Hazards associated with the Isobutane analyzer calibration routine and how to mitigate them.

Do not enter the gas shack if the rotating red light at the entrance is on. This warns of an oxygen deficiency.

In General the Gas Mixing shack can be a hazardous place – BE AWARE OF YOUR ENVIRONMENT.

There are hazardous gas detectors that will cut off any gas flow at 10% of the lower explosive limit and oxygen deficiency monitors that will alarm if there is a less than 19% oxygen level.

Gas bottles are a hazard to move. Breaking the stem on a gas bottle can cause flying debris

Never move a bottle without the cap fastened. Always earthquake brace bottles at two points in the place they are to be used or stored. Always keep control of the bottle with two hands while moving.

The gases used in the calibration routine present a cryogenic hazard.

Be certain that the bottle is plumbed into the correct gas circuit and the fittings are tight before opening. When removing a bottle be certain to valve off the gas; At the bottle first, at the gas panel second. Slowly bleed the lines before disconnecting.

There is a marked step up both on to the gas pad and into the gas shack.

Be aware. It easy to trip while making a step into empty space when coming out of either one.

Side of rack B636-05 must be removed.
To access the span gas valve and the nitrogen flush valve in rack B636-05 the side of the rack should be removed. This can fall rapidly and cause alarm or an injury. The rack side panel should be supported by one hand while turning the locking screw. Two hands should be used to lift and carry the side panel out of the way.
Figure 1. Analysis Meter in Center shows Pressure for Span Gas when that is selected by procedure.

Figure 2. Back of rack B636-05. Showing locations of VVM-91 and VVM-92.

Figure 3. Outside Gas Pad. Span Gas Bottles and Panel Location.

Figure 4. Front of rack B636-05.
Procedure for calibration of the BaBar DCH Isobutane analyzer

- Let the Shift Leader know what you are about to do as it may cause a DCH gas system alarm.
- On EPICS -> dch panel -> gas system -> mode status and alarm panel (ajstatsum.dl) -> press super user (NOTE: You must have super user privileges to do this procedure.)

Purging Phase:
- Open The Span gas Bottle to be used in the Explosive gas pad – If it is a brand new Span Gas bottle (About once every two years) then purge the gas line. Open the Span gas flow valve – Figure 3.
- Check pressure on the Span Gas Line (See Figure 1.) and make sure it is approx 200mbar. Adjust the bottle regulator if pressure is too low. Figure 1.
- Check the flow meter at front of rack B636-05 (Figure 4.) and see that the flow rate is approx .8 L/minute. Adjust it if it is too low.
- At the back of rack B636-05 open VVM-92 Nitrogen valve. Figure 2.
- On EPICS -> dch panel -> gas system – status and command control panel -> right click valve control panel (ajvvcrtl.dl) -> press analyzer calibration Mode – Press Push to Calibrate.
- Wait until reading on the Isobutane analyzer is 0% and then ~5 minutes more.
- On the Isobutane analyzer:
  - Press Menus
  - Select “Basic Menus” - Enter
  - Select “Zero All Ranges” – Enter
  - Wait Until Remaining Procedure Time Is Zero.
  - Back To Basic Controls
  - Select “Span Gas Concentration” - Enter
  - Change concentration to the value written on the span gas bottle being used for this calibration. – Enter.

Calibration Phase:
- At back of rack B636-05 open Span Gas Valve VVM-91. Figure 2.
- Close Nitrogen Valve VVM-92. Figure 2.
- Wait until the Isobutane analyzer reading stabilizes and the Oxygen analyzer just below it reads approximately the oxygen level written on the Span Gas bottle – Then wait another 2 minutes.
- On the Isobutane analyzer:
  - Make Sure Current range is set to 2
  - Select “Start Spanning the Current Range” – Enter
  - Wait until remaining procedure time = zero (about 10 seconds.)
  - Back to “Basic Controls”
  - Select “Actual Measurement Range Number
  - Change the Measurement Range Number to 1 – Enter
  - Change Span Gas Concentration to the value on the bottle label. – Enter
  - Select “Start Spanning Current Range” – Enter
  - Wait until remaining procedure time = zero (about 10 seconds.)
  - Select “Back”
  - Select “Main”
  - Select “Measure” – This will read out Range 1 - From 0% to 30% - See that the analyzer reads 20.xx % - (very close to value on Span Gas bottle)
  - Select “Menu”
  - Select “Basic Controls”
  - Select “Actual Measurement Range” – Enter
☐ Change value of range to 2 – Enter
☐ Main
☐ Measure
☐ Reads out Range 2 – From 18% to 22% - This is the normal operating mode of the analyzer. See that the value read out is 20.xx% - (very close to value on Span Gas bottle)

**Finish Up – Back to Operations Mode**
☐ At back of rack B636-05 Close Span Gas Valve VVM-91
☐ On EPICS panel (ajvvertl.dl) select “Push To Validate”
☐ On EPICS panel (ajvvertl.dl) select “Analyzer Calibration Mode ” – This will end the calibration and reset the analyzer input valve VVPC_14
☐ Check flow meter at front of rack B636-05 and make sure flow is approximately .8 L/min.
☐ Wait and check reading of Isobutane mix.
☐ Close Span gas bottle and valve on Span gas panel
☐ Fill out Calibration Log Form on side of rack B636-03