Appendix C

ARA-16 Radionuclide Waste Tank Cleaning and Removal

Document ID: EDF-2718
Revision ID: 0
Effective Date: 06/12/01

Engineering Design File

PROJECT FILE NO. 020911

ARA-16 Radionuclide Waste Tank Cleaning and Removal

The following statement is optional:
Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho

INEEL
Idaho National Engineering & Environmental Laboratory
BECHTEL BWXT IDAHO, LLC

Form 412.14
10/05/99
Rev. 02

ENGINEERING DESIGN FILE

PROJECT FILE NO. 020911
EDF SERIAL NO. EDF-2718
FUNCTIONAL FILE NO. N/A

PROJECT/TASK **Waste Area Group 5 Remedial Design/Remedial Action-Phase 1**

SUBTASK **Tank Cleaning and Removal**

TITLE **ARA-16 Radionuclide Waste Tank Cleaning and Removal**

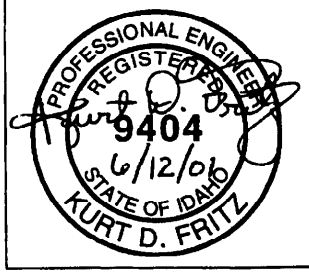
SUMMARY

This EDF provides background information on the ARA-16 Radionuclide Waste Tank and details of the selected remediation methods identified in the "Operable Unit 5-12's Record of Decision for the Power Burst Facility and Auxiliary Reactor Area," dated January 2000. This selected method includes removing the tank contents to an off-site thermal treatment facility, cleaning the tank's interior and excavating and removing the tank system. Waste disposition is discussed in the RD/RA Workplan - Phase 1. Other remediation methods (not discussed in this EDF) include the removal of the tank and contents intact for shipment to an approved thermal treatment facility. Final selection of the remediation method used shall be based upon access to an approved treatment facility.

QUALITY LEVEL ☐ 1 ☐ 2 ☒ 3 ☐ 4

KEYWORDS (e.g. area, structure no., general subject matter, etc.) :

AUTHOR



DISTRIBUTION (COMPLETE PACKAGE):
K.D. Fritz MS 3650, S.A. Davies MS 3650, R.P. Wells MS 3950, D.H. Preussner MS 3950

DISTRIBUTION (COVER SHEET ONLY):

CHECKED	DATE	APPROVED/ACCEPTED	DATE
S. A. Davies, P.E.	6/12/01	R. P. Wells	6/12/01
BBWI REVIEW	DATE	BBWI REVIEW	DATE

Tank Description:

The ARA-16 Radionuclide Tank (also identified as ARA-729) is located in the Auxiliary Reactor Area 1 (ARA-1), accessed by Fillmore Boulevard within the INEEL Site. ARA-16 is a 1000-gallon, 304 stainless steel underground holding tank. The tank measures 12 feet long by 4 feet in diameter with a single 4-inch diameter inlet on the West end. A total of six openings/fittings of various sizes are located on the tank's top (see Figure 1).

The tank rests inside a lidless concrete vault serving as secondary containment with the void between the vault and tank filled with pit run gravel. The inside dimensions of the concrete vault are approximately 13-ft., 4-in. long by 7-ft., 2-in. wide by 6-ft. 0-in. high. The sides and floor of the concrete vault are approximately 8 inches thick and are in partial contact with a shallow basalt formation. Approximately 3.5 feet of soil currently cover most of the vault and tank. The original tank area measured 30-ft. by 30-ft. with a 7-ft. tall, barbed-wire topped chain-link fence. Events during and since 1988 have resulted in an expansion of the area and a partial modification to the fencing.

Tank Contents:

From 1959 to 1988, the tank received radioactive liquid waste, including wash water from the ARA-1 hot cells, and methanol, acetone, chlorinated paraffin and mixed acids from materials testing and research and metal-etching processes. Up to 100 L per year of contaminated soapy water wash and about 5 L per year each of the methanol, acetone, chlorinated/paraffin and mixed acids were flushed to the hot-drain line and subsequently to the tank via a 4-in. stainless steel pipe (EDF Serial #ER-WAG5-106). The tank was taken out of service in 1988 when ARA-1 was closed. At this time all lines into and out of the tank were cut and capped and the tank contents were agitated and pumped out, leaving a small amount of residual liquid and sludge.

