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ACCEPTANCE TEST REPORT FOR THE HIGH PRESSURE WATER
JET SYSTEM CANISTER CLEANING FIXTURE

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7. Abstract

This Acceptance Test confirmed the test results and recommendations, documented in WHC-SD-SNF-DTR-001, Rev. 0 Development Test Report for the High Pressure Water Jet System Nozzles, for decontaminating empty fuel canisters in KE-Basin. Optimum water pressure, water flow rate, nozzle size and overall configuration were tested.

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CONTENTS

	<u>Page</u>
RECOMMENDATIONS	ii
1.0 INTRODUCTION	1
2.0 TEST DESCRIPTION.	2
3.0 TEST RESULTS	5
4.0 CONCLUSIONS AND RECOMMENDATIONS	7
5.0 DISPOSITION OF TEST ITEMS	8
6.0 REFERENCES	9
APPENDIX I - ACCEPTANCE TEST PROCEDURE AND DATA SHEETS	I-1
APPENDIX II - HPWJS P&ID	II-1
APPENDIX III - STONEAGE RJV3 ROTARY WATERBLAST NOZZLES OPERATOR'S MANUAL	III-1
APPENDIX IV - ORIGINAL ACCEPTANCE TEST PROCOEDURE AND DATA SHEETS	IV-1

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**ACCEPTANCE TEST REPORT
FOR THE HIGH PRESSURE WATER JET SYSTEM
CANISTER CLEANING FIXTURE**

RECOMMENDATIONS

The High Pressure Water Jet System and Canister Cleaning Fixture should be accepted for use in cleaning aluminum (Mk 0) and stainless steel (Mk II) fuel canisters at the K-Basins. The following recommendations are based on the performance of the equipment during Acceptance Testing at the Cold Test Facility in the Engineering Test Laboratory (ETL); Building 305 in the 300 Area.

- Clean the exterior of the canisters with the Nozzle Cleaning Assembly moving down the canister.
- Clean the interior of the canisters with the Nozzle Cleaning Assembly moving up the canister.
- Size and install a flotation cell to slow the rate of descent of the Nozzle Cleaning Assembly.
- Operational Health Physics should evaluate the minor water disturbance due to canister cleaning during training and after installation in the Basin to verify that further engineering controls are not required for contamination control.

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ACCEPTANCE TEST REPORT
FOR THE HIGH PRESSURE WATER JET SYSTEM
CANISTER CLEANING FIXTURE

1.0 INTRODUCTION

The Scientific Ecology Group (SEG®), in conjunction with the Spent Nuclear Fuel (SNF) Process Systems Group and the Engineering Testing Laboratory (ETL), tested the High Pressure Water Jet System and Canister Cleaning System. These systems were designed and fabricated by SEG® based on the results of the development testing conducted during April and May, 1995 and reported in Reference 1. The equipment will be used in the decontamination of empty fuel storage canisters in KE-Basin to support the clean-up of the South Loadout Pit and ultimately Spent Nuclear Fuel removal from the K-Basins.

These Acceptance Tests were conducted to confirm optimum water pressure, water flow rate, nozzle size and overall configuration needed to effectively decontaminate empty fuel storage canisters in KE-Basin. These tests were conducted in accordance with References 2 and 3 and occurred in mid-August 1995, at the Cold Test Facility in the ETL.

The test basin dimensions are 4.6m wide x 6.0m long x 4.6m deep (15' x 18' x 15') and the basin contains approximately 130 m³ (30,000 gallons) of demineralized water. The Canister Cleaning Fixture was assembled and all testing was performed on the east side of the test basin.

2.0 TEST DESCRIPTION

SLIDE® Thin Line Layout Blue (manufactured by the Percy Harms Corporation, Wheeling, Illinois) and Dykem Spray Steel Blue SP-100 (manufactured by the Dykem Company, St. Louis, Missouri) were used to simulate oxide contamination on the canisters. They were chosen because they provided a comparable base for wire brushing versus high pressure water jet washing of contaminated canisters. The simulant was applied to at least 98% of the surface of the fuel storage canisters and allowed to dry away from direct sunlight for approximately 24 hours prior to removal with the high pressure water jet system.

The canisters were placed on the Canister Cleaning Cradle and the Nozzle Cleaning Assembly was positioned and used to remove the simulant. Both aluminum and stainless steel canisters were cleaned. The following data was recorded during the cleaning operations:

- Cleaning Water Pressure (psig)
- Cleaning Water Flowrate (gpm)
- Cleaning Time (minutes)
- Number of Passes required for cleaning

A pass was defined as the number of times a surface had to be cleaned; i.e. removal of the simulant oxide. Therefore, cleaning the interior of both chambers of the canister AND the exterior of both chambers of the canister is defined as one (1) pass.

The top of the canister was approximately eight feet beneath the surface of the water during cleaning operations and the operator was positioned on the grating of the test basin to simulate the actual operating conditions which will be encountered at the K-Basins. A simplified drawing of the Canister Cleaning Fixture and the relative elevations are shown in Figures 1 and 2. References 4 and 5 are the detailed fabrication drawings of the Canister Cleaning Fixture.

Installed as part of the Canister Cleaning Fixture, specifically the Nozzle Cleaning Assembly was the following equipment:

- One (1) O'Connell fabricated "T" nozzle spin fixture with two (2) .047"/15° (1.1938mm/15°) nozzles, offset ½" (1.27cm) from the canister surface, with a flow rate 7.5gpm/nozzle (28.3875lpm/nozzle) for interior cleaning.
- Two (2) Stoneage RJV3, Model 15K, Rotary Nozzle Heads each with two (2) .033"/0° (0.8382mm/0°) nozzles, located 180° apart, offset 2" (5.08cm) from the canister surface, with a flow rate of 3.6gpm/nozzle (13.626lpm/nozzle) for exterior cleaning.

Figure 1

Figure 2

This development testing of these nozzles is described in Reference 1. The cleaning water pressure during testing was approximately 15,000psi (103,425kPa).

Technical direction for testing was provided by qualified SEG® personnel. All safety requirements were identified through a Job Safety Review prior to the start of testing. A Pre-Job Safety Meeting was also conducted prior to the test.

The P&ID for the HPWJS (SK-1-33488) is included as Appendix II. However, a submersible pump installed in the test basin was used as a feedpump instead of the skid mounted centrifugal pump configuration that will be used in actual operation.

3.0 TEST RESULTS

Two canisters coated with simulant were successfully cleaned on August 18, 1995, one (1) aluminum Mk 0 canister and one (1) stainless steel Mk II canister. Successful cleaning was defined as the following in Reference 3, "Removal of 80% of the simulant [sic] (dye coating) from the inner and outer surfaces of each of the canisters." The Acceptance Test Data sheets are included in Appendix I, a summary of the test data is provided in Table 1.

Table 1

CANISTER CLEANING TEST DATA SUMMARY					
Canister Type	H ₂ O Flow (gpm)	H ₂ O Press (psig)	Time (minutes)	No. of Passes ¹	Percentage Cleaned ²
Mk 0 - Al	15	15,000	6.9	1	94%
Mk II - SS	15	15,000	9.3	1	85%

- Notes:
1. The Number of Passes is defined as, the number of times a surface had to be cleaned. Therefore, cleaning the interior of both chambers of the canister AND the exterior of both chambers of the canister is defined as one (1) pass.
 2. The percentage cleaned was determined as follows:

$$\text{Percent Clean} = 1 - \frac{\text{Remaining Dye}}{2(2) \left(\pi \frac{8^2}{4} H \right)}$$

Remaining Dye: The amount of dye remaining on the canister, in square inches, as measured with a tape after cleaning

H: Canister Height
 Aluminum Canister: H = 28"
 S.S. Canister: H = 27"

SUPPLEMENTAL TESTS

Though not specified as part of the Acceptance Test Procedure, two additional aluminum (Mk 0) canisters were also successfully cleaned. Results are described below.

The first aluminum (Mk 0) canister was obtained from the 100K Area where it had been stored for an unknown period of time outside and was covered with "salt-like" deposits similar in appearance to those recorded on the video survey of the canisters in the KE-Basin. Underlying the "salt-like" deposits the aluminum surface was severely pitted. One chamber of the canister was "cleaned;" the deposits were removed from the surface with no residue in the

pitted aluminum. Time for cleaning was consistent with the times recorded in Table 1.

The second canister was corroded at the Cold Test Facility by immersion in a 55 gallon (208.175 liters) carbon steel drum filled with demineralized water and heated to approximately 140°F (60°C) for approximately three weeks. After that time commercial baking soda (sodium bicarbonate - NaHCO_3) was added to the water and the pH was raised to approximately 8 and the canister remained in the water several additional weeks resulting in a dull film deposit on the canister surface. One chamber of the canister was "cleaned;" the film was removed from the surface. Again, time for cleaning was consistent with the times recorded in Table 1.

Prior to the successful tests completed above, one unsuccessful attempt was made to clean a Mk 0 canister. The interior of the canister was cleaned, however, not to the extent achieved in the development tests and only irregular cleaning was achieved on the exterior of the canister. This test is documented on Test Log Number 001 included in Appendix 1. The reasons for failure were determined to be:

- The surface standoff of the exterior nozzles was greater than the desired two inches.
- The canister had previously been stored outside and exposed to heat and sunlight for several days.

As a result of this test, the Nozzle Cleaning Assembly was modified slightly and these modifications documented on the Canister Cleaning Fixture Drawings. These modifications were implemented prior to beginning the successful tests described above.

WATER DEPTH

The depth of canister cleaning operations selected during the development tests is adequate for actual canister cleaning operations. The depth selected for canister placement during development testing positions the top of canister at an elevation of (-)12'-9" (-3.89m) based on a grating elevation of 0'-0" (0m) i.e., the top of the canister is eight feet (2.44m) below the surface of the water. This location provides a compromise between disturbances at the surface of the water during cleaning and the length of the cleaning fixture.

During testing, water surface disturbance was minimal consisting of minor ripples and fine bubbles generated from the cleaning process. This occurred primarily during the start of cleaning operations when there is entrained air within the system. The configuration tested is acceptable for use in the basins, however, Operational Health Physics should evaluate the water disturbance during training and after installation in the Basin to verify that further engineering controls are not required for contamination control. This was a subjective evaluation made by the WHC Test Engineer, the SEG® Technical Advisor and the WHC QA/QC Witness.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of these tests, operator training should be scheduled and conducted with the High Pressure Water Jet System and Canister Cleaning Fixture.

The following procedural items will be noted in the Training Package and Operating Procedure:

- Clean the exterior of the canisters with the Nozzle Cleaning Assembly moving down the canister.
- Clean the interior of the canisters with the Nozzle Cleaning Assembly moving up the canister.

The following minor equipment modifications may be made to the Canister Cleaning Fixture for enhanced effectiveness:

- Size and install a flotation cell to slow the rate of descent of the Nozzle Cleaning Assembly.
- Provide an indexing system to allow the Nozzle Cleaning Assembly to be accurately positioned over the center of each canister chamber if water clarity is degraded due to ongoing operations.

NOTE:

An original stamped "TEST CONTROL COPY" acceptance test procedure is included in Appendix IV. This had been misplaced and a copy of the original was used to finish the acceptance testing. The data from the acceptance test procedure in Appendix I was used for this acceptance test report.

5.0 DISPOSITION OF TEST ITEMS

The High Pressure Water Jet System and Canister Cleaning Fixture will remain at the Cold Test Facility until operator training is complete. After operator training is complete the HPWJS High Pressure Pump Skid will be modified, specifically a new feed water pump will be mounted on the skid.

The new feed water pump must undergo acceptance testing prior to installing the system at K-Basins.

