Some comments on the gas safety issue

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The following are some comments on the recommendations mentioned in Dana's "Fire safety aspects of the RPC gas system" and a note on the Ar flow limiter.

1. "A gas detector in low areas of the EH should be considered along with good air flow".

If we direct put the RPC exhaust gas mixture into the EH ventilation exhaust duct, the gas mix will be diluted immediately: as we know that the ventilation air rate is one half EH volume/hour, > 500m^3/hour. RPC gas mix flow rate is 0.11m^3/hour, Isobutane is only 4% of the mixture, therefore isobutane exhausting rate is 4.3l/hour. 4.3 litter Isobutane diluted by 500m^3 air, it is only 0.05% of LEL, which is much lower than any standard. Looks to me in EH if we place some flammable gas detectors there they wouldn't be any use. The EH size is similar to a tennis court, in such a large space where you should place the gas detectors?

2. "A gas purge needs to be added to the system."

The RPC gas mixture itself is non-flammable, which might be different from what BNL has experienced in their experiments. Do we need to purge the RPC with different inert gas in emergency situation? If we do it, after such incident we need to flush the whole system for long time. BTW, our gas system is designed for normal flow rate as one volume change per day. To get the good accuracy for each gas flow controller the working flow rate should be kept no more less than 1/3 of the full range. It means the maximum flow rate would be 3 volume changes per day. So the flushing time after the purging accident would be at least two days to get more than 5 volume changes.

3. "A final pressure regulator should reduce the outlet pressure to less than 5 psi"

In present design there is no outlet pressure regulator on the gas mixing panel. The outlet tubing is connected to the gas distribution system as shown in figure 2. Long S.S. tubing will connect the gas outlet on the gas mixing panel, through the wall of gas mixing room, to the gas manifold in EH. The downstream gas tubing from the manifold will be all flexible Polyflo, which connect the manifold to the flow resistor panels, then followed by RPC modules and

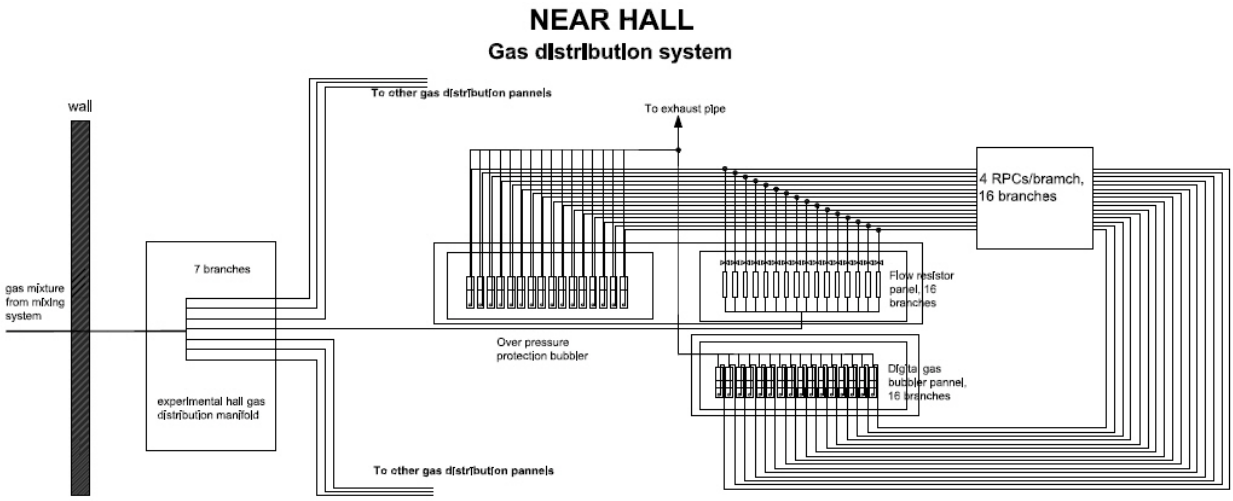

Fig. 2. Gas distribution system.

output bubblers. After the flow resistors there are Tees to split the gas to RPC modules and the

overpressure protection bubblers. Under the normal flow rate the pressure drop through the flow resistor is ~1cm W.C. The protection bubbler's pressure limit is set at 2cm W.C. Thus we can expect that the gas pressure at the gas manifold is at most 3cm W.C. which is much less 5 psi. Since we are monitoring the bubbling rate on line, any unusual behavior of the gas distribution system will be reflected on the bubbling rate that will be shown on the slow control display screen.