The tank contents are classified as principal threat waste consisting of primarily radionuclides, toxic metals and organics. The contents also include a small amount of PCBs (Polychlorinated Biphenyls) in the form of Aroclor-1260. The contents were sampled in 1988, 1994 and 1997, with the 1994 and 1997 sample results listed in EDF Serial#-EDF-ER-30/1000-69.

Tank Volume History:

In 1988, all lines into tank out of the tank were cut and capped. The tank contents were agitated and pumped out leaving approximately 3-in. or 28 gallons of combined liquid and sludge (EDF Serial #ER-WAG5-106).

As of November 1999, the tank was reported to contain approximately 4.5 gallons of sludge and 312 gallons of liquid for a total of 316.5 gallons (EDF Serial #-EDF-ER-30/1000-69, Rev. 1). The increase in volume is thought to be from the infiltration of water from rain and melting snow.

In September 2000, the ARA-16 piping was flushed and cleaned using a high-pressure water spray. This rinse water was allowed to drain into the ARA-16 tank. Through this process, further liquid volume was added to the tank. Currently there is approximately 700 gallons of liquid in the ARA-16 tank.

Tank Integrity:

Samples collected of the surface and subsurface soil and gravel inside the concrete vault in 1997 showed no radionuclides above background. Additional subsurface soil samples collected outside the vault were surveyed for radioactivity with negative results (see Operable Unit 5-12's Record of Decision for the Power Burst Facility and Auxiliary Reactor Area, dated January 2000). Photographs and recorded video of the tank's interior show it to be in excellent condition.

Discussion: Isolating Tank Contents During Remediation

During its active use, the Radionuclide Waste Tank was vented to the atmosphere via 1 ½ in. opening. Wastes susceptible to volatilization would have been allowed to exit the tank through the supplied vent at any time up until facility shut down in 1988. As previously stated, the tank contents were agitated and pumped out in 1988 leaving approximately 3 inches or 28 gallons of combined liquid and sludge. As of April 2000, the combined total liquid and sludge has been approximated to be 700 gallons. This additional volume to the tank (thought to be due to the infiltration of water from rain and melting snow and from pipe rinsing operations) has diluted the original volume by over 1000 percent further reducing the potential for airborne contaminant release. Any hazard to the environment or workers is believed to be from the physical contact with the liquid in the tank and not from any airborne release. However, to reduce further possibility of airborne releases, the remediation design described below, includes the use of a peristaltic hosepump. This specialized pump can suck both air, water and sludge with up to 80 percent solids and will maintain a slight negative pressure inside the waste tank during the content transfer and subsequent cleaning. The air, liquid and sludge will be transferred into a high integrity container with an attached air filtering system.

Details of the Selected Remediation Method

The proposed method for the ARA-16 tank cleaning and removal are designed around the physical, chemical and radiological characteristics of the material inside the tank.

Physical – Recorded video of the tank's interior show liquid with most of the sludge settled out on the bottom. A small amount of material is seen adhered to the tank's surface plus several small stalagtites have formed on the tank's ceiling.

Chemical – The tank's contents include PCB's of up to 98 ppm (parts per million) in the sludge phase which is above the TSCA (Toxic Substance Control Act) action level of 50 ppm. The tank also contains a variety of solvents.

Radiological – The primary threat to human health is from exposure to ionizing radiation emanating from the tank's contents. The main radiological constituents of concern are

Co-60 and Cs-137. From the document EGG-ER-11425, entitled "Health and Safety Plan for D&D of the ARA-729 Hot Waste Tank" dated September 1994, dose rates were measured in several areas around the tank. With a portion of the tank excavated and exposed, the whole body field measured 5-30 mR/hr (milliroentgen per hour) beta-gamma. On contact, readings were 10-30 mR/hr at several of the pipes connected to the tank. The inlet line and valve measured 300-500 mR/hr on contact. With the manhole removed, the dose rate was 2R/hr beta-gamma.

