Loose Ends in the Daya Bay RPC Gas Safety Systems

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In addition to the "loose ends" in the RPC gas system mentioned in DocDB #1919 (Mar 20, 2008), there are several issues related to the gas safety system that should be discussed further.

1. Oxygen Deficiency Hazard (ODH) and Flammability/Explosion Hazard

The use of gases other than air/oxygen in the RPC system represents an oxygen deficiency hazard. In addition, the use of Isobutane represents a hazard of explosion (although the RPC gas mixture Ar/R134A/Isobutane/SF_6 (75.4/20/4/0.6 by volume) is not flammable). Any ODH sensors used near the Isobutane bottles must therefore be explosion proof.

2. Who is responsible for design and fabrication of the ODH and HAD Safety Systems?

The RLS has an item, 1.02.04, for the Muon System ODH System, but no institution and no budget are identified.

There appears to be no item (or budget) in the RLS for the HAD (hazardous gas) Safety System.

Can/should these two safety systems be implemented together?

3. Gas safety system designs.

DocDB #950 (Xiaolan Luo, Apr 27, 2007) listed components that might be appropriate for both the ODH and HAD systems, with vendor prices of $55-70k. No detailed design of a safety system was given, and no commitment was made by IHEP to take responsibility for these systems.

DocDB #1754 (Changguo Lu, Jan 17, 2008) presented a design and cost estimate of $37k for the HAD safety system only. Princeton is prepared to take responsibility for this and the RPC ODH safety system, but such responsibility has not formally been assigned by the Collaboration. While we have not made a design/estimate for the combined ODH/HAD safety system, an extrapolation using DocDB #950 to $70k is not unreasonable (if no explosion-proof cabinets are used; see item 4).

4. Option to locate the Isobutane bottles in explosion-proof cabinets.

As we understand it, the three experimental halls include rooms designated for the gas supply bottles. The ODH and HAD sensors must therefore be deployed in these three rooms. Explosion-proof ODH sensors are more expensive than ordinary ones, so the cost of these sensors can be reduced if the Isobutane bottles are located in explosion-proof cabinets (with one explosion-proof ODH sensor inside each cabinet). However, explosion-proof cabinets are expensive.

It has not been resolved whether or not it is advantageous to use explosion-proof cabinets.