

# **Rogue Materials for Pressure Equipment Supplied from New Markets**

## **Summary of a Second Meeting Held at Institution of Mechanical Engineers, London 20 April 2009**

### **Summary**

This meeting was the second organised jointly by the Engineering Equipment and Materials Users' Association (EEMUA) and the Pressure Systems Group (PSG) of the IMechE to discuss the apparent increase in the number of cases where materials for pressure equipment and fabricated items supplied from the newer, non-traditional markets around the world were found either not to meet specification or defective, or where the associated documentation was wrong and appeared fraudulent.

The aim of the meeting was to give an opportunity for inspection bodies, the regulator (HSE), government (BERR) and other interested parties to meet and discuss the issues, understand the scale of the problem, and identify common issues and possible solutions.

This document summarises the discussions that took place. The next step is to consult more widely on the extent of the problem, with a view to the development of guidelines to minimise the risks associated with sourcing pressure equipment materials, parts and fabrications from the newer markets.

### **Introduction**

A meeting was held on 20 April 2009 to discuss the problem of incorrect or defective (rogue) materials and fabrications for pressure equipment being supplied from new markets organised jointly by the Engineering Equipment and Materials Users Association (EEMUA) and the Pressure Systems Group (PSG) of the Institution of Mechanical Engineers. Attendance at the meeting was restricted to inspection organisations, certification bodies, the regulator (HSE) and officials overseeing new approach directives in UK Department of Business, Enterprise and Regulatory Reform (BERR). The meeting followed an earlier meeting on the same topic held on 2 December of twenty representatives from major procurers and users of materials, including oil and gas, processing, power and chemicals companies, as well as engineering contractors.

The purpose of both meetings was to identify any common issues and highlight the existence and scale of the problem in general rather than to focus on particular markets or companies. This second meeting with inspection organisations etc. had a threefold objective.

- to brief them on the findings from the December meeting,
- to seek their views on the problem,
- to determine whether those present would
  - support a more detailed study to establish the true scale of the problem
  - support the production of guidelines that would assist procurers, users and inspection bodies to identify the risks and the potential problems that could be encountered and possible ways to protect themselves.

### **Brief of the meeting with procurers and users**

Andrew Pearson and John Wintle presented the findings from the December meeting under the conditions that had been laid down by those that had been present. These had been summarised in a note that had been placed on the EEMUA and IMechE's websites.

An exchange of experience had found that all the companies present had encountered problems with the quality of materials for pressure equipment purchased from markets that had not historically supplied European industry. It was agreed that from about 2003 the volume of material purchased from such markets had increased progressively. In the same period the rate at which materials were found to be defective, or were not what had been specified, had also increased significantly and was continuing to do so.

In the absence of industry wide data, the scale of the problem in global terms is uncertain. A wide range of quality problems was being reported. These included:

- parent material that did not meet chemical or tensile specification
- castings and forgings that contained unacceptable defects
- where the specified material was substituted with another inappropriate material
- incorrect heat treatment
- defective fabrications
- uncontrolled repairs

In many instances, the paperwork supplied with the parts had apparently been forged somewhere along the supply chain. A separate issue was that in some instances the materials supplied, while meeting the basic specification, were not of the quality that procurers and users had come accustomed to expect from traditional steel making sources. Examples of problems included:

- 300 flanges ordered to ASTM specification arrived in the UK with material not meeting composition specification and containing cracks.
- Cast tubes did not conform to the documentation and were found by radiography to contain serious casting defects.
- P91 tubing required for a fired heater had been replaced with the less heat resistant alloy P9.
- Valve bodies that were required to be heat treated had clearly not been.
- Casting defects had been repaired using mixed welding rods without evidence of a repair procedure.
- Certificates for bolts had plainly been counterfeited, and in one case bolts had been necked to an unacceptable reduced diameter.

Rogue materials, often discovered late in the procurement chain, were having a major impact on the companies affected. While there were no reported cases of in-service failures, in some cases, had they not been discovered, they would have given rise to early in-service failure with serious safety and production consequences.

### **View from inspection organisations**

The inspection organisations recognised the problem of rogue materials and were equally concerned. They accepted their responsibility in the supply chain and believed they had an important role in improving matters. Inspection organisations in the UK were part of global network, and any changes would have far reaching consequences.

