Buncefield response

The German response to the tank fires and explosions in Buncefield

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The explosion and subsequent fires at the Hertfordshire Oil Storage Terminal (HOSL) tank storage depot on 11 December 2005 was the largest explosion in Europe since the Second World War and had effects over a great distance including a smoke plume that drifted across France, eventually reaching Spain. Economic impacts were experienced across parts of Europe as a result of the restrictions to the fuel supply for London's airports and the need for flights to land elsewhere to refuel.

If anything is to be learned from catastrophic events such as Buncefield then it is not sufficient to just investigate and publish reports[1] — it is necessary to analyse how the facts and any new knowledge and understanding apply to one's own situation and to work out which measures need to be applied to avoid a repetition.

In Germany, the Federal Environment Minister Sigmar Gabriel requested on 13 October 2005 that the Commission for Plant Safety (Kommission für Anlagensicherheit – KAS) provide a position paper as to whether the events in Buncefield should lead to measures to be taken with respect to German tank storage depots. In particular it should be considered whether the legal framework and technical regulations were sufficient or whether additions were possibly required.

The Commission for Plant Safety is a body established under Paragraph 51a of the Federal Pollution Control Act[2] with the task of advising the Federal Government and the Federal Environment Ministry on matters related to process safety. The membership of the KAS is multipartite covering a wide range of stakeholder groups including federal and state authorities, academia, industry, third-party experts and inspection bodies as well as environmental NGOs. The KAS does not itself investigate accidents and has no enforcement responsibilities. A particular role is providing advice on the "state of the art of safety technology" (Stand der Sicherheitstechnik) and where necessary to formulate technical regulations.

The "state of the art of safety technology" is a particular terminology anchored in Paragraph 3 of the Major Accident Ordinance (Störfall-Verordnung)[3], the German implementation of the Seveso Directive, since 1980 as a requirement on operators of major hazards establishments to construct, operate and maintain their operations to this standard. The standard is defined in Paragraph 2, No. 10 of the Ordinance as being the development status of advanced processes, installations and operations, which appear with certainty to be practically suitable as a measure for the prevention of a major accident or the limiting of the consequences. Thus, this standard is not fixed but is dynamic and requires that operators of major hazard establishments continually assess the status of their safety measures and take the necessary measures to improve.

The Commission for Plant Safety set up a working party on tank storage. The membership of the committee was drawn from academia, industry, technical inspection bodies, public authorities and institutions as well as environmental NGOs. From its start the working party established a close contact with the authorities in the UK so as to be able to follow the developments and the release of information as closely as possible.

The urgency of the Federal Environment Minister was possibly in part motivated by claims by a tank storage inspection expert in the media, that Buncefield could not have happened in Germany. A claim made at a time when the Buncefield site was still covered in water, foam and petroleum products and the investigation team of the Major Incident Investigation Board (MIIB) had not yet had access to it.

Early on it became clear that the operation of tank storage fuel depots in the UK was substantially different to the way that they were operated in Germany. Whereas the UK has a pipeline network connecting refineries with the fuel depots, Germany generally has large fuel storage tanks at the refineries with distribution to remote depots via river barge, road tanker and rail tank-cars. There are a few cases where refineries distribute to a remote fuel storage depot by pipeline, however these operations are in the hands of one operator and should therefore be simpler to manage. This does not mean that an overfilling of tanks is not possible. Any situation in which the quantity of fuel to be transferred exceeds the free capacity in a tank has the potential to lead to an overfill.

The working party met eleven times, the last time on 12 October 2009 and published two interim reports. The first report was released by the KAS at its meeting on 22–23 June 2006, the second report was released in November of the same year and was followed by three further updates as more information became available. The final report was published in November 2009[4].

The conclusions and recommendations in the final report were grouped under the headings:

- prevention of an overfilling
  - technical measures
  - organisational measures
  - testing of over-fill protection
- leak detection and product retention
- prevention of turbulence and other critical transport effects
- measures for limiting the consequences (safety distances, emergency response, firefighting and emergency planning).

