

Site Visit Report – Review of the Lawrence Livermore National Laboratory Identified Defective Department of Transportation Hazardous Material Packages

This site visit report documents the results of Office of Health, Safety and Security's review of the Lawrence Livermore National Laboratory (LLNL) identification, immediate actions, communications, documentation, evaluation, reporting and follow-up to the discovery of defective Department of Transportation (DOT) UN1A2 55- and 30-gallon open head single bolt closure steel drums intended for storage and transportation of hazardous waste and materials. This review, conducted on January 26-29, 2010, was sponsored by the DOE Livermore Site Office (LSO) to support interface with the lab and this report is intended to support follow-up and closure of the LLNL Occurrence Reporting and Processing of Operations System (ORPS) report of the discovery of the defective drums.

BACKGROUND:

As described in the LLNL-2010-0001 ORPS report, nonconformances were identified on October 8, 2009, during receipt inspection of 20 55- and 15 30-gallon steel drums. Specifically, it was determined that the required drum closure ring clamping force could not be achieved for some inspected 55-gallon drums because of contact between the closure ring ends prior to reaching the manufacturer's specified closure ring bolt torque value. Additionally, the quality of drum welds of the lugs to the drum closure rings for both 55- and 30-gallon drums were determined to be suspect.

LLNL, through a documented and mature process managed by the Nuclear Operations Directorate, Packaging and Transportation Safety (PATS) organization, purchased the drums from their distributor, United States Container Corporation. The distributor obtained the drums from the manufacturer, Myers Containers Corporation, an LLNL evaluated and approved vendor. Myers Containers obtained the drum closure rings from the Sorini Ring Manufacturing Company.

The package/drum manufacturer is the design authority with responsibility for qualification of the package/drum to DOT performance standards following any design change. The manufacturer is required to provide drum specific closure instructions, such as the drum closure ring bolt torque, to facilitate user assembly of the drum to a design configuration identical to that of the prototype drum that passed DOT specified performance tests. The manufacturer closure instructions indicate that in order for the supplied drums to safely perform to their rated ability, the provided assembly instructions need to be strictly followed and that any other method of assembly or the use of any drum components (rings, gaskets, or fittings) that is not specified in this design type will immediately invalidate the United Nations (UN) System of markings and DOT performance rating of the drums.

OBSERVATIONS:

- **PATS Procurement Program Quality** – PATS has established high quality programs for evaluation and qualification of packaging suppliers, trending supplier performance,

maintaining the list of approved evaluated suppliers, procuring packaging, training and qualifying receiving inspectors, performing receipt inspections, segregating, responding to and documenting identified nonconformances, and performing and documenting periodic internal management assessments.

