~~XXXX~~ RMIS View/Print Document Cover Sheet ~~XXXX~~

This document was retrieved from the Boeing ISEARCH System.

Accession #: D196050157

Document #: SD-SNF-DTR-001

Title/Desc:

DEVELOPMENT TEST REPORT FOR THE HIGH PRESSURE
WATER JET SYSTEM NOZZLES

Sta. 4

3

SEP 28 1995

ENGINEERING DATA TRANSMITTAL

Page 1 of 1

1. EDT 140380

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.: Spent Nuclear Fuel	6. Cog. Engr.: J. B. Crystal	7. Purchase Order No.: N/A
8. Originator Remarks: For Release		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: 105-KE
11. Receiver Remarks:		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: N/A

15. DATA TRANSMITTED					(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Approval Designator	Reason for Transmittal	Originator Disposition	Receiver Disposition
1	WHC-SD-SNF-DTR-001, Rev. 0	ALL	0	Development Test Report for the High Pressure Water Jet System Nozzles	N/A	2	1	

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)	(H)
Reason	Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	Reason	Disp.
1	1	Cog. Eng. J. B. Crystal	<i>J. B. Crystal</i>	9/11/95	X3-85	M. J. Schliebe	<i>M. J. Schliebe</i>	9/11/95	L6-13	1	1
1	1	Team Leader D. S. Takasumi	<i>D. S. Takasumi</i>	9/11/95	X3-85	M. J. Wiemers	<i>M. J. Wiemers</i>	9/11/95	X3-85	3	
3		SNF Project File			R3-11	M. J. Langevin			X3-74	3	
3		J. R. Burdin			R3-48	J. G. Wagner			R3-48	3	

18. <i>J. B. Crystal</i> J. B. Crystal Signature of EDT Originator 9/11/95 Date	19. <i>D. S. Takasumi</i> D. S. Takasumi Authorized Representative for Receiving Organization 9/21/95 Date	20. <i>D. S. Takasumi</i> D. S. Takasumi Cognizant Manager 9/21/95 Date	21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments
---	--	---	---

THIS PAGE INTENTIONALLY
LEFT BLANK

RELEASE AUTHORIZATION

Document Number: WHC-SD-SNF-DTR-001, REV 0

Document Title: Development Test Report for the High Pressure Water Jet System Nozzles

Release Date: 9/28/95

**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 Broz

9/28/95

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy. Available in paper copy. Printed in the United States of America. To obtain copies of this report, contact:

Westinghouse Hanford Company - Document Control Services
P.O. Box 1970, Mailstop H6-08, Richland, WA 99352
Telephone: (509) 372-2420; Fax: (509) 376-4989

**THIS PAGE INTENTIONALLY
LEFT BLANK**

SUPPORTING DOCUMENT

1. Total Pages 81

2. Title

Development Test Report for the High Pressure
Water Jet System Nozzles

3. Number

WHC-SD-SNF-DTR-001

4. Rev No.

0

5. Key Words

HPWJS
High Pressure Water Jet System
Nozzles
K-Basin
Canister Cleaning
Debris Removal
Canister Decontamination

6. Author

Name: Jared Burdin

Signature

Organization/Charge Code

2G000/LD24C

7. Abstract

The high pressure water jet nozzle tests were conducted to identify optimum water pressure, water flow rate, nozzle orifice size and fixture configuration needed to effectively decontaminate empty fuel storage canisters in KE-Basin. This report gives the tests results and recommendations from the these tests.

8.

RELEASE STAMP

OFFICIAL RELEASE
BY WHC

DATE SEP 28 1995

Sta. 4

THIS PAGE INTENTIONALLY
LEFT BLANK

CONTENTS

	<u>Page</u>
RECOMMENDATIONS	ii
1.0 INTRODUCTION	1
2.0 TEST DESCRIPTION.	2
3.0 TEST RESULTS	3
4.0 CONCLUSIONS AND RECOMMENDATIONS	7
5.0 DISPOSITION OF TEST ITEMS	8
6.0 REFERENCES	9
APPENDIX I - DEVELOPMENT TEST DATA SHEETS AND LOG	I-1
APPENDIX II - DEVELOPMENT TEST PLAN	II-1
APPENDIX III - STONEAGE RJV3 ROTARY WATERBLAST NOZZLES OPERATOR'S MANUAL	III-1

DEVELOPMENT TEST REPORT
FOR THE HIGH PRESSURE
WATER JET SYSTEM NOZZLES

RECOMMENDATIONS

The high pressure water jet nozzles should be configured for Acceptance Testing for use at the K-Basins as follows:

- Interior decontamination of a fuel storage canister, use two (2) Stoneage .047"/15° (1.1938mm/15°) nozzles delivering 7.5gpm/nozzle (28.3875lpm/nozzle) with a water pressure of 15,000psi (103,425kPa), ½" (1.27cm) nozzle offset distance from the surface of the canister, and an O'Connell "T" nozzle spin fixture.
- Exterior decontamination of a fuel storage canister, use four (4) N.L.B. (National Liquid Blaster) .033"/0° (0.8382mm/0°) nozzles delivering 3.6gpm/nozzle (13.626lpm/nozzle) with a water pressure of 15,000psi (103,425kPa), 2" (5.08cm) nozzle offset distance from the surface of the canister, and two (2) Stoneage RJV3, Model 15K, Rotary Nozzle Heads, 180° apart.
- Canister elevation for decontamination is (-)12'-9" (-3.89m), based on a top of grating elevation of 0'-0" (0m). This places the top of the canister eight feet below the water surface.

**DEVELOPMENT TEST REPORT
FOR THE HIGH PRESSURE
WATER JET SYSTEM NOZZLES**

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 various high pressure water jet nozzles, to be used in the decontamination of empty fuel storage canisters in KE-Basin. The high pressure water jet nozzle tests were conducted to identify optimum water pressure, water flow rate, nozzle orifice size and fixture configuration needed to effectively decontaminate empty fuel storage canisters in KE-Basin. Testing was conducted in accordance with References 1 and 2. Testing occurred from April 17 through May 31, 1995, at the Cold Test Facility in the ETL; Building 305 in the 300 Area.

Results of these tests will be incorporated into the design of the Canister Cleaning Fixture, which will undergo Acceptance Testing at the Cold Test Facility in the ETL prior to use at K-Basins.

The test basin dimensions are 4.6m wide x 18.5m long x 4.6m deep (15' x 60' x 15') and the basin contains approximately 390 m³ (100,000 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. The simulant was applied to the fuel storage canisters and allowed to dry under normal building temperatures, 70°F +10°F/-5°F (21.1°C +5.56°C/-2.78°C), for 24 hours prior to removal with the high pressure water jet system.