6.0 REFERENCES

1. WHC-SD-SNF-DTR-001, Revision 0, *Development Test Report for the High Pressure Water Jet System Nozzles*, Westinghouse Hanford Company, Richland, Washington.
2. WHC-SD-SNF-TP-001, Revision 0, *K-Basins Debris Removal Equipment Test Plan*, Westinghouse Hanford Company, Richland, Washington.
3. WHC-SD-SNF-ATP-010, Revision 0, *Acceptance Test Procedure for the High Pressure Water Jet System*, Westinghouse Hanford Company, Richland, Washington.
4. SEG® Drawing No. KEM101, Canister Cleaning Fixture, sheets 1, 2, 3, 4, 5, 6, and 7 of 7
5. SEG® Drawing No. KEM102, Canister Cleaning Station Support Riser Details, sheet 1 of 1

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APPENDIX I
ACCEPTANCE TEST PROCEDURE AND TEST DATA SHEETS

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1	1	Cog. Mgr. DS Takasumi	<i>D. S. Takasumi</i>	5/24/95	X3-85	305 Facility Mgr. <i>[Signature]</i>	<i>[Signature]</i>	5/24/95	X3-85	1	1
1	1	QA RE Lacey	<i>R E Lacey</i>	6/5/95	X3-85	SEG Proj. Mgr. CD May	<i>CD May</i>	6/5/95	X3-85	4	
1	1	Safety SA Norling	<i>SA Norling</i>	5-31-95	56-57	K-Basin Cog. MJ Langevin	<i>MJ Langevin</i>	6/5/95	X3-74	1	1
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Table of Contents

1.0 TEST ITEM IDENTIFICATION	1
2.0 GENERAL DESCRIPTION	1
3.0 TEST OBJECTIVES	1
3.1 DESIGN CRITERIA	2
3.2 ACCEPTANCE TEST CRITERION FOR DECONTAMINATION	2
3.3 TEST METHOD	2
4.0 TEST CONDITION LIMITS	2
5.0 INSTRUMENTS AND CALIBRATION	3
6.0 FACILITIES, EQUIPMENT AND MATERIALS	3
6.1 FACILITIES	3
6.2 EQUIPMENT SYSTEM DESCRIPTION	4
6.3 ACCESSORIES	4
7.0 OPERATION PROCEDURE	4
8.0 MAINTENANCE AND FAILURES	5
9.0 ACCEPTANCE TEST DATA	6
10.0 PERSONNEL REQUIREMENTS	6
10.1 <u>Qualifications/Training</u>	6
10.2 <u>Responsibilities</u>	6
10.2.1 <u>Test Technician</u>	6
10.2.2 <u>WHC Test Engineer</u>	6
10.2.3 <u>SEG Technical Advisor</u>	6
10.2.4 <u>Quality Assurance</u>	6
11.0 TEST EXECUTION	7
11.1 <u>Safety Meeting</u>	7
11.2 <u>Safety Walk Down</u>	7
11.3 <u>Water Jet Fixture Configuration</u>	7
11.4 <u>Test Conduct</u>	7
11.5 <u>Set Up</u>	7
11.6 <u>Scope</u>	7
12.0 TEST STEPS	8
13.0 DISPOSITION OF DEBRIS ITEM	8
14.0 ACCEPTANCE DATA SHEETS	8
ATTACHMENT A - SAFETY CHECKLIST	A-1
ATTACHMENT B - ACCEPTANCE TEST DATA SHEET	B-1
ATTACHMENT C - ACCEPTANCE TEST DATA SHEET INDEX LOG	C-1

TEST CONTROL COPY

**ACCEPTANCE TEST PROCEDURE
HIGH PRESSURE WATER JET SYSTEM****1.0 TEST ITEM IDENTIFICATION**

The test items are a specially designed water jet cleaning fixture and the associated support equipment. These include the High Pressure Water Jet System (HPWJS), hoses, control valves, associated nozzles, handling tools, positioning and support equipment to retrieve, hold and transfer canisters.

2.0 GENERAL DESCRIPTION

The overall objective of the acceptance test is to demonstrate a combined system. This includes associated tools and equipment necessary to perform cleaning in the 105 K East Basin (KE) for achieving optimum reduction in the level of contamination/dose rate on canisters prior to removal from the KE Basin and subsequent packaging for disposal. Acceptance tests shall include necessary hardware to achieve acceptance of the cleaning phase of canisters.

This acceptance test procedure will define the acceptance testing criteria of the high pressure water jet cleaning fixture. The focus of this procedure will be to provide guidelines and instructions to control, evaluate and document the acceptance testing for cleaning effectiveness and method(s) of removing the contaminated surface layer from the canister presently identified in KE Basin. Additionally, the desired result of the acceptance test will be to deliver to K Basins a thoroughly tested and proven system for underwater decontamination and dose reduction.

3.0 TEST OBJECTIVES

Utilizing the HPWJS connected to specially designed water jet cleaning fixture:

- Clean surfaces of canister with simulated contamination ensuring safe and efficient decontamination process.
- Demonstrate a controlled process for the decontamination of canisters, ~~equipment and miscellaneous materials underwater with minimal water surface disturbance.~~ *me 8/18/95*
- Demonstrate the best combination of water jet nozzle configuration, water pressure, water flow rate and cleaning speed to decontaminate canisters.
- Perform the acceptance testing for the most effective combinations of fixtures and nozzles as determined during development testing.

3.1 DESIGN CRITERIA

The following design criteria shall be considered in changes to the designs developed during the development testing phase:

- As Low As Reasonably Achievable (ALARA), engineered into the process.
- Minimize handling of items to be decontaminated.
- Minimize the moving parts of the special support equipment and water jet fixture heads.
- Ease of operation by the operators.
- Ease of maintenance; replacement of degraded nozzles.
- Minimize cleaning time for each canister.

3.2 ACCEPTANCE TEST CRITERION FOR DECONTAMINATION

The following acceptance test criterion for cleaning shall be utilized in evaluation for effectiveness of the HPWJS fixture and nozzles:

- Removal of 80% of the simulate (dye coating) from the inner and outer surfaces of each of the canisters. *After the canister has been painted & dried for 24 hrs at room temperature (70°F).*

3.3 TEST METHOD

The test shall be performed under water within a mocked up controlled radiological environment to simulate normal work conditions at KE Basin.

The cleaning fixture and/or water pressure and water flow may require adjustment if acceptance is not reached during the first test. The tests may be performed as many times as necessary to reach the expected results of removing 80% of the simulated contamination (dye coating) from the canisters in an effective and efficient manner. Each test re-test shall require a newly coated canister.

4.0 TEST CONDITION LIMITS

Personnel involved in these tests shall use, wear and employ required safety equipment and practices during the operation of the HPWJS and associated tools and equipment. Protective equipment shall be provided for the eyes, ears, face, head and feet.

At the start of each test and before starting the HPWJS, the Safety Checklist (Attachment A) will be completed by the Scientific Ecology Group (SEG) Technical Advisor after a walkdown of the system is completed to ensure and verify that tools and equipment are safe to operate.

TEST CONTROL COPY

Only trained and qualified personnel shall start-up and operate the HPWJS. During these tests, SEG personnel shall be present and provide overall technical direction for the set up of cleaning fixture and associated hardware. (See Section 10.2 for responsibilities)

The simulated coating material criteria is that 98% of the surfaces be coated with dye to simulate the contaminated surface.

5.0 INSTRUMENTS AND CALIBRATION

Pressure gauges are calibrated by the vendor prior to shipping. No other calibration is required.

6.0 FACILITIES, EQUIPMENT AND MATERIALS

6.1 FACILITIES

The 305 Cold Test Facility test basin will be utilized for the acceptance test program.

The HPWJS will provide water at the desired pressures and flow rate. The system can provide up to 15,000 psi with a flow rate of up to 15 gpm. The water jet skid will be located outside of the 305 building on the south east corner. Electrical service to the skid will be provided by a portable diesel generator unit connected directly to the motor control panel and grounded to a building ground. Feed water will be pumped from the test basin to the water jet pump through a 2 inch PVC line from an auxiliary feed pump. Electrical service to the feed pump will be provided via a control panel from the 480 volt, 3 phase outlet near the test basin. The high pressure hose will be run to and be discharged through a control valve and the fixtures and/or heads to the test basin. Bypass water and drains will be routed back to the basin.

A work station will be set up in the test basin on the east side at the 305 Cold Test Facility. The item to be cleaned will be placed into the test basin. A high pressure water jet nozzle with varying discharge pressures and flow rates will be directed at the surfaces to be cleaned through nozzles on the water jet fixtures. An assortment of tools and equipment will be utilized to lift, hold, place, position and manipulate canisters under water during cleaning activities. Additionally, mockups of the associated process equipment and tools may be set up separately (mocked up) to verify process flow and operability.

Any one of the following type canisters can be used for the acceptance test and shall be stained with dye to simulate surface contaminants: Mark 0, Mark I, and Mark II Fuel Storage Canisters. Both a stainless steel and aluminum canister shall be tested.

NOTE: The dye to be used is SLIDE ® Thin-line Layout Blue

6.2 EQUIPMENT SYSTEM DESCRIPTION

The HPWJS contains the following skid mounted components:

- Butterworth T375H, Model 615 ES Pump, 15,000 PSI @ 15 gpm
- Electric Motor, Model P44G00 - Reliance Electric, 150 HP, 460 Volts, 170 Amps, 3 Phase, 60 Hz
- Suction Surge Tank (Galvanized, 33 gal with stand, 0-160 psi Pressure Gauge
- Stainless Steel Filter Assembly (10 Micron, 42 g.p.m.)
- Discharge Pressure Control Vessel (rated 15,000 psi)
- Contactor/Starter - NEMA enclosure, 3R/4 ½ ATL Starter with stand & conduit, full voltage, reduced voltage, low amperage draw, slow start

6.3 ACCESSORIES

The following accessories may be utilized in various combinations to direct and control the water flow from the HPWJS skid:

- High pressure hose .50 inch ID X 50 foot, 15,000 psi working pressure, 60,000 psi burst pressure, protective outer cover, 9/16 MP ends (4 hoses, total of 200 ft.)
- Hand held control gun 15,000 psi (shut off style) with 10 foot shielded hose and slimline fitting quick disconnect, 9/16 MP (15,000 psi)
- Foot control valve 15,000 psi (shut off style)

7.0 OPERATION PROCEDURE

The HPWJS Operating Procedure (SEG #HPWJOPR5.GA) and/or vendor manuals shall be used for operation of the HPWJS in support of these test activities.

- 7.1 A Job Hazard Analysis (JHA) form specific to these tests will be required in accordance with WHC-CM-4-3, Standard A-3. Existing JHAs may be applicable.
- 7.2 Applicable JHAs and Material Safety Data Sheets (MSDS) shall be posted or located in the 305 Cold Test Facility test area.
- 7.3 Test area personnel shall observe safety precautions outlined in the JHA and MSDS.

TEST CONTROL COPY

WARNING!!!

If malfunction occurs, immediately stop all water jet cleaning activity and relieve system pressure per the operating procedure. Follow manufacturer's repair instructions.

8.0 MAINTENANCE AND FAILURES

Use only products intended for high pressure water jetting. Do not use damaged items. Inspect condition of all parts prior to use. Immediately inform test supervision of any water or oil leakages. Failure to do so may result in equipment damage. A logbook will be kept by the operator of the HPWJS concerning all breakdowns, repairs, or leaks. The log book will be located at or near the unit; it shall be reviewed and initialed at the end of each shift by the SEG Technical Advisor to ensure proper maintenance is performed.

- Do not alter products. Products should be used only as intended.
- Do not touch water coming from weep holes on fittings and parts with bare hands or try to stop the leakage by plugging the holes. Water coming from the weep holes is at high pressure and will cause injury by penetrating the skin.
- Check condition of all high pressure threads. Use Teflon tape only on male threads on low pressure pipe and fittings before connection. Do not let tape overlap and block end of tubing. Use "Never Seize" thread lubricant on high pressure pipe and fittings. Be sure there is a minimum engagement of four threads. Do not use pipe wrenches on high pressure pipe or fittings.
- Any protective shielding removed from high pressure tubing and hoses during servicing must be replaced when servicing is complete. Failure to replace shielding may result in serious injury to personnel or damage to the equipment.
- Prior to water jet cleaning, operate pump at low flow and low pressure (500 psi) to flush debris from system before attaching nozzle. Stop pump and relieve all pressure if adjustments are needed and prior to installing nozzle. If properly working, install nozzle, slowly increase flow and pressure until operating pressure is reached.
- Only trained personnel should perform maintenance or repair.
- In case of freezing conditions, drain water from all components.

TEST CONTROL COPY

9.0 ACCEPTANCE TEST DATA

The acceptance test data shall be recorded for the effectiveness and rate of surface area cleaned at the associated flow and pressure for each of the identified simulated tests per section 11.0, Acceptance Test Execution.

10.0 PERSONNEL REQUIREMENTS

10.1 Qualifications/Training

Personnel performing these tests shall be trained and qualified by the HPWJS vendor representative or a vendor certified person for the safe start up, operation and shutdown of the HPWJS.

10.2 Responsibilities

10.2.1 Test Technician

The Test Technician (305 Facility Technician) is responsible for performing the physical hands on manipulation of tools and equipment and for general facility support.