The tank remediation process has been divided into two parts. The processes shall be repeated until the tank is thoroughly cleaned and liquid contents removed.

Note: The equipment and materials listed below may be substituted with approved equivalents as required.

Part 1: Extract Tank Contents (see Figure 2)

Objective: Pump tank contents to an above-ground holding tank. Maintain containment of contaminants. Minimize worker exposure to gamma radiation.

Equipment:
(1) Peristaltic Hosepump, Watson-Marlow/Bredel Model SPX-40, GDR2010-31.5-20" (5 HP, 230 V) equipped with a variable frequency drive (VFD)
(1) Peristaltic Hosepump, Watson-Marlow/Bredel Model SP-25, 1.5 HP, 230 V
(1) 50-ft. of 1 ½-in. Spiralite-115 suction hose w/connections (or length as required)
(1) 50-ft. of 1-in. Spiralite-115 suction hose w/connections (or length as required)
(1) 50-ft. of 1 ½-in. Buna N (nitrile rubber) discharge hoses w/connections (or length as required)
(1) 50-ft. of 1-in. Buna N (nitrile rubber) discharge hoses w/connections (or length as required)
8-ft. of 1 ½-in. PVC suction pipe
550 gal. Shielded de-watering High Integrity Container (HIC) w/lid and air filter
Culligan Cullar Granular Activated Carbon Filter Model HR-20
0-10 psi Pressure Gauge
Hose/pipe fittings
Support tools/equipment
55 gallon drums (approximately 13)

Process: Pump the contents of the tank using the SPX-40 peristaltic hosepump at a rate of approximately 15 to 20 gpm. If surging becomes excessive, decrease flow rate to approximately 8 to 9 gpm. Maintaining a high tank-pumping rate will develop a slight negative pressure inside the waste tank, which will prevent uncontrolled air emissions. By design, the peristaltic hose pump will isolate the tank contents from the pump structure, isolate the contaminants from the environment and can operate dry without damage in the event of clogging. Pump contents into a de-watering shielded high integrity container and allow the contents to set for at least

1. Project File No. 020991 2. Project/Task Waste Area Group 5 Remedial Design/Remedial Action-Phase 1

Mix 12 gal of cleaning solution consisting of 3 parts water to1 part CAPSUR®. Install Accu-Clean Slow Rotation Tank Washing Machine 2.5 to 3 ft above tank bottom (see Figure 4). Apply mixture to tank's interior using pressure-washer (20-psi minimum) and Tank Washing Machine. Allow for a 15-minute minimum dwell time. Rinse tank interior with 100 gallons of 70-80° F water using the Tank Washing Machine. Rinse the tank a second and third time using the same 100 gallons of water previously used. Pump the tank dry.

Part 4: Tank and Vault Removal

Objective: Excavate SST tank and concrete vault. Backfill the excavation.

Equipment: Standard construction/hoisting and rigging equipment.

Process: Excavate soil away from the tank and vault. Maintain soil slope excavations to a minimum of 1.5:1. Remove tank inlet from the concrete vault wall using a hydraulic hammer. Remove no less then 50 percent of the vault walls. Remove and containerize concrete rubble and gravel. Extract the stainless steel tank from the vault. Cut up and dispose of the tank as directed by project management and radiation control. Demolish and remove remaining concrete. Fill excavation with clean backfill. Containerize concrete rubble, gravel and associated soils as directed by project management and radiation control.

6. Distribution (complete package):
Distribution (summary package only):

7. Review (R) and Approval (A) Signatures: (Minimum reviews and approvals are listed. Additional reviews/approvals may be added as necessary.)

	R/A	Printed Name	Signature	Date
Author		Dean Shanklin	Kurt Fritz for	5/30/00
WAG 5 Project Manager	A	Frank Webber	Frank Webber	5/24/00
Technical Coordinator	R	Kurt Fritz	Kurt Fritz	5/30/00
Project Engineer	R	Steve Davies	Steve Davies	5/30/00

24 hours. From the de-watering HIC, pump the contents through the activated carbon filter to a 55-gallon drum using the SP-25 peristaltic pump.

Part 2: Tank Cleaning (see Figure 3)

Objective: Clean the tank's interior using a high-pressure water spray. Direct spray in an effort to remove remaining sludge from the tank to the maximum extent possible.