The canisters were placed 16ft (4.88m) underwater in the ETL Cold Test Facility basin. Different water pressures, water flow rates, nozzle orifice size and fixture configurations were tested. Nozzle distances, from the canister surface, varied from $\frac{1}{2}$ " to 2" (1.27cm-5.08cm) on the inside and 1" to 3" (2.54cm-7.62cm) on the outside. Sketches of the test setup are included in each test log, which are included in Appendix I. For testing, Stoneage nozzles were used in a Stoneage Spin Head for interior cleaning and N.L.B. nozzles were used in two (2) N.L.B. Spin Tips for exterior cleaning. Technical direction for testing was provided by SEG qualified high pressure water jet personnel.

Due to a redefinition of project priorities and schedule, between the preparation of Reference 2 and the completion of this test, debris other than fuel canisters were specifically excluded from these tests.

A series of tests were conducted using the selected nozzle configurations to determine the minimum water depth where canister cleaning could be performed without significantly disturbing the water surface. The water disturbance was subjectively evaluated, by the testing personnel, for water and canister clarity.

Stoneage nozzles and spin heads were purchased from D. E. O'Connell & Associates (800-320-4848). N.L.B. nozzles and spin heads were purchased from N.L.B. (810-624-5555).

3.0 TEST RESULTS

Various water pressures, 13,000-15,000psi (89,635-103,425lpm/nozzle), water flow rates, 3.4-7.5gpm/nozzle (12.869-28.3875lpm/nozzle), and nozzle configurations removed the simulant from the canister surface. The simulant was removed from 85% of the canister without causing damage to the canister. In most cases, the high pressure jet washing was very effective and productive, with productivity defined as the quickest removal of the simulant. Therefore, the testing concentrated on finding the combination of the above parameters which resulted in the shortest decontamination times.

Twenty-three different tests were conducted and documented on test data sheets, which are included in Appendix I.

CANISTER DECONTAMINATION - INTERIOR

Fourteen tests were conducted to determine the optimum configuration for the decontamination of the fuel canister interior. Table 1 summarizes the results of these tests. The following configuration listed on Test Log #10 was selected for the Acceptance Test:

Stoneage .047"/15° (1.1938mm/15°) nozzles, offset ½" (1.27cm) from the canister surface, 7.5gpm/nozzle (28.3875lpm/nozzle) at an operating pressure of 14,000psi (96,530kPa).

CANISTER DECONTAMINATION - EXTERIOR

Nine tests were conducted to determine the optimum configuration for the decontamination of the fuel canister exterior. Table 2 summarizes the results of these tests. The following configuration listed on Test Log #20 was selected for the Acceptance Test:

N.L.B. .033"/0° (0.8382mm/0°) nozzles, located 180° apart, offset 2" (5.08cm) from the canister surface, 3.6gpm/nozzle (13.626lpm/nozzle) at an operating pressure of 15,000psi (103,425 kPa).

NOTE

Upon completion of the tests, and during the design of the Canister Cleaning Fixture, SEG contacted D. E. O'Connell and Associates to determine if these results could be improved. As a result of these discussions, O'Connell fabricated a "T" nozzle spin fixture for interior cleaning. The "T" spin fixture is a Stoneage RJV3, Model 15K, Rotary Nozzle body with a specially designed and fabricated "T" nozzle. Subsequent testing indicated that the "T" nozzle improved performance and would be used during Acceptance Testing. Test Results for the "T" nozzle spin head will be provided as part of the Acceptance Test Report.

In addition Stoneage RJV3, Model 15K, Rotary Nozzles were purchased for exterior cleaning. During subsequent testing, it was decided to substitute the Stoneage Spin Heads for the N.L.B. Spin Heads. The primary advantage to the Stoneage Spin Heads is a smaller guard which allows the cleaning fixture to be maneuvered closer to the center trunnions thereby increasing the

external surface area which is cleaned. Test Results for these spin heads will be provided as part of the Acceptance Test Report.

WATER DEPTH

The minimum depth at which canister cleaning operations may be conducted is governed by the water surface disturbances generated when cleaning the inside of a solid bottom canister.

The depth selected for canister placement during Acceptance Testing is (-)12'-9" (-3.89m), where the top of canister is eight feet (2.44m) below water surface. This location is based on a grating elevation of 0'-0" (0m) and provides a balance between disturbances at the surface of the water during cleaning and the length of the cleaning fixture. Surface disturbance was evaluated subjectively, by the test performer(s), for water and canister clarity.

Table 1

CANISTER INTERIOR								
Test Log Number	Number of Nozzles	Nozzle Size and Type*	Nozzle Brand	Canister Offset (inches)	Water Pressure (psi)	Water Flow Rate (gpm)**	Cleaning Time (min)	Test Remarks
001	6	.021/15°	Stoneage	2½	15000	1.22	1½	NE
002	4	.036/15°	Stoneage	½	14000	3.79	1½	NE
003	2	.047/15°	Stoneage	½	14000	7.50	1	VE
004	4	.043/15° & .028/15°	Stoneage	½	13000	Varied	1	NE
005	2	.047/15°	Stoneage	½	13000	6.75	1	VE
006	2	.041/15°	Stoneage	½	15000	5.76	1	VE
007	2	.047/15°	Stoneage	½	14000	7.18	1	VE
008	6	.027/0°	Stoneage	½	15000	2.44	1	NE
009	4	.036/0°	Stoneage	½	13000	3.65	1	NE
010	2	.047/15°	Stoneage	½	14000	7.45	1	VE
011	4	.043/15° & .020/15°	Stoneage	½	14500	Varied	1	E
012	2	.047/0°	Stoneage	½	15000	7.50	1	NE
022	2	.047/0°	Stoneage	½	15000	7.50	2	NE
023	2	.047/15°	Stoneage	½	15000	7.50	1	E

* Orifice diameter (inches)/Fan angle, 0° denotes straight nozzle

** Water flow from each nozzle, for total flow rate multiply flow rate by number of nozzles

E - Effective, NE - Not Effective, VE - Very Effective (This is based on # of passes needed for cleaning.)

Table 2

CANISTER EXTERIOR								
Test Log Number	Nozzle Size and Type*	Nozzle Brand	Canister Offset (inches)	Water Pressure (psi)	Water Flow Rate (gpm)**	Tip to Tip (inches)	Cleaning Time (min)	Test Remarks
013	.042/15°	N.L.B.	1	8500	12.0	10½	6	NE
014	.035/15°	N.L.B.	1½	13000	14.6	11½	2-3	E/NE
015	.035/15°	N.L.B.	2	13000	14.6	12	3-4	E
016	.035/15°	N.L.B.	2½	13000	14.6	12½	4-5	E
017	.035/15°	N.L.B.	3	13000	14.6	13	5-7	E
018	.032/0°	N.L.B.	2½	14750	13.6	12½	2-3	E
019	.032/0°	N.L.B.	2	15000	13.6	12	2-3	E
020	.033/0°	N.L.B.	2	15000	14.4	12	2-3	VE
021	.032/0°	N.L.B.	2	15000	13.6	12	2-3	E

* Orifice diameter (inches)/Fan angle, 0° denotes straight nozzle

** Total for four Nozzle Tips

E - Effective, NE - Not Effective, VE - Very Effective (This is based on # of passes needed for cleaning.)