10.2.2 WHC Test Engineer

The Test Engineer is responsible for ensuring that the test is performed per the Acceptance Test Procedure and shall sign off on the Test Data Sheets verifying that the test was performed, validated and acceptable.

10.2.3 SEG Technical Advisor

The SEG Technical Advisor(s) are responsible for the overall coordination of the special fixtures and equipment including interfacing with equipment vendors for SEG procured equipment. A major role is to ensure proper equipment set up and safe operation. Prior to the acceptance test he shall perform the Safety Checklist (Attachment A) of the system and complete the initial input to the Acceptance Test Data Sheet (Attachment B).

10.2.4 Quality Assurance

Witnessing by quality assurance/quality control (QA/QC) personnel shall be required for the validated test results; and shall be indicated by sign offs on Attachment B, Acceptance Test Data Sheet.

TEST CONTROL COPY

11.0 TEST EXECUTION

11.1 Safety Meeting

A pre-job safety meeting will be conducted with test personnel prior to starting acceptance testing.

11.2 Safety Walk Down

A Pre-test safety walk down will be performed by the SEG Technical Advisor prior to starting the acceptance test.

11.3 Water Jet Fixture Configuration

The water jet fixture design is the result of the development testing. Any adjustments and/or changes to the fixture during the acceptance testing shall be noted on an "as-built" drawing to identify the final acceptance test configuration.

11.4 Test Conduct

Testing shall be documented by recording acceptance test data. The Acceptance Test Data Sheet (Attachment B) will be utilized to record specific test information. The water jet fixture and associated support equipment configurations will be tested for process flow and compatibility with interfaces. The water pressures and flows for the test configuration along with nozzle size, type and arrangement shall be recorded. Manifolds, control valve type and hose arrangement will also be included and recorded in a sketch or an as-built drawing.

11.5 Set Up

The operations procedure for the HPWJS and/or vendor manual shall be utilized in conjunction with this acceptance test procedure. This skid mounted pump system provides water at various pressures and flow rates. The high pressure hose will be connected through a manifold to 2 foot control valves. High pressure hose/pipe will be connected to the under water jet cleaning fixtures from the foot control valves.

Special handling tools and equipment will be used for positioning and manipulating the canister through the cleaning jet fixture. These fixtures may be supported from the hand rail of the test basin. A crane or jib may be used to manipulate the canisters.

11.6 Scope

Test the effectiveness of fixtures configuration for cleaning the simulated surface contamination on a canister underwater. The test will be performed on at least one of both stainless steel and aluminum material type canisters.

TEST CONTROL COPY

12.0 TEST STEPS

The following test steps require QA/QC validation on the Acceptance Test Data Sheet (Attachment B):

- 12.1 Connect hoses and place the water jet fixture into the test basin work station.
- 12.2 Place the pre-coated canister into the test basin work station holder.
- 12.3 Start-up the HPWJS following the detailed steps in the HPWJS Operation Procedure.
- 12.4 Set the water pressure at the skid and control water flow to the fixture by operating the foot control valve(s).
- 12.5 Position and manipulate the canister and/or the water jet fixture until the item appears to be clean.
- 12.6 Record time, number of passes and pressure and flow rate for each test.
- 12.7 Remove the cleaned canister from the water and inspect.
- 12.8 Document level of "decontamination" on the Acceptance Test Data Sheet (Attachment B) percentage of paint/dye removed from the surface of the canister. Acceptance is removal of 80% of the dye.
- 12.9 Repeat steps 12.1 through 12.8 as necessary for each of the canister material type acceptance tests.

13.0 DISPOSITION OF DEBRIS ITEM

Save for reuse in future testing.

14.0 ACCEPTANCE DATA SHEETS

Data will be recorded on the Test Data Sheet. An SEG Technical Advisor is responsible for initially filling out the Test Data Sheet. It is the responsibility of the WHC Test Engineer to maintain the test records and a daily shift log of test activities.

A Test Data Sheet Index Log (Attachment C) shall also be maintained by the WHC Test Engineer starting with number 001.

8
TEST CONTROL COPY

ATTACHMENT A
SAFETY CHECKLIST

* SAFETY CHECK LIST *

Test Log Number 2FOR
HIGH PRESSURE WATER JETTING SYSTEMDate 8-18-95 SEG Technical Advisor Don KasserTIME: 0900
INSPECTION PERFORMED BY: Don Kasser

	YES	NO
1. Has the Pre-job briefing been completed?	☒	☐
2. Are personnel trained and qualified to operate the HPWJS?	☒	☐
3. Is personnel safety equipment available at the job site?	☒	☐
4. Have the work area and the skid area been roped off with proper signs posted?	☒	☐
5. Have precautions been taken to protect electrical equipment?	☒	☐
6. Is the area cleared of tripping hazards?	☒	☐
7. Is the operating pressure of the fittings greater than the planned test pressure? (max test pressure is 15,000 psi)	☒	☐
8. Are all hoses, lances, guns and foot control valves rated for the maximum operating pressure?	☒	☐
9. Are all fittings, hoses, lances, guns and foot control valves in good working condition?	☒	☐
10. Is the feed water pump properly placed in the basin and connected to the pump skid and has it been flushed?	☒	☐
11. Has the filter and Y-strainer been checked for cleanness and is it in good operating condition?	☒	☐

	YES	NO
12. Are the skid drains, cooling water and dump water properly routed?	✓	—
13. Are the safety shrouds on guns, valves and hoses?	✓	—
14. Confirm electrical service connections are properly connected and power from the Portable Generator is available?	✓	—
15. Have the high pressure hoses been flushed and all air removed prior to nozzle being installed?	✓	—
16. Is the cooling water to the plungers operating properly?	✓	—
17. Has the oil level been checked on the sight glass for the power end?	✓	—
18. Has the Pressure Regulator been charged with nitrogen to the desired operating pressure?	✓	—
19. Has hookup, including pipes, hoses and connections, been pressure tested with water at the maximum operating pressure?	✓	—
20. Is the dump pressure regulator drain line connected properly?	✓	—
21. Has Job site been examined for environmental considerations, with action as appropriate?	✓	—
22. Are all control systems operational?	✓	—
REMARKS:		

ATTACHMENT B
ACCEPTANCE TEST DATA SHEET

ACCEPTANCE TEST DATA SHEET
HIGH PRESSURE WATER JET SYSTEMTest Log Number 001SAFETY WALK DOWN COMPLETED and PREPARED BY: Don Kooser (Print)Don Kooser
Signature of SEG Technical AdvisorDate 8/11/95 Time 10:30 am Hearts LarsonTest Engineer Jeremy Crystal Test Technician Don KooserTest Debris Item Canister Mk 0 Material Type AluminumWater Jet Fixture Configuration Number 001Nozzle Size and Type Inner 0.04" Ø, 15° Fan / Outer 0.033" Ø, 0° FanControl Valve Configuration See attached sketches for canister cleaning device and PED

TEST DATA:

Pressure 1500 psi Flow Rate 15 S.P.M.Cleaning Time 7.5 minutes Number of Passes 2 passes on Outer Side of one canister

Test Objectives: Have the following test objectives have been met?

- * Clean surfaces with simulated contamination to ensure safety and efficient decontamination process. Yes ☒ No ☐
- * Demonstrate a controlled process for the decontamination of canisters, equipment, and miscellaneous materials underwater with minimal water surface disturbance. Yes ☒ No ☐
- * ~~Demonstrate the best combination of nozzle configuration, water pressure, water flow rate and cleaning speed to clean canisters as identified during the development testing.~~ N/A This is a development test objective. JBC 8/11/95 Yes ☒ No ☐
- * Perform the acceptance testing for the most effective combinations of fixtures and nozzles as determined during the development testing. Yes ☒ No ☐

Acceptance Test Criterion:

The following acceptance test criterion has been met?

1. Removal of 80% of the simulate (dye coating) from the debris surface of each of the canisters. Yes ☐ No ☒

Test Log #001

Remarks on cleanness Blue dyeing was not removed.
Nozzle offset distances were checked and found to
be approximately 3" off of canister surface, but should
be 2" off. The cleaning heads will be moved in and
Other Remarks retested. The canister was found to have
been painted previously and left out in the sun which
caused the dye to "bake" onto the canister. Typical
canisters are painted and allowed to dry @ room
temperature (70°F) for 24 hrs. A new canister will be
painted and tested.

Single Line Sketch of Fixture and Control Valve Arrangement or Drawing
Number # see attached P&ID

Signatures

QC Witness (When required)

*John Nuthmacher*Date: 8/18/95

WHC Test Technician

*D. C. Larson*Date: 8/18/95

WHC Test Engineer

*Jeremy Crist*Date: 8/18/95

ACCEPTANCE TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 002SAFETY WALK DOWN COMPLETED and PREPARED BY: Don Kooser (Print)Don Kooser
Signature of SEG Technical Advisor

Date 8/10/95 Time 9:45 am Dennis Larson (WHC)
 Test Engineer Jeremy Crystal Test Technician Don Kooser (SEG)
 Test Debris Item Canister MKO Material Type Aluminum
 Water Jet Fixture Configuration Numbers See attached drawings 001
 Nozzle Size and Type Inner 0.04" Ø, 15° Fan / Outside 0.033" Ø, 0° Fan
 Control Valve Configuration See attached sketch, next page.

TEST DATA:

Pressure 15000 psiFlow Rate 15 g.p.m.Cleaning Time 6.9 minutesNumber of Passes Inside: 1 / Outside: 1Back & Forth motion

Test Objectives: Have the following test objectives have been met?

- * Clean surfaces with simulated contamination to ensure safety and efficient decontamination process. Yes ☒ No ☐
- * Demonstrate a controlled process for the decontamination of canisters, equipment, and miscellaneous materials underwater with minimal water surface disturbance. minor Yes ☒ No ☐
JBC 8/10/95
- * ~~Demonstrate the best combination of nozzle configuration, water pressure, water flow rate and cleaning speed to clean canisters as identified during the development testing.~~ N/A This was a development test objective. JBC 8/10/95 Yes ☐ No ☒
- * Perform the acceptance testing for the most effective combinations of fixtures and nozzles as determined during the development testing. Yes ☒ No ☐

Acceptance Test Criterion:

- JBC 8/10/95* The following acceptance test criterion has been met?
Canister has been coated w/ dye over 90% of cylinder surface QA RCP
1. Removal of 80% of the simulate (dye coating) from the debris surface of each of the canisters. Yes ☒ No ☐

JBC 8/10/95

QA

RCP

Test Log 002

Remarks on cleanliness 162 in² not cleaned, Total Area 2816 in²
(Two cylinders inside & out) 90 cleaned 94.25%. Surfaces
cleaned had a polished finish appearance.

Other Remarks Outside nozzles were 2" off from the outside surface
of the canister.

Single Line Sketch of Fixture and Control Valve Arrangement or Drawing
 Number # See attached P&ID SK-1-133488

Signatures

QC Witness (When required) RE Lacey (R.E. Lacey) Date: 8/18/95

WHC Test Technician D.C. Larson, D.C. Larson Date: 8/18/95

WHC Test Engineer Jimmy Crystal Date: 8/18/95

Attendees

Print	Sign	Date
J.R. Burdick (SOG)	J.R. Burdick	8/18/95

J.G. WAGNER [Signature] 8-18-95

ACCEPTANCE TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 003SAFETY WALK DOWN COMPLETED and PREPARED BY: Don Kooser (Print)Don Kooser
Signature of SEG Technical Advisor

Date 8/10/95 Time 10:30 Dennis Larson (WHC)
 Test Engineer Jeremy Crystal Test Technician Don Kooser (SEG)
 Test Debris Item Canister MK II Material Type Stainless Steel
 Water Jet Fixture Configuration Number See attached drawings, RB/
 Nozzle Size and Type Inner 0.04" Ø, 15° Fan / Outside 0.033" Ø, 0° Fan
 Control Valve Configuration See attached sketches & P&ID for canister cleaning fixture.

TEST DATA:
 Pressure 15000 psi Flow Rate 15 g.p.m.
 Cleaning Time 9.3 minutes Number of Passes Inside 1 / Outside 1
Back & Forth

Test Objectives: Have the following test objectives have been met?

