

Safety Alert – Purity of N2 supply

Approximately 2 weeks ago, we received some Safety Critical information, regarding a serious High Potential Well Operations incident.

The incident involved a pulsation dampener on a high pressure mud pump, exploding catastrophically.

See the following images.



Close up view of the exploded Pulsation dampener – wall thickness of this material is 8 cm's plus – Pressure Rating approximately 5000 psi.

One of the “bomb” fragments



It is also possible to see the explosive power, which destroyed an adjacent “Pop” valve line, wall thickness 1.5 cm's

Below, it is possible to see the normal Pulsation Dampener, as well as the exploded one.

In addition the viewer can see the Catwalk, pipe slide, V-Door stairs in the upper right background



Again it is also possible to see the explosive power, which destroyed an adjacent "Pop" valve line, wall thickness 1.5 cm's

Red arrow indicates possible direction of one exploded fragment, toward the derrick tower, with stands of drill pipe, as well as the V Door/catwalk stairs on which at least eight stair steps were destroyed.

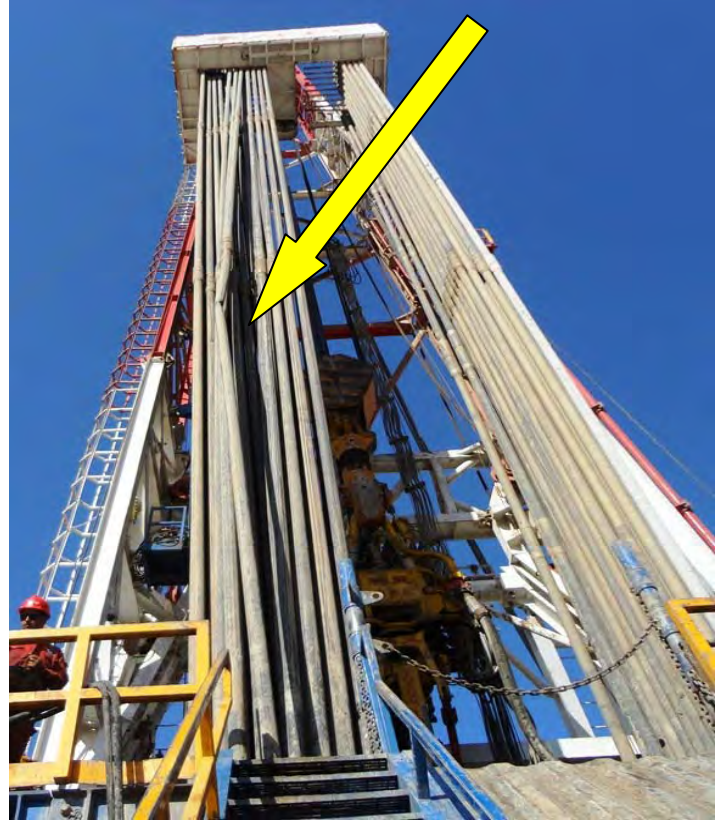
Preliminary investigation has identified that the source bottle of Nitrogen that had been used to precharge this Pulsation dampener, had more than 20% oxygen. Weakly emulsified diesel oil in the mud, may have phase-separated, and accumulated under the diaphragm/bladder. If oil under pressure in a closed system, can mix with oxygen and explosion can take place.

Post accident investigation analysis indicated the diaphragm material was in poor condition.

This may be the fragment that went toward the rig monkey board, hitting two stands of pipe 8 meters above the rig floor [15+ meters above the pump]



Two stands of drill pipe damaged from the velocity and energy of the impact.



Catwalk Stairs damaged by flying fragment of Pulsation Dampener

3 essentials for a fire/explosion to take place are 1) fuel, 2) O₂ and 3) ignition.

Oil [relatively high gravity oils like diesel, higher API gravity crude oils, can ignite with pressure and Oxygen, this is the principle of Rudolph Diesels engine <http://inventors.about.com/library/inventors/bldiesel.htm>

Subsequent investigation of many more N₂ bottles indicated the presence of up to 30% Oxygen.

One contractor recently checked the N₂ bottles in one Accumulator and found 13 bottles had oxygen present.

It is a common practice with local Compressed gas vendors, that are not respecting QA/QC standards, or safe handling practices, regularly mix bottles of different colors and manufacturers intended applications.