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the test results, the optimum operating pressure for canister cleaning is 15,000psi (103,425kPa). While it was noted that the exterior could be cleaned sufficiently at 13,000psi (89,635kPa) to meet the acceptance criteria, 15,000psi (103,425kPa) produced the best cleaning test results. The interior of the canister required 14,000 psi (96,530kPa) for acceptable cleaning, but 15,000psi (103,425kPa) will be used.

The advantages of operating continuously at the higher pressure, 15,000psi (103,425kPa), are:

- It simplifies the operating procedure by not requiring multiple pressure settings,
- It reduces wear on the flow and pressure regulating valves and
- It does not induce excessive wear on the high pressure components.

CANISTER DECONTAMINATION - INTERIOR

SEG recommends using 15,000psi (103,425kPa) water pressure with Stoneage .047"/15° (1.1938mm/15°) nozzles delivering 7.5gpm/nozzle (28.3875lpm/nozzle) for interior decontamination of a fuel storage canister. Nozzle offset distance from the surface of canister should be ½" (1.27cm). Using the O'Connell "T" nozzle spin fixture would be the most effective and productive setup.

CANISTER DECONTAMINATION - EXTERIOR

SEG recommends using 15,000psi (103,425kPa) water pressure with N.L.B. .033"/0° (0.8382mm/0°) nozzles delivering 3.6gpm/nozzle (13.626lpm/nozzle) for exterior decontamination of a fuel storage canister. Nozzle offset distance should be 2" (5.08cm) from the surface of canister. Using two (2) Stoneage RJV3, Model 15K, Rotary Nozzle Heads, 180° apart, would be the most effective and productive setup.

5.0 DISPOSITION OF TEST ITEMS

The high pressure water jet nozzles may remain at the Cold Test Facility in the ETL until acceptance testing and training of the Canister Cleaning Fixture is complete.

~~THIS PAGE INTENTIONALLY~~
~~LEFT BLANK~~ *3w 3/19/06*

6.0 REFERENCES

1. WHC-SD-SNF-TP-001, Revision 0, *K-Basins Debris Removal Equipment Test Plan*, Westinghouse Hanford Company, Richland, Washington.
2. WHC-SD-SNF-TC-004, Revision 0, *Development Test Procedure for High Pressure Water Jet System*, Westinghouse Hanford Company, Richland, Washington.

THIS PAGE INTENTIONALLY
LEFT BLANK

APPENDIX I
DEVELOPMENT TEST DATA SHEETS AND LOG

**THIS PAGE INTENTIONALLY
LEFT BLANK**

WMC-SD-SNF-DTR-001, Rev. 0

* TEST DATA SHEET INDEX LOG * I-2
DEVELOPMENT TESTING

Test Log Number	Date	Test Engineer
001	5/25/95	Donald Koser
002	5/25/95	Donald Koser
003	5/25/95	Donald Koser
004	5/25/95	Donald Koser
005	5/25/95	Donald Koser
006	5/25/95	Donald Koser
007	5/25/95	Donald Koser
008	5/25/95	Donald Koser
009	5/25/95	Donald Koser
010	5/25/95	Donald Koser
011	5/25/95	Donald Koser
012	5/25/95	Donald Koser
013	5/25/95	Donald Koser
014	5/25/95	Donald Koser
015	5/25/95	Donald Koser
016	5/25/95	Donald Koser
017	5/25/95	Donald Koser
018	5/25/95	Donald Koser
019	5/25/95	Donald Koser
020	5/25/95	Donald Koser
021	5/25/95	Donald Koser
022	5/25/95	Donald Koser
023	5/25/95	Donald Koser

Test Log Number 001

SAFETY WALK DOWN COMPLETED Donald Koenig
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Kooser Test Technician Dennis Larsen
 Test Item Fuel Canister Inside
 Material Type Alum.
 Water Jet Fixture Configuration Number 6 Nozzles 2 Top, 2 Side, 2 Bottom
 Nozzle Size and Type .021/15° Fan
 Control Valve Configuration Full Open 15,000 PSI @ 7.2 gpm

Pressure 15,000 psi Flow 1.2 gpm
Cleaning Time 1.5 minutes Number of Passes 6

Remarks On Cleanliness Nozzles Not Effective

Other Remarks Nozzle 2.5" from wall of Canister
Crane Speed to Fast
Spin Head to Slow
Heavy Oil in Spin Head Slows R.P.M.

Stoneage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<i>Arthur W. Fleming</i>	
Test Technician (305 Bldg.)	<i>OC Larson</i>	
SEG Technical Advisor	<i>Ronald Kasper</i>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

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

Date _____ Time _____
Test Engineer Donald Kooser Test Technician Dennis Larson
Test Item Fuel Canister Inside
Material Type Alum
Water Jet Fixture Configuration Number 4 Nozzles 1 Top, 2 Side, 1 Bottom
Nozzle Size and Type .036/15° Fan
Control Valve Configuration Full Open 14 1000 PSI 15 gpm

Pressure OK 14 100 psi Flow 3.79 gpm
Cleaning Time 1.5 minutes Number of Passes 4

Remarks On Cleaness Nozzles Not Effective

Other Remarks Nozzles .5" from wall of Canister
Crane Speed to fast
Spin Head to Slow
Heavy Oil in Spin Head Slows R.P.M.
Striping
Stoneage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. Fleming</u>	
Test Technician (305 Bldg.)	<u>D.C. Larson</u>	
SEG Technical Advisor	<u>Donald Kooser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 003PREPARED BY: Donald Keeser (Print)SAFETY WALK DOWN COMPLETED Donald Keeser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Keeser Test Technician Dennis Larson
 Test Item Fuel Canister Inside
 Material Type Alum.
 Water Jet Fixture Configuration Number 2 Nozzles Side
 Nozzle Size and Type .047/15° Fan
 Control Valve Configuration Full Open 14,000 psi 15 gpm

Pressure 14,000 psi Flow 2.5 gpm
 Cleaning Time 1 minutes Number of Passes 2

Remarks On Cleanness Nozzles Very Effective

Other Remarks Nozzles .5" from wall of Canister
Crane speed a little fast
Spin Head a little slow
Heavy Oil in spin head slows R.P.M.