- * Clean surfaces with simulated contamination to ensure safety and efficient decontamination process. Yes ☒ No ☐
- * Demonstrate a controlled process for the decontamination of canisters, equipment, and miscellaneous materials underwater with minimal water surface disturbance. Yes ☒ No ☐
JEC 8/10/95
- * ~~Demonstrate the best combination of nozzle configuration, water pressure, water flow rate and cleaning speed to clean canisters as identified during the development testing.~~ *N/A This was a development test objective.* Yes ☒ No ☐
- * Perform the acceptance testing for the most effective combinations of fixtures and nozzles as determined during the development testing. Yes ☒ No ☐

Acceptance Test Criterion:

- JEC 8/10/95* The following acceptance test criterion has been met? QA RSP
1. Canister coated with dye over 90% of cylinder surface
 Removal of 80% of the simulate (dye coating) from the debris surface of each of the canisters. Yes ☒ No ☐

JEC 8/10/95 QA RSP

JEC 8/10/95 Attendees
8/10/95 Bm
 See next page.

Test Log 003

Remarks on cleanliness 408 in² not cleaned, Total area 2816 in²
(Two cylinders inside & out) percent cleaned = 85%
Area cleaned had a polished appearance

Other Remarks Outside nozzle offset of 2" from
cont. surface

Single Line Sketch of Fixture and Control Valve Arrangement or Drawing
 Number # see attached P&ID

Signatures

QC Witness (When required) R. E. Lacey (R. E. Lacey) Date: 8/18/95

WHC Test Technician D. C. Larson, D. C. Larson Date: 8/18/95

WHC Test Engineer J. B. Crystal Date: 8/18/95

Attendees

Print	Sign	Date
J. R. Burdick (SOS)	J. R. Burdick	8/18/95
J. G. WAGNER	J. G. Wagner	8-18-95

B-3

TEST CONTROL COPY

ATTACHMENT C
* ACCEPTANCE TEST DATA SHEET INDEX LOG *

Test Log Number	Date	Test Engineer
001	8/11/95	Jeremy Crystal
002	8/18/95	Jeremy Crystal
003	8/18/95	Jeremy Crystal
004		
005		
006		
007		
008		
009		
010		
011		
012		
013		
014		
015		
016		
017		
018		
019		
020		
021		

TEST CONTROL COPY

I-25

305 BUILDING WORK PLAN/INSTRUCTION

Page 1 of 2

Work Title

HIGH PRESSURE WATER JET SYSTEM

System

Location

Impact Level

305 BUILDING

Originator

Date

Cost Code

GREG WAGNER

07/07/95

LD24C

Work Instruction

ASSEMBLE AND SETUP HIGH PRESSURE WATER JET EQUIPMENT IN DRY SIDE OF PIT.
LOCATE 6 FOOT HIGH SCAFFOLDING ON SOUTH WEST SIDE OF PIT STAIRWAY OPENING.
SETUP PIT SUMP PUMP WITH HOSE DRAINING INTO SEWER DRAIN.

OPERATE HIGH PRESSURE WATER JET FROM EXISTING HIGH PRESSURE PUMP. SPRAYING
TIME WILL BE LIMITED TO ENSURING THE SYSTEM DOES NOT LEAK AND OPERATES AS
DESIGNED.

AFTER THE ABOVE CHECKOUT, THE JETING SYSTEM WILL BE RELOCATED IN TO THE TEST
BASIN FOR ACCEPTANCE TESTING.

Restrictions - Special Conditions - Sequence and End Use

THE PIT ACCESS SHALL BE ROPED OFF AND CONTROLLED, LIMITING PERSONNEL ACCESS
DURING TEST ACTIVITIES.
HIGH PRESSURE WATER, 15,000 PSI IS AVAILABLE AT THE SPRAY NOZZELS.
HIGH PITCH NOISE IS MADE BY THE FLOW OF LIQUID THROUGH THE HOSES AND
EQUIPMENT.

Hold Points - Tests - Inspections - and Other Verification

PERSONNEL INVOLVED IN TESTING WILL WORK IN ACCORDANCE TO THE 305 FACILITY
PROCEDURES.
HOLD PRE JOB SAFETY MEETING.
PRIOR TO START OF TESTING FILL OUT SAFETY CHECK LIST FOR PUMP.
MASK OFF ELECTRICAL OUTLETS IN TEST AREA TO PREVENT WATER FROM ENTERING.

Supporting Documents (i.e., Drawings, ECMs, Test Plans, etc.)

EQUIPMENT SKETCHES AND ASSEMBLIES TO BE SUPPLIED BY SEG COG ENGINEER.

Materials Needed

MATERIALS TO BE SUPPLIED BY SEG.

Special Tools, Building Modifications, (supplied by whom?)

NO SPECIAL TOOLS OR BUILDING MODIFICATIONS AT THIS TIME.

Schedule AUGUST 7 THROUGH AUGUST 10, 1995

Donald K...
Requester Signature

8-7-95
Date

MJ SCHLIEBE
Building Administration

8/7/95
Date

ADDITIONAL INFORMATION

I-24

JOB SAFETY REVIEW		Page 2 of 2		
		NA	Y	N
ELECTRICAL:	Supply Adequate		X	
	Materials	X		
ENVIRONMENTAL:	Hazardous Waste (contact Hazardous Waste Coordinator)	X		
	Minimization/Alternate Material	X		
	MSDS	X		
	Plan for Disposal	X		
	Noise		X	
	Chemical Mixing Hazards	X		
	Airborne Particulate/Ventilation	X		
FIRE:	Burning and Welding	X		
	Flammable Liquids	X		
	Flammable Gases	X		
MECHANICAL:	Sharp Edges		X	
	Rotating Equipment		X	
	Projectiles	X		
	Pressure		X	
	Temperature	X		
PERSONAL PROTECTION:	Ear Protection		X	
	Breathing Aparatus/Mask	X		
	Special Equipment/Handling		X	
RADIOLOGICAL:	Shielding	X		
	Transportation	X		
	Decontamination	X		
TOOLING:	Special Tools		X	
	Other	X		
<p>DISCUSSION:</p> <p>PERSONNEL SHALL WEAR HEARING PROTECTION AND ANY OTHER REQUIRED SAFETY EQUIPMENT TO MEET SPECIFIED SAFETY HAZARDS.</p> <p>SAFFOLDING SHALL BE SECURED SO AS TO PREVENT ROLLING WHEN PERSONNEL ARE ON BOARD.</p> <p style="text-align: right;">SAFETY GLASSES YES 8/7/95</p>				

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APPENDIX II

HPWJS P&ID

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The attached High Pressure Water Jet System (HPWJS) Piping and Instrumentation Diagram (P&ID) (SK-1-33488) shows a skid mounted centrifugal pump as the Feed Pump which was not used during acceptance testing. The feed pump used during testing was a submersible pump located in the Cold Test Facility Basin. Pertinent Pump Data is listed below:

Manufacturer:	Grundfos
Model No.:	40S15-5
Flowrate:	30 gpm @ 120' H ₂ O
Motor:	1½ Hp 460V/3φ

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APPENDIX III

**STONEAGE RJV3 ROTARY WATERBLAST NOZZLES
OPERATOR'S MANUAL**

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WHC-SD-SNF-ATR-010, REV. 0
III-02

STONEAGE Inc

WATERJET ENGINEERING

54 Girard Street ~ Durango, Colorado 81301

FAX 970-259-2868 ~ Phone 970-259-2869

Please deliver to: **Jared Burdin**
Scientific Ecology Group
509-372-2403

From: **John Wolgamott**
Date: Sep. 12, 1995

Re: **RJV Tools**

We are pleased that you have had success using the **RJV** tools in your application.

You have our authorization to use the associated "Operation and Maintenance Manual for the **RJV**" in your reporting process.

Please let me know if we can be of further assistance.

Best Regards

Total number of pages 1 including this cover sheet. If all pages are not received, please call 970-259-2869.

ROTARY WATERBLAST NOZZLES

RJV3

15,000 PSI

&

20,000 PSI

OPERATOR'S MANUAL

11/94

WATERJET ENGINEERING
54 Girard St. • Durango, CO 81301 • (303) 259-2888 • FAX 259-2888

TABLE OF CONTENTS

1.0	INTRODUCTION
2.0	GENERAL DESCRIPTION
3.0	SAFETY WARNING
4.0	PARTS LIST
5.0	ASSEMBLY DRAWING
6.0	MAINTENANCE
7.0	WARRANTY
	APPENDIX
A	VISC FLUID MATERIAL DATA SHEET

Rotary Nozzle For Waterblast Cleaning

RJV3

The **RJV3** is specifically designed for hand held waterblast cleaning. The rotating jets are hard-hitting and cover a large area for efficient cleaning. The jet reaction force powers the head to rotate up to 2000 rpm. The speed is controlled by an internal viscous fluid governor. A single high pressure seal provides leak-free operation so that no power is wasted. The seal is economical and easy to change.

The tool is simple to work on and can be serviced in the field. Two models are available, one rated to 15,000 psi and the other to 20,000 psi.

FEATURES:

- No-leak seal will not waste power
- Controlled rotation speed
- Easy to maintain and repair
- Rugged, compact design
- Replaceable carbide nozzles
- Operating pressures to 20,000 psi

Rotary Nozzle For Waterblast Cleaning

RJV3

RJV3 Head & Nozzle Selection Guide

		Flow Rate, gpm					
		5	6	8	10	12	14
Pressure, psi	20,000	0.025 24°	0.028 18°	0.031 15°	0.037 12°	Nozzle Size Head Angle	
	15,000	0.028 24°	0.031 18°	0.037 15°	0.042 12°		
	10,000		0.031 24°	0.037 18°	0.042 15°	0.047 12°	
	8,000		0.037 24°	0.042 18°	0.047 15°	0.052 12°	
	6,000			0.042 24°	0.047 18°	0.052 15°	0.060 12°

SPECIFICATIONS:

Model	15K	20K
Inlet port, 15K	1/2 npt	9/16 MP**
Max pressure	15,000 psi	20,000 psi

Length overall7.7 in.
 Body diameter1.8 in.
 Nozzle head diameter2.0 in.
 Weight, complete3.5 lb.
 Flow capacity0.6 Cv
 Rotation speed, rpm1500-2000

* Special heads & nozzles available without pipe threads
 ** Medium Pressure cone and thread

1.0 INTRODUCTION

These guidelines were prepared to provide the operator of the RJV3 rotary nozzle with the basic information needed to use and service these tools. All operators or service personnel responsible for the care of this equipment should be familiar with the information in this manual.

WARNING: HIGH PRESSURE FLUID SYSTEMS ARE POTENTIALLY DANGEROUS AND ONLY COMPETENT AND TRAINED PERSONS SHOULD BE INVOLVED IN THE MAINTENANCE AND OPERATION OF THESE TOOLS.

If you have any questions or problems with this product, please contact the distributor you obtained the tool from, or the manufacturer:

StoneAge, Inc.

54 Girard Street
Durango, CO 81301
303-259-2869

2.0 DESCRIPTION

The RJV3 is specifically designed for hand held waterblast cleaning. The rotating jets are hard-hitting and cover a large area for efficient cleaning. The jet reaction force powers the head to rotate at up to 2000 rpm. The speed is controlled by an internal viscous fluid governor. A single high pressure seal provides leak-free operation so that no power is wasted. The seal is economical and easy to change.

2.1 RJV3 15K

The RJV3 can be used at operating pressures of 6000 to 15,000 psi. Standard nozzle heads are available for normal operating pressures and flow rates. These heads have 1/4 npt ports for using common replaceable nozzles. However the correct combination of head and nozzle size must be used. Please refer to the "Head and nozzle selection guide" on the back of the data sheet.

2.2 RJV3-20K

The RJV3-20K is designed for operating pressures of up to 20,000 psi. The RJV3-20K has an inlet nut with 9/16 medium pressure cone & thread connection.

The nozzle head needs to be fitted with the proper size of nozzle. Please refer to section 5 for nozzle size selection. Please refer to the "Head and nozzle selection guide" on the back of the data sheet.

2.3 Nozzle Head

A series of four nozzle heads are available. They have a jet angle of 12°, 15°, 18°, and 24°. All will fit on the RJV3 and are used for both the 15K and 20K models. It is important to select the head angle that matches the nozzle size for the operating pressure intended. These factors determine the rotating torque and the ability of the RJV3 to govern the speed. Too little torque and the head will not rotate fast enough or at all. Too much torque will over spin the head and wearout the high pressure seal quickly. Please refer to the "Head and nozzle selection guide" on the back of the data sheet.

A special head and nozzle insert style is available that do not use npt threads. Instead a straight thread with o-ring seal is employed. This design is rated for 20,000 psi working pressure as an alternative to the standard 1/4 npt design. Please refer to Section 4.0 Parts list for the part number and name.

