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Subject: Blue Alert: Swivel Hoist Ring Fails

Title: Swivel Hoist Ring Fails During Cask Lift

Identifier: B-1999-OR-LMERX10-1001 Date: 10-19-99

Lessons Learned Statement: Using swivel hoist rings on a shipping cask for tie-down points may overstress the hoist ring when it is cantilevered over the edge of the cask and cause it to fail during lifting operations.

Discussion: On July 27, 1999, a swivel hoist ring failed when a site rigging crew attempted to lift an empty 4,700-lb shield cask from a truck. The cask is designed and fabricated to transport canisters of uranium-233. The swivel hoist ring, manufactured by The Crosby AE Group, Inc., had a working load limit of 4,000 lb. The swivel hoist ring had not been tested other than by the manufacturer; however, the rigging crew did inspect the swivel hoist ring visually before the attempted lift. The crew attempted to use two of the swivel hoist rings to lift the cask, and one ring failed before they lifted the cask from the truck. The rigging crew stopped the lift, and facility personnel discontinued the use of Crosby AE hoist rings for lifting the shielding cask until they could determine the cause of the failure.

Analysis: The hoist ring that failed was Model HR125. These swivel hoist rings are quenched and tempered alloy steel. They have a design factor of 5 to 1 and are individually proof-tested to 2.5 times the work load limit. The rings are fatigue-rated to 20,000 cycles at 1.5 times the working load limit.

Investigators determined that before this attempted lift riggers had used these swivel hoist rings more than ten times to lift and move the cask between a fabrication shop and the facility. They also determined that, since the hoist rings were last used to lift the cask, they had been used to secure the cask to the truck more than once in a manner contrary to the manufacturer's instructions. When the rigging crew used the swivel hoist rings to tie down the cask, they pulled the rings down more than 90 degrees from vertical. Investigators learned that the pivot pins on both sides of the failed lifting-ring were broken. They believe the pins may have been broken before the crew attempted the lift; this would not have been evident during the pre-lift visual inspection. Indentations on the cask from the swivel hoist ring that did not fail indicate that the crew also inappropriately used it as a tie-down point. Investigators believe that using the swivel hoist rings as tie-downs may have overstressed them. The swivel hoist ring that did not fail was disposed of.

Resolution/Recommended Actions:

- The lift attempt was discontinued immediately. All lifts in the facility using this brand of swivel hoist ring were discontinued until the cause of the failure could be identified.
- Metallurgical examinations were performed and determined the swivel host ring was not defective but

overstressed during use in a configuration not recommended by the manufacturer.

- The rigger crews were informed of the proper use of swivel hoist rings during documented safety meetings.
- A proper tie-down fixture is being designed for the cask to be used during transfer.
- A Safety Bulletin on procurement control and testing of hoisting and rigging accessory items was issued to site personnel (http://www.ornl.gov/OQPI/LL/hr_bulletin.pdf).
- The site's overhead crane lesson plan has been revised to emphasize the importance of the proper use of swivel hoist rings.

The manufacturer makes the following recommendations regarding swivel hoist ring inspection/maintenance:

- Always inspect hoist rings before use.
- Regularly inspect hoist ring parts.
- Never use hoist rings that show signs of corrosion, wear, or damage.
- Never use hoist rings if the bail is bent or elongated.
- Always check with a torque wrench before using an already installed swivel hoist ring.
- Always make sure no spacers (washers) are used between the busing flange and the mounting surface. Remove any spacers (washers) and retorque before use.
- Always ensure free movement of the bail. The bail should pivot 180 degrees and swivel 360 degrees. http://www.ornl.gov/OQPI/LL/crosby_ring.pdf
- Always be sure the total work piece surface is in contact with the hoist ring bushing mating surface.

Drilled and tapped holes must be 90 degrees to load (work piece) surface.

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Priority Descriptor: Blue / Information (Fact or Discovery of Benefit to Others)

DOE Functional Category: Safety

LMER Functional Category: Safety and Health

Keywords: swivel hoist ring, lifting, cask, tie down

Reference(s): Occurrence Report ORO--ORNL-X10CHEMTEC-1999-0014; Operating

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http://nattie.eh.doe.gov:80/web/oeaf/oe_weekly/oe_weekly_99/oe99-31.pdf

Follow-up Action: Information in this report is accurate to the best of our knowledge. As a means of measuring the effectiveness of this report, please notify Connie Arnwine at 423/241-3134, e-mail at a93@ornl.gov, of any action taken as a result of this report or of any technical inaccuracies you find. Your feedback is important and appreciated.