Stoneage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W.D. Denning</u>	
Test Technician (305 Bldg.)	<u>D. Larson</u>	
SEG Technical Advisor	<u>Donald Keeser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 004PREPARED BY: Donald Keaser (Print)SAFETY WALK DOWN COMPLETED Donald Keaser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Keaser Test Technician Dennis Larson
 Test Item Fuel Canister Inside
 Material Type Alum.
 Water Jet Fixture Configuration Number 4 Nozzles 1 Top / 2 Side / 1 Bottom
 Nozzle Size and Type .043/15° .028/15° .028/.042/.028
 Control Valve Configuration Full Open 13,000 PSI, 15gpm

Pressure 13,000 psi Flow 2x 5.36, 2x 2.20 gpm
 Cleaning Time 1 minutes Number of Passes 4

Remarks On Cleanliness Not Very Effective

Other Remarks Nozzles .5" from wall of Canister
Crane Speed to Fast
Spin Head to Slow
Heavy Oil in Spin Head Slow R.P.M.

Stoneage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. E. Elving</u>	
Test Technician (305 Bldg.)	<u>D. Larson</u>	
SEG Technical Advisor	<u>Donald Keaser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 005PREPARED BY: Donald Kooser (Print)SAFETY WALK DOWN COMPLETED Donald Kooser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Kooser Test Technician Dennis Larson
 Test Item Fuel Canister Inside
 Material Type Alum
 Water Jet Fixture Configuration Number 2 Nozzles Side
 Nozzle Size and Type 047/15°
 Control Valve Configuration Full Open 13,000 psi, 15 gpm

Pressure 13,000 psi Flow 6.75 gpm
 Cleaning Time 1 minutes Number of Passes 4

Remarks On Cleaness Very Effective

Other Remarks OK Nozzles .5" from wall of canister
Crane speed a little fast
Spin head speed good
Light oil in spin head fast R.P.M.

Storage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>Arthur N. Fleming</u>	
Test Technician (305 Bldg.)	<u>DC Larson</u>	
SEG Technical Advisor	<u>Donald Kooser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 006PREPARED BY: Donald Kasser (Print)SAFETY WALK DOWN COMPLETED Donald Kasser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Kasser Test Technician Dennis Larson
 Test Item Fuel Canister Inside
 Material Type Alum
 Water Jet Fixture Configuration Number 2 Nozzles Side
 Nozzle Size and Type .041/15°
 Control Valve Configuration Full Open 15,000 psi, 11 gpm

Pressure 15,000 psi Flow 5.76 gpm
 Cleaning Time 1 minutes Number of Passes 4

Remarks On Cleanliness Very Effective

Other Remarks Nozzle .5" from wall of canister
Crane speed a little fast
Spin head speed good
Light oil in spin head fast R.A.M.

Storage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. R. Riving</u>	
Test Technician (305 Bldg.)	<u>D. Larson</u>	
SEG Technical Advisor	<u>Donald Kasser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 007PREPARED BY: Donald Kaaser (Print)SAFETY WALK DOWN COMPLETED Donald Kaaser
Signature of SEG Technical Advisor

Date _____ Time _____
Test Engineer Donald Kaaser Test Technician Dennis Larson
Test Item Fuel Canister Inside
Material Type Alum
Water Jet Fixture Configuration Number 2 Nozzle Bottom
Nozzle Size and Type 047/15°
Control Valve Configuration Full Open 14,000 psi, 15 gpm

Pressure 14,000 psi Flow 2.8 gpm
Cleaning Time 1 minutes Number of Passes 4 passes

Remarks On Cleanliness Excellent, Very Effective

Other Remarks Nozzle .5" from wall of canister
Crane Speed Good
Spin Head Speed Good
Light oil in spin head fast R.P.M.

Stoneage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>John J. Dering</u>	
Test Technician (305 Bldg.)	<u>D C Larson</u>	
SEG Technical Advisor	<u>Donald Kaaser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 008PREPARED BY: Donald Kooser (Print)SAFETY WALK DOWN COMPLETED Donald Kooser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Kooser Test Technician Dennis Larson
 Test Item Fuel Canister Inside
 Material Type Alum
 Water Jet Fixture Configuration Number 6 Nozzles 2 Top, 2 Side, 2 Bottom
 Nozzle Size and Type 027/0°
 Control Valve Configuration Full Open 15,000 psi, 15 gpm

Pressure 15,000 psi Flow 2.44 gpm
 Cleaning Time 1 minutes Number of Passes 4

Remarks On Cleanness Not Very Effective

Other Remarks Nozzles .5" from wall of canister
Crane speed to fast
Spin tip to slow
Heavy Oil

Stoneage Spin Head. O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. Flinn</u>	
Test Technician (305 Bldg.)	<u>D. Larson</u>	
SEG Technical Advisor	<u>Donald Kooser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 009PREPARED BY: Donald Keaser (Print)SAFETY WALK DOWN COMPLETED Donald Keaser
Signature of SEG Technical Advisor

Date _____ Time _____
Test Engineer Donald Keaser Test Technician Dennis Larson
Test Item Fuel Canister Inside
Material Type Alum.
Water Jet Fixture Configuration Number 4 Nozzles 1 Top 2 Side 1 Bottom
Nozzle Size and Type .036/0°
Control Valve Configuration Full Open 13,000 psi 15 gpm

Pressure 13,000 psi Flow 3.65 gpm
Cleaning Time 1 minutes Number of Passes 4 passes

Remarks On Cleaness Not Effective

Other Remarks Nozzles .5" from wall of canister
Crane Speed to Fast
Stripping
Heavy Oil

Storage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. H. Fleming</u>	
Test Technician (305 Bldg.)	<u>D. C. Larson</u>	
SEG Technical Advisor	<u>Donald Keaser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 010PREPARED BY: Donald Keiser (Print)SAFETY WALK DOWN COMPLETED Donald Keiser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Keiser Test Technician Dennis Larsen
 Test Item Fuel Canister Inside
 Material Type Alum
 Water Jet Fixture Configuration Number 2 Nozzles Side
 Nozzle Size and Type .047/0°
 Control Valve Configuration Full Open 14,000 psi 15 gpm

Pressure 14,000 psi Flow 2.45 gpm
 Cleaning Time 1 minutes Number of Passes 4 passes

Remarks On Cleanliness Very Effective

Other Remarks Nozzles .5" from wall of canister
Scane Little Fast
Spin Head Little Slow
Heavy Oil

Stoneage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. Dennis</u>	
Test Technician (305 Bldg.)	<u>D. C. Larsen</u>	
SEG Technical Advisor	<u>Donald Keiser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 011PREPARED BY: Donald Kooser (Print)SAFETY WALK DOWN COMPLETED Donald Kooser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Kooser Test Technician Dennis Larson
 Test Item Fuel Canister Inside
 Material Type Alum.
 Water Jet Fixture Configuration Number 4 Nozzles 2 Side 2 Bottom
 Nozzle Size and Type .043/0° .020/0°
 Control Valve Configuration Full Open 14500 psi 14 gpm

Pressure 14500 psi Flow 2X 1.22
 Cleaning Time 1 minutes Number of Passes 2
 Flow 2X 5.76 gpm

