASTE RETRIEVAL PROJECT

†† NO PVC RISER LINER

IN PRACTICE ALL ENRAFS USED AS ANNULUS LEAK DETECTORS HAVE THE SAME REFERENCE ELEVATION (RL). WHICH IS 0.15". THE DISPLACER IS SET ON THE BOTTOM OF THE ANNULUS. THE RL IS CODED IN AS 0.15", AND THE REFERENCE IS ACCEPTED. UNLIKE THE STANDARD ENRAFS THE DISPLACER IS NOT CALIBRATED TO THE BALL VALVE ELEVATION, BUT TO THE BOTTON OF THE ANNULUS INSTEAD. THE DISPLACER WILL BEGIN TO FLOAT AT A LIQUID LEVEL OF 0.15", WHICH IS WHY THAT WAS CHOSEN AS THE RL VALUE. WHEN IT REACHES 0.25" THE ALARM IS TRIGGERED.

PARTS LIST MOVED TO SH 7
FOR NOTES SEE SH 1 & 5

3 DIRECT REV PER ECN-14-000833 AND INC ECN-14-000363

REVISIONS

DWG NUMBER | TITLE | REF NUMBER | TITLE

DRAWING TRACEABILITY LIST | NEXT USED ON | REFERENCES

241G

CAUTION
NOT COMPLETE WITHOUT CURRENT CHANGE DOCUMENTS FROM DATABASE

[redacted]

5901

NAME

U.S. DEPARTMENT OF ENERGY
Office of River Protection

INST
ENRAF NONIUS ASSY
INSTALLATION & RISER

F H-2-817634 9 03

NONE

10331

With the help of Hanford SST engineers, DST engineers, SST CSEs (cognizant system engineers), DST CSEs, all four Tank Farm Area engineers, engineers from the Waste Monitoring Group & Design Engineering Group and environmental regulators from WRPS, the State of Washington and the DOE ORP, H-2-817634, Revision 37 and 3 were developed for Sheets 6 & 9, respectively.

Section VII: Enraf & Densitometer PMID Reference Levels

The Enraf/Densitometer PMID Reference Level is the control system used to keep parts and equipment up to date. The PMID is the identification number associated with each individual Enraf/densitometer. This identification number is specific to each individual Enraf/densitometer and contains information regarding the reference level of the device, work packages created to install the gauge, latest calibration dates, specific tank information, etc.

The Enraf PMID is the primary means of calibration for the Enraf/densitometer calibration team. The Enraf and densitometer PMID reference levels are located in a Hanford program called PCSACS. This program, PCSACS, is the only source of obtaining the Enraf/densitometer reference level information for the calibration workers. Therefore, without an updated reference level in the PMID, the Enraf/densitometer NOVRAM (non-volatile random access memory) will show the incorrect reference level, even though both the Enraf & Densitometer Gauge Reference Level Summaries document and H-2-817634 drawings show correct, updated reference levels.

To comply with Figure 6 (also located in WHC-SD-WM-CN-078, Revision 1 under the “Documents Affected” section), the reference levels were updated to repair all inconsistencies between the PMID reference levels and the WHC-SD-WM-CN-078, Revision 1 document. Without properly updating PMID reference levels, there is no way to calibrate the Enraf/densitometers to display the correct reading. Without current and updated PMID reference levels, the gauge calibrations would remain unchanged and would be conflicting with the Enraf & Densitometer Reference Level Summaries document and the H-2-817634 drawings.

The Environmental Group at WRPS (Washington River Protection Solutions), along with the engineers involved with the Enraf/densitometer reference level updates, created a system to prioritize the calibration dates for tanks whose reference levels required updating. The prioritizing depends on three factors, listed in order of importance: tanks that are assumed leakers (taken from Table 11), tanks that have declared intrusion (listed in Table 12) and tanks whose reference level is being updated by a value greater than 1 inch (the value of 1 inch is equal to 2,750 gallons of high level nuclear waste in the 1 million gallon capacity waste tanks).

