

# **Minutes of 2<sup>nd</sup> Meeting of the HSE Gas Cylinder Research Steering Committee**

**11 June 2002**

**HSL Buxton**

## **1.0 Attendance**

|           |                 |      |
|-----------|-----------------|------|
| Chairman  | Roy Irani       | (RI) |
| Secretary | Graeme Hughes   | (GH) |
|           | Steve Elliot    | (SE) |
|           | Andy Webb       | (AW) |
|           | Peter Bates     | (PB) |
|           | Roy Mellick     | (RM) |
|           | Janet Joel      | (JJ) |
|           | Oliver Crichton | (OC) |

Apologies received from Mrs M Howarth and Barrie Shepherd.

## **2.0 Minutes of first meeting**

The minutes of the first meeting were accepted with the following editorial comments.

Final paragraph section 5 should read 'ISO 11114-4' not 'ISO 1114-4'

First line section 6 should read 'pleased' not 'please'

First line section 8 should read 'RI' not 'IR'

Second paragraph of section 8.4 should read 'highlighted' not 'high lighted'

Section 9 should read 'on 26' not 'on26'

## **3.0 Actions from minutes not covered elsewhere**

Action 1 was for all to discuss in house as appropriate and was not discussed further in this meeting. No feedback was forthcoming.

Action 2 on GH had not been discharged and was to carry forward.

Action 3 on GH was awaiting consultative document on TPER.

## **4.0 Interim news letter**

The interim newsletter was accepted without comment.

## **5.0 Report of failures since last meeting**

### **5.1 Messer valve failure**

RM reported on stress corrosion failure of a brass parallel thread valve in an aluminium beverage gas cylinder. He stated that this was similar to fire extinguisher failures from some years previous where water had been left in cylinders at manufacture, which led to dezincification and chloride attack. No chlorides were found in this instance but it is believed that poor cleaning practices at manufacture could have contributed to the failure. Messer has removed all such cylinders from beverage gas service.

RI said that it was often the case that a small detail missed by a manufacturer would lead to failure and that it highlighted the need for PVE3/1 to ensure that their valve standards fully address the issue of final cleaning.

RI also said that correct application of thread tape, even though not required for parallel threads, prevented any galvanic action and thereby removed the problem.

AW suggested that BCGA should have a valve working group.

### **5.2 Southwark cylinder failure**

GH presented a series of pictures from the pub cellar failure in Southwark and the subsequent HSL investigation.

The failure was clearly due to SCC and the cylinder appeared to have been half full of liquid at the time of failure. The cylinder also appears to have been lying on its side prior to failure. There was much discussion on the competence of the filler who should have noted such a large amount of liquid prior to filling and the fact that by filling carbon dioxide by weight he would have not achieved the required 30/70 mixture, which could have led to very high pressures inside the cylinder.

It was again noted that the fitting of an RPV is not the end of the problem; there must be pre fill checks to ensure that RPVs remain satisfactory.

### **5.3 Leaking carbon dioxide cylinder**

JJ reported on a cylinder that had been handed to HSE by an employee who had found it leaked on first fill after return from the test house. She showed a photograph of the external surface where a small linear indication was stated to be the source of the leakage.

GH reported that, as the cylinder was not in the possession of HSE at this time HSL could not remove the valve or carry out any destructive testing. GH would find a way of taking the cylinder into possession without involving the employee who had dropped it off.

AW stated that his company had stopped purchasing from IWKA in 1988 due to poor manufacturing quality – this cylinder was IWKA 1989.

RI explained the manufacturing process used by IWKA at that time which involved drawing the cylinder in two processes rather than three and could lead to linear scores on the internal surfaces.

#### **5.4 Failures in Israel**

AW reported several fatalities involving Austrian manufactured cylinders in Israel. It was not yet clear if these were related to manufacture or to terrorism. AW to monitor and report back if terrorism is ruled out. **Action 1 AW**

### **6.0 Report of acoustic emission research**

GH presented the results to date of the gas cylinder acoustic emission project. The final report will compare the initial visual examination with the acoustic emission results and the cylinder sectioning.