Remarks On Cleanliness Effective

Other Remarks Nozzles .5" from wall of Canister
Crane speed little fast
Spin Head little slow
~~Heavy Oil in Spin Head from P.A. MOK~~
Light Oil in Spin Head fast R.P.M.
Stoneage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>William W. Quinn</u>	
Test Technician (305 Bldg.)	<u>D. C. Larson</u>	
SEG Technical Advisor	<u>Donald Kooser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 012PREPARED BY: Donald Kasser (Print)SAFETY WALK DOWN COMPLETED Donald Kasser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Kasser Test Technician Dennis Larson
 Test Item Fuel Canister Inside
 Material Type Alum.
 Water Jet Fixture Configuration Number 2 Nozzles Side
 Nozzle Size and Type .047/0° 15,000 psi 15 gpm
 Control Valve Configuration Full Open

Pressure 15,000 psi Flow 2x7.5 gpm
 Cleaning Time 1 minutes Number of Passes 4

Remarks On Cleaness Not Very Effective

Other Remarks Nozzles .5" from wall of Canister
Crane speed to fast
Spin Head to Slow
Heavy Oil in Spin Head Slow R.P.M.

Stoneage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W.F. Dunning</u>	
Test Technician (305 Bldg.)	<u>D. Larson</u>	
SEG Technical Advisor	<u>Donald Kasser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 013PREPARED BY: Donald Kasser (Print)SAFETY WALK DOWN COMPLETED Donald Kasser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Kasser Test Technician Dennis Larson
 Test Item Fuel Canister Outside
 Material Type Alum.
 Water Jet Fixture Configuration Number 4 Nozzles
 Nozzle Size and Type .042/15°
 Control Valve Configuration Full Oper 8500 psi 12gpm

Pressure 8500 psi Flow 4x 3.0 gpm
 Cleaning Time 6 minutes Number of Passes 2

Remarks On Cleaness Not Effective

Other Remarks Nozzles at 1" from wall of Canister
Cleaning Pattern 2"
5 to 7 min. per cylinder
N.L.B. Spin Tips

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. Priney</u>	
Test Technician (305 Bldg.)	<u>D C Larson</u>	
SEG Technical Advisor	<u>Donald Kasser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 014PREPARED BY: Donald Kasser (Print)SAFETY WALK DOWN COMPLETED Donald Kasser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Kasser Test Technician Dennis Larson
 Test Item Fuel Canister Outside
 Material Type Alum.
 Water Jet Fixture Configuration Number 4 Nozzles
 Nozzle Size and Type 0.35" / 15°
 Control Valve Configuration Full Open 13,000 psi 14.62 gpm

Pressure 13,000 psi Flow 14.62 gpm
 Cleaning Time 2 to 3 minutes Number of Passes 2

Remarks On Cleaness Effective but not efficient

Other Remarks Nozzles 1.5" from wall of Canister
Cleaning Pattern 2"
2 to 3 min per cylinder
1/2" Spin Tips

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. Fleming</u>	
Test Technician (305 Bldg.)	<u>D. Larson</u>	
SEG Technical Advisor	<u>Donald Kasser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 015PREPARED BY: Donald Kasser (Print)SAFETY WALK DOWN COMPLETED Donald Kasser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Kasser Test Technician Dennis Larson
 Test Item Fuel Canister Outside
 Material Type Alum.
 Water Jet Fixture Configuration Number 4 Nozzles
 Nozzle Size and Type .036/15°
 Control Valve Configuration Full Open 13,000 psi 14.62 gpm.

Pressure 13,000 psi Flow 14.62 gpm
 Cleaning Time 3 to 4 minutes Number of Passes 2

Remarks On Cleanness DKS-3045 Effective

Other Remarks Nozzles 2" from wall of Canister
Cleaning Pattern 2.5"
3 to 4 min. per cylinder
N.L.B. Spin tips

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. C. Davis</u>	
Test Technician (305 Bldg.)	<u>D. C. Larson</u>	
SEG Technical Advisor	<u>Donald Kasser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 016PREPARED BY: Donald Keeser (Print)SAFETY WALK DOWN COMPLETED Donald Keeser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Keeser Test Technician Dennis Larson
 Test Item Fuel Canister Outside
 Material Type Alum.
 Water Jet Fixture Configuration Number 4 Nozzles
 Nozzle Size and Type .036/15°
 Control Valve Configuration Full Open 13,000 psi 14.62 gpm

Pressure 13,000 psi Flow 14.62 gpm
 Cleaning Time 4 to 5 minutes Number of Passes 2

Remarks On Cleaness Effective

Other Remarks Nozzles 2.5" from wall of Canister
Cleaning Pattern 1.5"
4 to 5 min per cylinder
N.L.B. Spin Tips

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>Robert W. Plunig</u>	
Test Technician (305 Bldg.)	<u>D. C. Larson</u>	
SEG Technical Advisor	<u>Donald Keeser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 012PREPARED BY: Donald Keeser (Print)SAFETY WALK DOWN COMPLETED Donald Keeser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Keeser Test Technician Dennis Larson
 Test Item Fuel Canister Outside
 Material Type Alum
 Water Jet Fixture Configuration Number 4 Nozzles
 Nozzle Size and Type .036/15°
 Control Valve Configuration Full Open, 13,000 psi 14.62 gpm

Pressure 13,000 psi Flow 4x 3.25 gpm
 Cleaning Time 5 to 7 minutes Number of Passes 2

Remarks On Cleanliness Effective

Other Remarks Nozzles 3" from wall of Canister
Cleaning Pattern 1"
5 to 7 min. per cylinder
N.L.B. Spin Tips

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. H. Fleming</u>	
Test Technician (305 Bldg.)	<u>D. C. Larson</u>	
SEG Technical Advisor	<u>Donald Keeser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 018PREPARED BY: Donald Kaaser (Print)SAFETY WALK DOWN COMPLETED Donald Kaaser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Kaaser Test Technician Dennis Larson
 Test Item Fuel Canister Outside
 Material Type Alum.
 Water Jet Fixture Configuration Number 4 Nozzles
 Nozzle Size and Type .032/0°
 Control Valve Configuration Full Open OK 5-7-95 14,750 psi 13.60 gpm

Pressure 14,750 psi Flow 13.6 gpm
 Cleaning Time 2 to 3 minutes Number of Passes 2

Remarks On Cleanliness Effective

Other Remarks Nozzles 2.5" from wall of Canister
Cleaning Pattern 2"
2 to 3 min per cylinder
N.L.B. spin Tips

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. H. Penning</u>	
Test Technician (305 Bldg.)	<u>D. Larson</u>	
SEG Technical Advisor	<u>Donald Kaaser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 219PREPARED BY: Donald Kooser (Print)SAFETY WALK DOWN COMPLETED Donald Kooser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Kooser Test Technician Dennis Larson
 Test Item Fuel Canister Outside
 Material Type Alum.
 Water Jet Fixture Configuration Number 4 Nozzles
 Nozzle Size and Type .032/0°
 Control Valve Configuration Full Open 15,000 psi 13.60 gpm