Tanks that meet all three of the above criteria will have immediate calibration dates to update the Enraf and densitometer reference levels. Tanks that met two of the above criteria will have calibration dates following the tanks that met all three factors. Tanks that met only one of the above criteria will be last on the priority list for calibration, but will still be calibrated earlier than their scheduled calibration date. Tanks that did not meet any of the criteria (reference level change of less than on inch) will be updated on their regularly scheduled calibration date.

With the help of Hanford SST engineers, DST engineers, SST CSEs (cognizant system engineers), DST CSEs, all four Tank Farm Area engineers, engineers from the Waste Monitoring Group and environmental regulators from WRPS, the State of Washington and the DOE ORP, the Enraf & densitometer PMID reference levels were updated.

Table 11. Inventory and Status by Tanks

Inventory and Status by Tanks - Double-Shell Tanks

All volume data obtained from Tank Waste Information Network System (TWINS)

Tank	Tank Integrity	Tank Level (inches)	Total Waste (kgal)	Available Space (kgal)	Waste Volumes: Supernatant Liquid (kgal)	Waste Volumes: Sludge (kgal)	Waste Volumes: Saltcake (kgal)	Solids Volume Update
241-AN TANK FARM STATUS								
AN-101	SOUND	282	774	386	340	403	31	04/28/14
AN-102	SOUND	388	1067	93	913	0	154	05/21/06
AN-103	SOUND	350	962	198	476	0	486	09/30/09
AN-104	SOUND	382	1051	109	608	0	443	07/01/02
AN-105	SOUND	410	1126	34	590	0	536	09/24/09
AN-106	SOUND	242	665	495	233	407	25	03/28/14
AN-107	SOUND	391	1076	84	835	0	241	04/01/10
7 TANKS - TOTAL			6721	1399	3995	810	1916	
241-AP TANK FARM STATUS								
AP-101	SOUND	448	1233	24	1200	0	33	07/01/11
AP-102	SOUND	414	1138	22	1110	28	0	07/01/07
AP-103	SOUND	449	1234	23	1182	0	52	10/01/08
AP-104	SOUND	272	747	413	647	0	100	07/01/11
AP-105	SOUND	453	1245	12	1140	0	105	10/01/07
AP-106	SOUND	411	1129	31	1129	0	0	10/17/02
AP-107	SOUND	160	439	721	439	0	0	04/02/08
AP-108	SOUND	451	1240	17	1128	0	112	07/01/08
8 TANKS - TOTAL			8405	1263	7975	28	402	
241-AW TANK FARM STATUS								
AW-101	SOUND	412	1132	28	736	0	396	01/31/03
AW-102	SOUND	351	964	196	912	52	0	04/01/10
AW-103	SOUND	393	1080	80	760	280	40	03/03/09
AW-104	SOUND	383	1054	106	800	97	157	01/01/08
AW-105	SOUND	146	401	759	153	248	0	03/03/09
AW-106	SOUND	413	1136	24	872	0	264	10/01/11
6 TANKS - TOTAL			5767	1193	4233	677	857	
241-AY TANK FARM STATUS								
AY-101	SOUND	363	998	20	893	105	0	01/05/09
AY-102	ASMD LKR - PRI TNK	289	794	224	643	151	0	01/06/09
2 TANKS - TOTAL			1792	244	1536	256	0	
241-AZ TANK FARM STATUS								
AZ-101	SOUND	300	825	193	773	52	0	09/11/08
AZ-102	SOUND	360	991	27	886	105	0	11/01/08
2 TANKS - TOTAL			1816	220	1659	157	0	
241-SY TANK FARM STATUS								
SY-101	SOUND	407	1119	41	864	0	255	04/01/08
SY-102	SOUND	203	559	601	360	199	0	10/01/10
SY-103	SOUND	267	733	427	377	0	356	01/31/14
3 TANKS - TOTAL			2411	1069	1601	199	611	

Notes:
1 kgal differences are the result of computer rounding.
Supernatant + Sludge (includes liquid) + Saltcake (includes liquid) = Total Waste.
Available Space Volumes include restricted space.
Tanks AN-103, AN-104, AN-105, AW-101, SY-101 and SY-103 contain retained gas in the saltcake.
Solids Volume Update lists the last verified date when the Sludge or Saltcake volume in the tank changed or was measured for changes.

