STUDY CASE N° 22: RETRIEVAL OF A FIRE DAMAGED GAUGE CONTAINING A RADIOACTIVE SOURCE

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❑ Introduction

On the 16th January 2006 the Radiological Protection Institute of Ireland (RPII) (the Regulatory Authority) learned from media reports that a fire had destroyed part of a factory situated in the midlands of Ireland. It was reported to have started on the 15th January and firemen fought throughout the night and into the next morning to contain the fire. As the company who owned the factory held a licence from the RPII for the custody and use of a gauge containing a radioactive source, plans were initiated to visit the scene.

As preparations were underway, the assistant chief fire officer for the area and a representative of the licensee contacted the RPII and requested assistance regarding the detection and retrieval of the gauge. After a brief discussion it was decided that the RPII would assist in assessing any possible radiological implications of the fire arising from possible damage to the gauge and would also assist and advise on its recovery and removal from the factory.

The gauge formed part of a Heuft fill-height detection system (Model – Basic 4) (Figure 1) and it contained a 1.67 GBq Americium-241 (Am-241) source. The system was used on a production line as part of a quality control process to determine the volume of contents in metal cans. The Am-241 source and the associated radiation detector are contained within a 'bridge unit'.

Figure 1. Heuft fill-height detection system (Model Basic 4) on the production line of the plant (pre-fire)

RPII Inspectors arrived at the factory on the afternoon of the 17th January and immediately met with representatives of the Emergency Services (fire officers and crew) and the licensee to assess the situation on the ground. The building housing the production line was gutted in the fire and all existing access routes were considered by the fire officers to be unsafe. However, the fire crew managed to cut an opening in the side of the building as close as possible to the known location of the fill-height detection system (Figure 2). This subsequently allowed safer access to the vicinity of the bridge unit.

Figure 2. Portion of galvanised sidewall that was cut through by fire crew to facilitate access to the production line area

Initial efforts focused on assessing if any contamination or damage to the integrity of the sealed source had occurred, and efforts were then concentrated on locating and removing the bridge unit from the building.

❑ Recovery Operation – Part 1

Measurements of ambient dose equivalent rates (dose rate) were undertaken at the improvised entry location using a hand held Mini-Instruments / Thermo Electron Corporation Mini-Rad 1000 Radiation Survey Meter and a Telepole (telescopic GM Tube). A number of back-up instruments with various scales and contamination monitors were also available for use as required. No dose rates above background were measured at the improvised entry location using the hand held survey meters, and at locations 4m distance inside the factory using the Telepole instrument. Based on these measurements the RPII Inspectors advised the fire crew to cut a pathway through the galvanized panels and other debris into the production line area.

On entering the production line area the remnants of the fill-height detection system were identified (Figure 3). The environment in the area around the remains of the level system was completely destroyed and the array of galvanized metal and debris made access and working conditions very difficult. The bridge unit was located at the base of the fill height detection system. As no dose rates above background were detected using the hand held instruments the bridge unit was removed by a fire officer for closer inspection (see Figure 4).

Figure 3. Remnants of the Heuft fill-height detection system

Figure 4. Damaged bridge unit being surveyed outside the building

Once outside the building further measurements and wipe tests were undertaken on the surface of the bridge unit. No levels above background were detected using the field contamination monitor (Berthold LB 1210 B). The wipes which were analysed the next morning by the RPII's Measurement Services confirmed that no traces of Am-241 were present.

Given the damage to the unit it wasn't possible to confirm the presence of the source and it was considered necessary to send photographs (Figure 4) to the manufacturer in England

(Heuft UK) for their assessment of the bridge unit. Heuft UK advised that the source block was missing from the bridge unit and provided a description of the source block to facilitate the recovery operation.

A second recovery operation was then arranged. In the interim the building was secured by the licensee and the fire crew.

❑ **Recovery Operation – Part II**

Once the production line area was confirmed as being relatively stable, an RPII Inspector along with the licensee's radiation protection officer entered the building through the opening created earlier in the week by the fire crew. They were suitably attired and equipped with Electronic Personal Dosimeters, TLD's, Finger TLD's and radiation survey meters. A small stepladder made access to the remains of the production line area easier, and the ground directly beneath their feet was scanned with a contamination monitor prior to dismounting from the bottom rung of the ladder.

The floor in the production line area was covered in debris, and after, scanning with the contamination monitor, items of debris were sifted through using a long handled tweezers and then set aside if no radiation was detected above background. At a location close to the fill-height detection system the contamination monitor registered a deflection of 300 cps (background 6 cps) and a metal component was recovered (Figure 5). This component was set aside and the surrounding area scanned to determine if there had been any contamination or leakage. No readings above background were detected.

