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SAFETY EVALUATION FOR THE INNER CANISTER CLOSURE STATION

The attached memo by S. L. Goudelock and J. M. O'Rourke describes equipment operation and points out potential operating hazards during the operability test of the Inner Canister Closure Station at ETF. Safeguards for personnel and equipment protection are explained.

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SAFETY EVALUATION FOR THE INNER CANISTER CLOSURE STATION

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Safety Evaluation: Inner Canister Closure Station

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SAFETY EVALUATION FOR THE INNER CANISTER CLOSURE STATION

1. SUMMARY

The Inner Canister Closure Station (ICCS), built by Remote Technology Corporation, will be operability tested in building 673-T at TNX. The ICCS is used to remotely leak test Inner Canister Closures (ICC's) and replace ICC's that are not water tight. After operability testing, the ICCS will be inspected and sent to the 717-F mock-up shop for remotability demonstration and dimensional checks, then installed in the Vittrification Building, 221-S.

An analysis of potential safety hazards, equipment safety features, and procedural controls indicates that the ICCS can be operated without undue hazard to employees or to the public. A safety inspection and a new equipment inspection will be held before operation to verify that the ICCS meets SRP and SRL safety requirements.

2. INTRODUCTION

The ICC temporary seal is a shrink fit seal used to keep water out of a Defense Waste Processing Facility (DWPF) glass waste canister during decontamination by wet frit slurry blasting. The ICCS is used to leak-check temporary seals for water tightness. The ICCS is also used to install ICC's or repair plugs when needed, using an electric resistance heater.

The following safety analysis describes equipment operation and points out potential hazards during operability testing. Safety measures in addition to building 673-T rules are identified.

The operability tests will be used to refine operating parameters and to confirm that the ICCS will satisfactorily seal and leak check canisters.

3. DISCUSSION

3.1 DESCRIPTION OF OPERATION

The ICCS is shown in Figures 1 and 2. A flowsheet for its operation in the DWPF is shown in Figure 3.

A DWPF reference canister is loaded into the ICCS using an overhead crane. The canister is raised approximately 20 feet, moved over the ICCS support stand, and lowered. The canister, made of stainless steel, is 9' 10" tall and 2' in diameter. A glass-filled canister weighs approximately 4500 lb. Guides on the ICCS support stand help to position the canister during lowering.

If the canister does not have a temporary seal installed, the canister flange and inner sleeve are heated using the ICCS heater, and a temporary seal plug is put into place with a positioning tool. A shrink fit seal is made as the nozzle cools. The heater is powered by 240 VAC current.

For leak testing, a bell jar is fitted with a seal gasket and clamped to the canister nozzle. The temporary seal is checked for gross leaks by pressurizing a small helium reservoir to 100 psi, then opening it to the leak test bell jar and noting the pressure drop over a period of time. This valving sequence prevents direct connection of the helium supply to the canister so that the canister is not overly pressurized if the temporary seal leaks. If the seal passes the gross leak test, it is then checked for fine leaks by pressurizing the bell jar to 100 psi and measuring the pressure drop over a period of time. If the leak rate is acceptable, the canister is removed from the support stand. If the leak rate is found to be too large, the seal gasket is checked for leaks before rejecting the temporary seal by pressurizing the bell jar on the blank test flange. Unacceptable temporary seals are removed by rapidly heating the canister nozzle, expanding it away from the temporary plug and sleeve, which drop into the canister. A repair plug is then installed in the same manner as a temporary seal, but a tighter interference fit is obtained since the plug is oversized. The leak rate of the repair plug is then measured.

3.2 DESCRIPTION OF EQUIPMENT

3.2.1 SWINGARM ASSEMBLIES

Both the leak test bell jar and the heater are held at the end of swingarms three feet long. The swingarms require about 2 minutes to rotate from the retracted position to the canister flange. The swingarms stop motion when a limit switch is activated at either end of their travel. Mechanical stops terminate movement in the event of a limit switch failure. The linear actuators used to drive the bell jar and heater to the canister flange are mounted on floating head assemblies at the end of the swingarms. For each swingarm, two 120 VAC three phase motors with gear reducers are used to rotate the swingarm and drive the linear actuator.

3.2.2 HELIUM LEAK TESTER

Helium for leak tests is supplied from a compressed gas bottle. A resistive temperature device (RTD) is used to measure the bell jar temperature. Pressure transducers are mounted on the helium receiver and the bell jar. The bell jar temperature element and pressure transducer are connected to two Moore Products Mycro 352 controllers. These controllers read transducer inputs, then compute and display the leak rate of the temporary seal. Instrumentation and controls for the helium leak tester are shown in Figure 4.

3.2.3 HEATER

The resistance heater is powered by a silicon controlled rectifier (SCR) with a current limiter capable of delivering 100 amps of current to the heater. The SCR is fed from a 240 VAC 25 KVA power source. The heater is operated with a programmable LFE model 2010 temperature controller located in the control console. Two thermocouples are available to monitor the heater temperature and

provide controller input. Heater power and controls are shown in Figure 5.

3.2.4 TEST FLANGE

The test flange is a blank flange used for positioning and testing the bell jar seal gasket. This flange is used for checking the helium supply lines, piping, instrumentation, and seal gasket for leaks. The test flange can be raised or lowered to provide clearance for moving the leak test swingarm. The linear actuator is powered by a three phase 120 VAC motor connected to gear reducers. Limit switches define the travel range of the test flange.

3.2.5 CANISTER NOZZLES

Many of the operability tests will be done on replaceable canister nozzles. Nozzles, which weigh about 60 pounds, can be safely and easily handled by one operator using a lifting yoke and the overhead crane. A jig mounted on top of the ICCS will hold the nozzles during leak tests and heater tests.

