

Minutes

4th meeting of the HSE/Industry Pressure Drum Working Group

Ineoschlör Runcorn 5 October 2004

1.0 Attendance

Graeme Hughes	HSE HID CTG5	GH
Janet Joel	HSL	JJ
James Hobbs	HSL	JH
John Roberts	Ineosfluor	JR
Chris Mulliss	Rhodia	CM
Tim Heumann	Ineoschlör	TH
John Billows	A-Gas	JB
Gary Brown	Ineosfluor	GB
Geoff Rogers	Lloyds QA	GR
David Holt	Calor Gas	DH
Charles Pullar	Thames Water	CP

1.1 Apologies

Roy Irani	BOC	RI
Glyn Evans	Jackson and Kaye	GE
Rod Timms	DfT	RT

2.0 Minutes of last meeting

The minutes of the last meeting were accepted without any alteration. Actions were all included within the agenda.

3.0 Research – Ineosfluor drums

JJ gave a presentation on the work that she has so far carried out on the Ineosfluor pressure drum and the Rhodia pressure drum.

Sections of the first drum had been sent for mechanical testing but the results were not yet available. JJ said that she had asked for charpy values at 20, 0 and –20C and that she had used EN14208 as a guide to where the specimens should be taken. MPI had revealed one indication on the inside weld and this is to be further investigated. The dents had all been characterised and it was clear that one dent failed the EN14208 criteria for depth and all failed the criteria for dent width.

Drum 2 showed an odd weld profile on the circumferential weld over approximately 400mm length. This looks like a lack of weld metal and will be examined more completely. MPI had not shown any indications and thickness measurement ranged from 11.2 to 11.9mm with most 11.5 to 11.7mm. The hardness values would indicate a UTS of around 425 Mpa. The valve studs were found to be heavily corroded below the spring washer. The drum was last inspected in 1998 and this again calls into question the replacement strategy for these studs.

The micro section of the ends to shell weld was discussed in detail. It was clear that a crack like defect was present at the weld to intersection of the two plates. The defect was seen in both sections taken to date with the extension moving through the shell plate in the heat affected zone towards the outer surface of the drum. It is not yet clear what is driving this defect but the two indications seen have extensions of 0.1 and 0.2mm. Further work will be carried out to try to find out if these defects are driven by hydraulic testing, working pressure or some other mechanism. GH suggested that pulsed echo at 60 or 70 degrees should be capable of detecting a growing crack in this area and he would speak to NDT experts to gain an opinion on this.

Action 4-1 GH

JJ reported that chemical analysis of drum 1 showed phosphorous levels of 0.035% and sulphur levels of 0.039%. These are well in excess of current standards but would have met the levels required at time of build. JJ also reported vast quantities of inclusions within the plate – this would not be acceptable today. The TWI ageing report points to these factors as a prime reason for the ageing process in welded structures and this group needs to understand exactly what effect these inclusions and impurities have on fatigue life. JJ had some information on this and DH said he would ask his metallurgical consultant. GH would talk to the ageing pressure plant working group to get their view.

Action 4-2 JJ/DH/GH

GH asked if any internal NDT had been carried out at the sites of dents to see if any surface defects were visible. JJ said that this had not been done, as she could not get MPI probe into the dent. GH suggested the use of penetrants.

Action 4-3 JJ

DH pointed out the importance of knowing the material grain direction when taking charpys. JJ stated that she was following EN14208 but that she would report the grain direction with the charpy results.

Action 4-4 JJ

GH asked if JR had forwarded the calculations required by action 3.3 to JJ and JJ asked for copies of drawing GC107/380 relating to drum 2.

Action 4-5 JR

4.0 Research – Calculation methods

JH reported that he had found nothing in BS7910 that related to dents but API579 was very useful. He had looked through API579 but had not yet had time to apply the methodology to dents in pressure drums. He said that the method would only use the circumferential part of the dent and ignore the length. His feeling is that the dent criteria in EN14208 will prove to be very conservative. The group needs to know this in order to judge just how conservative the criteria are and if the standard needs to be challenged. GH asked if anyone knew where the criteria in EN14208 had come from and JR thought it may have been some old work by ICI but was not sure. DH stressed

that the cylinder standards used much different dent criteria and it was not clear why these different approaches existed. JH will set up a model to test out dent criteria using API579 and report back to the group. **Action 4-6**

JH

5.0 End of life guidance principles

GH had circulated a draft document on ageing pressure drums prior to the meeting and this was used to stimulate discussion.