4. Ar cylinder dumping rate - Flow limiter

For choosing a flow limiter a general recommendation is to choose a flow limiter with a catastrophic flow that is some multiple of the rated flow of the MFC. In our case Ar flow rate is ~ 1.4SLM, the maximum flow rate for the MFC is chosen as 4SLM, so we may choose the flow restrictor of 6SLM. For a #300 cylinder with 2400psi pressure, it will take ~ one day to dump one bottle. The location of the flow limiter is shown in figure 1.

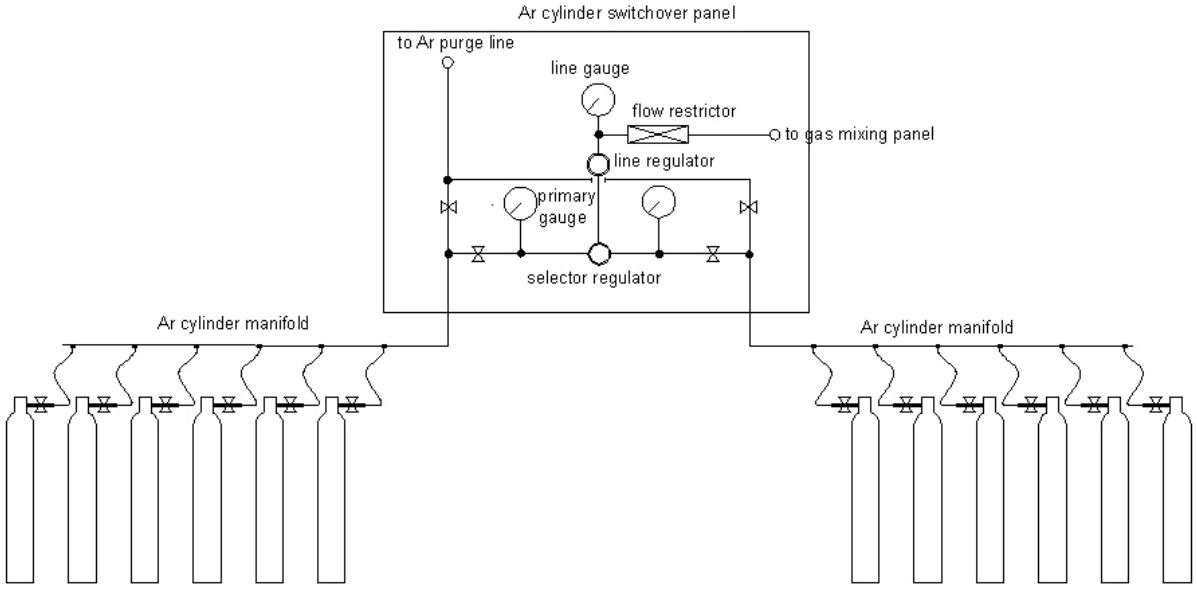

Fig. 1. Ar cylinder changeover panel with cylinder manifold and flow limiter.

The flow limiter has a maximum pressure rating, which is in the range of 100 ~ 200 psi. I am contacting with the manufacture about the use of this flow limiter at much higher pressure, e.g. >2400psi, so far no answer yet. For the present specs this type of orifice flow limiter can't be used at the gas cylinder end. The only location is at the downstream of the regulator, where the gas pressure has been regulated ~40 psi.