Inventory and Status by Tanks - Single-Shell Tanks

All volume data obtained from Tank Waste Information Network System (TWINS)

Tank Number	Tank Integrity	Tank Status	Waste Volumes (26) Total Waste (kgal)	Supernatant Liquid (kgal)	Drainable Interstitial Liquid (kgal)	Sludge (kgal)	Saltcake (kgal)	Solids Volume Update
				241-A TANK FARM STATUS				
A-101	SOUND	IS/IP(27)	320	0	37	3	317	06/30/04
A-102	SOUND	IS	40	3	9	0	37	01/31/03
A-103	SOUND (28)	IS/IP	378	4	86	2	372	07/01/05
A-104	ASMD LKR	IS/IP	28	0	0	28	0	01/27/78
A-105	ASMD LKR	IS/IP	37	0	0	37	0	10/31/00
A-106	SOUND	IS/IP	79	0	9	50	29	01/01/02
6 TANKS - TOTAL			**882**	**7**		**120**	**755**	
				241-AX TANK FARM STATUS				
AX-101	SOUND	IS	358	0	44	3	355	12/31/03
AX-102	ASMD LKR	IS/IP	30	0	0	6	24	01/01/02
AX-103	SOUND	IS/IP	107	0	22	8	99	09/30/03
AX-104	ASMD LKR	IS/IP	7	0	0	7	0	01/01/02
4 TANKS - TOTAL			**502**	**0**		**24**	**478**	
				241-B TANK FARM STATUS				
B-101	ASMD LKR	IS/IP	109	0	20	28	81	01/01/02
B-102	SOUND	IS/IP	32	4	7	0	28	06/30/99
B-103	ASMD LKR	IS/IP	56	0	10	1	55	01/01/02
B-104	SOUND	IS/IP	374	0	45	309	65	01/01/02
B-105	ASMD LKR	IS/IP	290	0	20	28	262	01/01/02
B-106	SOUND	IS/IP	123	1	8	122	0	12/31/03
B-107	ASMD LKR	IS/IP	161	0	23	86	75	01/01/02
B-108	SOUND	IS/IP	92	0	19	27	65	06/30/04
B-109	SOUND	IS/IP	126	0	23	50	76	10/01/05
B-110	ASMD LKR	IS/IP	245	1	27	244	0	01/01/02
B-111	ASMD LKR	IS/IP	242	1	23	241	0	01/01/02
B-112	ASMD LKR	IS/IP	35	3	2	15	17	01/01/02
B-201	ASMD LKR	IS/IP	29	0	5	29	0	07/01/04
B-202	SOUND	IS/IP	28	0	4	28	0	07/01/04
B-203	ASMD LKR	IS/IP	50	1	5	49	0	04/01/14
B-204	ASMD LKR	IS/IP	50	2	5	48	0	04/01/14
16 TANKS - TOTAL			**2042**	**13**		**1035**	**724**	
				241-BX TANK FARM STATUS				
BX-101	ASMD LKR	IS/IP	48	0	4	48	0	01/01/02
BX-102	ASMD LKR	IS/IP	79	0	0	79	0	06/30/04
BX-103	SOUND	IS/IP	77	15	4	62	0	01/01/14
BX-104	SOUND	IS/IP	100	3	4	97	0	01/01/02
BX-105	SOUND	IS/IP	72	5	4	42	25	01/01/05
BX-106	SOUND	IS/IP	38	0	4	10	28	01/01/05
BX-107	SOUND	IS/IP	347	0	37	347	0	09/18/90
BX-108	ASMD LKR	IS/IP	31	0	4	31	0	01/31/01
BX-109	SOUND	IS/IP	193	0	25	193	0	09/17/90
BX-110	ASMD LKR	IS/IP	214	1	35	65	148	08/25/05
BX-111	ASMD LKR	IS/IP	188	0	6	32	156	08/25/05
BX-112	SOUND	IS/IP	164	1	9	163	0	01/01/02
12 TANKS - TOTAL			**1551**	**25**		**1169**	**357**	

