

Minutes of 6th Meeting of the HSE Gas Cylinder Research Steering Committee

19 June 2003
HSL Sheffield

1.0 Attendance

Chairman	Roy Irani	(RI)
Secretary	Graeme Hughes	(GH)
	Steve Elliott	(SE)
	Roy Mellick	(RM)
	Eddie Ojak	(EO)
	Glyn Evans	(GE)
	Jim Bentley	(JB)
	Peter Bates	(PB)
	Andy Webb	(AW)
	Janet Joel	(JJ)
	Oliver Crichton	(OC)
	David Hopper	(DH)

Apologies received from	Michaline Howarth	(MH)
	George Georgio	(GG)
	Simon Davies	(SD)

2.0 Minutes of 5th meeting

Page 3 has 'k' missing in 'UKAS' and 'know' and 'keay' was wrongly spelt.

3.0 Actions from minutes not covered elsewhere

- 3.1 Action 5.9 on GG. No contact has yet been made with BOC or the MOD.
Action continues.

4.0 Updates since last meeting

- 4.1 JJ has discuss rapid filling further with fluid dynamic colleges. The distance from storage, pipe sizes etc all have an effect. It is suggested that thermocouples be fitted to cylinders to see what happens in reality. RI discussed the chilling effect of CO2 but was more concerned with CM type cylinders. High speed filling since 1992. Cylinders are moved straight away after filling – whilst still cold – maybe this could induce low temperature cracking due to impact damage. Rapid filling is not just beverage gas – BA, Special gases etc. No cracking reported in

these areas. RM to put thermocouples onto cylinders and monitor the temperatures seen. JB asked for cylinders to go through UT prior to testing to ensure defect free. JJ says that thermocouples need to be spaced down the cylinder to give a distribution of temperatures. RI suggested that cylinders go to Chesterfield for the UT. Then back to Chesterfield post test. JJ says that expert says that change to N2 or end of N2 may be problem areas. RI says one cylinder should be CM, DH says Messer are not allowed to fill CM cylinders but will see if this can be overcome within their procedures. JB says that he has a cylinder model he could pass data through. RM to send test data and drawings to JB

Action 6-1 RM/JB

4.2

JJ gave a presentation on the on going investigation into the Ceodeux valve failures. No lead detected on failure surfaces and no lead segregation found. Visited David Birch at BOC who suggested we look again at everything. From meeting more chemical analysis of brass, 'o' rings etc. Hardness testing was all to specification. 'o' rings showed styrene – should have been EPDM. Had meeting with Ceodeux in August – they say styrene is from paint contamination. RM says EPDM is cured in two ways and DH says styrene can migrate from plastic bag in which 'o' rings were carried. JJ says that it can come from incorrect curing process – she does not think 'o' ring is the problem. RI surprised that no lead was found as Capsis report had clearly shown lead as a problem. JJ has reproduced this Capsis work – this was from batch 02-02 rather than the initial batch 03-01. DH says this is a widespread problem and not restricted to an individual batch. Cleaning fluid has been analysed by JJ. Ethanol Amine is present and has a smell of ammonia. If this cleaner is left on this could result in failure. GH reported that Ceodeux had a washing cycle after use of this chemical cleaner but that had no documentary evidence to support each batch cleaning. They admitted that it could be possible to miss the cleaning cycle and were going back to check on this feasibility. RI asked how much ammonia was in the cleaner. He has a test method to test for corrosion. AW said that they have had a failure in Argon service. RI said that CO2 may not be a problem but rather the concentration of ammonia. JJ says 3 – 5% solution of the cleaner and then ammonia only a very small part of that – if their enough ammonia there to cause failure ? RI says to use a fracture mechanics section and put into solution, stress and see if cracks grow.

Action 6-2 JJ

GE says he has heard of a problem with Ceodeux fire extinguisher valves. A technical alert (July 2003) has asked for tightening torque to be reduced. GE attended a FETA meeting in July. GE to provide more information to GH and GH to contact FETA.

