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ATOMICS INTERNATIONAL
A Division of North American Aviation, Inc.

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				PAGE 1 OF 7

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SUBJECT: Removal of a Radioactive Primary Sodium Pump or a Radioactive Primary Cold Trap

CONTENTS:	I	STATEMENT OF PROBLEM	PAGE 1
	II	SUMMARY OF RESULTS AND RECOMMENDATIONS	PAGE
	III	METHOD USED, DESCRIPTION OF EQUIPMENT, SAMPLE CALCULATIONS . . .	PAGE
	IV	REFERENCES AND APPENDICES	PAGE

I STATEMENT OF PROBLEM

Describe methods and procedures for the removal of a radioactive primary sodium pump or primary cold trap using the handling casks which are provided for this purpose.

II SUMMARY OF RESULTS AND RECOMMENDATIONS

A. Primary Sodium Pump (Fig. 1-Appendix)

When maintenance or replacement of a radioactive primary sodium pump is required, a decay period of at least 14 days is necessary to eliminate the activity of Na^{24} prior to removal. After this decay period, it is estimated (TDR 4757) that the unshielded dose rate will be 10 mr/hr @ 90 ft. With a three inch thick lead shield, the dose rate will be 40 mr/hr @ 1 meter. This is considered satisfactory for the short-time radiation involved in this operation.

An inert atmosphere is another consideration in primary pump handling. Because of the fire hazard from exposed sodium and also because of the danger of contaminating the sodium system, an inert atmosphere must be maintained in both the cask and the pump housing.

B. Primary Cold Trap (Fig. 2-Appendix)

After a decay period of 180 days, the dose rate from the unshielded cold trap will be about 100 mr/hr @ 120 ft. (TDR 4757) and with three inches of lead, 10 mr/hr @ 20 ft.

6-2

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. 5238
DATE May 2, 1960
PAGE 2 OF 7

Fire danger from any exposed sodium in the cold trap cell makes it necessary to maintain an inert atmosphere in the cell and also in the cask.

III DESCRIPTION OF EQUIPMENT AND HANDLING METHODS

A. Primary Pump Handling Equipment

The primary pump handling equipment consists of an upper shell and a lower shield tube, a bail assembly, a grapple adapter, an electro-magnetic shield plate lifter assembly, two shield plate assemblies, and extension rods.

B. Method of Handling the Primary Pump

As shown in Fig. 1-(Appendix), the pump assembly consists of a drive motor and coupling; the pump; and a pump housing. Only the pump is handled by the cask.

The following sequence is to be followed in radioactive pump removal (Fig. 1).

1. Remove drive motor and coupling. (Fig. 1-a)
2. Purge the pump with argon gas until all the helium in the pump has been replaced.
3. Bolt the grapple adapter in place. (Fig. 1-b)
4. Unbolt the pump from the base plate at the floor line.
5. Locate pump handling cask over the pump, and purge the cask with nitrogen gas.
6. Attach extension rods to grapples and the bail assembly to extension rods.
7. Lower grapples with crane and engage in grapple adapters.
7. Lower grapples with crane and engage in grapple adapters. (Fig. 1-c)
8. Raise pump into the cask and secure in "up" position with pins through grapples. (Fig. 1-d)
9. Detach extension rods from grapples, and unhook bail from crane.
10. Lift pump and cask about one inch from floor, slide shield plates under cask, and set cask down on plates.
11. Energize electro-magnets, and pick up pump cask and top shield plate, and move to pump wash cell. (Fig. 1-e)

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. 5238
DATE May 2, 1960
PAGE 3 OF 7

12. After wash cycle is complete, lift pump into cask and secure grapples. Remove extension shafts, E-M pick-up ring, and shield plate; and move cask and pump to storage, Maintenance Shop, or Shipping Department.

C. Primary Cold Trap Handling Equipment

The primary cold trap handling equipment consists of an upper shield cap and a shield tube, a bail assembly, and the plate lifter assembly.

D. Method of Handling Primary Cold Trap

During normal operation, the cold trap is mounted in a tilted position at 5° from vertical, the pivot point 7" off the center-line of the cell.

A single flanged connection near the top of the cold trap provides both the sodium inlet and outlet connections. The vessel flange and the system flange are "made up" with a Vee band clamp. The clamp is fitted with two screws remotely controlled by means of flexible shafts. The shafts terminate with hex ends in a recess in the floor near the cell. A standard socket with handle is used to drive the clamp shafts.