Equipment: "Hotsy" high-pressure washer, minimum 1000 psi @ 2 to 4 gpm
Video monitor, personnel work platform (as required)
Camera, light source, spray wand, spray nozzel, discharge line
Minimum 100 gal water storage tank (i.e. polyethylene)
Support tools/equipment

Process: Install the personnel work platform. Using warm water, clean the tank's interior by using the camera image to direct the high pressure/low volume spray. Water volume used and duration will depend on cleaning effectiveness. Total water usage shall be limited to 100 gallons or less. Repeat Parts 1 and 2 as necessary.

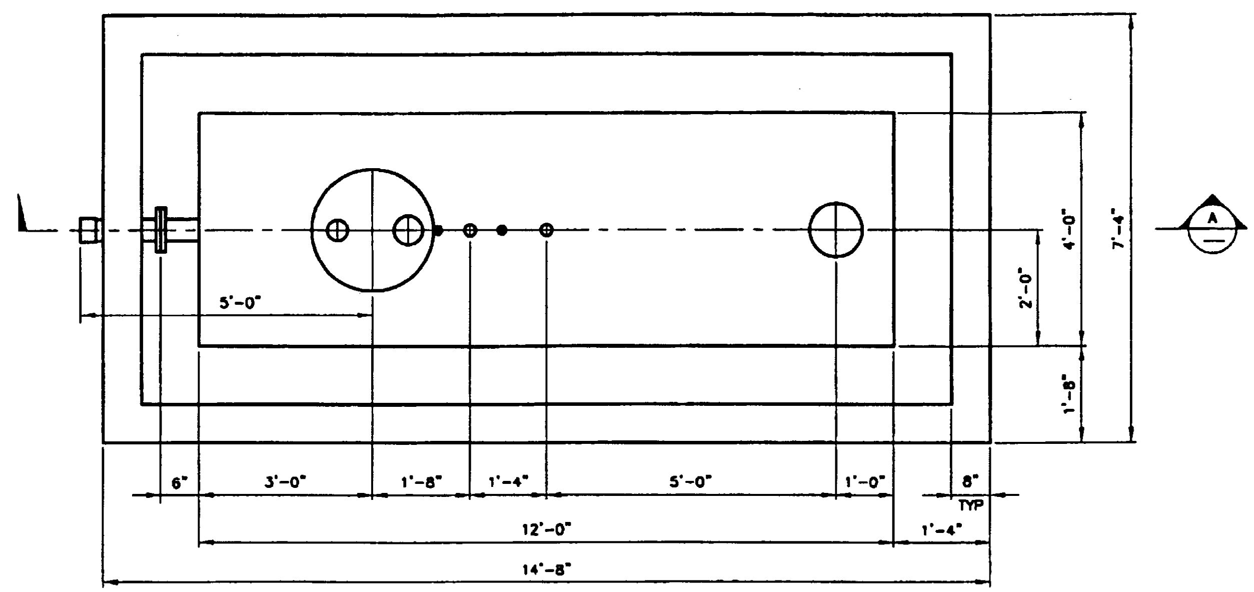
Tank and Vault Removal

Objective: Excavate SST tank and concrete vault. Backfill and compact the excavation.