Inspection organisations were themselves victims of malpractice. There were instances of signatures being forged, certification being altered to imply a higher level of approval,

and local agency inspectors that did not always come up to the company's normal standards and control were a particular problem. A high turnover rate of local agency inspection staff and a lack of local control were key problems. The assurance of quality management that should be provided with ISO 9000 certification often did not exist.

The culture in some parts of the world makes raising issues with fabricators difficult. Communication and surveillance was more difficult when fabricators subcontracted work and inspections to others. The role of the manufacturer under the PED could be taken by a turn-key engineering contractor sited remotely from the actual fabrication.

Traceability to source was a key issue. Leaking valves that had been ordered from European suppliers had had their bodies manufactured in the Far East without documentation. Original certification for fasteners (bolts etc) was frequently unavailable.

Inspection organisations believed that the extent of the problems was not huge, but could not quantify it. They accepted that it was of an extent that a more detailed study should be made. It was clear that problems were more likely to emerge under some circumstances than others. It might be possible to be able to draw up a list of risk factors that procurers and users could apply.

#### **View from the regulator (HSE)**

Representatives from the regulator had been informed by end users of rogue material problems. Examples included inadequate treatment of duplex stainless steel, out of specification P91 fired heater tubing and a batch of valves ordered for offshore oil and gas duty that contained defects in their bodies. The regulator was not aware of any in-service failures to pressure equipment that had been attributed to rogue materials, but there had been examples when equipment had failed under pressure test.

The regulator stated that it was the user's duty to take all necessary measures. These might include supplier vetting, more rigorous quality assurance during fabrication, and post manufacturing inspections when there is a recognised potential risk the material may be suspect. European suppliers of rogue pressure parts would also be liable even if they were not the original fabricator. Where suppliers put their own brand name on products made elsewhere, they took on the manufacturer's liability.

It was accepted that there were weaknesses in the ISO 9000 certification. While under the PED there was a requirement for the fabricator's quality system to be approved by an inspection body established in Europe, some inspection bodies were not properly established in this way. This problem extended much wider than pressure equipment and included chemicals used offshore.

The HSE may be able to help those affected but it would need to know of specific instances of rogue materials and equipment being supplied. It would advise any company receiving such material or equipment to inform its local Site Inspector of specific issues and, if evidence was available, then in some cases the HSWA would allow the deficient suppliers to be pursued through the courts.

HSE also emphasised that stating that a piece of equipment has been produced to, for example, an ASME Standard would not be taken as evidence as being fit for purpose. Similarly, if HSE ever had to investigate an accident that was tracked back to rogue materials then certification alone would not be accepted as compliance with legislation. A level of due diligence would be expected commensurate with factors suggesting the possibility of a problem and the scale of hazards that would occur in the event of failure.

## **View from the UK Department of Business Enterprise and Regulatory Reform<sup>1</sup>**

Representatives from BERR as UK Competent Authority for the PED believed that the objectives in ensuring a good market in pressure equipment in Europe were being met. They stated that the wording of new approach directives allowed companies to market equipment without knowledge of material processes. Where a material manufacturer has an appropriate QA system certified by a Conformity Assessment Body established in the Community, and having undergone a specific assessment for materials, certificates issued by the manufacturer are presumed to ensure conformity with the materials section of the essential safety requirements. There were instances where there had been a withdrawal of approval, but nothing was known about reinstatement.

BERR was sensitive to the concerns of procurers and users, importers and suppliers, and regulators about the quality of material for pressure equipment. It would raise the issue with its counterparts in other Community countries to find out how general this problem was in Europe and how other countries were handling it. The government was, however, limited in the extent to which it could influence matters in the producing countries.

## **View from NDT certification bodies**

Representatives of NDT certification bodies reported that there was misinterpretation among some overseas fabricators about the scope of EN 473. This was a standard for bodies certifying NDT personnel qualification, not an NDT certification for individuals. Sometimes fabricators could self-certify NDT personnel under the so called second party route but there were limits to the equipment that could be inspected by such individuals. Where equipment was inspected by NDT personnel holding personal certification for NDT (PCN), it was possible to check their qualification relatively easily on-line. BINDT has placed a statement on its website on PED approvals to clarify the situation which is shown below<sup>2</sup>.

