

# **Coulson Ice Blast (CIB)**

**Report no. 1070601**

**July 6, 2001**

## **“Ice Blast Surface Decontamination Test”**

**Prepared in fulfillment of Bechtel BWXT Idaho, LLC (BBWI)  
Purchase Order no. 0000759**

# Table of Contents

<b>Table of Contents</b> -----	<b>2</b>
<b>Scope of Work:</b> -----	<b>3</b>
<b>Summary:</b> -----	<b>4</b>
<b>Test Parameter Comparisons:</b> -----	<b>5</b>
Table 1: Test Settings -----	6
<b>Results:</b> -----	<b>7</b>
Picture 1: Group A prior to testing. -----	7
Picture 3: Group B prior to testing.-----	8
Picture 4: Group B after testing. -----	8
Picture 5: Group C prior to testing.-----	9
Picture 6: Group C after testing. -----	9
Picture 7: Group D prior to testing. -----	10
Picture 8: Group D after testing.-----	10
Picture 9: Group E prior to testing.-----	11
Picture 10: Group E after testing.-----	11

## Scope of Work:

Coulson Ice Blast (CIB) report no. 1070601, prepared in fulfillment of Bechtel BWXT Idaho, LLC (BBWI) Purchase Order no. 0000759, per Statement of Work entitled: Scope of Work for Coulson Ice Blast Decontamination” as follows:

“Coulson Ice Blast (CIB) will conduct surface stripping tests on surrogate coupons they will receive from the INEEL Radioactive Liquid Waste Group. The INEEL will supply five (5) plates with coupons glued to them. The plates will be nominally 4 or 5 inches square by ¼ inch thick, and will have 5 coupons glued to each plate, for a total of 25 coupons. The coupons will be made from 316 stainless steel and consist of 1 inch diameter disks a quarter inch thick. The coupons will be coated on one side with a mixture of non-radioactive, non-hazardous zirconium and cesium nitrate salts. The coupons will have been coated and baked at nominally 800 °C prior to supplying them to Coulson Ice Blast.

Coulson Ice Blast will use their ice blasting process to attempt removing the surface coating from the coupons. CIB will process the plates one at a time while varying the process parameters between plates so that the impact pressure, ice particle size, distance between nozzle and plate, angle of incidence, spray-time, etc. will be different between tests. The objective is not to vary all parameters independently, but rather, provide coupons back to the INEEL that vary in cleanliness from that achievable under routine to vigorous blasting conditions. One plate will be blasted under routine operating conditions comparable to those required to remove light to moderate adherent coatings like paint. Another plate will be blasted under rigorous conditions comparable to those anticipated for non-removable coatings like electroplated coatings. The conditions used for the remaining 3 plates will be intermediate between the first two described and represent somewhat of a continuum in the performance that might be expected over a wide operation range.

Coulson Ice Blast will determine which parameters are varied and report the information to the INEEL upon completion of the testing. In addition, CIB will provide back to the INEEL, video footage of the blasting process, as the plates are undergoing testing. The work is to be completed during the 2001 fiscal year.”

## Summary:

The sample coupons were received July 2, 2001 and subjected to ice blast cleaning on July 3, 2001.

The five (5) sample plates, each containing five (5) round disk coupons, were recorded prior to, and immediately after, test cleaning with a digital camera.

The sample plates were identified into Groups A-E. The individual coupons on each plate were removed from the backing plates and checked for identification. Each coupon had been metal stamped with unique identification prior to receipt by CIB. After test cleaning, the coupons were remounted to the backing plates with silicon adhesive.

The test cleaning was performed under the following conditions:

- Blast Air Pressure (psig): 80, 115, 150
- Dwell Time (seconds): 10, 20, 30
- Blast Angle (degrees): 45, 90

The ice blast machine fitted with a M2 blast gun assembly, was supplied with:

- 240V-3Ø-60 power (15 KW)
- 280 CFM air (max pressure 150 psig)
- Municipal water supply (25 GPH)

A pressure gauge was installed at the working end of the blast air supply hose in order to correctly adjust the supply air pressure regulator to the desired setting for each phase of the testing.

