

**BEAMS DIVISION DEPARTMENTAL PROCEDURE**

**BD/MECHANICAL SUPPORT**

**BDDP-ME-0708**

**LITHIUM LENS FILL CLEANUP PROCEDURE**

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## 1.0 PURPOSE AND SCOPE

The purpose of this procedure is to define the methods by which to clean lithium from the lens fill apparatus. The hazards involved are addressed and the methodology developed attempts to minimize risk to personnel and property. Lithium is highly reactive, and as such every attempt is made to avoid person exposure. Lithium contaminated parts are exposed to oxygen and water in the most controlled circumstances. After the parts are cleaned, standard waste disposal procedures will be followed.

## 2.0 RESPONSIBILITIES

At the request of the Antiproton Source Department, Mechanical Support Department personnel will carry out all necessary pre-planning tasks and perform the lithium contamination cleanup. The Target Station Coordinator will oversee this effort. The Target Station Coordinator will also make arrangements with the appropriate Beams Division ES&H Safety personnel.

## 3.0 SUPPORTING DOCUMENTS

### 3.1 DRAWING REFERENCES

The following drawings may be referenced should questions concerning hardware configuration arise.

- 3.1.1 Antiproton Source – Lithium Lens Assembly I: 8000 – ME - 322083
- 3.1.2 Antiproton Source – Lithium Lens Assembly II: 8000 – ME - 322453
- 3.1.3 Antiproton Source - Lithium Lens Filler Device: 8000 – ME - 170160
- 3.1.4 Antiproton Source - Lithium Lens Filler Arm: 8000 – MD - 322435
- 3.1.5 Antiproton Source – Lithium Lens Bellow Assembly: 8000 – MD - 170162
- 3.1.6 Antiproton Source - Lithium Lens Filler Slug: 8000 – MB - 170085

### 3.2 ENGINEERING SPECIFICATION REFERENCES

- 3.2.1 Construction Notes for Lithium Lens Water Circuit Titanium Sub - Assembly: ES 8000 – MD - 170505

## 4.0 INSTRUCTIONS

### 4.1 TARGET HALL POST-FILL ACTIVITIES

The lens fill station will remain under an argon atmosphere until permission to perform the lithium cleanup is granted by the BD/ES&H department. Once permission is obtained the fill arm and two stainless steel tubes will be placed in a container that is lined with graphite powder and filled with argon. If the septum broke during the fill, any stray pieces of lithium will be collected and stored in a container filled with low weight motor oil, and an attempt to melt out as much lithium as possible from the lens will be made.

### 4.2 SEPTUM FAILURE PROVISIONS

To prepare to melt out the lithium, the lithium lens must be disassembled. The eight steel studs (with washers) holding the upstream and downstream end flanges must be removed. Once the end flanges are removed, the beryllium windows must be removed using a suction cup. Depending on the failure mechanism, and the ensuing investigation as to the cause, either an incision in the titanium window will be made, or the titanium window will be removed. The lens body will then be fixed vertically and heated to 190 C. A stainless steel container lined with graphite powder will catch the dripping liquid lithium. After as much lithium as reasonably possible has been salvaged from the lens, the heat will be turned off and the container of lithium and graphite powder will be sealed. The lens will then be placed in the other container, along with the fill arm and tubes, for later transport to the cleanup facility.

### 4.3 CHEMICAL CLEANING METHOD

The fill arm, stainless steel tubes, lens assembly, and any other contaminated parts, are immersed in water to cleanse them of lithium. Lithium is highly reactive with water and an estimated maximum of 115 grams of lithium combined with 298 grams of water produces 397 grams of lithium hydroxide and 16 grams (190 liters) of hydrogen gas. The lithium hydroxide is quite basic and is to be diluted with more water. A well-ventilated building will disperse the hydrogen gas whose volume is 5 percent of the Risk 0 maximum.

### 4.4 CLEANUP PREPARATION

The Fermilab fire barn is a suitable location for the chemical cleaning. It has overhead doors that may be opened to provide adequate ventilation. To perform the chemical cleaning with the overhead doors open, it is necessary to have a temperate and clear day. Permission must be obtained to do the cleanup in the fire barn from the building manager. Arrangements will be made to have a representative from BD/ES & H present during the cleanup. The fire department will be notified and the area will be cleared of ignition sources before cleanup begins. ***At a minimum, all personnel present must wear gloves and goggles.***

## 4.5 CLEANUP

### 4.5.1 EQUIPMENT ARRANGEMENT

The container holding the lithium-contaminated parts will be transported from the APO Target Hall to the fire barn. The overhead doors will be opened to vent the hydrogen that will be produced from the lithium-water reaction. Three 55-gallon drums will be arranged 10 feet apart. The parts container will be placed in one, the second is filled with water, and the third is nearby to transfer the waste liquid. A pump with an inlet hose in the water and an outlet hose in the parts drum will be setup. After the cleaning, the pump will be used to pump the waste liquid into the empty drum. Should the Safety representative deem it necessary to reduce the pH of the waste liquid, baking soda will be on hand to neutralize the lithium hydroxide.

### 4.5.2 CLEANING THE PARTS

The lid will be removed from the parts container. Water will be pumped until it covers the parts by 6 inches. When the reaction is complete, the waste liquid will be pumped into the waste drum and baking soda will be added. The parts will be taken back to APO and allowed to dry in the drum. The waste liquid will also be transported back to APO after the material move is approved.

## 4.6 WASTE DISPOSAL

The special waste and hazardous waste forms will be filled out as necessary. To dispose of the waste liquid, the appropriate BD/ ES & H personnel will be notified.

## 5.0 CONTROLLED COPY DISTRIBUTION

5.0.1 Reference Appendix A. The Mechanical Support Department Head is responsible for approving Appendix revisions.

APPROVED \_\_\_\_\_  
Mechanical Support Department Head

DATE \_\_\_\_\_

**APPENDIX A: Controlled Copy Distribution List**

| <u>Controlled Copy No.</u> | <u>Recipient</u>                                   |
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