All volume data obtained from Tank Waste Information Network System (TWINS)

			Waste Volumes (26)					
Tank Number	Tank Integrity	Tank Status	Total Waste (kgal)	Supernatant Liquid (kgal)	Drainable Interstitial Liquid (kgal)	Sludge (kgal)	Saltcake (kgal)	Solids Volume Update
			BY TANK FARM STATUS					
BY-101	SOUND	IS/IP	370	0	24	37	333	01/01/02
BY-102	SOUND	IS	278	0	40	0	278	08/25/05
BY-103	ASMD LKR	IS	414	0	55	9	405	07/01/05
BY-104	SOUND	IS/IP	405	0	44	46	359	01/01/02
BY-105	ASMD LKR	IS	481	0	47	48	433	03/31/03
BY-106	ASMD LKR	IS	430	0	37	32	398	12/31/03
BY-107	ASMD LKR	IS/IP	271	0	42	15	256	07/01/05
BY-108	ASMD LKR	IS/IP	222	0	33	40	182	01/01/02
BY-109	SOUND	IS	287	0	37	24	263	06/30/04
BY-110	SOUND	IS/IP	366	0	20	43	323	01/01/02
BY-111	SOUND	IS/IP	402	0	14	0	402	08/25/05
BY-112	SOUND	IS/IP	286	0	24	2	284	03/31/02
12 TANKS – TOTAL		**241**	**4212**	**0**		**296**	**3916**	
			241-C TANK FARM STATUS					
C-101	ASMD LKR	IS/IP	5					
C-102	SOUND	IS/IP	304					
C-103	SOUND	IS/RC	3					
C-104	SOUND	IS/IP	2					
C-105	ASMD LKR	IS	140					02/29/00
C-106	SOUND	IS/RC	3					2/26/04
C-107	SOUND	IS/IP	16					03/28/14
C-108	SOUND	IS/IP/RC	3					01/01/13
C-109	SOUND	IS/IP/RC	2					09/12/12
C-110	SOUND	IS/IP/RC	2					01/01/14
C-111	SOUND	IS/IP	33					06/30/04
C-112	SOUND	IS/IP	13					1/31/14
C-201	ASMD LKR	IS/IP/RC	0					04/27/06
C-202	ASMD LKR	IS/IP/RC	0					08/11/05
C-203	ASMD LKR	IS/IP/RC	0					03/24/05
C-204	ASMD LKR	IS/IP/RC	0					01/31/03
16 TANKS - TOTAL			**526**	**11**		**514**	**2**	
			241-S TANK FARM STATUS					
S-101	SOUND	IS	352	0	45	235	117	04/30/04
S-102	SOUND	IS	93	2	5	22	69	10/01/10
S-103	SOUND	IS	237	1	45	9	227	06/30/04
S-104	ASMD LKR	IS/IP	288	0	49	132	156	12/20/84
S-105	SOUND	IS/IP	406	0	42	2	404	01/01/02
S-106	SOUND	IS	455	0	26	0	455	02/28/01
S-107	SOUND	IS	358	0	42	320	38	02/26/04
S-108	SOUND	IS	550	0	4	5	545	01/01/02
S-109	SOUND	IS	533	0	16	13	520	07/01/04
S-110	SOUND	IS	389	0	30	96	293	07/01/04
S-111	SOUND	IS	401	0	42	76	325	07/01/04
S-112	SOUND	RC	2					04/01/09
12 TANKS - TOTAL			**4064**	**3**		**912**	**3149**	

All volume data obtained from Tank Waste Information Network System (TWINS)