Pressure 15,000 psi Flow 4X 3.4 gpm
 Cleaning Time 2 to 3 minutes Number of Passes 2

Remarks On Cleanness Effective

Other Remarks Nozzles 2" from wall of Canister
Cleaning Pattern 3"
2 to 3 min per cylinder
N.L.B. Spin Tips

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>John H. Fleming</u>	
Test Technician (305 Bldg.)	<u>D. Larson</u>	
SEG Technical Advisor	<u>Donald Kooser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 020PREPARED BY: Donald Kasser (Print)SAFETY WALK DOWN COMPLETED Donald Kasser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Kasser Test Technician Dennis Larson
 Test Item Fuel Canister Outside
 Material Type Alum
 Water Jet Fixture Configuration Number 4 Nozzles
 Nozzle Size and Type .033/10°
 Control Valve Configuration Full Open 15,000 psi 14.40 gpm

Pressure 15,000 psi Flow 3.6 gpm
 Cleaning Time 2 to 3 minutes Number of Passes 2

Remarks On Cleaness Very Effective / Very Efficient

Other Remarks Nozzles 2" from wall of Canister
Cleaning Pattern 3"
2 to 3 min per cylinder
N.L.B. Spin Tips

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. Fleming</u>	
Test Technician (305 Bldg.)	<u>D. Larson</u>	
SEG Technical Advisor	<u>Donald Kasser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 021PREPARED BY: Donald Keeser (Print)SAFETY WALK DOWN COMPLETED Donald Keeser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Keeser Test Technician Dennis Larson
 Test Item Fuel Canister Outside
 Material Type Alum.
 Water Jet Fixture Configuration Number 4 Nozzles
 Nozzle Size and Type .032/0°
 Control Valve Configuration Full Open, 15,000 psi 13.60 gpm

Pressure 15,000 psi Flow 443.4 gpm
 Cleaning Time 2 to 3 minutes Number of Passes 2

Remarks On Cleaness Effective

Other Remarks Nozzles 2" from wall of Canister
Cleaning Pattern 3"
2 to 3 min. per cylinder
M.B. Spin Tips

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>John W. Fleming</u>	
Test Technician (305 Bldg.)	<u>D. Larson</u>	
SEG Technical Advisor	<u>Donald Keeser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 022PREPARED BY: Donald Koser (Print)SAFETY WALK DOWN COMPLETED Donald Koser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Koser Test Technician Dennis Larson
 Test Item Fuel Canister Inside
 Material Type Alum.
 Water Jet Fixture Configuration Number 2 Nozzles 2 Bottom
 Nozzle Size and Type 047/0°
 Control Valve Configuration Full Open 15000 psi 15gpm

Pressure 15,000 psi Flow 2x 7.5 gpm
 Cleaning Time 2 minutes Number of Passes 8

Remarks On Cleaness Not Very Effective

Other Remarks Nozzles .5" from wall of Canister
Crane Speed little fast
Spin Head R.P.M. Good
Light Oil

Stoneage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. Fleming II</u>	
Test Technician (305 Bldg.)	<u>D C [Signature]</u>	
SEG Technical Advisor	<u>Donald Koser</u>	

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number 023PREPARED BY: Donald Keeser (Print)SAFETY WALK DOWN COMPLETED Donald Keeser
Signature of SEG Technical Advisor

Date _____ Time _____
 Test Engineer Donald Keeser Test Technician Dennis Larson
 Test Item Fuel Canister Inside
 Material Type Alum
 Water Jet Fixture Configuration Number 2 Nozzles 2 Bottom
 Nozzle Size and Type .047/15°
 Control Valve Configuration Full Open 15,000 psi 15 gpm

Pressure 15,000 psi Flow 2 x 2.5 gpm
 Cleaning Time 1 minutes Number of Passes 2

Remarks On Cleaness Effective

Other Remarks Nozzles .5" from wall of Canister
Frame speed little fast
Spin head speed good
Light Oil in Spin Head

Stoneage Spin Head O'Connell

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)	<u>W. P. ...</u>	
Test Technician (305 Bldg.)	<u>DC ...</u>	
SEG Technical Advisor	<u>Donald Keeser</u>	

APPENDIX II
DEVELOPMENT TEST PLAN

**THIS PAGE INTENTIONALLY
LEFT BLANK**

JUN 6 1995
Sta #19

ENGINEERING DATA TRANSMITTAL

Page 1 of 1
1. EDT 161593

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 Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: 5/24/95

15. DATA TRANSMITTED					(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Approval Designator	Reason for Transmittal	Originator Disposition	Receiver Disposition
1	WHC-SD-SNF-TC-004		0	Development 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)	(H)
Reason	Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	Reason	Disp.
1	1	Cog. Eng. JB Crystal	<i>[Signature]</i>	5/24/95	X3-85	305 Test Coordinator GE Dixon	<i>[Signature]</i>	5/24/95	N1-61	4	
1	1	Cog. Mgr. DS Takesumi	<i>[Signature]</i>	5/24/95	X3-85	305 Facility Mgr. MJ [Signature]	<i>[Signature]</i>	5/24/95	L6-13	1	1
1	1	QA RE Lacey	<i>[Signature]</i>	6/5/95	X3-85	SEG Proj. Mgr. CD May	<i>[Signature]</i>		X3-85	4	
1	1	Safety SA Norling	<i>[Signature]</i>	5/24/95	X3-57	K-Basin Cog. MJ Langevin	<i>[Signature]</i>		X3-74	4	
		Env.									
						Central Files					
						O.S.T.I.					

18. <i>[Signature]</i> J. B. Crystal Signature of EDT Originator Date 5/24/95	19. <i>[Signature]</i> D. S. Takesumi Authorized Representative for Receiving Organization Date 6/5/95	20. <i>[Signature]</i> D. S. Takesumi Cognizant Manager Date 6/5/95	21. DOE APPROVAL (if required) Ctrl. No. ☐ Approved ☐ Approved w/comments ☐ Disapproved w/comments
--	---	--	---

RELEASE AUTHORIZATION

Document Number: WHC-SD-SNF-TC-004, REV 0

Document Title: Development Test Procedure 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

TRADEMARK DISCLAIMER. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy. Available in paper copy and microfiche. Printed in the United States of America. Available to the U.S. Department of Energy and its contractors from:

U.S. Department of Energy
Office of Scientific and Technical Information (OSTI)
P.O. Box 62
Oak Ridge, TN 37831
Telephone: (615) 576-8401

Available to the public from:

U.S. Department of Commerce
National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Telephone: (703) 487-4650