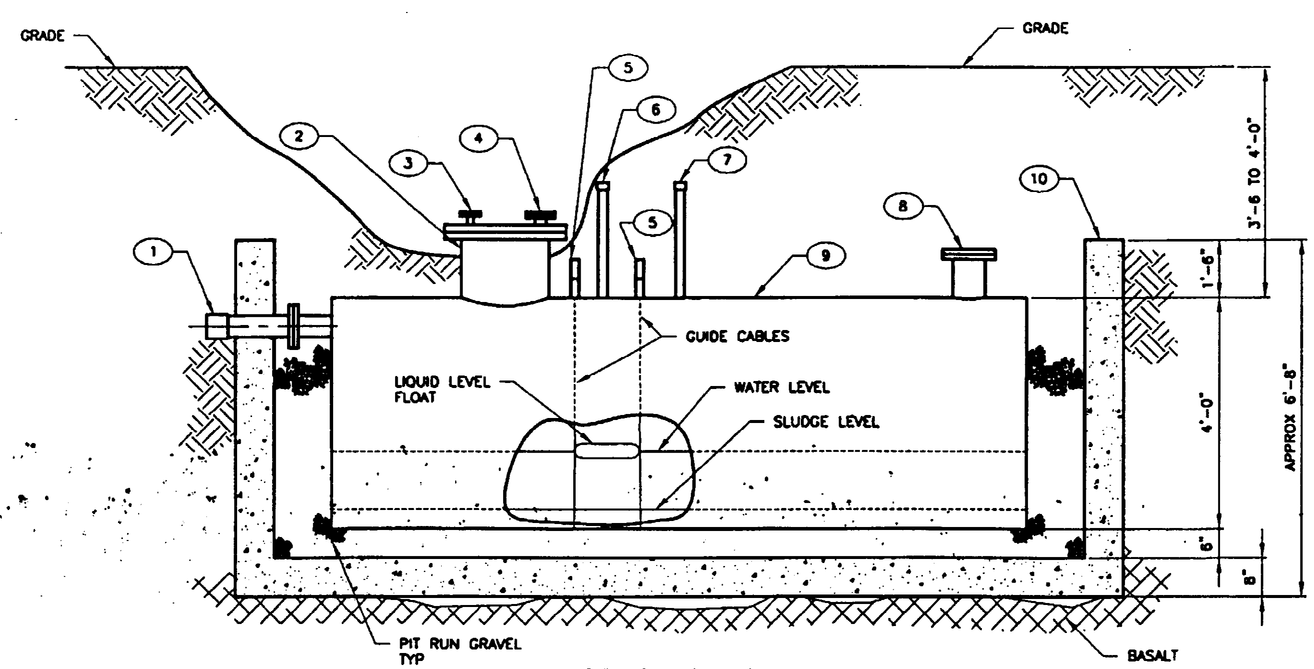
Equipment: Standard construction/hoisting and rigging equipment.

Process: Excavate soil away from the tank and vault. Maintain soil slope excavations to 1.5:1 or flatter. Remove tank inlet from the concrete vault wall using a hydraulic hammer. Remove no less than 50 percent of the vault walls. Remove and containerize concrete rubble and gravel. Extract the stainless steel tank from the vault. Cut up and dispose of the tank as directed by project management and radiation control. Demolish and remove remaining concrete. Fill excavation with clean backfill. Containerize concrete rubble, gravel and associated soils as directed by project management and radiation control.

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE



WASTE TANK DETAIL (1 / C-5)
SCALE: 3/4"=1'-0"



SECTION (A)
SCALE: 3/4"=1'-0"

LEGEND

1. 4" DIAMETER INLET PIPE, 304 SST.
2. 18" DIAMETER MANHOLE. EXTENDS 12" ABOVE TANK. FLANGED CLOSED. (EXPOSED)
3. 1" DIAMETER PIPE (FORMER HIGH LEVEL ALARM ELECTRODE). CUT AND BLIND FLANGE 18" ABOVE TANK
4. 2" DIAMETER SST PIPE (FORMER PUMP RETURN LINE). CUT AND BLIND FLANGED 18" ABOVE TANK.
5. 1 1/4 X 4" PIPE NIPPLE WITH EXTENSION SUPPORT GUIDE CABLES FOR EXISTING LIQUID LEVEL FLOAT.
6. 1 1/2" PIPE COUPLING (FORMER TANK LEVEL INDICATOR SUPPORT) WITH EXTENSION. CUT AND CAPPED APPROXIMATELY 24" ABOVE TANK.
7. 1 1/2" PIPE COUPLING (FORMER TANK VENT). CUT AND CAPPED APPROXIMATELY 24" ABOVE TANK.
8. 6" DIAMETER FLANGED SUBMERSIBLE PUMP ACCESS (REMOVED). EXTENDS 8" ABOVE TANK. BLIND FLANGED CLOSED, APPROXIMATELY 3' BELOW GRADE.
9. ?1000 GALLON 304 SST UNDERGROUND TANK, SINGLE WALL, FLAT ENDS. MANUFACTURED BY UNITED STATES STEEL (18-8L).
10. CONCRETE FOUNDATION.