Tank Number	Tank Integrity	Tank Status	Waste Volumes (26) Total Waste (kgal)	Supernatant Liquid (kgal)	Drainable Interstitial Liquid (kgal)	Sludge (kgal)	Saltcake (kgal)	Solids Volume Update
			241-SX TANK FARM STATUS					
SX-101	SOUND	IS	420	0	44	144	276	06/30/04
SX-102	SOUND	IS	342	0	37	55	287	08/31/04
SX-103	SOUND	IS	509	0	40	78	431	09/30/03
SX-104	SOUND (34)	IS/IP	446	0	48	136	310	04/30/00
SX-105	SOUND	IS	375	0	39	63	312	12/31/02
SX-106	SOUND	IS	396	0	37	0	396	01/31/03
SX-107	ASMD LKR	IS/IP	94	0	7	94	0	07/01/04
SX-108	ASMD LKR	IS/IP	74	0	0	74	0	06/30/04
SX-109	ASMD LKR	IS/IP	241	0	0	66	175	07/01/04
SX-110	SOUND (35)	IS/IP	56	0	0	49	7	07/01/04
SX-111	ASMD LKR	IS/IP	115	0	11	97	18	07/01/04
SX-112	ASMD LKR	IS/IP	75	0	6	75	0	07/01/04
SX-113	ASMD LKR	IS/IP	19	0	0	19	0	01/01/02
SX-114	ASMD LKR	IS/IP	155	0	30	126	29	07/01/04
SX-115	ASMD LKR	IS/IP	4	0	0	4	0	01/01/02
15 TANKS - TOTAL			**3321**	**0**		**1080**	**2241**	
			241-T TANK FARM STATUS					
T-101	ASMD LKR	IS	99	0	16	37	62	06/30/04
T-102	SOUND	IS/IP	32	13	3	19	0	08/31/84
T-103	ASMD LKR	IS/IP	27	4	4	23	0	10/01/04
T-104	SOUND	IS	317	0	31	317	0	11/30/99
T-105	SOUND	IS/IP	98	0	5	98	0	05/29/87
T-106	ASMD LKR	IS/IP	22	0	0	22	0	01/01/01
T-107	ASMD LKR	IS	173	0	34	173	0	05/31/96
T-108	ASMD LKR	IS/IP	16	0	4	5	11	01/01/01
T-109	ASMD LKR	IS/IP	62	0	11	0	62	01/01/02
T-110	SOUND	IS	370	1	48	369	0	03/31/02
T-111	ASMD LKR	IS	447	0	38	447	0	01/01/02
T-112	SOUND	IS/IP	67	7	4	60	0	04/28/82
T-201	SOUND	IS/IP	30	2	4	28	0	07/01/04
T-202	SOUND	IS/IP	20	0	3	20	0	07/01/04
T-203	SOUND	IS/IP	36	0	5	36	0	07/01/04
T-204	SOUND	IS/IP	36	0	5	36	0	07/01/04
16 TANKS - TOTAL			**1852**	**27**		**1690**	**135**	
			241-TX TANK FARM STATUS					
TX-101	SOUND	IS/IP	87	0	7	74	13	01/01/02
TX-102	SOUND	IS/IP	217	0	27	2	215	03/31/03
TX-103	SOUND	IS/IP	145	0	18	0	145	01/01/02
TX-104	SOUND	IS/IP	69	2	9	34	33	06/30/04
TX-105	ASMD LKR	IS/IP	571	0	25	11	560	01/01/02
TX-106	SOUND	IS/IP	348	0	37	5	343	03/31/02
TX-107	ASMD LKR	IS/IP	30	0	7	0	30	01/31/03
TX-108	SOUND	IS/IP	127	0	8	6	121	06/30/04
TX-109	SOUND	IS/IP	359	0	6	359	0	01/01/02
TX-110	ASMD LKR	IS/IP	467	0	14	37	430	01/01/02
TX-111	SOUND	IS/IP	364	0	10	43	321	06/30/04
TX-112	SOUND	IS/IP	634	0	26	0	634	01/01/02
TX-113	ASMD LKR	IS/IP	638	0	18	93	545	06/30/04
TX-114	ASMD LKR	IS/IP	532	0	17	4	528	01/01/02
TX-115	ASMD LKR	IS/IP	553	0	25	8	545	06/30/04
TX-116	ASMD LKR	IS/IP	599	0	21	66	533	04/30/03
TX-117	ASMD LKR	IS/IP	626	0	10	29	597	04/01/11
TX-118	SOUND	IS/IP	247	0	31	0	247	06/30/04
18 TANKS - TOTAL			**6613**	**2**		**771**	**5840**	