JJ reported that it was very difficult to find growing cracks as there were so many manufacturing defects in the base of the ‘noisy’ cylinders. It would not be cost effective to section each defect.

SE said that the results could have been confirmed by carrying out prototype testing on each suspect cylinder and seeing when and how it failed. GH stated that it was too late for that at this stage.

RI said that it would be a good idea to put artificial defects into cylinders before AE. These could be placed mid wall from the external surface and sized to give varying crack growth rates. (GH Note post meeting. As well as cracks it would be useful to have a corrosion site on each cylinder that could be easily monitored.) EN1968 Annex G gives the size of a cylinder notch for UT inspection. We may need sharper notches to induce crack growth. OC and JJ were asked to put forward a project proposal using up to 8 of the remaining East German cylinders and HT testing methods only. If pressure cycling post AE would be a problem for HSL it is suggested that Luxfer or Chesterfield are asked to carry out that work.

**Action 2 OC & JJ**

### **7.0 Corrosion project update**

JJ reported that 4 containers are now on site at Buxton and that HSL need to carry out test explosions inside of one to check venting capacities, site safety and required exclusion zones. Due to site restrictions they hope to allow 5 – 10m approach with ear protection during the project.

RM reported that his chemist said that there was very little difference in CO content of ammonia produced and distillation produced carbon dioxide. It was therefore agreed to obtain the carbon dioxide from one source – BOC Derby.

JJ reported that she had received the billet made cylinders and was awaiting the tube cylinders later in June from PB. The carbon dioxide cylinders were 140 mm diameter and the mixed gas 160 mm diameter.

OC reported that piping should not be a problem. All batches of cylinders will be manifolded together with a release valve outside the container. AW was to supply an EIGA document on leak testing to OC, which called for a 1% tepol solution.

**Action 3      AW**

RI was requested to supply a carbon dioxide analysis at time of filling.

**Action 4      RI**

JJ asked if BOC could fit the valves just prior to filling. JJ suggested that she would travel with the cylinders and pour in the contaminants just prior to valve fitting. This approach was agreed. It was important to ensure cylinders were closed from now until they were put into use. JJ was to obtain brass plugs from BOC and fit to all cylinders as soon as possible.

**Action 5      JJ**

RI reminded GH that he had to write to BOC to confirm that paragraph 5 of schedule 8 of CDGCPL2 would not apply to this research project, as the filler cannot fill a cylinder that is not 'safe' due to liquid contamination. The letter should also confirm the date ring to be fitted to each cylinder.

**Action 6      GH**

BOC will need to issue a consignment note to the HSL driver before the full cylinders are taken away from the BOC filling plant. This is standard practice. No note is required for the empty cylinders as they are new and have never contained gas.

Each cylinder will need to be safely transported and each will need to be fitted with a dome cap. AW offered to send 40 caps from Crewe to JJ.

**Action 7      AW**

RI said that BOC would palletise cylinders after filling.

**Action 8      RI**

JJ will need to ensure cylinder is safely stowed for transport from HSL to BOC. This will be on an open van.

**Action 9      JJ**

JJ said that the time scale is not yet available as it depends on approval of the risk assessment by HSL. This has to go through three approval loops but is hoped to run through smoothly once the container testing has been completed. RI asked JJ for at least one weeks notice for filling.

**Action 10      JJ**

Andrew Jackson was to obtain the contaminants. He was not at this meeting so the position is not known. JJ offered to chase him up for a report on progress.

**Action 11      JJ**

RM made Luxfer reports on cylinder testing with coca cola syrup available to the group. These reports looked at both aluminium and steel and concluded that aluminium appears to self-seal thus preventing corrosion whereas steel continues to corrode.

RI questioned the valves to be used. BOC can only fill cylinders with BOC approved valves fitted. JJ had received valves from British Fire Protection with the billet cylinders; she will send valve details to BOC for approval. **Action 12 JJ**

PB said that he would supply Codeux valves that would be acceptable to BOC and AW said that if JJ needed more valves he could also supply Codeux valves.

## **8.0 Grinding project update**

GH gave a presentation of the grinding project results to date. With smooth grinding, FE modelling showed a 40% loss of wall near to the cylindrical section to head transition would lead to failure. No work had yet been completed on notched grinding due to urgent HSL work in other areas.