- **Procurement Record Review Results** - Reviewed records demonstrated: (1) that Myers Container was appropriately qualified and periodically assessed for continued listing as an approved member of the PATS evaluated suppliers list, (2) that the defective drums were appropriately specified and procured from the PATS Just-In-Time Distributor, (3) that the receiving inspector was appropriately trained and qualified, (4) that the receiving inspection was appropriately conducted, (5) that all Myers Container drums not yet issued were placed under a QA Hold, (6) that the extent-of-condition was appropriately assessed and controlled, (7) that appropriate notifications were made, (8) that an appropriate nonconformance report (NCR) was promptly drafted that recommended the drums be returned to the manufacturer, and (9) that an appropriate Supplier Corrective Action Request (SCAR) was issued to the drum distributor describing the identified conditions adverse to quality and soliciting the supplier's assessment of the root causes and corrective actions taken or planned. The LLNL SCAR and follow-up correspondence was directed to the drum distributor versus the manufacturer because the drums were procured from the distributor and the distributor receives payment from LLNL if the provided drums are accepted.
- **Receiving Inspector Performance** - The Receiving Inspector who identified and reported the defective drums was experienced, well qualified, and appropriately responded to the situation. As a result of his response, other professionals and managers were notified and became involved, the inspection sample size was increased to 100 percent as required, the suspect nature of the lug welds to the drum closure rings was confirmed, and none of the suspect drums were issued for use.
- **Receiving Inspection Form Quality** - The PATS Receiving Inspection form is comprehensive, applicable to multiple packages of different design, and appropriately requires detailed physical inspection of a specified sample of the packages for critical package characteristics, including closure of the package with a calibrated torque wrench per the manufacturer's closure instructions. However, achieving the specified drum closure ring bolt torque during closure of the open head drums does not in of itself ensure the package's rated performance characteristics can be achieved. The manufacturer's closure instructions also include additional verifications necessary to ensure package performance; e.g., verification the gasket is seated on the drum lip and remains positioned within the drum cover recess, verification the specified torque can be reached without causing the ring end to meet, verification the ring is properly positioned around the drum curl and the drum cover recess, etc.
 - **Opportunity For Improvement (OFI)** - To avoid the potential that some of these necessary verifications are not performed (an error of omission), as a Human Performance Improvement initiative, consider revising the generic packaging receiving inspection form to require verification that packages can be appropriately closed with strict step-by-step adherence to the provided manufacturer's closure instructions.
- **Receiving Inspection Form Adherence** - The reviewed 55- and 30-gallon drum receiving inspection forms indicated that NCR 1162 had been written; however, all inspection blocks were initialed showing acceptance and the NCR number was not shown opposite the

calibrated torque wrench and weld quality inspection blocks as required by the “NOTE” at the bottom of the form.

- **NCR Procedure Quality** – Section 4 of the PATS’s procedure for “Preparing and Processing a PATS Nonconformance Report” indicates that the Receiving Inspector who identifies a nonconforming item determines if an occurrence report needs to be issued by working with appropriate individuals. However, the procedure does not identify who these appropriate individuals are by name or title and the LLNL Environment, Safety and Health (ES&H) Manual assigns responsibility for determining the need to issue an Occurrence Report to a Principal Associate Director or other designated individual, neither of which are the Receiving Inspector.

OFI - Because the PATS’s NCR procedure provides guidance to Receiving Inspectors and is part of their formal training program, consider revising section 4 of the PATS’s NCR procedure to be consistent with the roles and responsibilities for workers and managers as defined in section 8 of the ES&H Manual, volume I, document 4.3.

- **ORPS Timeliness** - Although the suspect drums were originally identified as non-conforming and reported in NCR 1162 on October 8, 2009, the LLNL-2010-0001 ORPS report was not issued until January 8, 2010, when the LLNL individual authorized to approve the ORPS report concluded that the ORPS reporting criteria had been met. DOE Manual 231.1-2 and the LLNL ES&H Manual, document 4.3, require an ORPS report for events or conditions that meet listed reporting criteria. Reporting criteria 4C(3) states:

“Discovery of any defective item or material, other than a suspect/counterfeit item or material, in any application whose failure could result in a loss of safety function, or present a hazard to public or worker health and safety. A defective item or material is any item or material that does not meet the commercial standard or procurement requirements as defined by catalogues, proposals, procurement specifications, design specifications, testing requirements, contracts, or the like. It does not include parts or services that fail or are otherwise found to be inadequate because of random failures or errors within the accepted reliability level.”

Facts contributing to the concern for the ORPS Report timeliness include:

- The fact that some of the Myers Container drums were defective, were not suspect/counterfeit items, and were intended for application where failure could present a hazard to the public or worker health and safety was known shortly after the non-conformances were identified. However, the Myers Containers quality performance trends maintained by PATS as far back as the early 1990s were good, making it unclear whether the drum inadequacies were the result of random failures or errors. As a result, it is reasonable to conclude that the ORPS reporting criteria was not met until additional information became known.
- Additional information was developed by the LLNL staff during a visit to the Myers Container manufacturing facility as document to LLNL management in a trip report dated November 17, 2009. That report assessed the corrective actions that had been taken, noted that drum curl and closure ring length tolerances were being tightened, that Myers Container did not have welding expertise, that Sorini Ring weld acceptance criteria was subjective, and suggested a number of manufacturing process control enhancements that Myers Container and Sorini Ring could make to ensure design specifications and package performance requirements were met and trends

were detected and corrected before the specifications were violated and/or package performance capabilities were degraded.