All volume data obtained from Tank Waste Information Network System (TWINS)

Waste Volumes (26)

Tank Number	Tank Integrity	Tank Status	Total Waste (kgal)	Supernatant Liquid (kgal)	Drainable Interstitial Liquid (kgal)	Sludge (kgal)	Saltcake (kgal)	Solids Volume Update
				241-TY TANK FARM STATUS				
TY-101	ASMD LKR	IS/IP	118	0	2	72	46	04/01/08
TY-102	SOUND	IS/IP	69	0	13	0	69	01/01/02
TY-103	ASMD LKR	IS/IP	154	0	23	103	51	06/30/04
TY-104	ASMD LKR	IS/IP	44	1	4	43	0	03/31/02
TY-105	ASMD LKR	IS/IP	231	0	12	231	0	04/28/82
TY-106	ASMD LKR	IS/IP	16	0	1	16	0	01/01/02
6 TANKS - TO	**TALS**		**632**	**1**		**465**	**166**	
				241-U TANK FARM STATUS				
U-101	ASMD LKR	IS/IP	23	0	4	23	0	06/30/04
U-102	SOUND	IS	327	1	37	43	283	12/31/02
U-103	SOUND (27)	IS	417	1	33	11	405	01/01/05
U-104	ASMD LKR	IS/IP	54	0	0	54	0	01/01/02
U-105	SOUND	IS	353	0	44	32	321	03/30/01
U-106	SOUND	IS	170	2	36	0	168	06/30/04
U-107	SOUND	IS	294	0	32	15	279	12/31/03
U-108	SOUND	IS	434	0	46	29	405	09/30/04
U-109	SOUND (27)	IS	401	0	47	35	366	04/30/02
U-110	ASMD LKR	IS	176	0	16	176	0	01/01/02
U-111	SOUND	IS	222	0	31	26	196	08/31/03
U-112	ASMD LKR	IS/IP	45	0	4	45	0	02/10/84
U-201	SOUND	IS/IP	4	1	1	3	0	06/30/03
U-202	SOUND	IS/IP	4	1	0	3	0	06/30/03
U-203	SOUND	IS/IP	3	1	0	2	0	06/30/03
U-204	SOUND	IS/IP	3	1	0	2	0	06/30/03
16 TANKS - TOTALS			**2930**	**8**		**499**	**2423**	

Note: 1 kgal differences are the result of computer rounding. For example, volumes in this table reported as 0 may represent as much as 499 gallons of waste.

Table 12. Declared Intrusion Tanks

100-Series Single-Shell Tank Intrusion Prevention Checklists

Tank	Tank	Tank
241-AX-101	241-S-103	241-SX-104
241-BY-102	241-S-107	241-U-105
241-BY-103	241-S-111	241-U-108
241-BY-105	241-SX-101	241-U-109
241-BY-106	241-SX-102	241-U-111
241-S-101	241-SX-103	----

Diversion Box	**Double-Contained Receiver Tank**	**Underground Storage Tank**
241-TX-152	244-TX	241-UX-302A

