

November 20, 2012

To: Michael Lindgren
Head, Particle Physics Division

From: Jay Theilacker
Chair, Large Quantity Liquid Argon Cryogenic Safety Review Panel

Subject: Liquid Argon Purity Demonstration (LAPD) Run 2 Recommendation

The Panel has reviewed the Liquid Argon Purity Demonstration (LAPD) Run 2 documentation in accordance with your charge of February 11, 2010. Our conclusion is that cryogenic aspects of the system, its enclosures, and associated infrastructure allow operation which is safe for people and the environment. In reaching that conclusion, we have confirmed that those requirements of the Fermilab Environmental Safety & Health Manual (FESHM) which apply to cryogenic systems have been satisfied.

The following documentation was provided to the Panel and is posted at <http://lartpc-docdb.fnal.gov:8080/cgi-bin/ShowDocument?docid=553>.

- System equipment and operation description, updated 06-12-12
- Flow sheets (444897), updated 06-26-12
- Component list, updated 06-25-12
- PLC interlock documentation, no change from Run 1
- System procedures, no change from Run 1
- Commissioning plan, no change from Run 1
- Emergency procedures, no change from Run 1
- System expert list, no change from Run 1
- FMEA, updated 06-25-12
- What-If Analysis, no change from Run 1
- PC-4 Enclosure ODH Analysis, updated 11-13-12
- PC-4 Gas Shed ODH Analysis, no change from Run 1
- ODH system check out, updated 03-05-12
- PC-3 upstream ODH barrier and fan with streamers, no change from Run 1
- Condenser PV note, updated 06-18-12
- Phase Separator PV note, no change from Run 1
- Tank engineering note, no change from Run 1
- Molecular sieve and oxygen filter PV notes, updated 06-18-12
- LN₂ supply and LAr supply piping engineering note, updated 06-25-12
- Argon purification piping engineering note, updated 06-25-12
- Run 2 tank center flange for Long Bo TPC, new 07-03-12

Panel members have reviewed each of these documents and recommended changes to them to ensure FESHM requirements will be satisfied. We are pleased that those recommendations were implemented and are satisfied that the present documents satisfy FESHM requirements. They should lead to cryogenic operations which are safe for people and the environment. Vessel and piping systems follow applicable portions of FESHM chapters 5031, 5032, 5033, and 5034 (and

associated sub-sections) and sound engineering practices. Vessels and piping have been properly designed, fabricated, and tested. We are satisfied that engineering notes, the Failure Mode and Effects Analysis (FMEA), and What-If Analysis demonstrate that vessels and piping should remain safe under single component and plausible multiple component failures. The Piping and Instrumentation Drawing and the Valve and Instrument List are complete and accurate to the best knowledge of the Panel.

Oxygen deficiency hazards were re-evaluated in accordance with FESHM 5064. The revised and approved ODH analysis considers the installation of a second ODH exhaust fan, but does not consider operation of the 35 ton membrane cryostat. The revised ODH analysis changes the PC-4 ODH classification from Class 1 to Class 0. This was made possible by the addition of a second exhaust fan which is automatically activated by oxygen deficiency monitors.

The system procedures, commissioning plan, emergency procedures, and the system expert list continue to be essential documents for ensuring safe operation of the system.

We recommend that you authorize LAPD Run 2 cool down, fill and operation once the following have been completed:

1. ODH classification signs have been re-posted.
2. Isolation valves on cryogenic lines for future expansion to the 35 ton cryostat have been properly LOTOed (MV-5001-Ar, MV-5002-Ar, and MV-1005-N2).
3. PC-4 electrical distribution improvements have been completed.

The electrical distribution work will require powering down the cryogenic controls as well as the ODH fans. As a result, this will need to be completed prior to system cool down. It may be desirable to the project to purge the tank with clean gas and to regenerate the LAPD filters prior to completion of the electrical work. This does not require cryogenics to be present in the PC-4 enclosure. A limited quantity of gas will need to be circulated. The Panel accepts performing this activity after items 1 and 2 have been satisfied.

Sincerely,



Jay Theilacker,
On behalf of the Panel

cc:

L. Bellantoni (Committee Coordinator, PPD Experimental ES&H Review Committee)
A. Klebaner (Head, Cryogenic Safety Subcommittee)
R. L. Schmitt
T. Tope
Review Panel Members
(W. Cooper, B. DeGraff, G. Ginther, L. Hammond, E. McHugh, R. Rabehl, J. Theilacker)