3.0 SAFETY WARNING

Operations with the RJV3 Rotary Head can be potentially dangerous if caution is not exercised prior to and during tool use. Please read and follow all of these instructions.

- 3.1 Only competent and trained persons should operate this equipment.
- 3.2 Do not exceed the maximum operating pressure specified for any component in a system.

<p>NOTE: It is recommended that all operating personnel be familiar with the <u>"Recommended Practices for the use of Manually Operated High Pressure Water Jetting Equipment"</u>, which is published by the Water Jet Technology Association.</p>
--

- 3.3 This equipment should always be used with an operator controlled dump mechanism to release the high pressure water.
- 3.4 The immediate work area should be marked off to keep out untrained persons.
- 3.5 All personnel in the area should wear eye protection, and other protective clothing in accordance with specific conditions.
- 3.6 The tool should be securely supported. Strong back thrust is created by waterjets and these forces can become unbalanced if a nozzle should become plugged.
- 3.7 Inspect the equipment for visible signs of deterioration, damage, or improper assembly. Do not operate until repaired. Make sure all threaded connections are tight and leak free.
- 3.8 Check to see that all control functions work properly before going to high pressure.
- 3.9 If it is necessary to have a person work near the cleaning jets, then it is this person who should have control of the pressure dump mechanism.

4.0 Parts List

RJV3 Rotary Nozzle

REF. NO.	DESCRIPTION	QTY.	RJV3-15K	RJV3-20K	INCLUDED IN:	
					SERVICE KIT	OVERHAUL KIT
1	Shaft	1	RJ 01-K3	RJ 01-K3		
2	End Nut	1	RJ 02-P	RJ 02-A9		
3	Body	1	RJ 03	RJ 03		
7	Thrust Brg.	1	RJ 07	RJ 07		Y
8	Case O-Ring	1	RJ 08	RJ 08	Y	Y
9	Ball Brg.	1	RJ 09	RJ 09		Y
10	Shaft Seal	1	RJ 10	RJ 10		Y
11	Brass Seat	1	RJ 11-K		Y	Y
11	Carbide Seat	1		RJ 11-KC	Y	
12	H.P. Seal	1	RJ 12-K	RJ 12-K	Y	Y
13	Coil Spring	1	RJ 13-K	RJ 13-K	Y	Y
14	Wave Spring	1	RJ 14	RJ 14		Y
15	Washer	1	RJ 15-S	RJ 15-S		
21	Weep Seal	1	RJ 21-S	RJ 21-S		Y
28	Piston	1	RJ 28	RJ 28		
29	Piston Seal	1	RJ 29	RJ 29		Y
30	Piston O-Ring	1	RJ 30	RJ 30		Y
32	Retaining Ring	1	RJ 32	RJ 32		
38	Clamp Ring	1	RJ 38-K	RJ 38-K		
39	Nozzle Guard	1	RJ 39-KA	RJ 39-KA		
40	O-Ring	2	RJ 40-K	RJ 40-K		Y
41	Pin	1	RJ 41-K3	RJ 41-K3		
51	Nozzle Head	1	RJ 51-P-X°			
51	Nozzle head	1		RJ 51-K-X°		
52	Nozzle Shield	1	RJ 52	RJ 52		
Optional Items						
48	Viscous fluid	1	GP 48-VF	GP 48-VF	Y	Y
60	Service Kit	1	RJ 60-K	RJ 60-K		
61	Overhaul Kit	1	RJ 61-K	RJ 61-K		
62	Anti-Seize	1	GP 62	GP 62	Y	Y
64	Fill Tube	1	RJ 64	RJ 64		
OCSH	Carbide Nozzle	2	OCSH-X°	OCSH-X°		
OCKH	Carbide Nozzle	2		Optional		
***X° indicates jet angle of head. "P" indicates 1/4 npt port						
"K" indicates o-ring seal						
***X indicates orifice size of nozzle.						
1/95

RJV3 Rotary Nozzle

November 1994

6.0 MAINTENANCE

There are two important items in maintaining the swivel. First, always operate within the designed torque/speed range. Operating at higher rotation rates is detrimental to the swivel components and will reduce their useful life. Second, keep the swivel full of viscous fluid. The viscous fluid provides bearing lubrication as well as torque drag. An insufficient supply of fluid will cause the swivel to lose it's ability to govern rotation rate and cause excessive seal and bearing wear. Water in the viscous fluid will also ruin the speed control. If water is suspected to be in or found in the viscous fluid, replace it immediately to prevent the bearings from being damaged by corrosion.

The single high pressure plastic seal (12) is spring loaded to ride against a floating brass seat (11). During high pressure operation, the seal is pressed against the seat and the seat is pressed against the inlet nut by water pressure. The high pressure seal has a lip on one end that is colored blue. When installing, the blue lip end should go into the shaft recess first and ride against the spring. The brass seat has a beveled end which faces the nut and a flat end, colored blue, which faces the seal.

NOTE: The blue end of both the seal and the seat faces downstream.

Figure 3. High Pressure Seal Components

6.1 HIGH PRESSURE SEAL MAINTENANCE

1. Disconnect the swivel from the inlet line. Be sure to use the wrench flats on the inlet nut. Do not hold the body to remove the inlet line.
2. Position the swivel with the inlet up, this will keep the viscous fluid in the swivel (If a vise is used to hold the body, clamp the wrench flats in the jaws, Do not clamp or strike the round portion of the body).
3. The seal seat (11) and high pressure seal (12) can be lifted out of the shaft end for servicing. Compare the used seal with a new one. Replace if more than 50% is consumed, or if otherwise defective. Check the seat O.D. and replace it if it is smaller than, .308". Also check to see if the shaft bore is worn where the seal fits. Consider replacing if it is larger than .318 I.D.
4. The fluid level can also be checked at this time. Examine to see if water has mixed with the fluid, replace if necessary. Add enough viscous fluid to the open cavity to completely cover the washer (15-S).
5. Install the seal (12) into the shaft with the blue end towards the spring. Set the blue end of the seat (11) on the seal, make sure at least half of the seat is sticking out of the shaft.
6. Be sure the body and nut threads are clean. Apply anti-seize compound to the threads. Thread nut (02-S) into the body slowly this allows air and excess fluid to escape through the weep port. Continue threading until nut shoulders on body.

6.2 SWIVEL DISASSEMBLY

1. Unscrew the inlet nut (02-S). Lift out the washer (15-S), wave spring (14), seat (11), seal (12) and spring (13).
2. Push the shaft (01) and bearings (07, 09) out the open end of the body.
3. Gently press the bearings (07, 09) off the shaft. Be careful, the angular contact bearing (07) will come apart if the outer race is heavily forced. Be careful not to scar the outside of the rotor, it has a very close fit to the inside of the body and any raised burrs could cause rotation problems.
4. The piston can be removed by pushing out through the open end of body, or by removing the retaining ring (32).
5. The shaft seals (10, 29) can be removed by prying out. This usually damages the seals and new ones will be required.

6.3 SWIVEL ASSEMBLY

1. Clean all parts of dirt and contaminants.
2. Press a piston shaft seal (29) in the piston (28). The flat side goes in first with cup side out. (See figure 4) Press a shaft seal (10) into the nut. The cup side goes in first with the flat side out. (See figure 6)
3. Place an O-Ring (30) around the piston (28). Press the piston (28) into the body seal first, past the retaining ring groove. Install the retaining ring (32). With a screwdriver, pry the exposed lip of the piston (28) back so that the piston rests against the retaining ring (32).
4. Place an angular bearing (07) on to the threaded end of the shaft. It is important that this bearing be installed so that the thicker end of the outside race will face the piston. (See figure 5.)
5. Press the ball bearing (09) on the other end of the shaft.
6. While holding the lip of the piston (28) with a screwdriver, insert the fill tube (64) through the piston shaft seal (29) in the body so the tube sticks through about 1 inch. Pour viscous fluid (48) into the body around the fill tube (64) approximately 3/4 inch deep. (See figure 4)
7. Smear some viscous fluid into the grooves on the outside of the shaft. Gently slide the shaft assembly into the body. The bearings & rotor should displace the fluid, push the fill tube out and stop against the shoulder of the body. The fill tube (64) is no longer needed. (See figure 5)
8. Spin the shaft by hand to help remove any air bubbles which may be in the fluid.
9. Lay a wave spring (14) and washer (15-S) in place.
10. There should be enough viscous fluid in the body to cover the washer (15-S) 1/16". If not, add more. (See figure 6)
11. Insert the spring (13), seal (12), and seat (11) into the shaft end. Be sure to push the blue ends in first, refer to section 6.0.
12. Be sure the body and nut threads are clean and undamaged. Apply anti-seize compound to the threads and install o-ring (08). With port plug (26) removed, thread nut (02-S) into the body. Allow air and excess fluid to escape through the bleed port and continue threading until nut shoulders on body, tighten the nut.
13. Install the weep seal (21-S) so the flap is facing the weep holes. (See assembly drawing).
14. Rotate the shaft (01) to check that it turns smoothly.

Figure 4. Install piston assembly, insert fill tube and fill with viscous fluid as shown.

Figure 5. Insert shaft assembly.

Figure 4. Install piston assembly, insert fill tube and fill with viscous fluid as shown.

Figure 5. Insert shaft assembly.

Figure 6. Top off with 1/16" of viscous fluid, insert 11, 12, 13, 14 & 15-S (11 & 12 should have the blue sides down), install nut assembly.

Figure 7. Push piston up 1/16", install plug screw.

6.4 TROUBLESHOOTING GUIDE

SYMPTOM	PROBLEM	SOLUTION
Leaks out weep holes	<ol style="list-style-type: none"> 1. Worn H.P. Seal 2. Worn seat 3. Worn inlet nut 	<ol style="list-style-type: none"> 1. Replace seal (12) 2. Replace seat (11) 3. Repair or replace nut (02)
Seals wear out too quickly	<ol style="list-style-type: none"> 1. Worn out seat 2. Rough shaft finish 3. Shaft ID worn 	<ol style="list-style-type: none"> 1. Replace if smaller than .308 diameter. 2. Polish shaft ID with clean 600 grit paper or replace. 3. Replace if larger than .318 Ø.
Water found in viscous fluid	<ol style="list-style-type: none"> 1. Operated with H.P. seal leaking badly 2. Worn shaft seal 	<ol style="list-style-type: none"> 1. Replace seal (12) 2. Replace seal (10)
Shaft won't rotate	<ol style="list-style-type: none"> 1. Not enough jet torque 2. Bad bearings 3. Internal damage 4. Clamped in rotor area 	<ol style="list-style-type: none"> 1. Test by hand, if ok check nozzle/head chart 2. Replace bearing (07 & 09) 3. Inspect and repair 4. Move clamp
Head spins too fast	<ol style="list-style-type: none"> 1. Too much power for head design 2. Low or empty on viscous fluid 3. Water in viscous fluid 	<ol style="list-style-type: none"> 1. Reduce power or correct head design 2. Refill viscous fluid 3. Clean and refill
Shaft wobbles	<ol style="list-style-type: none"> 1. Bearings are worn 2. Shaft is worn 	<ol style="list-style-type: none"> 1. Replace bearing (07 & 09) 2. Replace bearings and shaft (01)

7.0 LIMITED WARRANTY

StoneAge, Inc. warrants to the extent herein provided the products of its own manufacture against defects in material and workmanship under normal use and service for which the products were designed for a period of six (6) months after shipment from the factory. If such products should fail through defect in workmanship or material and specific written notice of failure is made within six (6) months after date of shipment from the factory, StoneAge, Inc. will either repair or replace any such items, F.O.B. its factory without charge. StoneAge, Inc. shall not be liable for expense incurred in repairs or alterations made outside the factory without the proper and prior authorization. StoneAge, Inc. shall have the option of requiring the return of the defective products to its factory, with transportation charges prepaid, to establish the claim. StoneAge, Inc. shall in no event be held liable for damages or delay resulting from or arising out of defective products nor for consequential damages or otherwise except for repair or replacement of items of defective material or workmanship asforesaid.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE AND NEITHER ASSUMES, NOR AUTHORIZES ANY PERSON TO ASSUME FOR STONEAGE, INC. ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF ITS PRODUCTS. THIS WARRANTY SHALL NOT APPLY TO PRODUCTS OR ANY PARTS THEREOF WHICH HAVE BEEN SUBJECT TO ACCIDENT, NEGLIGENCE, ALTERATION, ABUSE, OR MISUSE. STONEAGE, INC. MAKES NO WARRANTY WHATSOEVER IN RESPECT TO ACCESSORIES, PARTS OR PRODUCTS NOT MANUFACTURED BY STONEAGE, INC.