SUPPORTING DOCUMENT		1. Total Pages 16
2. Title Development Test Procedure High Pressure Water Jet System	3. Number WHC-SD-SNF-TC-004	4. Rev No. 0
5. Key Words Development test, High pressure water jet, K-Basin, Debris, Decontamination (JCB 6/6/95)	6. Author Name: J. B. Crystal <i>[Signature]</i> 6/5/95 signature Organization/Charge Code 2G000/LD24C	
7. Abstract Test procedure for developmental testing of High Pressure Water Jet System.		
8. RELEASE STAMP <div data-bbox="1045 1633 1484 1864" style="border: 1px solid black; padding: 5px; text-align: center;">OFFICIAL RELEASE BY WHC DATE JUN 6 1995 (15) Str #19</div>		

WHC-SD-SNF-TG-004, Rev. 0

Table of Contents

1.0 TEST ITEM IDENTIFICATION	1
2.0 GENERAL DESCRIPTION	1
2.1 TEST OBJECTIVES	1
2.2 TEST METHOD	2
3.0 TEST CONDITION LIMITS	2
3.1 FIXTURE DESIGN CRITERIA	3
4.0 INSTRUMENTS AND CALIBRATION	3
5.0 FACILITIES, EQUIPMENT AND MATERIALS	3
5.1 <u>FACILITIES</u>	3
5.2 <u>EQUIPMENT</u>	3
6.0 OPERATION PROCEDURE	4
7.0 MAINTENANCE AND FAILURES	4
8.0 TEST DATA	5
8.1 TEST GOAL	5
9.0 PERSONNEL REQUIREMENTS	6
9.1 <u>Qualifications/Training</u>	6
9.2 <u>Responsibilities</u>	6
9.2.1 <u>Test Technician</u>	6
9.2.2 <u>WHC Test Engineer</u>	6
9.2.3 <u>SEG Technical Advisor</u>	6
10.0 WITNESSES	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
11.3.1 Purpose	7
11.4 <u>Scope</u>	7
11.5 <u>Set Up</u>	7
12.0 TEST STEPS	8
13.0 DISPOSITION OF TEST ITEM	8
14.0 DATA SHEETS	8
ATTACHMENT A - SAFETY CHECKLIST	A-1
ATTACHMENT B - DEVELOPMENT TEST DATA SHEET	B-1
ATTACHMENT C - DEVELOPMENT TEST DATA SHEET INDEX LOG	C-1

WHC-SD-SNF-TC-004, Rev. 0

DEVELOPMENT TEST PROCEDURE HIGH PRESSURE WATER JET SYSTEM

1.0 TEST ITEM IDENTIFICATION

Development testing will be performed on the water jet cleaning fixture to determine the most effective arrangement of water jet nozzles to remove contamination from the surfaces of canisters and other debris.

The following debris may be stained with dye to simulate surface contaminants: Mark O, Mark I, and Mark II Fuel Storage Canisters (both stainless steel and aluminum), pipe of various size, (steel, stainless, carbon steel and aluminum). Carbon steel and stainless steel plate, channel, angle, I-beam and other surfaces, specifically based on the Scientific Ecology Group (SEG) inventory and observations of debris within the basin.

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

2.0 GENERAL DESCRIPTION

The overall objective of the development test is to develop and demonstrate a combined system. This includes associated tools and equipment to perform cleaning of canisters and other debris in the 105 K East (KE) Basin. The development testing shall achieve optimum reduction in the level of contamination/dose rate on debris, prior to removal from the basin and packaging for disposal. Repetitive tests may be necessary to achieve proper configuration and process control steps for the operations procedure for use at K Basins.

This development test procedure will define the performance testing of the High Pressure Water Jet System (HPWJS) fixture(s). This procedure will provide guidelines and instructions to control and evaluate the most effective arrangement of water jets for removing the contaminated surface layer from canisters and other debris presently identified in the KE Basin. Additionally, the desired result will be to deliver to K Basins a thoroughly tested and proven method for under water decontamination and dose reduction.

2.1 TEST OBJECTIVES

Utilizing the HPWJS connected to specially designed water jet fixture head(s):

- Clean surfaces of canisters coated with simulated contamination ensure the most safe and efficient process.
- Demonstrate a simulated controlled radiological environment for the decontamination of canisters, equipment and miscellaneous materials under water with minimal water surface disturbance.

- Demonstrate the best combination of nozzle configuration, water pressure, water flow rate and cleaning speed to clean canisters.
- Complete the testing of all variables and combinations of variables in the most effective and safe manner while maintaining complete development test records.
- Demonstrate the configuration of associated support tools and equipment required to perform decontamination and dose reduction tasks at the K Basins for the Debris Removal Program.
- Develop an operations work procedure for the implementation of this process at the K Basins (consistent with the development test report).
- Based on test report conclusions, develop the necessary training documents required to train and qualify support personnel in the safe and efficient performance of this process.

2.2 TEST METHOD

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

The development test will be repeated as many times as necessary to reach the expected results of removing most of the simulated contamination (dye coating) from the test items in an effective and efficient manner.

3.0 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 shift and before starting the HPWJS, the Safety Checklist (Attachment A) will be completed by the SEG Technical Advisor after a walkdown of the system is completed to ensure and verify that tools and equipment are safe to operate.

Only trained and qualified personnel shall start up and operate the HPWJS. During testing, SEG personnel shall be present and provide overall technical direction for the set up of fixtures and associated hardware. (See Section 9.0 for responsibilities)

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

3.1 FIXTURE DESIGN CRITERIA

The fixture design shall include the following features:

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

4.0 INSTRUMENTS AND CALIBRATION

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

5.0 FACILITIES, EQUIPMENT AND MATERIALS

5.1 FACILITIES

The test basin in the 305 Cold Test Facility and the tank in the tent located outside at the east end of the building will be utilized for the test program.

5.2 EQUIPMENT

The HPWJS will provide water at the desired pressures and flow rates. The system can provide up to 15,000 psi water, with flow rate up to 15 gpm. The water jet skid will be located outside of the 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 either to one of the tanks in the tent or the test basin through a control valve to the fixtures and/or heads. Bypass water and drains will be routed back to the test basin.

WHC-SD-SNF-TC-004, Rev. 0

A work station will be set up in the test basin on the south side hand rail within the 305 Cold Test Facility. The item to be cleaned will be placed into the test basin and a HPWJS with varying discharge pressures and flow rates will be directed at the surfaces to be cleaned through nozzles on the underwater jet fixtures. An assortment of tools and equipment will be utilized to lift, hold, place and manipulate items under water during the cleaning activities. Additionally, a work station may be set up in the tent located on the east side of the 305 facility to perform simulated cleaning of items in one of the tanks.

6.0 OPERATION PROCEDURE

The HPWJS operating procedure and/or vendor manuals shall be used for operation of the HPWJS in support of these test activities.

- 6.1 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.
- 6.2 Applicable JHAs and Material Safety Data Sheets (MSDS) shall be posted or located in the test facility test area.
- 6.3 Test area personnel shall observe safety precautions outlined in the JHA and MSDS.