NOTES

1. DIMENSIONS AND LAYOUT SHOWN ARE BASED ON A REVIEW OF THE AS-BUILT DRAWINGS, ACTUAL DIMENSIONS MAY VARY SLIGHTLY.

SUBCONTRACT NO.	INEEL
REQUESTER: R. WELLS	WASTE AREA GROUP 5 REMEDIAL DESIGN/REMEDIAL ACTION PHASE I ARA-16 WASTE TANK
DESIGN: KURT FRITZ	
DRAWN: ROB HERGESHEIMER	
PROJECT NO.	
SPEC CODE	
FOR REVIEW/APPROVAL SIGNATURES SEE DAR NO.	SIZE D; CAGE CODE; INDEX CODE NUMBER: AREA 068, TYPE 0300, CL. 50, DISC 090; DWG-FIG. 1; REV
EFFECTIVE DATE:	SCALE 3/4"=1'-0"; SHEET 1 OF 1

File: FIG-1-REV-h2.dwg Layout Name: D Size Path: C:\wag-5 Date: 06/12/01 - 09:10 A.M. RDHS

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE

ARA-16 TANK CLEANING PROCESS

PART 1 – EXTRACT TANK CONTENTS

STEP 1. REMOVE ALL FENCING AROUND TANK AREA (APPROX 90 FT OF 7 FT. HIGH, BARB WIRED TOPPED CHAIN LINK PLUS APPROX 60 FT OF 4 FT HIGH TEMPORARY FENCING). USING A SMALL BACKHOE AND SHOVEL, EXCAVATE AREA AROUND MANHOLE AND 6 INCH FLANGE TO PROVIDE ACCESS. EXCAVATED WALLS SHALL NOT EXCEED A SLOPE OF 1.5:1. PLACE LEAD APRONS OVER EXPOSED TANK AS REQUIRED.

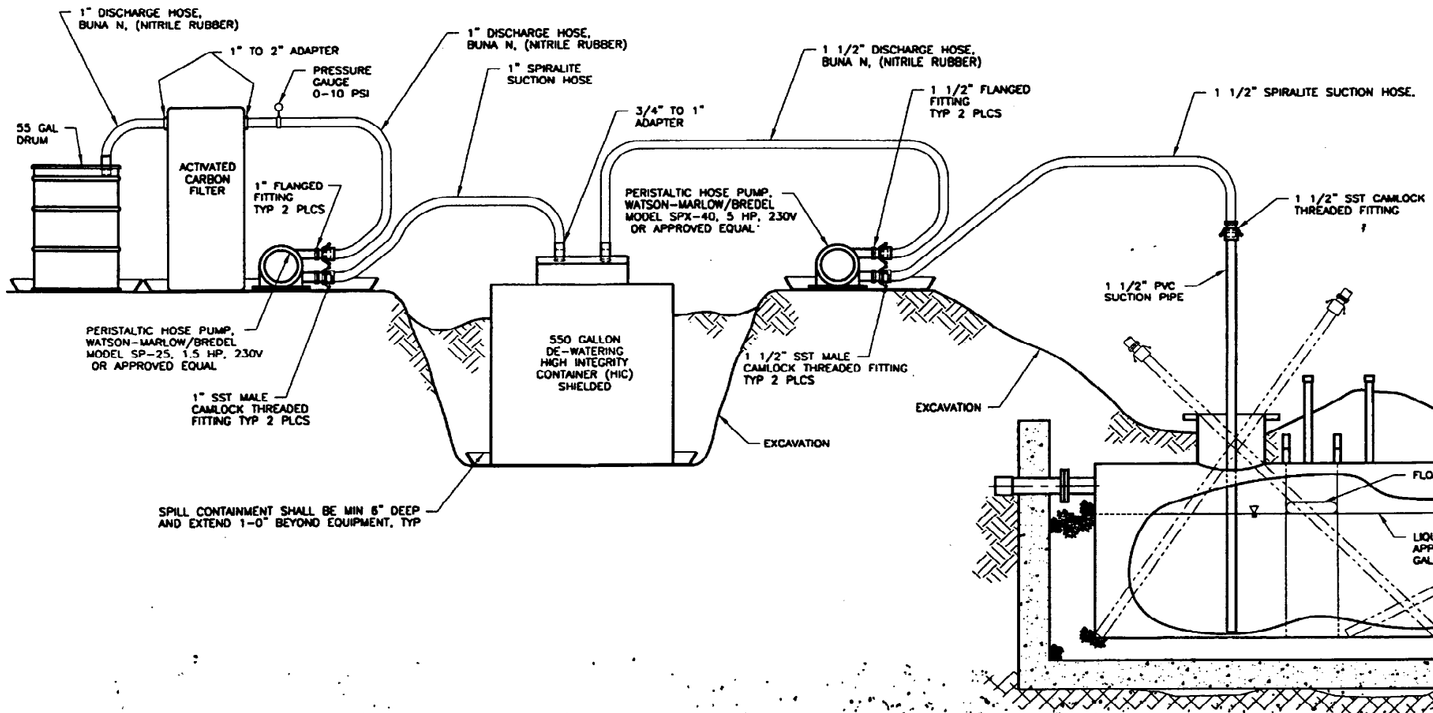
STEP 2. INSTALL SUCTION PIPE AND PERSONNEL PLATFORM AS REQUIRED.