## **View from accreditation services**

The role of accreditation services is to assess, against internationally agreed standards, organisations that provide certification, testing, inspection and calibration services i.e. those organisations with Competent Body or Notified Body status. As these organisations could be global and have local subsidiaries, it is difficult for the accreditation services (and even the inspection organisations themselves) to cover and guarantee every part of the organisation. While an organisation might have good procedures and intentions, there was sometimes an inadequate level of control and internal audit of remote operations, outstations and subsidiaries.

The approval of materials and of materials certificates is a difficult area, particularly when the original certificates are not available. There is a need to clarify which material certificates can be accepted and when they might be refused. The high turnover of inspection staff within some inspection organisations is a matter of concern, particularly in countries remote from the base, but reflected the reality of the inspection market. The practice of subcontracting inspections to agency staff weakened the supply chain, and

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<sup>1</sup> Since June 2009 BERR was disbanded and replaced with The Department of Business, Innovation and Skills (BIS).

<sup>2</sup> This certificate (PCN) is not an EN 473 certificate of competence, it is confirmation that BINDT have approved the named NDT personnel to carry out the specified non-destructive tests on the basis of qualification criteria equivalent to those of the Harmonised European standard EN 473, which fulfils the NDT personnel approval requirements of the European Directive 97/23/EC, and on the results of an on-site audit conducted by BINDT appointed assessors.

this was a risk factor that procuring companies should take into account. In some instances there was a perceived difficulty with specifying the brief of inspection bodies by the procuring companies and this was an area where more advice would be beneficial.

### **Controlling the Problems**

From the limited information available it would appear that the problem has its roots in the control of inspection of both materials and fabricated equipment at different points in the supply chain. The meeting would like to see a clear process for controlling inspection on site that is both practical and not prohibitively expensive. Accountabilities and responsibilities in the supply chain needed to be clarified and strengthened so that there was a greater chance of detecting rogue materials and fabrications at an early stage.

Local culture and customs also influence the working practices of suppliers and fabricators. Although these cannot be controlled by purchasers and users, generating a greater understanding where problems may arise is a good step forward.

### **Next steps**

EEMUA has already taken the first steps in investigating the issue of rogue materials and equipment as part of a project agreed by the EEMUA Council. The meeting therefore agreed that EEMUA should lead the work proposed by the joint EEMUA/IMEchE PSG initiative as outlined below. In order to progress the work further a small Work Group is to be created. A number of individuals representing inspection bodies, users and independent technical organisations that are members of EEMUA and IMechE/PSG/TWI have expressed a willingness to form the Work Group. The HSE and BINDT also agreed to provide assistance if required or requested.

It was unanimously agreed that the next steps should initially be aimed towards establishing more clearly the size of the problem and increasing awareness. This would involve an awareness campaign, particularly amongst the inspection bodies that are either ignorant of the problem altogether or believe that their experience is unique. The campaign may include a further meeting specifically for the inspection bodies. The experiences of users and procurers of materials and equipment would be collated on a non attributable basis.

Via the contacts made through this awareness campaign and from further discussions with users, procurers, specifiers and perhaps also material testing companies, it is intended to quantify the type and regularity and origins of the occurrence of rogue materials and fabrications in the area of pressure equipment.

All parties agreed that once the size of the problem has been established and the issues clarified then a set of guidelines should be proposed that would provide advice to users, procurers and inspection bodies. All such guidelines should be both reasonable and practical and state what the consequences would be for each step that may be taken. EEMUA has agreed to produce and publish the guidance.

The guidelines will include a check list which will advise parties of the areas where they could expect problems when dealing with manufacturers, fabricators and suppliers and what to look for. They will also include some measures that users and procurers can take to minimise the risk of rogue materials and equipment and for their early detection. The guidelines would assist in determining appropriate due diligence.

Some interest was expressed at the meeting around the idea of creating a 'database of incidents' that could accept information anonymously from anyone who had had



experiences with rogue materials and allow them to add whatever information, views or data they wished. Exactly how this would work was not clear; there were clearly some practical difficulties with an entirely open and anonymous system – for example, it would be open to abuse. EEMUA has commented that it already maintains a database of incidents within the Association, for use by its member companies; and, following the meeting, EEMUA will carry out some investigative work on how its internal database of incidents could be modified to address the wider industry requirement.

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