In the preamble to the conclusions and recommendations it

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was clearly stated that tank storage facilities are not constructed to survive such massive fires and explosions as occurred in Buncefield. The German technical regulations for storage tanks for petroleum presumed that the maximum extent could be a leak and fire involving one tank. This underlines the importance of prevention, i.e. the left-hand side of a bow-tie diagram.

This meant that the following requirements were placed on the technical measures for the prevention of overfilling:

- Overfill protection should have a high reliability. This may be through the use of redundancy or through the use of self-monitoring overfill protection devices.
- A warning should be given before the main alarm level is reached. These are known as Hi-Alarm and Hi-Hi-Alarm.
- Overfill protection systems should stop the filling process sufficiently early before the maximum fill level is reached and trigger an alarm. The function of the remotely operated valves should be signalled to the control room. On closing the inlet valve the pump must be switched off.
- Failures in the function of the level indication, the overfill protection and the relevant valves should be detected quickly, with certainty, and reliably. In such situations operators should be instructed not to commence filling or to stop the filling operation.
- For emergencies, the function of at least the safety relevant elements of the process control system are to be supplied with a sufficiently sized, non-interruptible power supply, unless their safety is guaranteed by a "fail-safe" design. "Fail-safe" in this context means that the component fails to a safe mode, in the event of a power failure.

These criteria effectively make mechanical over-fill protection devices, as implemented in Buncefield, unacceptable in German petroleum fuel depots.

The organisational measures described in the final report are based on the fact that fuel depots are generally Seveso establishments of the upper tier, with requirements to produce a safety report and to develop a safety management system. The organisational measures are targeted towards ensuring that the quantity of fuel which is to be transferred to the depot is not greater than the available free capacity. In addition, requirements are to be placed on the definition of alarm levels, maximum fill-levels as well as on the maintenance and testing of the overfill protection system.

The overfill protection systems are to be regularly inspected within the requirements of the Technical Regulations for Operational Safety. Petroleum tanks storage facilities fall within the equipment and plant to be regularly inspected by authorised inspection bodies. The authorised inspection bodies were recommended to establish guidelines for the extent and frequency of the testing and inspection of overfill protection systems.

The Commission for Plant Safety recommended that operators of petroleum storage tanks consider, within their overarching safety concept, the installation of leak detection devices which would at least lead to an alarm signal. If appropriate this could be coupled with interruption of filling operations. The Commission for Plant Safety also found that the retention systems such as bunds should remain intact for an appropriate amount of time in the event of fire and the relevant bodies were recommended to draw up standards to this effect.

One of the key consequences for the emergency planning which followed Buncefield was the realisation that no single operator would have sufficient firefighting foam to be able to deal with a large-scale fire. Thus, a network was established between the refinery operators, fuel depot operators and others to be able to share foam in an emergency. Firefighting foam has a limited shelf life and this improves the efficient use of resources. This network has recently been a subject of discussion, due to the legal requirements on the use of PFAS- and PFOA-free foam. It is therefore essential that industry ensures that the foams are compatible and that the network can continue its operation. This cooperation has recently been achieved.

As the Commission for Plant Safety released its interim reports and eventually its final report it was the responsibility of the operators and the authorities of the German States (Länder) respectively to implement, and to oversee the implementation of the recommendations. One of the earliest enforcement activities was to identify the relevant petroleum storage facilities and to assess their overfill protection systems. In addition, discussions with operators were necessary to consider which measures were to be implemented and within which time frame.

It can be seen that the fires and explosions at the Buncefield fuel depot were considered intensely in Germany and that measures were identified and implemented to ensure that tanks are fitted with reliable overfill protection systems and that petroleum storage facilities are operated and managed in a manner that ensures that fuel transfer and storage is carried out as safely as possible.

However, Germany is only one jurisdiction in Europe. What happened in the other countries? Were changes made to operating practices? Were there recommendations on the standards and quality of overfill protection systems? Whilst it is recognised that it is the operator's responsibility to construct and operate their establishment in a safe manner, it is also known that if the authorities do not declare what their expectations are, there is a drive towards the lowest level of acceptance. Major accidents are low frequency, high consequence events, thus it is necessary for operators to take all measures necessary to prevent such events and to reduce the consequences as far as possible.

References

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