The group were concerned at the stress distribution of the whole cylinder as it indicated a lowering of stresses down the cylinder wall. GH explained that the shoulder area was of concern and that the rest of the cylinder was for support but took the point that it should look right. GH to question project leader and seek better representation.

**Action 13 GH**

## **9.0 Bursting disc update**

AW gave an update on a burst disc test rig he had set up. 12 new valves with 200 bar bursting discs had been tested and these showed very consistent burst pressures of between 205 and 210 bar. This gives a maximum error of +5%, which is in excess of standard requirements.

AW was asked to continue this work by randomly testing valves taken from service after 5 years use to see if there was a fall off in performance. It would be useful to note length of time in service against each test.

**Action 14 AW**

## **10.0 NDT possibilities**

GH gave a short presentation on the capabilities of laser shearography. HSE are hoping to be involved in a GSP on this topic with MBEL and will take gas cylinders to the project as one of the test samples. Inspection at time of filling would be the goal.

GH also spoke about a recent ImechE seminar on in service inspection of aircraft. Several techniques used to inspect aero engines may have potential for internal examination of gas cylinders. These included digital stereo boroscope; digital video dye penetrant and eddy current techniques were the sensor moves across the internal surface.

## **11.0 300 bar cylinder research**

AW reported that the EIGA conference is in two weeks time where he will try to drum up support from other European gas companies. He asked JJ for a more detailed outline proposal to present to EIGA.

**Action 15 JJ**

## **12.0 HSE DINs for gas cylinders**

GH presented Discipline Information Notes that had been issued or were in draft that concerned gas cylinders. He explained that a DIN was the view of the writer and was used to give information to the field inspectors.

The DINs covered were:

The use of BCGA GN6 and making a hierarchy of the prevention methods

Inspection of gas cylinder test houses

Management of gas cylinders (draft)

Inspection of filling plants (to do)

Both RI and AW expressed interest in the test house DIN. This has been given to UKAS to assist in development of RG3. A copy is attached to these minutes.

The GN6 DIN has been circulated to TC2 of BCGA via Simon Nicholson – if anyone else requires a copy please ask GH.

## **13.0 Date of next meeting**

The next meeting will be at HSL Buxton starting at 09.30 on 17 October 2002.

## 16.0 Summary of Actions

| <b>Action No.</b> | <b>Person</b> | <b>Action</b>                                            | <b>Date to Complete</b>      |
|-------------------|---------------|----------------------------------------------------------|------------------------------|
| 1-2               | GH            | Discuss ISO TC58 FM work with Bill Geary.                | 31/07/02                     |
| 1-3               | GH            | Competent person information pack for Rose Court         | End of consultation for TPER |
| 2-1               | AW            | Monitor and report back on Israel failures               | 17/10/02                     |
| 2-2               | OC/JJ         | Put together addition AE work proposal                   | 15/07/02                     |
| 2-3               | AW            | Send leak test document to OC                            | 30/06/02                     |
| 2-4               | RI            | Give JJ CO2 analysis at time of fill                     | ?                            |
| 2-5               | JJ            | Obtain brass plugs from BOC and fit into empty cylinders | 18/06/02                     |
| 2-6               | GH            | Write to BOC to confirm fill and tag details             | 30/06/02                     |
| 2-7               | AW            | Send 40 cylinder caps to JJ                              | 30/06/02                     |
| 2-8               | RI            | Palletise cylinders after fill                           | ?                            |
| 2-9               | JJ            | Stow cylinders safely during empty transit               | ?                            |
| 2-10              | JJ            | Give BOC at least one weeks notice of fill               | ?                            |
| 2-11              | JJ            | Contact Andrew Jackson for update on contaminants        | 20/06/02                     |
| 2-12              | JJ            | Send valve details to BOC for approval                   | 20/06/02                     |
| 2-13              | GH            | Discuss grinding project with Graham White               | 15/07/02                     |
| 2-14              | AW            | Test used bursting discs and note time in service        | 17/10/02                     |
| 2-15              | JJ            | Submit outline proposal to AW for 300 bar cylinders      | 20/06/02                     |