Action 6-3 GH/GE

JJ has also carried out dimensional checks but has found only a 0.06mm deviation. She has also looked for discolouration on threads. RM looked at about 400 cartridges and 14% showed corrosion. The valve should withstand this corrosion. AW said that we are not designing swiss watches and surely a small deviation in a contaminate should not cause failure. RI says that thread profile improvement could be an issue. JJ said that the corrosion seen was not at the failure point. RM says that CO2 can get down to the susceptible thread. GE says

that there are designs that hold the cassette captive in event of failure – other designs do hold failed part captive. AW said that design is very poor and can lead to high stresses which would be susceptible to SCC. RI suggested that the surface of the cassettes should be examined for traces of the cleaner and this compared with other batches and if it was shown that the cleaner was present on batch 03-01 but not on other then the investigation could be closed off. RI suggests the use of a solvent wash. DH says that the chemical will not be hard to detect. JJ said that she does have some valve left and RM said that PB could have other valves to send to her if needed. **Action 6-4 JJ**

- 4.3 ISO11114-4 has been review at BSI and will be discussed at ISO on October 27th in Clearwater. UK require the B method only. Formal vote 18/20 in favour of the standard so change will be difficult. USA want only the C method. JJ says that HSL would wish to attend the meeting. RI said that HSL must write to Peter Slot and ask to represent UK as an expert. **Action 6-5 JJ**

5.0 NDT

5.1 JB will give GH an overview of his work after the EIGA conference in January. He is working on a go-no go test rig using AE that will operate at normal fill pressure. This will have a red/green and amber light system with a 6 cylinder charge in a modular form that can multiply up. Maximum possible at this time would be 32 cylinders. Cylinder size is limited to 30 litres with a lower limit to 5 litres. At the moment this is for composites but will be back-tracked to include metals if possible. RI says that he fills 44 cylinders at a time. JB says this may be possible for small cylinders where only one sensor is required. This would not give positioning data but would still give defect presence. GH reported that Gordon Drummond at IMES would like to put our corrosion test cylinders through the AE process and it was agreed that this would be done via JB. **Action 6-6 JJ/JB** GH also

reported that HSE were carrying out a large AE project that looked at AE for pressure systems. The approach was to have a decision tree followed by a gap analysis, which would lead to work to fill gaps. Then testing the final decision tree would lead to Industry Guidance. This may be useful for the Gas Cylinder community. GH also asked if a further project could be the fitting of AE equipment at a test house and at a filling centre and there was support for this idea. JB said that any such proposal should wait until his research was finished as it could influence the type of equipment specified. GH suggested that this was discussed with JB and IMES. RI stated the the final version of the ISO gas cylinder/AE standard has not yet been seen.

5.2 GG is still working on his report and will be visiting BOC and MOD during the next period. **Actions 5-8 and 5.9 GG/JB remains.**

JB questioned the future of revalidation and how this will develop into a more risk based approach. There was some discussion on the approach to defect tolerance, sizing, moves towards higher stress levels and the need for more risk based approaches to design construction and periodic examination. It was clear that JB already took a risk based approach based on the environment and operating conditions of critical plants and high lighted the need for the operator to now the critical defect

sizes for each cylinder. GH said that the gap analysis from the GG report would help to determine the next stage of this project.

6.0 Project updates

6.1 OC reported that half of the cylinders are still pressurised. The pressure is still as expected and has gone through the very warm summer months. It was agreed to terminate the test and get on with the remaining work. RI asked if a few could be left on test but this was too difficult. JJ reported on the work she had completed on the cylinders previously taken off test. She has carried out a boroscope examination. A tide mark is very evident on each and generally they are all corroded. Tonic water was seen as having the worst corrosion. Pitting can be seen in some but most is at the liquid/gas interface. JB asked for the Ph of the liquids and DH said an analysis of the liquid for dissolved metals would be interesting. **Action 6-7 JJ**

JJ has carried out thickness measurements of some of the cylinders with the greatest reduction in thickness being 0.5 mm on cylinder 3. RI suggested that weight checks would be useful if compared with the stamped empty weight. **Action 6-8 JJ**