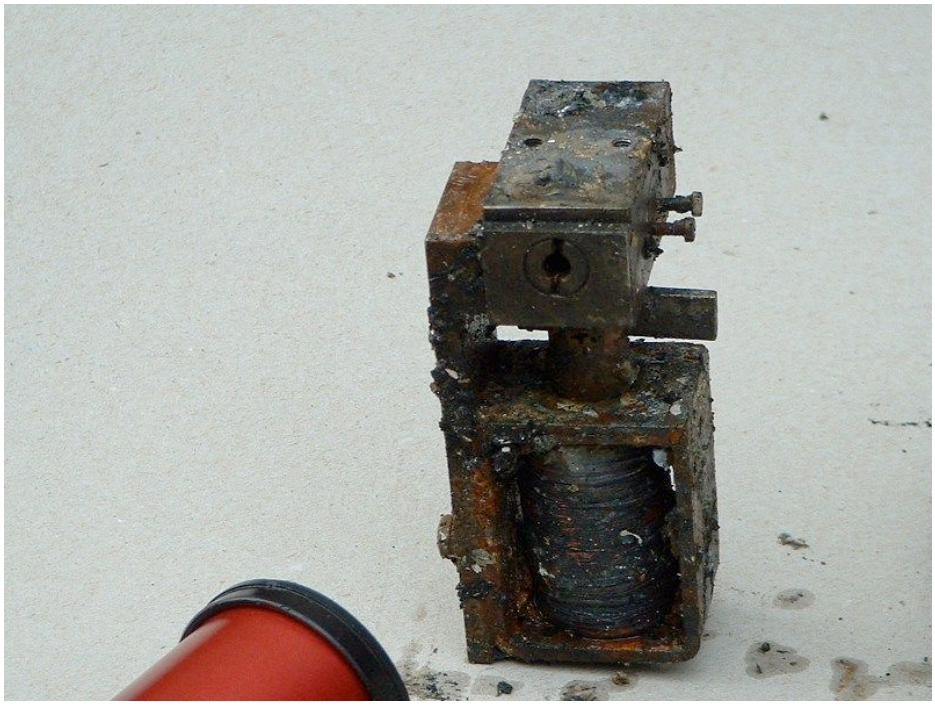

Figure 5. Front view of the recovered component which included the source block containing the Americium-241 source.

The component was removed from the building for further examination. A dose rate of approximately 10 μSv/hr was detected at the front face, and approximately 2-3 μSv/hr at the rear face, and it was therefore assumed to be the missing source housing. On further inspection the shutter mechanism was identified and, although loose, it was confirmed to be

closed. Wipes were taken of all exposed surfaces. No contamination was found on the wipes using the contamination monitor. The wipes were subsequently given to the RPII Measurement Services for analysis, which confirmed that there was no contamination present and therefore no leakage from the source had occurred.

With the component pointing away from all personnel the RPII Inspector opened the shutter with a long handled tweezers and the measured dose rate reached approximately 200 μSv/hr. This confirmed that the recovered component was in fact the Am-241 source contained within its protective housing

The shutter was fixed in a closed position and the component was put in a secure metal container. This container was labelled as containing radioactive material and placed in secure storage on site along with the previously recovered bridge unit. Dose rates around this container were less than 1 μSv/hr.

The licensee is storing the device until arrangements for its disposal with Heuft or its agents can be made.

❑ Findings

The metal source block and the metal bridge unit used by Heuft in this model of fill-height gauge are very robust as they survived a significant fire (estimated to be greater than 1000 ^{o}C for several hours), and prevented any leakage or contamination of the source.

However, this incident has identified one potential flaw in the safety design of this model of Heuft fill-height gauge. The mounting plate which holds the Am-241 source block inside the bridge unit is made of aluminium, and during this fire the mounting plate melted which resulted in the source block detaching from the bridge unit and falling out onto the floor.

The metal radiation warning labels riveted to the outside of the bridge unit were also destroyed in the fire. These labels were subsequently found to be located on the detector end of the bridge unit rather than the source end.

❑ Lessons Learned and Actions Taken

This incident highlights the importance of involving the manufacturers of measurement systems containing radioactive sources at an early stage. In this case the information provided by Heuft UK was instrumental in recovering the source.

The manufacturer, the RPII and other licensees with a similar fill-height detection system have consulted on the findings of this incident and the aluminium mounting plate in all units has been replaced by one made of stainless steel. Heuft UK has also indicated that all fill-height detection systems being currently manufactured now have a stainless steel mounting plate.

The question of fire proof radiation warning labels and engraved trefoil signs is being pursued by Heuft UK.

All licensees in Ireland with fill-height detection systems, irrespective of the manufacturer or model have also been advised of the findings from this incident and asked to incorporate them into their Safety Plans and / or to contact their manufacturers for further advice.