There is no respect for [or perhaps even knowledge of standards such as BS 349 which provides that "All gas cylinders should be colour coded in accordance with - Oxygen ="Black", Nitrogen ="Gray body with black top", Acetylene = "Maroon".

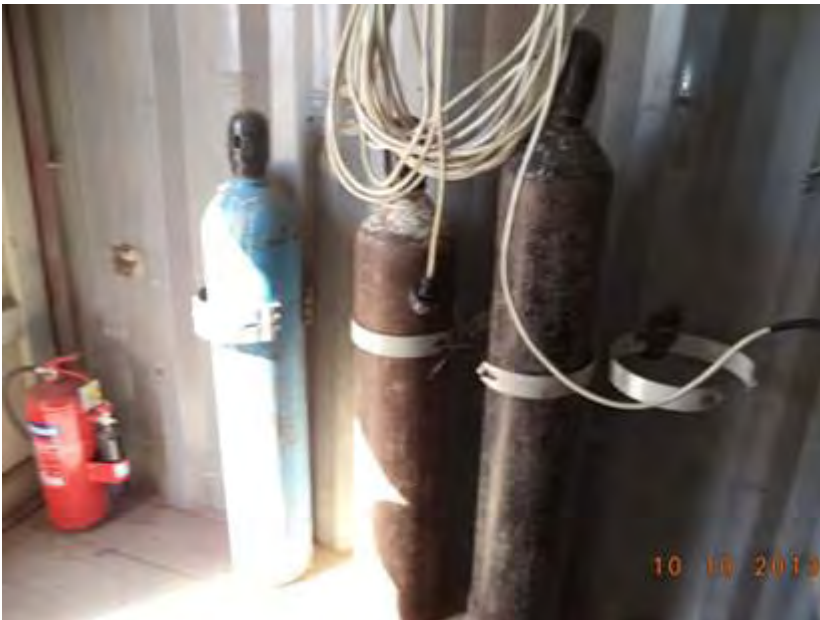
In addition the name of the gas contained within the cylinder should be clearly stenciled on the cylinder body . See pictures below



The 3 black bottles - manufactured and identified as to gas type according to BS 349 standard – have been filled locally with N₂. Grey bottles to the side in upper right corner are colored and stenciled correctly for N₂.



More examples of the variety of color cylinders available for pressurized gases.



Oxygen Cylinders with two different colored code!!!!!!!!!!

It has been confirmed that Oxygen and Nitrogen bottles have the same size of valve / connection.

It has been established that during routine maintenance in the recent past, nitrogen bladders (e.g. from BOPs Koomey unit / mud pump's pulsation dampener) appear to have been charged / re-charged without prior checking the contents of the HP bottles. This unsafe practice must be stopped with immediate effect. Contractors must recognize this hazard now, and develop procedures and controls to manage the risk. Good practice and responsible management will also ensure that this hazard is captured in each Contractors overall operations hazards/risk register [HIRCAs etc], and further more will be included in JHA's which will support PTW for energized / pressure works.

As a minimum,

1. Develop a system to inspect nitrogen bottles on the rig to ensure no other gases are present.
2. Develop a procedure to check all nitrogen cylinders upon being received at the work site and before placing in use.
3. Adopt an international standardized color code system for all gas cylinders used [such as BS 349].
4. Develop a program to require testing and documentation of all nitrogen cylinders contents at rig site.
5. Standardize valves used for nitrogen to be different from other valves used in other gas cylinders.
6. work on energized systems should be performed under PTW, under which the potential hazard of O2 being present in N2 bottles is identified and the mitigation controls are specified. .

Recently rig F-17 introduced a new method to verify the gas bottle content .



The best method is by using N2 purity tester to verify the gas bottle content accurately

Due to the completely unreliable and therefore dangerous condition, where there is no Quality Control at the local Gas Bottle Resupply centers, this seems like an achievable, realistic solution, to an “explosively dangerous” condition.

COMPANY requests that all of Contractors take these previous alerts/warnings seriously, [the exploded Pulsation Dampener on the Lukoil Project] and are considering or hopefully are introducing similarly

Please reply, with the actions your Organization is taking to ensure this risk is managed properly.