DH was of the view that ageing was not an issue and that just because welded structures were getting old, they were made to standards that were good at the time, there was no history of failure and so why were they being deemed unsafe now.

GH said that it was not a case that the drums were suddenly unsafe it was a case that it was not clear if the drums were safe or not as no-one had looked at design life and there was no programme, excepting periodic examination, to withdraw drums from service. What was needed was a methodology to assess a drums life and then a policy to withdraw drums as that end of life was reached.

It was agreed that the NDT/BS7910 route was too expensive for use on a pressure drum that would cost less than £2000 to replace. It was therefore decided that a simple method based on an assessment against PD5500 would be used and that the document would address design issues firstly and then the additional requirements at periodic examination secondly. It was also agreed that the design assessment would relate to each batch of drums to one design but the periodic examination requirements would relate to each drum. In essence PD5500 annexe c would be used to set a design life from when the drum was manufactured with the guidance giving parameters such as estimates of pressure cycles since new, factors for chemical impurities, heat treatment levels etc. GR said that the concave dished ends may prove a problem with the fatigue analysis and JH was asked to look at this aspect of PD5500 and get a view on how the standard could be used to deal with such ends. **Action 4- 7 JH**

The possibility of carrying out fatigue testing of a drum with concave ends was discussed. Post meeting GH discussed this further with Oliver Crichton at HSL. JR said that Ineosfluor could make an old drum available for this work. GH said we would wait until JJ has completed her work on the two drums before deciding on this.

TH questioned the lack of use of statistical analysis in the guidance. GH was of the view that insufficient data had been created so far and the cost to obtain such data would be prohibitive.

It was agreed that the real problem for design was the longitudinal and circumferential welds and that just these should be looked at in the design assessment – the periodic examination would take care of other features.

The use of weld procedures and qualified welders at build had to be ensured particularly for imported drums. Where drums were not to a British Standard it would need to be confirmed that welds were qualified and if this could not be confirmed then the drums should be taken from service.

GH agreed to redraft the guidance note based on these discussion and circulate electronically for comment within the next two months. **Action 4 – 8 GH**

6.0 Pressure drums in pool fires

GH reported the results of the sub group on the behaviour of pressure drums in pool fires. Calculation showed that a 1000 litre drum filled with 900kg of R22 would burst in 6.5 minutes with an explosive potential of between 5.5 and 8.6kg TNT equivalent. The best case was given as a 750kg fill – this increased the time to failure to 7 minutes. GH said that 3 drums were at HSL Buxton awaiting bursting to try to confirm the predicted burst pressure but that there were no plans to subject the drums to pool fires. GH said that sufficient work had been done on vessels in pool fires and that HSL were confident that their results could be used to predict the behaviour of a refrigerant gas drum. DH questioned the effect of safety valves, as this was a factor with the LPG testing. GH assured him that the model worked with and without safety valves.

JR pointed out that there was BCGA guidance on storage and that maybe this said enough to ensure drum safety. CM said that drums did need to go inside buildings for use. CP suggested the drum area inside any building should be kept free of all combustible materials and that the DSEAR assessment should take care of this aspect. DH suggested that risk assessment should be used to decide on storage plan.

GH will take on board all of the comments made and electronically circulate a draft guidance note to the group within 2 months. **Action 4 – 9 GH**

7.0 AOB

TH reported that chlorine valves are now correctly certified to the TPED and that currently the manufacturer is having to use full third party inspection whilst awaiting approval of their quality system.

JR questioned the status of prEN14876 and GH reported that the Joint ADR/RID committee of experts had agreed to the standard for the 2007 ADR so it can now be published with no technical changes.

TH questioned the check of weighing scales in 6.1 of TF01. It was pointed out to him that this was not calibration but a simple daily check using a known weight.

8.0 Date and venue of next meeting

HSL Buxton 08/03/05 at 10.00.