The coupons were firmly clamped in a bench vise individually for blasting and re-glued to the original sample plate as received.

A distance gauge was fixed to the blast nozzle and set to a distance of 2.75 inches from the tip of blast nozzle to surface of target. All samples were blasted at this stand-off distance.

Video footage of the blasting was taken for each coupon tested on VHS-C format. Sample coupon V-18 was not recorded due to technical difficulties.

Test parameters were set to vary the blast pressure, dwell time and blast angle. The stand-off distance remained constant to ensure 100% ice particle coverage on the test coupons.

## Test Parameter Comparisons:

### 1. Samples A/B = (Blast Angle)

- a. Compare blast effect by varying Blast Angle.
  - i. 90° versus 45°
- b. Light Impact Pressure.
  - i. 80 psig
- c. Constant Stand-off Distance.
  - i. 2.75 inches
- d. Constant Dwell Time
  - i. 10 seconds each coupon.

### 2. Samples A/E = (P & t)

- a. Compare blast effect between Light Impact Pressure/Rigorous Impact Pressure & Dwell Time of Blast Spray.
  - i. 80 psig versus 150 psig
  - ii. 10 seconds each coupon versus 30 seconds each coupon.
- b. Constant Stand-off Distance
  - i. 2.75 inches

### 3. Samples C/D= (t)

- a. Compare blast effect by varying Dwell Time
  - i. 10 seconds each coupon versus 20 seconds each coupon.
- b. Constant Stand-off Distance
  - i. 2.75 inches
- c. Constant Impact Pressure
  - i. 110 psig
- d. Constant Blast Angle
  - i. 90°

### 4. Samples A/C =(P)

- a. Compare blast effect by varying Blast Pressure from Light Impact Pressure to Moderate Impact Pressure.
  - i. 80 psig versus 110 psig
- b. Constant Stand-off Distance
  - i. 4 inches
- c. Constant Blast Angle
  - i. 90°
- d. Constant Dwell Time
  - i. 10 seconds each coupon

### 5. Samples A/D/E= (P & t)

- a. Compare blast effect by varying Blast Pressure from Light Impact Pressure to Moderate Impact Pressure to Rigorous Impact Pressure & Dwell Time.
  - i. 80 psig (10 seconds each coupon), 110 psig (20 seconds each coupon), 150 psig (30 seconds each coupon).
- b. Constant Stand-off Distance
  - i. 2.75 inches
- c. Constant Blast Angle

<b>Sample Group</b>	<b>Sample ID (1)</b>	<b>Blast Air Pressure (2)</b>	<b>Blast Angle (3)</b>	<b>Dwell Time (4)</b>
A	V-16	80	90°	10
	V-17			
	V-18			
	V-19			
	V-20			
B	V-21	80	45°	10
	V-22			
	V-23			
	V-24			
	V-25			
C	V-31	115	90°	10
	V-32			
	V-33			
	V-34			
	V-35			
D	V-36	115	90°	20
	V-37			
	V-38			
	V-39			
	V-40			
E	V-41	150	90°	30
	V-42			
	V-43			
	V-44			
	V-45			

**Table 1: Test Settings**

1. Air pressure supplied to blast nozzle (psig).
2. Angle of Blast Nozzle to Target (degrees).
3. Distance from Blast Nozzle tip to target surface (inches).
4. Duration Target remains in Blast Spray (seconds).

**Results:**

The following are photographic records of samples before and after ice blasting per conditions noted. Samples were returned to Bechtel BWXT Idaho, LLC (BBWI) for examination and analysis.



Picture 1: Group A prior to testing.



Picture 2: Group A after testing.





Picture 3: Group B prior to testing.



Picture 4: Group B after testing.





Picture 5: Group C prior to testing.



Picture 6: Group C after testing.



Picture 7: Group D prior to testing.



Picture 8: Group D after testing.





Picture 9: Group E prior to testing.



Picture 10: Group E after testing.