An insulated shield encloses the cold trap. The upper part of this shield is a hinged clam shell which is remotely controlled with a flexible shaft. This shaft also ends in a recess in the floor adjacent to the cold trap cell.

A toggle linkage, remotely controlled, is used to move the cold trap from the 5° tilted position to the upright position required for removal. This toggle is strong enough to break any frozen sodium which might remain at the connection between the trap and the primary sodium system.

Calculations (TDR 4757) show a high dose rate even after a decay period of 180 days. With a stand-by cold trap in the sodium system, it is assumed that the full 180-day decay period will be allowed before the spent trap will be removed.

The sequence for cold trap removal (Fig. 2) is as follows.

1. Close inlet and outlet sodium valves to the spent cold trap, and open the valves to the stand-by cold trap.
2. After 180 days (to permit decay) remove covers from the remote control access boxes.
3. Using the remote controls, loosen the Vee clamp on the sodium connection flange.

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. 5238
DATE May 2, 1960
PAGE 4 OF 7

4. Remotely open the clam shell shield.
5. Tilt the cold trap to vertical position using the tilt toggle.
6. Using the crane, lift the cell plug just enough to slide a pit cover plate over the cell.
7. Move the cell plug to temporary storage, and pick up the cold trap handling cask.
8. Locate the cask (the E-M plate lifter and magnetic cover plate in place on the bottom of the cask) over the centerlines of the cold trap.
9. Purge the cask with nitrogen, lift approximately one inch, and withdraw magnetic and pit cover plates. Relocate the cask.
10. Attach extension rod and bail assembly to the grapple, remove the lock pin, lower bayonet-type grapple, and engage in pick-up socket on the cold trap.
11. Lift cold trap into "up" position in cask, replace lock pin, remove extension rod and bail.
12. Pick up cask and cold trap approximately one inch, relocate cover sheet and magnetic sheet.
13. Replace the cask, energize the electro-magnets.
14. Move cask cold trap electro-magnetic plate pick-up and the magnetic plate to the storage location.
15. Remove cover sheet, clean cell thoroughly, install new cold trap, replace plug, and purge cell with argon gas.

IV REFERENCES AND APPENDICES

1. TDR 4757 - W. A. Rhoades - December 15, 1959
2. Drawing No. 7518-D74147 Primary Pump Handling Cask Assembly
3. Drawing No. 7518-D74151 Bail Assembly - Primary Pump Lifting
4. Drawing No. 7518-D74154 Electro-Magnetic Shield Plate Lifter Assembly
5. Drawing No. 7518-D74131-5 Shield Plates and -11
6. Drawing No. 7518-D74104-7 Extension Rods

ATOMICS INTERNATIONAL

A Division of North American Aviation, Inc.

NO. 5238
DATE May 2, 1960
PAGE 5 OF 7

IV REFERENCES AND APPENDICES (CONT'D)

7.	Drawing No. 7518-D74153	Cold Trap Handling Cask
8.	Drawing No. 7518-D74152	Bail Assembly - Cold Trap Handling
9.	Drawing No. 7518-D74155	Grapple Adapter - Pump

a

b

c

LEGEND

1-MOTOR-COUPLING
2-PUMP
3-PUMP HOUSING
4-CASK
5-GRAPPLE ADAPTER
6-CRANE

7-ELECTRO-MAGNET ASSEMBLY.
8-GRAPPLE & LIFT FIXTURE
9-PLUG
10-WASH CELL
11-CASK LIFT RIGGING

d

e

f

FIGURE 1 - PRIMARY PUMP REMOVAL

6-7

a

b

c

d

- LEGEND
- 1-CRANE
 - 2-CELL PLUG
 - 3-COVER SHEET (PIT)
 - 4-CRANK TOOL
 - 5-FLEX. SHAFT
 - 6-MARMAN CLAMP
 - 7-CELL
 - 8-CLAM SHELL SHIELD
 - 9-TILT TOGGLE
 - 10-CASK
 - 11-MAGNETIC SHEET
 - 12-CASK HOIST
 - 13-STORAGE CELL PLUG
 - 14-STORAGE CELL

FIGURE 2 - COLD TRAP HANDLING