APPENDIX A VISC FLUID

OSi Specialties, Inc.
MATERIAL SAFETY DATA SHEET

WHC-SD-SNF-ATR-010, REV. 0
III-20

EFFECTIVE DATE 07/28/93

OSi Specialties urges each customer or recipient of this MSDS to study it carefully to become aware of and understand the hazards associated with the product. The reader should consider consulting reference works or individuals who are experts in ventilation, toxicology, and fire prevention, as necessary or appropriate to use and understand the data contained in this MSDS.

To promote safe handling, each customer or recipient should: (1) notify its employees, agents, contractors and others whom it knows or believes will use this material or the information in this MSDS and any other information regarding hazards or safety; (2) furnish this same information to each of its customers for the product; and (3) request its customers to notify their employees, customers, and other users of the product of this information.

I. IDENTIFICATION

PRODUCT NAME:

L-45/500

Stone Age Part# GP 48-5

CHEMICAL NAME:

Polydimethylsiloxane

CHEMICAL FAMILY:

Organosilicone Fluid

FORMULA:

$((CH_3)_2SiO)_x$

MOLECULAR WEIGHT:

Polymer

SYNONYMS:

None

CAS # AND NAME:

63148-62-9
Siloxanes and Silicones, di-methyl

II. PHYSICAL DATA(Determined on Typical Material)

BOILING POINT, 760 mm Hg:

Polymer
> 200°C

SPECIFIC GRAVITY(H₂O = 1):

0.97 @ 25/25°C

FREEZING POINT:

< -25°C

VAPOR PRESSURE AT 20°C:

< 1 mmHg

Copyright 1993 OSi Specialties, Inc.

EMERGENCY PHONE NUMBERS: 1-800-UCC-HELP (NUMBER AVAILABLE AT ALL TIMES) OR (304) 744-3487

OSi Specialties, Inc.
39 Old Ridgebury Road, Danbury, CT 06810-5121

PRODUCT NAME: L-45/500

VAPOR DENSITY (AIR = 1): >1

EVAPORATION RATE (Butyl Acetate = 1): <1

SOLUBILITY IN WATER by wt: Insoluble

APPEARANCE: Transparent colorless

ODOR: Mild

PHYSICAL STATE: Liquid

III. INGREDIENTS

%	MATERIAL	CAS#	EXPOSURE LIMIT
100	Polydimethylsiloxane	63148-62-9	None established

See Section X for chemicals appearing on Federal or State Right-To-Know lists.

IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT(test method(s)): >400°F
Pensky-Martens Closed Cup ASTM D 93

FLAMMABLE LIMITS IN AIR LOWER: Not determined.
% by volume: UPPER: Not determined.

SPECIAL FIRE FIGHTING PROCEDURES: Do not direct a solid stream of water or foam into hot, burning pools; this may cause frothing and increase fire intensity.
Use self-contained breathing apparatus when fighting fires in enclosed areas.

EXTINGUISHING MEDIA: Apply alcohol-type or all-purpose-type foam by manufacturer's recommended techniques for large fires. Use carbon dioxide or dry chemical media for small fires.

UNUSUAL FIRE AND EXPLOSION HAZARDS: This material may produce a floating fire hazard.

PRODUCT NAME: L-45/500

STABILITY: Stable

CONDITIONS TO AVOID: None known.

INCOMPATIBILITY (materials to avoid):
None known.

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS:

Burning can produce the following combustion products:

Oxides of carbon and silicon.

Formaldehyde.

Carbon monoxide is highly toxic if inhaled; carbon dioxide in sufficient concentrations can act as an asphyxiant.

Acute overexposure to the products of combustion may result in irritation of the respiratory tract.

HAZARDOUS POLYMERIZATION: Will Not Occur

CONDITIONS TO AVOID: None known.

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

Collect for disposal.

WASTE DISPOSAL METHOD:

Incinerate in a furnace or otherwise dispose of in accordance with appropriate Federal, State, and local regulations.

VIII. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (specify type):

None expected to be needed.

VENTILATION:

General (mechanical) room ventilation is expected to be satisfactory.

PROTECTIVE GLOVES:

PVC-coated

EYE PROTECTION:

Safety Glasses

OTHER PROTECTIVE EQUIPMENT:

Eye Bath, Safety Shower

IX. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:

Normal precautions common to safe manufacturing practice should be followed in handling and storage.

PRODUCT NAME: L-45/500

Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires submission of annual reports of release of toxic chemicals that appear in 40 CFR 372 (for SARA 313). This information must be included in all MSDSs that are copied and distributed for this material.

Components present in this product at a level which could require reporting under the statute are:
**** NONE ****

Toxic Substances Control Act (TSCA) STATUS:

The ingredients of this product are on the TSCA inventory.

STATE RIGHT-TO-KNOW

CALIFORNIA Proposition 65

This product contains no levels of listed substances, which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute.

MASSACHUSETTS Right-To-Know, Substance List (MSL) Hazardous Substances and Extraordinarily Hazardous Substances on the MSL must be identified when present in products.

Components present in this product at a level which could require reporting under the statute are:
**** NONE ****

PENNSYLVANIA Right-to-Know, Hazardous Substance List Hazardous Substances and Special Hazardous Substances on the List must be identified when present in products.

Components present in this product at a level which could require reporting under the statute are:
**** NONE ****

CALIFORNIA SCAQMD RULE 443.1 VOC'S:

Volatile Organic Components (VOC's) = Substances with vapor pressure of
= > 0.5 mmHg at 104°C (219.2°F).

This product contains 0.00 g/liter VOC's
and 0.00 g/liter VOC's (less water and exempt compounds).

OTHER REGULATORY INFORMATION:

EPA Hazard Categories: None

NOTE —

The opinions expressed herein are those of qualified experts within OSi Specialties. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of the use of the product are not under the control of OSi Specialties, it is the user's obligation to determine the conditions of safe use of the product.

REVISED SECTIONS:

Section IX

PRODUCT: 01080
F NUMBER: S02740

SERVICE BULLETIN

January 1995

Improved Seat Design for BJV, SG, RJV3

A recent design change has been made to the high pressure seat used in several models of swivels. The change is to use a carbide seat instead of brass. This change will be effective with swivels shipped beginning in January 1995. The carbide seat offers several advantages over brass. It is harder, smoother, and keeps an edge longer. The carbide seat is more expensive than the brass, but it will pay for itself quickly. High pressure seals will last longer running against the carbide seat.

1. The new seat design is completely interchangeable with the earlier brass style. No changes are required other than to swap the brass out for the new carbide style.
2. The benefits to this design change are; longer lasting seal life and less maintenance.
3. The new carbide seat will come standard in the BJV, SG-P8, SG-P12, SG-A12, and RJV3.
4. All service kits for the swivels affected will have the carbide seat included, beginning in January also.
5. Brass seats will continue to be used in the BJV-M, SG-P12-M, and RJV.

Old Part

BJ 11	Seat, Brass
RJ 11-K	Seat, Brass

New Part

BJ 11-C	Seat, Carbide
RJ 11-KC	Seat, Carbide

Please consult StoneAge or your distributor if you have any questions.

SERVICE BULLETIN

RJV
Service

Improved Design for RJV

November 1994

A recent design change has been made to the RJV Swivel to eliminate the bleed port in the body. This change was effective with swivel serial number 1465. The port is not needed with the new shaft seal lip direction (as described in RJV Service Bulletin, April 1993). Earlier models had the seal lip oriented in a way that trapped the viscous fluid and a bleed port was necessary to assemble the unit. The new design will have any excess fluid from refilling, push past the lip and spill out the weep ports.

1. The new body design is completely interchangeable with the earlier body style. No changes are required other than to have the shaft lip seal facing so viscous can push past.
2. The benefits to this design change are; less parts, easier filling procedure, and an effectively smaller diameter.
3. Earlier model bodies can be modified by filling the port with epoxy to eliminate the need for a plug screw.

Please consult StoneAge or your distributor if you have any questions.

APPENDIX IV
ORIGINAL ACCEPTANCE TEST PROCEDURE

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DISTRIBUTION SHEET

To	From	Page 1 of 1			
Distribution	SNF/K Basin Projects	Date 5/30/95			
Project Title/Work Order		EDT No. 161592			
SNF/ K Basins Engineering Project		ECN No.			
Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
JB Crystal	X3-85	X			
DS Takasumi	X3-85	X			
RE Lacey	X3-85	X			
SA Norling	L6-57	X			
GE Dixon	N1-41	X			
MJ Schliebe	L6-13	X			
CD May	X3-85	X			
MJ Langevin	X3-74	X			
Central Files	A3-88 L8-04	X			
O.S.T.I. (2)	A3-36 L8-07	X			

TEST CONTROL COPY

15
JUN 6 1995

ENGINEERING DATA TRANSMITTAL

Page 1 of 1
1. EDT 161592

2. To: (Receiving Organization) SNF K Basins Projects		3. From: (Originating Organization) SNF K Basins Projects		4. Related EDT No.: N/A							
5. Proj./Prog./Dept./Div.: SNF/K Basins Projects		6. Cog. Engr.: Jeremy B. Crystal		7. Purchase Order No.: N/A							
8. Originator Remarks: Please review for approval.				9. Equip./Component No.: High Pressure Water Jet							
				10. System/Bldg./Facility: 305/300							
11. Receiver Remarks:				12. Major Asm. Dwg. No.: N/A							
				13. Permit/Permit Application No.: N/A							
				14. Required Response Date: 5/24/95							
15. DATA TRANSMITTED											
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Approval Designator	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition			
1	WHC-SD-SNF-ATP-010		0	Acceptance Test Procedure for High Pressure Water Jet System	QS						
16. KEY											
Approval Designator (F)			Reason for Transmittal (G)			Disposition (H) & (I)					
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)			1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)			1. Approved 2. Approved w/comment 3. Disapproved w/comment 4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged					
17. SIGNATURE/DISTRIBUTION (See Approval Designator for required signatures)											
(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1	1	Cog.Eng. JB Crystal	<i>JB Crystal</i>	5/24/95	X3-85	305 Test Coordinator GE Dixon	<i>GE Dixon</i>	5/24/95	N1-41	4	
1	1	Cog. Mgr. DS Takasumi	<i>DS Takasumi</i>	5/24/95	X3-85	305 Facility Mgr. <i>Michael Spilke</i>	<i>Michael Spilke</i>	5/24/95	X3-85	1	1
1	1	QA RE Lacey	<i>R E Lacey</i>	5/24/95	X3-85	SEG Proj. Mgr. CD M...	<i>CD M...</i>	5/24/95	X3-85	4	
1	1	Safety SA Norling	<i>SA Norling</i>	5/24/95	X3-85	K-Basin Cog. MJ Langevin	<i>MJ Langevin</i>	5/24/95	X3-85	1	1
		Env.									
18. <i>Jeremy B. Crystal</i> Signature of EDT Originator Date 5/24/95											
19. <i>DS Takasumi</i> Authorized Representative for Receiving Organization Date 5/24/95											
20. <i>DS Takasumi</i> Cognizant Manager Date 5/24/95											
21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments											

RELEASE AUTHORIZATION

Document Number: WHC-SD-SNF-ATP-010, REV 0

Document Title: Acceptance Test Procedure for High Pressure Water Jet System

Release Date: 6/5/95

**This document was reviewed following the
procedures described in WHC-CM-3-4 and is:**

APPROVED FOR PUBLIC RELEASE

WHC Information Release Administration Specialist:

Kara M. Broz

June 5, 1995

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Table of Contents

1.0 TEST ITEM IDENTIFICATION	1
2.0 GENERAL DESCRIPTION	1
3.0 TEST OBJECTIVES	1
3.1 DESIGN CRITERIA	2
3.2 ACCEPTANCE TEST CRITERION FOR DECONTAMINATION	2
3.3 TEST METHOD	2
4.0 TEST CONDITION LIMITS	2
5.0 INSTRUMENTS AND CALIBRATION	3
6.0 FACILITIES, EQUIPMENT AND MATERIALS	3
6.1 FACILITIES	3
6.2 EQUIPMENT SYSTEM DESCRIPTION	4
6.3 ACCESSORIES	4
7.0 OPERATION PROCEDURE	4
8.0 MAINTENANCE AND FAILURES	5
9.0 ACCEPTANCE TEST DATA	6
10.0 PERSONNEL REQUIREMENTS	6
10.1 <u>Qualifications/Training</u>	6
10.2 <u>Responsibilities</u>	6
10.2.1 <u>Test Technician</u>	6
10.2.2 <u>WHC Test Engineer</u>	6
10.2.3 <u>SEG Technical Advisor</u>	6
10.2.4 <u>Quality Assurance</u>	6
11.0 TEST EXECUTION	7
11.1 <u>Safety Meeting</u>	7
11.2 <u>Safety Walk Down</u>	7
11.3 <u>Water Jet Fixture Configuration</u>	7
11.4 <u>Test Conduct</u>	7
11.5 <u>Set Up</u>	7
11.6 <u>Scope</u>	7
12.0 TEST STEPS	8
13.0 DISPOSITION OF DEBRIS ITEM	8
14.0 ACCEPTANCE DATA SHEETS	8
ATTACHMENT A - SAFETY CHECKLIST	A-1
ATTACHMENT B - ACCEPTANCE TEST DATA SHEET	B-1
ATTACHMENT C - ACCEPTANCE TEST DATA SHEET INDEX LOG	C-1

ACCEPTANCE TEST PROCEDURE HIGH PRESSURE WATER JET SYSTEM

1.0 TEST ITEM IDENTIFICATION

The test items are a specially designed water jet cleaning fixture and the associated support equipment. These include the High Pressure Water Jet System (HPWJS), hoses, control valves, associated nozzles, handling tools, positioning and support equipment to retrieve, hold and transfer canisters.