3.2.6 LIFTING YOKE AND DWPF GRAPPLE

Canisters will be moved using a lifting yoke and the overhead crane. The yoke is manually mounted, and retains the nozzle with a pin. The DWPF grapple will be used a few times to demonstrate DWPF operation.

3.2.7 CONTROL CONSOLE

All heater and leak check operations, except seal gasket installation, are performed remotely from the control console, shown in Figure 6. Leak test equipment controls and indicator lamps are located on the left hand side; heater controls and indicator lamps are on the right. The swingarm and actuator control switches are combination three-position rotary switch/push buttons. The rotary switches control motor drive direction and the pushbuttons interrupt power to the motors to stop them at any time. Two-position switches are used to open and close the helium line solenoid valves. Digital meters show the bell jar pressure, receiver pressure, canister flange temperature, heater voltage, and heater current. The bell jar temperature and seal leak rate are displayed using Moore Products Mycro 352 controllers, and the bell jar temperature, pressure, compensated pressure, and temporary seal leak rate are recorded using a Moore Products Model 362 strip chart recorder. An all stop mushroom button in the upper left corner of the console interrupts power to the heater and all drive motors when pushed.

3.3 POTENTIAL SAFETY HAZARDS

3.3.1 CANISTER HANDLING

The glass-filled canisters, weighing approximately 4500 lbs., will be moved in and out of the ICCS using the overhead crane. Nozzles, weighing approximately 60 lb., will be moved with the lifting yoke. Extra canisters will be stored in vertical storage racks. All canisters will be moved slowly and cautiously to prevent the can from swinging and damaging equipment or personnel.

The building crane, which has a 10 ton capacity rating, will be operated from floor level or platform level using a control pendant. Only qualified personnel will be allowed to operate the building bridge crane.

3.3.2 TIPPING AND FALLING OBJECTS

Canisters will be contained in the ICCS support stand, which is braced and anchored to concrete footings. The personnel platform is bolted to the floor and an adjacent platform.

Temporary seals, repair plugs, nozzles, and small tools will be used on top of the ICCS at a height of approximately 20'. Diamond plate decking surrounded by handrails and toeplates will be installed around the ICCS, but a risk of dropping a tool or part still exists. Hardhats will be worn by personnel under the platform and whenever the building crane is in use. The area around the ICCS will be partitioned with rope barricades when loading and unloading canisters at the ICCS. No personnel will be allowed underneath a load suspended from the building crane.

3.3.3 HIGH TEMPERATURES

The heater element may reach temperatures of up to 1100 °C, and the canister flange will reach temperatures of up to 370 °C. Insulated gloves and special tools will be used to install temporary seals and repair plugs. Signs labeled "HOT" will be placed on parts and equipment that could burn personnel. A halon fire extinguisher will be mounted on the platform near the heater. All combustible material will be kept clear of the heater and canister flange.

3.3.4 ELECTRICAL EQUIPMENT

The ICCS is supplied by three phase 480 VAC power for heater and motor current and single phase 120 VAC power for instrumentation and controls. The platform and electrical equipment will be grounded to reduce the hazard of electrical shock. Wire junctions will be checked for firm connections, and all junction boxes will be labeled with the origin and destination of their wires. All terminal strips will be enclosed, and terminals with high voltages present will be labeled. Once installed, no unusual electrical hazard should exist.

3.3.5 PRESSURIZED HELIUM

A helium line at 100 psig will be used to pressurize the bell jar. The helium supply line piping is rated at 225 psi, and will be service tested to 150 psi. An approved pressure regulator set at 100 psi will be installed in the helium supply line with a relief valve set at 15 per cent overpressure. All lines will be properly secured. Safety glasses are required in building 673-T, so the possibility of an eye injury will be minimized. The helium compressed gas bottle will be handled and stored in accordance with DPSOP 208-F-101, Compressed Gas Equipment.

3.3.6 PINCH POINTS

Personnel will stay away from pinch points created by swingarms, actuators, and canisters in motion. During normal operation, equipment will be remotely operated from the personnel platform. Swingarms and actuators will be locked, tagged, and tried before any maintenance or E&I work is performed on the ICCS.

3.3.7 TRIPPING/FALLING/BUMPING

No unusual tripping, falling, or bumping hazards exist. Personnel should, however, be aware of restricted aisle space on the ICCS platform and near its base. Hard hats will be worn under the ICCS, and aiseways will be kept clear of equipment and supplies.

REFERENCES

1. "Inner Canister Closure Station Operating Instructions", OM-4045-001 Revision 5, June 23, 1987.
2. "Inner Canister Closure Station Instrumentation and Control System Description", I&CFD-4045-001 Revision 5, June 23, 1987.
3. "DWPF Process and Equipment Description", DPSOP 257-1 Revision 0, pp. 1715-1732, February, 1987.
4. O'Rourke, J. M. and Goudelock, S. L., "Operability Testing Program for the DWPF Inner Canister Closure Station", DPST-87-460, May 20, 1987.

Figure 1. Elevation of ICCS.

Figure 2. Plan View of ICCS.

FIGURE 3: ICCS PROCESS FLOW DIAGRAM

FIGURE 4: HELIUM LEAK TEST SYSTEM

FIGURE 5: HEATER CONTROLS AND POWER

INNER CANISTER CLOSURE STATION CONTROL CONSOLE
EQUIP NO. S360-185-252-30
S360-LCS-92

FIGURE 6: CONTROL CONSOLE LAYOUT

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