STEP 3. SET UP PERISTALTIC PUMP AND PREPARE FOR USE. ATTACH SUCTION HOSE TO SUCTION PIPE AND PUMP. ATTACH DISCHARGE HOSE TO PUMP AND HIGH INTEGRITY CONTAINER.

STEP 4. PUMP CONTENTS FROM MANHOLE SIDE (~700 GAL) AND DISCHARGE TO DE-WATERING HIC. PUMP FROM ALTERNATIVE PUMPING LOCATION(S) AS REQUIRED TO ATTAIN LOWEST ACHIEVABLE TANK LEVEL.

STEP 5. REMOVE SUCTION PIPE.

STEP 6. ALLOW CONTENTS IN HIC TO SETTLE AT LEAST 24 HOURS. USING THE SECOND SET OF HOSES AND A SECOND PERISTALTIC PUMP, PUMP THE CONTENTS OF THE HIC INTO 55 GALLON DRUMS. NOTE: APPROXIMATELY 13 55-GALLON DRUMS WILL BE REQUIRED.



TANK DETAIL
NTS

SUBCONTRACT NO.	INEEL
REQUESTER: R. WELLS	WASTE AREA GROUP 5 REMEDIAL DESIGN/REMEDIAL ACTION PHASE 1
DESIGN: KURT FRITZ	PART 1 – EXTRACT TANK CONTENTS
DRAWN: ROB HERGESHEIMER	SIZE: D; CAGE CODE; DWG-FIG. 2; REV 1
PROJECT NO.	SCALE: NONE; SHEET 1 OF 1
SPEC CODE	
FOR REVIEW/APPROVAL SIGNATURES	
SCE DWG NO.	
EFFECTIVE DATE:	

REVISIONS		
REV	DESCRIPTION	EFFECTIVE DATE:

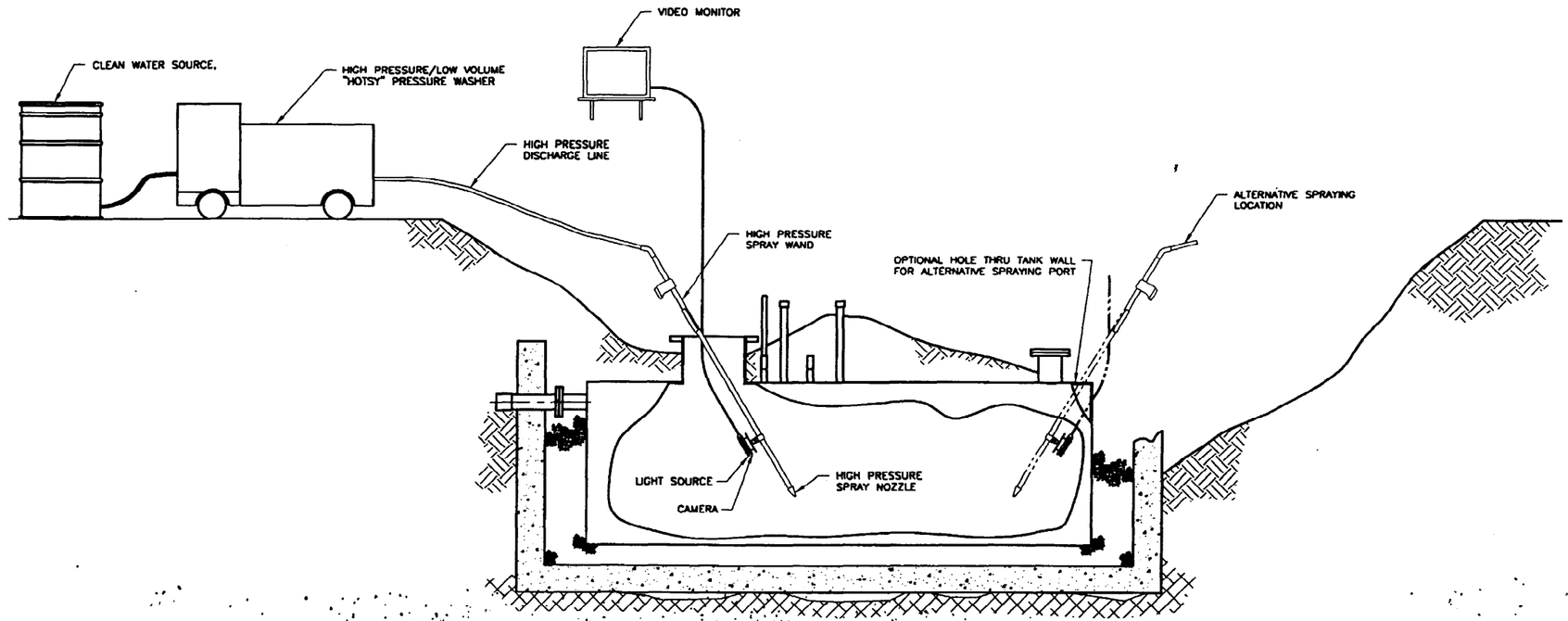
ARA-16 TANK CLEANING PROCESS

PART 2 – TANK CLEANING

STEP 1. PREPARE PRESSURE WASHER FOR USE. ATTACH CAMERA/LIGHT SOURCE TO SPRAY WAND. PREPARE VIDEO MONITOR, ATTACH VIDEO CABLE, POWER SUPPLY, AND HIGH PRESSURE SUPPLY LINE.

STEP 2. USING VIDEO CAMERA IMAGE ON MONITOR, DIRECT HIGH PRESSURE WATER SPRAY TOWARDS ATTACHED DEBRIS INSIDE TANK. SPRAY AT A RATE OF 2–4 GPM. CHANGE NOZZLES AND SPRAYING LOCATION AS REQUIRED. THE USE OF WATER SHALL BE MINIMIZED.

STEP 3. REPEAT PART 1 (EXTRACT CONTENTS). PROCESS OF PUMP AND SPRAY SHALL BE REPEATED AS NECESSARY, (LIMIT WATER USAGE TO 100 GALLONS).



TANK DETAIL
NTS

SUBCONTRACT NO.	
REQUESTER: R. WELLS	
DESIGN: KURT FRITZ	
DRAWN: ROB MERGESHEIMER	
PROJECT NO.	
SPEC CODE	
FOR REVIEW/APPROVAL SIGNATURES	
SIZE BAR NO.	
EFFECTIVE DATE:	

INEEL — WASTE AREA GROUP 5
REMEDIAL DESIGN/REMEDIAL ACTION
PHASE I

PART 2 – TANK CLEANING

SIZE	CAGE CODE	DRAWING NUMBER: AREA	TYPE	Q	SEQ	REV
D					090	1

DWG-FIG. 3

SCALE: NONE — SHEET 1 OF 1

File: FIG-3-REV-12.dwg; Layout Name: D Size
Path: C:\wag-5 — Date: 06/12/01 – 09:09 A.M.