2.0 GENERAL DESCRIPTION

The overall objective of the acceptance test is to demonstrate a combined system. This includes associated tools and equipment necessary to perform cleaning in the 105 K East Basin (KE) for achieving optimum reduction in the level of contamination/dose rate on canisters prior to removal from the KE Basin and subsequent packaging for disposal. Acceptance tests shall include necessary hardware to achieve acceptance of the cleaning phase of canisters.

This acceptance test procedure will define the acceptance testing criteria of the high pressure water jet cleaning fixture. The focus of this procedure will be to provide guidelines and instructions to control, evaluate and document the acceptance testing for cleaning effectiveness and method(s) of removing the contaminated surface layer from the canister presently identified in KE Basin. Additionally, the desired result of the acceptance test will be to deliver to K Basins a thoroughly tested and proven system for underwater decontamination and dose reduction.

3.0 TEST OBJECTIVES

Utilizing the HPWJS connected to specially designed water jet cleaning fixture:

- Clean surfaces of canister with simulated contamination ensuring safe and efficient decontamination process.
- Demonstrate a controlled process for the decontamination of canisters, equipment and miscellaneous materials underwater with minimal water surface disturbance.
- Demonstrate the best combination of water jet nozzle configuration, water pressure, water flow rate and cleaning speed to decontaminate canisters.
- Perform the acceptance testing for the most effective combinations of fixtures and nozzles as determined during development testing.

3.1 DESIGN CRITERIA

The following design criteria shall be considered in changes to the designs developed during the development testing phase:

- As Low As Reasonably Achievable (ALARA), engineered into the process.
- Minimize handling of items to be decontaminated.
- Minimize the moving parts of the special support equipment and water jet fixture heads.
- Ease of operation by the operators.
- Ease of maintenance; replacement of degraded nozzles.
- Minimize cleaning time for each canister.

3.2 ACCEPTANCE TEST CRITERION FOR DECONTAMINATION

The following acceptance test criterion for cleaning shall be utilized in evaluation for effectiveness of the HPWJS fixture and nozzles:

- Removal of 80% of the simulate (dye coating) from the inner and outer surfaces of each of the canisters.

3.3 TEST METHOD

The test shall be performed under water within a mocked up controlled radiological environment to simulate normal work conditions at KE Basin.

The cleaning fixture and/or water pressure and water flow may require adjustment if acceptance is not reached during the first test. The tests may be performed as many times as necessary to reach the expected results of removing 80% of the simulated contamination (dye coating) from the canisters in an effective and efficient manner. Each test re-test shall require a newly coated canister.

4.0 TEST CONDITION LIMITS

Personnel involved in these tests shall use, wear and employ required safety equipment and practices during the operation of the HPWJS and associated tools and equipment. Protective equipment shall be provided for the eyes, ears, face, head and feet.

At the start of each test and before starting the HPWJS, the Safety Checklist (Attachment A) will be completed by the Scientific Ecology Group (SEG) Technical Advisor after a walkdown of the system is completed to ensure and verify that tools and equipment are safe to operate.

TEST CONTROL COPY

Only trained and qualified personnel shall start-up and operate the HPWJS. During these tests, SEG personnel shall be present and provide overall technical direction for the set up of cleaning fixture and associated hardware. (See Section 10.2 for responsibilities)

The simulated coating material criteria is that 98% of the surfaces be coated with dye to simulate the contaminated surface.

5.0 INSTRUMENTS AND CALIBRATION

Pressure gauges are calibrated by the vendor prior to shipping. No other calibration is required.

6.0 FACILITIES, EQUIPMENT AND MATERIALS

6.1 FACILITIES

The 305 Cold Test Facility test basin will be utilized for the acceptance test program.

The HPWJS will provide water at the desired pressures and flow rate. The system can provide up to 15,000 psi with a flow rate of up to 15 gpm. The water jet skid will be located outside of the 305 building on the south east corner. Electrical service to the skid will be provided by a portable diesel generator unit connected directly to the motor control panel and grounded to a building ground. Feed water will be pumped from the test basin to the water jet pump through a 2 inch PVC line from an auxiliary feed pump. Electrical service to the feed pump will be provided via a control panel from the 480 volt, 3 phase outlet near the test basin. The high pressure hose will be run to and be discharged through a control valve and the fixtures and/or heads to the test basin. Bypass water and drains will be routed back to the basin.

A work station will be set up in the test basin on the east side at the 305 Cold Test Facility. The item to be cleaned will be placed into the test basin. A high pressure water jet nozzle with varying discharge pressures and flow rates will be directed at the surfaces to be cleaned through nozzles on the water jet fixtures. An assortment of tools and equipment will be utilized to lift, hold, place, position and manipulate canisters under water during cleaning activities. Additionally, mockups of the associated process equipment and tools may be set up separately (mocked up) to verify process flow and operability.

Any one of the following type canisters can be used for the acceptance test and shall be stained with dye to simulate surface contaminants: Mark 0, Mark I, and Mark II Fuel Storage Canisters. Both a stainless steel and aluminum canister shall be tested.

NOTE: The dye to be used is SLIDE ® Thin-line Layout Blue

3
TEST CONTROL COPY

6.2 EQUIPMENT SYSTEM DESCRIPTION

The HPWJS contains the following skid mounted components:

- Butterworth T375H, Model 615 ES Pump, 15,000 PSI @ 15 gpm
- Electric Motor, Model P44G00 - Reliance Electric, 150 HP, 460 Volts, 170 Amps, 3 Phase, 60 Hz
- Suction Surge Tank (Galvanized, 33 gal with stand, 0-160 psi Pressure Gauge
- Stainless Steel Filter Assembly (10 Micron, 42 g.p.m.)
- Discharge Pressure Control Vessel (rated 15,000 psi)
- Contactor/Starter - NEMA enclosure, 3R/4 $\frac{1}{2}$ ATL Starter with stand & conduit, full voltage, reduced voltage, low amperage draw, slow start

6.3 ACCESSORIES

The following accessories may be utilized in various combinations to direct and control the water flow from the HPWJS skid:

- High pressure hose .50 inch ID X 50 foot, 15,000 psi working pressure, 60,000 psi burst pressure, protective outer cover, 9/16 MP ends (4 hoses, total of 200 ft.)
- Hand held control gun 15,000 psi (shut off style) with 10 foot shielded hose and slimline fitting quick disconnect, 9/16 MP (15,000 psi)
- Foot control valve 15,000 psi (shut off style)

7.0 OPERATION PROCEDURE

The HPWJS Operating Procedure (SEG #HPWJOPR5.GA) and/or vendor manuals shall be used for operation of the HPWJS in support of these test activities.

- 7.1 A Job Hazard Analysis (JHA) form specific to these tests will be required in accordance with WHC-CM-4-3, Standard A-3. Existing JHAs may be applicable.
- 7.2 Applicable JHAs and Material Safety Data Sheets (MSDS) shall be posted or located in the 305 Cold Test Facility test area.
- 7.3 Test area personnel shall observe safety precautions outlined in the JHA and MSDS.

TEST CONTROL COPY

- In case of freezing conditions, drain water from all components.
- Only trained personnel should perform maintenance or repair.
- Prior to water jet cleaning, operate pump at low flow and low pressure (500 psi) to flush debris from system before attaching nozzle. Stop pump and relieve all pressure if adjustments are needed and prior to installing nozzle. If properly working, install nozzle, slowly increase flow and pressure until operating pressure is reached.
- Any protective shielding removed from high pressure tubing and hoses during servicing must be replaced when servicing is complete. Failure to replace shielding may result in serious injury to personnel or damage to the equipment.
- Check condition of all high pressure threads. Use Teflon tape only on male threads on low pressure pipe and fittings before connection. Do not let tape overlap and block end of tubing. Use "Never Seize" thread lubricant on high pressure pipe and fittings. Be sure there is a minimum engagement of four threads. Do not use pipe wrenches on high pressure pipe or fittings.
- Do not touch water coming from weep holes on fittings and parts with bare hands or try to stop the leakage by plugging the holes. Water coming from the weep holes is at high pressure and will cause injury by penetrating the skin.
- Do not alter products. Products should be used only as intended.
- Use only products intended for high pressure water jetting. Do not use damaged items. Inspect condition of all parts prior to use. Immediately inform test supervisor of any water or oil leakages. Failure to do so may result in equipment damage. A logbook will be kept by the operator of the HPWS concerning all breakdowns, repairs, or leaks. The log book will be located at or near the unit; it shall be reviewed and initialed at the end of each shift by the SEG Technical Advisor to ensure proper maintenance is performed.

8.0 MAINTENANCE AND FAILURES

WARNING!!
If malfunction occurs, immediately stop all water jet cleaning activity and relieve system pressure per the operating procedure. Follow manufacturer's repair instructions.

9.0 ACCEPTANCE TEST DATA

The acceptance test data shall be recorded for the effectiveness and rate of surface area cleaned at the associated flow and pressure for each of the identified simulated tests per section 11.0, Acceptance Test Execution.

10.0 PERSONNEL REQUIREMENTS

10.1 Qualifications/Training

Personnel performing these tests shall be trained and qualified by the HPWJS vendor representative or a vendor certified person for the safe start up, operation and shutdown of the HPWJS.

10.2 Responsibilities

10.2.1 Test Technician

The Test Technician (305 Facility Technician) is responsible for performing the physical hands on manipulation of tools and equipment and for general facility support.

10.2.2 WHC Test Engineer

The Test Engineer is responsible for ensuring that the test is performed per the Acceptance Test Procedure and shall sign off on the Test Data Sheets verifying that the test was performed, validated and acceptable.

10.2.3 SEG Technical Advisor

The SEG Technical Advisor(s) are responsible for the overall coordination of the special fixtures and equipment including interfacing with equipment vendors for SEG procured equipment. A major role is to ensure proper equipment set up and safe operation. Prior to the acceptance test he shall perform the Safety Checklist (Attachment A) of the system and complete the initial input to the Acceptance Test Data Sheet (Attachment B).

10.2.4 Quality Assurance

Witnessing by quality assurance/quality control (QA/QC) personnel shall be required for the validated test results; and shall be indicated by sign offs on Attachment B, Acceptance Test Data Sheet.

11.0 TEST EXECUTION

11.1 Safety Meeting

A pre-job safety meeting will be conducted with test personnel prior to starting acceptance testing.

11.2 Safety Walk Down

A Pre-test safety walk down will be performed by the SEG Technical Advisor prior to starting the acceptance test.

11.3 Water Jet Fixture Configuration

The water jet fixture design is the result of the development testing. Any adjustments and/or changes to the fixture during the acceptance testing shall be noted on an "as-built" drawing to identify the final acceptance test configuration.

11.4 Test Conduct

Testing shall be documented by recording acceptance test data. The Acceptance Test Data Sheet (Attachment B) will be utilized to record specific test information. The water jet fixture and associated support equipment configurations will be tested for process flow and compatibility with interfaces. The water pressures and flows for the test configuration along with nozzle size, type and arrangement shall be recorded. Manifolds, control valve type and hose arrangement will also be included and recorded in a sketch or an as-built drawing.