5. CONCLUSION

The description of the analysis and evaluation of the reference level for each Hanford Site high-level waste tank that is monitored by an Enraf Series 854 Level Gauge and or densitometer is presented in this report. The document control method used for keeping Enraf & densitometer reference levels updated was proved obsolete by technological advancements. Therefore, an updated document control system for Enraf and densitometer reference levels was developed for the purpose of continuing the monitoring of accurate was levels in the tank farms. This document control system was created to facilitate the process of updating multiple documents with reference level changes (see Figure 6 for a flow diagram containing a brief overview of the process used to update multiple documents). This method ensures all tank waste level documents remain updated through future revisions to comply with the State of Washington and the Department of Energy's (DOE) Office of River Protection (ORP) environmental regulations. Another method was developed for prioritizing calibration schedules for the Enraf and densitometer reference levels based on parameters given by environmental regulators to guarantee the safest, and quickest, approach towards significant updates.

For more information regarding the methods used in the newly developed document control system for Enraf and densitometer tank waste reference levels see Sections V-VII.

The development of WHC-SD-WM-CN-078, Revision 1 utilized information taken from field walk downs that were conducted from June 2014-August 2014 to create a source of current reference levels for all associated documents to maintain consistency. The analysis conducted from Revision 0 reference levels, along with the 38 Engineering Change Notices that updated the document, exposed over 63% of outdated Enraf and densitometer reference levels. Revision 1 of WHC-SD-WM-CN-078 fully updated all Enraf and densitometer reference levels to the correct values that are currently shown in the tank farms.

The development of H-2-817634, Sheet 6 Revision 37 (Figure 7) and H-2-817634, Sheet 9 Revision 3 (Figure 10) exposed inconsistencies with the updated WHC-SD-WM-CN-078, Revision 1. The analysis conducted in Sheet 6 Revision 36 (Figure 6) and Sheet 9 Revision 2 (Figure 9) showed that over 47% of the Enraf reference levels were outdated. H-2-817634, Sheet 6 Revision 37 and H-2-817634, Sheet 9 Revision 3 fully updated all Enraf reference levels to the correct values that are located in WHC-SD-WM-CN-078, Revision 1.

The analysis of the Enraf and densitometer PMID (discussed in Section VII) reference levels showed inconsistencies with the updated WHC-SD-WM-CN-078, Revision 1. Over 17% of Enraf and densitometer PMID reference levels were outdated per WHC-SD-WM-CN-078. Under the parameters given by the Environmental Group at Washington River Protection Solutions (see Section VII), the Enrafs and densitometers are awaiting calibration dates.

6. REFERENCES

WHC-SD-CN-078, Revision 1, “Enraf Gauge Reference Level Summaries,” dated (unknown).

WHC-SD-RE-TI-093 Revision 3, “Double-Shell Underground Waste Storage Tanks Riser Survey,” dated May 11. 1992.

H-2-817634 Sh. 6 Revision 36, “INST Enraf Nonius ASSY Installation & Riser,” dated May 8, 2014.

H-2-817634 Sh. 6 Revision 37, “INST Enraf Nonius ASSY Installation & Riser,” dated (unknown).

H-2-817634 Sh. 9 Revision 2, “INST Enraf Nonius ASSY Installation & Riser,” dated May 8, 2014.

H-2-817634 Sh. 9 Revision 3, “INST Enraf Nonius ASSY Installation & Riser,” dated (unknown).

HNF-EP-0182 Revision 316, “Waste Tank Summary Report for Month Ending April 30, 2014,” dated June 16, 2014.

RPP-RPT-56103 Revision 0, “Hanford Single-Shell Tank System Intrusion Prevention Checklists,” dated November 18, 2013.

RPP-TE-48867 Revision 0, “Technical Evaluation of Orientation of Enraf Ball Valve in Tank Farms.”

AW-Farm - OTP-T-990-00034 Rev A-0. “Operability Test Procedure for 241-AW-1 Tank Farm,” dated (unknown).

AN-Farm - OTP-T-990-00042 Rev A-0. “Operability Test Procedure for 241-AN Tank Farm (AN-1),” dated May 16, 1980.

AP-Farm - SD-WM-OTR-063 Rev 0. “Operability Test Report for 241-AP Tank Farm,” dated July 22, 1986.