

Title: Dewar top ruptures and injures two researchers

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Originator: Brookhaven National Laboratory

Lesson Learned Statement: Management, staff and researchers at DOE User Facilities need to ensure that adequate care and precautions are taken in the handling, storage and transport of cryogenic materials, in the lab setting as well as in transport on/off-site that may involve airlines or other public and private means of transportation.

Discussion of Activities: In preparation for work at BNL's National Synchrotron Light Source (NSLS), a researcher from Germany transported a "dewar" filled with shaved dry ice and vials containing small quantities of chemical and biological solutions to BNL via a commercial airline. The "dewar", actually a commercially available coffee thermos, was 10.5" high, with a 3.25" diameter mouth and a screw-in top. The screw-in top was kept loose to allow venting of the dry ice gases during transport. The thermos was placed in a cold room upon arrival at the NSLS, the top unscrewed, the contents examined to ensure sufficient dry ice remained to keep the contents cold, and the thermos top screwed back on by the researcher.

The researcher returned the next day to open the thermos, but couldn't unscrew the top. The researcher did not observe an absence of frosting on top of the thermos, an indication that the thermos was not venting the dry ice gas. The researcher obtained assistance from a colleague, who used both hands to try to remove the top of the thermos, while the researcher held the body of the thermos. While attempting this, overpressurization blew off the top of the thermos, which hit the researcher in the forehead. The body of the thermos hit the researcher's left thigh and thumb, while the colleague was sprayed with dry ice and suffered contusions on the left hand and knee. Both received medical attention (a splint was placed on the researcher's left thumb, and the colleague's left eye was irrigated), were released, and returned to work the next day.

Analysis: BNL carried out an immediate investigation and determined the causes to be a combination of personnel inattention to detail, training deficiency, and an error in equipment or material selection. A dewar or container with a screw-in top is inappropriate for the storage and transport of dry-ice or other cryogenic materials that can evolve gas. It may eventually overpressurize and rupture, which can clearly cause injury.

The airline had examined, x-rayed and approved transport of the thermos as part of the researcher's hand-carried luggage in the passenger compartment. It is possible that the thermos could have overpressurized and ruptured its top in-flight. This possibility raises concerns about potential impacts of cryogenic materials that could be improperly transported via airlines by research groups for use at DOE User (or other) facilities.

BNL is requiring additional training in cryogenic safety for the researchers involved, as well as surveying the training status and needs in this area for other beamline users and staff. Awareness about this incident and use of proper containers to transport cryogenic materials will be directly heightened by a forthcoming NSLS ES&H Highlight and Newsletter article addressing this and distributed to all users and staff. NSLS is also amending the NSLS experiment safety approval

form to more explicitly indicate potential cryogenic hazards associated with an experiment, to allow ES&H staff to better anticipate any specific cryogenic safety issues prior to conduct of an experiment.

Recommended Actions:

It is recommended that staff and management at DOE User Facilities:

- 1) Consider sharing details of this incident with members of the facility and ES&H staffs, as well as the local User community to emphasize the importance of safe storage, transport and handling of cryogenic materials. This applies to the lab setting, as well as transport on and off-site, particularly that which may involve airlines or other commercial transport systems (and particularly to never use a thermos, or a dewar with a top or cover that lacks adequate venting, or can become tightened or plugged).
- 2) Review training needs in the area of cryogenic safety for Users and staff.
- 3) Ensure that the experiment safety review process explicitly identifies potential use of cryogenic materials and any associated safety issues that may need to be addressed prior to the use of those materials at the facility.

It is recommended that other DOE facilities consider the items above, as appropriate.

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Priority Descriptor: Yellow/Caution

Functional Category: Cryogenic Safety, Experiment Safety, Transport of Materials

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References: ORPS Report CH-BH-BNL-NSLS-1997-0004