11.5 Set Up

The operations procedure for the HPWJS and/or vendor manual shall be utilized in conjunction with this acceptance test procedure. This skid mounted pump system provides water at various pressures and flow rates. The high pressure hose will be connected through a manifold to 2 foot control valves. High pressure hose/pipe will be connected to the under water jet cleaning fixtures from the foot control valves.

Special handling tools and equipment will be used for positioning and manipulating the canister through the cleaning jet fixture. These fixtures may be supported from the hand rail of the test basin. A crane or jib may be used to manipulate the canisters.

11.6 Scope

Test the effectiveness of fixtures configuration for cleaning the simulated surface contamination on a canister underwater. The test will be performed on at least one of both stainless steel and aluminum material type canisters.

TEST CONTROL COPY

12.0 TEST STEPS

The following test steps require QA/QC validation on the Acceptance Test Data Sheet (Attachment B):

- 12.1 Connect hoses and place the water jet fixture into the test basin work station.
- 12.2 Place the pre-coated canister into the test basin work station holder.
- 12.3 Start-up the HPWJS following the detailed steps in the HPWJS Operation Procedure.
- 12.4 Set the water pressure at the skid and control water flow to the fixture by operating the foot control valve(s).
- 12.5 Position and manipulate the canister and/or the water jet fixture until the item appears to be clean.
- 12.6 Record time, number of passes and pressure and flow rate for each test.
- 12.7 Remove the cleaned canister from the water and inspect.
- 12.8 Document level of "decontamination" on the Acceptance Test Data Sheet (Attachment B) percentage of paint/dye removed from the surface of the canister. Acceptance is removal of 80% of the dye.
- 12.9 Repeat steps 12.1 through 12.8 as necessary for each of the canister material type acceptance tests.

13.0 DISPOSITION OF DEBRIS ITEM

Save for reuse in future testing.

14.0 ACCEPTANCE DATA SHEETS

Data will be recorded on the Test Data Sheet. An SEG Technical Advisor is responsible for initially filling out the Test Data Sheet. It is the responsibility of the WHC Test Engineer to maintain the test records and a daily shift log of test activities.

A Test Data Sheet Index Log (Attachment C) shall also be maintained by the WHC Test Engineer starting with number 001.

TEST CONTROL COPY

ATTACHMENT A
SAFETY CHECKLIST

* SAFETY CHECK LIST *

FOR
HIGH PRESSURE WATER JETTING SYSTEMTest Log Number WHC-SD-SNF-
ATP-010-001Date 8-14-95 SEG Technical Advisor Donald KooserTIME: 11:30
INSPECTION PERFORMED BY: Donald Kooser

	YES	NO
1. Has the Pre-job briefing been completed?	☒	☐
2. Are personnel trained and qualified to operate the HPWJS?	☒	☐
3. Is personnel safety equipment available at the job site?	☒	☐
4. Have the work area and the skid area been roped off with proper signs posted?	☒	☐
5. Have precautions been taken to protect electrical equipment?	☒	☐
6. Is the area cleared of tripping hazards?	☒	☐
7. Is the operating pressure of the fittings greater than the planned test pressure?
(max test pressure is 15,000 psi)	☒	☐
8. Are all hoses, lances, guns and foot control valves rated for the maximum operating pressure?	☒	☐
9. Are all fittings, hoses, lances, guns and foot control valves in good working condition?	☒	☐
10. Is the feed water pump properly placed in the basin and connected to the pump skid and has it been flushed?	☒	☐
11. Has the filter and Y-strainer been checked for cleanness and is it in good operating condition?	☒	☐

	YES	NO
12. Are the skid drains, cooling water and dump water properly routed?	☒	☐
13. Are the safety shrouds on guns, valves and hoses?	☒	☐
14. Confirm electrical service connections are properly connected and power from the Portable Generator is available?	☒	☐
15. Have the high pressure hoses been flushed and all air removed prior to nozzle being installed?	☒	☐
16. Is the cooling water to the plungers operating properly?	☒	☐
17. Has the oil level been checked on the sight glass for the power end?	☒	☐
18. Has the Pressure Regulator been charged with nitrogen to the desired operating pressure?	☒	☐
19. Has hookup, including pipes, hoses and connections, been pressure tested with water at the maximum operating pressure?	☒	☐
20. Is the dump pressure regulator drain line connected properly?	☒	☐
21. Has Job site been examined for environmental considerations, with action as appropriate?	☒	☐
22. Are all control systems operational?	☒	☐

REMARKS:

ATTACHMENT B
ACCEPTANCE TEST DATA SHEET

ACCEPTANCE TEST DATA SHEET
HIGH PRESSURE WATER JET SYSTEMWHC-SD-SNF-ATP-010-
Test Log Number 001SAFETY WALK DOWN COMPLETED and PREPARED BY: Donald K... (Print)

Signature of SEG Technical Advisor

Date 8/14/95 Time 11:07 am
 Test Engineer Jeremy Crystal Test Technician Dennis Larson
 Test Debris Item Canister Material Type Aluminum
 Water Jet Fixture Configuration Number Canister Cleaning Fixture, S/N 1-7 (Attached)
 Nozzle Size and Type Inside: .047" Ø Tungsten Carbide 1.033" Ø Tungsten
 Control Valve Configuration See sketch, 2 foot pedals
 TEST DATA: SK-1-33488, Per G Attached
 Pressure 15,000 psi Flow Rate 15 g.p.m.
 Cleaning Time minutes Number of Passes

Test Objectives: Have the following test objectives have been met?

- * Clean surfaces with simulated contamination to ensure safety and efficient decontamination process. Yes No ✓
- * Demonstrate a controlled process for the decontamination of canisters, equipment, and miscellaneous materials underwater with minimal water surface disturbance. Yes ✓ No
- * Demonstrate the best combination of nozzle configuration, water pressure, water flow rate and cleaning speed to clean canisters as identified during the development testing. See WHC-SD-SNF-ATR-001, Rev. 0 N/A JEC 8/14/95
Development Test Report Yes No
- * Perform the acceptance testing for the most effective combinations of fixtures and nozzles as determined during the development testing. Yes No ✓

Acceptance Test Criterion:

The following acceptance test criterion has been met?

1. Removal of 80% of the simulate (dye coating) from the debris surface of each of the canisters. Yes No ✓
See remarks

Remarks on cleanness The canister cleaner did not perform as expected. Nozzle offset distance was suspected to be wrong.

Other Remarks The cleaning fixture was removed from the water and the nozzle to nozzle distance was measured at 13 1/2 inches. It is supposed to be 12". The nozzle distance will be corrected then retested.

Single Line Sketch of Fixture and Control Valve Arrangement or Drawing Number # See SK-1-33488 Attached.

Signatures

QC Witness (When required)

Date: 8/14/95

WHC Test Technician

Date:

WHC Test Engineer

Date: 8/14/95

ACCEPTANCE TEST DATA SHEET
HIGH PRESSURE WATER JET SYSTEM

Test Log Number _____

SAFETY WALK DOWN COMPLETED and PREPARED BY: _____ (Print)

Signature of SEG Technical Advisor _____

Date _____ Time _____
Test Engineer _____ Test Technician _____
Test Debris Item _____ Material Type _____
Water Jet Fixture Configuration Number _____
Nozzle Size and Type _____
Control Valve Configuration _____
TEST DATA:
Pressure _____ psi Flow Rate _____ g.p.m.
Cleaning Time _____ minutes Number of Passes _____

Test Objectives: Have the following test objectives have been met?

- * Clean surfaces with simulated contamination to ensure safety and efficient decontamination process. Yes ___ No ___
- * Demonstrate a controlled process for the decontamination of canisters, equipment, and miscellaneous materials underwater with minimal water surface disturbance. Yes ___ No ___
- * Demonstrate the best combination of nozzle configuration, water pressure, water flow rate and cleaning speed to clean canisters as identified during the development testing. Yes ___ No ___
- * Perform the acceptance testing for the most effective combinations of fixtures and nozzles as determined during the development testing. Yes ___ No ___

Acceptance Test Criterion:

The following acceptance test criterion has been met?

1. Removal of 80% of the simulate (dye coating) from the debris surface of each of the canisters. Yes ___ No ___

Remarks on cleanness _____

Other Remarks _____

Single Line Sketch of Fixture and Control Valve Arrangement or Drawing
Number # _____

Signatures	
QC Witness (When required)	Date:
WHC Test Technician	Date:
WHC Test Engineer	Date:

ACCEPTANCE TEST DATA SHEET
HIGH PRESSURE WATER JET SYSTEM Test Log Number _____

SAFETY WALK DOWN COMPLETED and PREPARED BY: _____ (Print)

Signature of SEG Technical Advisor _____

Date _____ Time _____
Test Engineer _____ Test Technician _____
Test Debris Item _____ Material Type _____
Water Jet Fixture Configuration Number _____
Nozzle Size and Type _____
Control Valve Configuration _____
TEST DATA:
Pressure _____ psi Flow Rate _____ g.p.m.
Cleaning Time _____ minutes Number of Passes _____

Test Objectives: Have the following test objectives have been met?

- * Clean surfaces with simulated contamination to ensure safety and efficient decontamination process. Yes ___ No ___
- * Demonstrate a controlled process for the decontamination of canisters, equipment, and miscellaneous materials underwater with minimal water surface disturbance. Yes ___ No ___
- * Demonstrate the best combination of nozzle configuration, water pressure, water flow rate and cleaning speed to clean canisters as identified during the development testing. Yes ___ No ___
- * Perform the acceptance testing for the most effective combinations of fixtures and nozzles as determined during the development testing. Yes ___ No ___

Acceptance Test Criterion:

The following acceptance test criterion has been met?

1. Removal of 80% of the simulate (dye coating) from the debris surface of each of the canisters. Yes ___ No ___

Remarks on cleanness _____

Other Remarks _____

Single Line Sketch of Fixture and Control Valve Arrangement or Drawing
Number # _____

Signatures

QC Witness (When required)

Date:

WHC Test Technician

Date:

WHC Test Engineer

Date:

ACCEPTANCE TEST DATA SHEET
HIGH PRESSURE WATER JET SYSTEM

Test Log Number _____

SAFETY WALK DOWN COMPLETED and PREPARED BY: _____ (Print)

Signature of SEG Technical Advisor _____

Date _____ Time _____
Test Engineer _____ Test Technician _____
Test Debris Item _____ Material Type _____
Water Jet Fixture Configuration Number _____
Nozzle Size and Type _____
Control Valve Configuration _____
TEST DATA:
Pressure _____ psi Flow Rate _____ g.p.m.
Cleaning Time _____ minutes Number of Passes _____

Test Objectives: Have the following test objectives have been met?

- * Clean surfaces with simulated contamination to ensure safety and efficient decontamination process. Yes ___ No ___
- * Demonstrate a controlled process for the decontamination of canisters, equipment, and miscellaneous materials underwater with minimal water surface disturbance. Yes ___ No ___
- * Demonstrate the best combination of nozzle configuration, water pressure, water flow rate and cleaning speed to clean canisters as identified during the development testing. Yes ___ No ___
- * Perform the acceptance testing for the most effective combinations of fixtures and nozzles as determined during the development testing. Yes ___ No ___

Acceptance Test Criterion:

The following acceptance test criterion has been met?

1. Removal of 80% of the simulate (dye coating) from the debris surface of each of the canisters. Yes ___ No ___

Remarks on cleanness _____

Other Remarks _____

Single Line Sketch of Fixture and Control Valve Arrangement or Drawing
Number # _____

Signatures

QC Witness (When required)

Date:

WHC Test Technician

Date:

WHC Test Engineer

Date:

ATTACHMENT C
* ACCEPTANCE TEST DATA SHEET INDEX LOG *

Test Log Number	Date	Test Engineer
001		
002		
003		
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020		
021

GENERAL NOTES: (1) SEE REVERSE SIDE

1. ALL HOSES ARE FITTED WITH FM-200 CONNECTIONS.
2. FIELD WHITE PICKING CRANES TO BASIN W/O UT LQUID
TANKS. MINIMUM HOSE SIZE 1 1/2"
3. ALL HOSES ARE 10' LONG
4. ALL 1 1/2" HOSE 1/7" O.D. 20,000 PSI WORKING
PRESSURE. 10' LONG HOSES AND 1/4" T
PREDICTIVE COVER AND 1/4" T THREADED ENDS.

[illegible]

TEST CONTROL COPY