WARNING!!!

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

7.0 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 logbook will be located at or near the unit, reviewed and initialed each day 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 low pressure pipe and fittings male threads 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. If properly working, install nozzle and 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.

8.0 TEST DATA

The test data recorded for each item cleaned shall include:

- Water Pressure
- Water Flow Rates
- Area Cleaned
- Time Required
- Fixture Configuration

8.1 TEST GOAL

The test goal is to remove at least 80% of the dye from the canister and other debris piece simulated.

9.0 PERSONNEL REQUIREMENTS

9.1 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. Training records shall be maintained in the project files for those who have received training on operation of the HPWJS.

9.2 Responsibilities

9.2.1 Test Technician

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

9.2.2 WHC Test Engineer

The WHC Test Engineer is responsible for ensuring that the test is performed per the development test procedure. He shall review each of the Test Data Sheets verifying the recorded information and write a test report summary and recommend final design of fixture and associated support equipment.

9.2.3 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. One of the major responsibilities is to ensure proper equipment set up and safety of operation. Prior to each test run they shall perform the walk down of the system and complete the initial input to the Safety Checklist (Attachment A) and Development Test Data Sheet (Attachment B).

The SEG Technical Advisors are certified trainers and will provide equipment training to test technicians and designated Operations personnel who perform testing.

10.0 WITNESSES

Witnessing requirements for the development testing (only by the 305 Facility Test Technician (WHC Person)), shall be indicated by sign offs on the Development Test Data Sheet (Attachment B).

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 and the 305 Facility Test Technician prior to starting and running each test configuration.

11.3 Water Jet Fixture Configuration

The water jet fixture shall be developed from the test configuration after the development test goal is achieved.

11.3.1 Purpose

This testing shall be documented by recording development test data. The steps may be reordered to provide the most efficient process. The Development Test Data Sheets (Attachment B) will be utilized to record specific test information. The water jet fixture/heads and associated support equipment configurations shall be recorded for each test using a single line sketch. The water pressures and water flows for each 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 the sketch.

11.4 Scope

Develop the most efficient configuration of fixtures for cleaning the simulated surface contamination under water. The testing is to be performed on each of the debris type of materials identified with varied configurations of the water jet fixtures and heads.

11.5 Set Up

The operations procedure for the HPWJS shall be utilized in conjunction with this 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 two foot control valves. High pressure hose/pipe will be connected to the underwater jet fixtures from the foot control valves.

Special handling tools and equipment will be used for positioning and manipulating of the debris to and through the cleaning water 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 large items (canisters).

12.0 TEST STEPS

- 12.1 Connect hoses and place the water jet fixture into the test basin.
- 12.2 Place the test material into the test basin.
- 12.3 Start-up the HPWJS following the detailed steps in the HPWJS Operations Procedure.
- 12.4 Control flow to the fixture by operating the foot control valve(s).
- 12.5 Position and manipulate the test material and/or the cleaning fixture to clean until the surface of the material appears to be clean with at least 80% of the dye coating removed.
- 12.6 Time the cleaning duration and count the number of passes.
- 12.7 Remove item from the water and inspect.
- 12.8 Document level of "decontamination" on the Test Data Sheet as a percentage of paint/dye removed from the surface of the debris test item.
- 12.9 Repeat steps 11.2.1 through 11.2.8 as necessary.

13.0 DISPOSITION OF TEST ITEM

Save for reuse in future testing.

14.0 DATA SHEETS

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

A Test Data Sheet Index Log (Attachment C) shall also be maintained by the SEG Technical Advisor starting with number 001. Test data shall be forwarded to the WHC Project Engineer for storage and control of official release as deemed necessary.

ATTACHMENT A
SAFETY CHECKLIST

* SAFETY CHECK LIST *

Test Log Number _____

FOR
HIGH PRESSURE WATER JETTING SYSTEM

SEG Technical Advisor: _____ (print)

DATE: _____ TIME: _____
INSPECTION PERFORMED BY SIGNATURE: _____

	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 ^{& return hose} properly placed in the basin and connected to the pump skid and has it been flushed?	_____	_____
11. Have the Filter and Y-strainer been checked for cleanliness and 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. Has 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
DEVELOPMENT TEST DATA SHEET

DEVELOPMENT TEST DATA SHEET

HIGH PRESSURE WATER JET SYSTEM

Test Log Number _____

PREPARED BY: _____ (Print)

SAFETY WALK DOWN COMPLETED

Signature of SEG Technical Advisor

Date _____ Time _____
Test Engineer _____ Test Technician _____
Test Item _____
Material Type _____
Water Jet Fixture Configuration Number _____
Nozzle Size and Type _____
Control Valve Configuration _____

Pressure _____ psi Flow _____ g.p.m.
Cleaning Time _____ minutes Number of Passes _____

Remarks On Cleanness _____

Other Remarks _____

Single Line Sketch of Fixture and Control Valve Arrangement

Sign Offs	Signature	Date
Witness (if required)		
Test Technician (305 Bldg.)		
SEG Technical Advisor		

ATTACHMENT C
* DEVELOPMENT TEST DATA SHEET INDEX LOG *

Test Log Number	Date	Test Engineer
001		
002		
003		
004		
005		
006		
007		
008		
009		
010		
011		
012		
013		
014		
015		
016		
017		
018		

APPENDIX III

STONEAGE RJV3 ROTARY WATERBLAST NOZZLES
OPERATOR'S MANUAL

THIS PAGE INTENTIONALLY
LEFT BLANK

WHC-SD-SNF-DTR-001, REV. 0
III-2

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.

THIS PAGE INTENTIONALLY
LEFT BLANK

ROTARY WATERBLAST NOZZLES

RJV3

15,000 PSI

&

20,000 PSI

OPERATOR'S MANUAL

11/94

WATERJET ENGINEERING

54 Girard St. • Durango, CO 81301 • (303) 259-2869 • FAX 259-2868

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

BEST AVAILABLE COPY

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

STONEAGE
WATERJET ENGINEERING

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 diameter.....1.8 in.
 Nozzle head diameter.....2.0 in.
 Weight, complete3.5 lb.
 Flow capacity0.6 Cv
 Rotation speed, rpm.....1500-2000

*Special heads & nozzles available without pipe threads

** Medium Pressure cone and thread

STONEAGE
WATERJET ENGINEERING

54 GIRARD STREET • DURANGO, COLORADO 81301 • (303) 259-2869 • FAX (303) 259-2868

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.

RJV3 Rotary Nozzle

RJV3 Rotary Nozzle

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 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-DTR-001, 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

<u>%</u>	<u>MATERIAL</u>	<u>CAS#</u>	<u>EXPOSURE LIMIT</u>
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.

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.

STONEAGE
WATERJET ENGINEERING

THIS PAGE INTENTIONALLY
LEFT BLANK