JB offered to do a full UT corrosion map on the cylinders are taken for AE. The footings will need to be removed for this. **Action 6-9 JB/JJ**

RI asked JJ for a time scale for all the 140mm cylinders for UT at BOC. BOC would wash and dry these cylinders and GE would wash and dry the others. JJ said that they can be delivered to BOC as soon as all the cylinders are taken off test. RI suggest mid Oct and then these would be sent on to IMES after BOC testing is complete. The UT will be carried out at Chester – le – Street. JB suggested that IMES would burst 3 and fatigue 3 of the cylinders. RI said that burst is a good idea but could see little value in fatigue. GH said that IMES wanted to use fatigue to prove the AE fatigue prediction. It was therefore agreed to burst 3 and fatigue 3. It was agreed to stop the corrosion test and start the analysis of results. SE suggested that hydrogen could be present within the cylinders, could this be tested ? OC said that it might be possible to reduce the pressure to a safe level and then to take a sample. OC said that with the ganging of the cylinders you could not find the exact cylinder hydrogen came from but you could see if there was hydrogen present. Venting was over a long period. RM suggested that a couple of bar was left in each cylinder until analysis for hydrogen was completed and then if necessary test each cylinder. **Action 6-10 JJ/OC**

6.2 AW stated that EIGA met at end of August. JJs proposal was discussed at length. The German delegate said that a lot of this work had already be done and that the results could be presented to HSE to show there was no effect. This was to be discussed further as results are confidential. They will present the work to EIGA WG2 and then RI and AW can report back any concerns and at that point push this work on further. **Action 6-11 AW/RI**

6.3 GH reported that the corrosion project was on hold due to lack of HSE funding at this time.

7.0 Other updates

7.1 Training was again discussed. JB reported that he was now sorted on this issue by creating an in house training scheme. UKAS had been asked but had said that they do not have the resource. Assessment is to RG3 but this is not a training document. AW said that UKAS do not carry out competence testing. GH said that CSWIP are trying to set up competent person training but as yet do not have a gas cylinder module – they do look at pressure systems, lift and crane etc. It would be worth trying to pursue this avenue to see if a cylinder course could be set up.

Action 6-12 GH

7.2 Only enforcement since last meeting is on LPG.

7.3 GH reported that GE was working on two 40 year old pressure drums and that his findings would be reported at the next meeting. GH said that he was concerned over the life expectancy of these drums and what consideration had been given to life end. RI and JB suggested that AE may be a way forward. JB said on line AE testing may be the answer backed up by UT or other volumetric examination.

7.4.1 GH reported that TPED Guidelines are available at http://europa.eu.int/comm/transport/tpe/index_en.html and that these need to be taken into account from now on. He also stated that these Guidelines are still being written and that if anyone needs an interpretation they should contact GH with details.

7.4.2 Standards work has been limited to hot air balloon LPG cylinders and cylinders of less than 0.5 litres.

7.4.3 GH reported that a pi mark must not be stamped on any cylinder that uses a GB derogation – this includes any cylinder made fully to BS5045-2

8 Any other business

8.1 Discussion of Nam Yang ovality. RI says that there is no safety issue at 4% ovality and suggested that this should be taken forward to the CEN WGs. PB says that this involves a large number of cylinders. RI said that the manufacturer should be pursued.

8.2 Reference temperatures and filling ratios under the proposed Regs can be based on BS5355 but must be in a Code of Practice for each industry.

8.3 AW set out on invite to the EIGA symposium in January for anyone interested.

8.4 GH suggested that Hydrogen be added to the agenda of future meetings. This was agreed. RI said that there was a lot of hydrogen info on the BOC and API websites. There was also a CHIP project working in this area. AW said that his company had a lot of experience with hydrogen in the areas of defence and the space shuttle.. JB said that the MOD used hydrogen as a propellant.

8.5 There was discussion with regards to representation on this committee by LPGA and GH said that he would invite David Holt of Calor.**Action 6-13 GH**

9 Date of next meeting

The next meeting was scheduled for 10: 30am, 13 January 2004 at HSL Sheffield