- On November 24, 2009, Myers Container provided revision 2 to their response to LLNL SCAR 1013. The response clearly indicated the original design tolerance of drum lip curl and drum closure ring length were not compatible. Specifically, mating a drum with minimum but originally allowed curl dimensions with a drum closure ring with maximum but originally allowed length would result in the nonconformance. The response also indicated that welds specs and drawings were under development.
- On December 1, 2009, the drum distributor was informed in writing that LLNL did not believe the root cause of the problems identified in the SCAR 1013 had been determined, again requested the distributor perform a root cause analysis to determine the underlying problems for the drum closure deficiencies and to propose corrective actions to prevent recurrence, and identified the questions that had not been answered. It is not clear why, at this point in time, that LLNL did not conclude the ORPS reporting criteria was met given the additional information developed during and following the LLNL staff visit to the manufacturer's facility.
- On January 4, 2010, Myers container provided revision 3 to their response to the LLNL SCAR 1013. As documented in the subsequent LLNL correspondence to Myers Container dated January 11, 2010, LLNL stated they had reviewed Myers' responses to SCAR 1013 and concluded that the root cause to the problems had not been identified and that there were concerns with the methodology Myers used in determining the root cause. The latter correspondence also discussed the basis for the LLNL concerns including deficiencies in weld specifications and drawings, and the lack of evidence that control of parameters other than drum curl and closure ring length were considered in assessing the root causes of the inability to reach specified torque levels before the ring ends met. Example parameters cited included drum diameter, material thickness, sheared blank dimensions, etc.

OFI - Although the LLNL-2010-0001 ORPS report is accurate, well written, effectively communicates the issues, and recommended reading for important details not discussed in this trip report, consider performing a self assessment of whether the ORPS report was initiated in a timely manner and met LLNL expectations as stated in the LLNL ES&H Manual, volume 1, document 4.3.

Additional Recommendations for DOE/Office of Environmental Management (EM)

- **DOE/EM Hazardous Material Packaging Safety Alert Review Results** – The January 14, 2010, Safety Alert was an appropriate mechanism for notifying the DOE complex of hazardous material packaging concerns identified at Hanford and LLNL. However, in retrospect, the value of the Safety Alert would have been enhanced had it mentioned that:
 - DOE sites should inspect not only the drums and rings in their warehouses, but all drums on site, including those awaiting use, being filled or used, and/or ready to be shipped, that were manufactured by Myers Containers Corporation. (Drums with intact but cracked or bent drum closure ring lug welds may not be able to meet DOT performance requirements when the package integrity is challenged.);

- some of the drum closure ring lug welds actually failed at Hanford during drum closure to the manufacturer's drum closure ring bolt torque specifications;
- the manufacture had not provided drum closure ring lug weld specifications to the drum closure ring manufacturer and did not have an adequate receipt inspection process to identify weld deficiencies;
- the inability to reach the manufacturer's drum closure ring bolt torque specifications before the drum closure ring ends met at LLNL was the result of both a long drum closure ring length and a small drum rolled edge curl, both within manufacturer specified excessive dimensional tolerances (resulting in the tolerance stacking deficiency); and
- the Office of Packaging and Transportation effort to codify drum ring specifications will include ensuring compatibility with interfacing dimensional tolerances for drum diameter, material thickness, rolled edge curl, etc. effecting drum closure clamping forces and satisfaction of DOT performance requirements.

CONCLUSIONS:

LLNL programs for procurement of hazardous material packages and identification of nonconformances were effectively implemented, preventing the use of defective items that might have otherwise endangered the environment and the health and safety of workers and the public. This fact-finding review identified several opportunities for improvement, as discussed above.