tukes

Investigation report abstract

Accident	Explosive fire during the gelatinisation of recycled material in gunpowder factory N at EURENCO Vihtavuori Oy
Time of accident	Monday 21 May 2012 at 17.51
Place of accident	EURENCO Vihtavuori Oy's explosives factory in Vihtavuori, Laukaa
Summary of the accident and the results of the investigation	An explosive fire producing extremely high temperatures broke out in connection with the gelatinisation of recycled material in gunpowder factory N. The fire was put out quickly once the fire extinguishing system was activated. Two employees were injured in the fire, one of whom sustained serious burns. The ignited material comprised ether/an ether-air mixture and recycled material. The gravity of the accident was increased by the high ether concentration in the air in the mixer room. No definitive reason for the fire was established in the investigation. The fire was caused either by static electricity or a hard bump which caused sparks. Factors having an impact on the high ether concentration in the room: • In the risk assessments carried out, the hazards of vaporized ether had mainly been regarded as a disadvantage in terms of occupational hygiene. • No attention had been paid to the ether content of the recycled material, and the risks involved were assumed to be similar to those of pure nitro-cellulose. • No efforts had been made to reduce the volume of ether in the gelatinization of the recycled material in connection with the filling of the mixers. • No efforts had been made to reduce the vaporization of ether in the recycled material barrels during their storage. • The ventilation operating principles in the gelatinization building were not fully understood. • The exhaust ventilation in the mixer room was not switched on while the mixer was being filled. • The ether contained in the recycled material had not been taken into account in the area classification of the mixer room. Factors having an impact on the fire: • Only conductive barrels should be used when handling the recycled material. A serious error was made in the introduction of recycled material barrels as a non-conductive barrel had been taken into recycled material use at some stage. • After modification work, problems were experienced in keeping the lid of the mixer open, and the barrel lifter structures may have bumped against the edge of the mixer. The organisation has solid traditions of carrying out risk analyses, but there is still room for improvement in risk assessments related to chemicals. In the risk analyses, fire risks had been identified, but the fire extinguishing systems were regarded as adequate for extinguishing a possible gunpowder fire. The volume of ether and the

	possibility of a quick, explosive fire as a result of the ether-air mixture had not been identified. The hazards related to the machinery and equipment used in the gelatinization process had been assessed from the viewpoint of machine safety, and decisions on remedial measures had been made on the basis of the hazard assessments carried out. The impacts of the changes on process safety had not been assessed. The company guidelines had been deviated from to a certain extent in the planning and implementation of the changes. As a result of the changes, the mixer encountered usability problems, which had not been fully repaired during the past year. Repair measures were delayed by a lack of clarity in the flow of information between employees and supervisors and ambiguity concerning repair measures between the client and the outsourced maintenance staff. In the past few years, there have been many personnel changes in the organization and maintenance has been outsourced. These have had an impact on the functionality, expertise and flow of information in the organization. The organization has a management system along with guidelines. As a rule, the system and the guidelines function well. However, the guidelines are not fully observed at all levels of the organization, and this deficiency has not been tackled. In safety-critical operations, this is a serious shortcoming that undermines safe operations. In an operating system based on quality, environmental and occupational health and safety standards, there is also scope for specifying the industrial handling and storage of hazardous chemicals and process safety.
Measures proposed by the investigation team to prevent similar accidents	The investigation team proposes the following measures to prevent similar accidents. The recommendations are general, concerning the entire industry and similar projects. Recommendations for the purposes of supervision and the industry: • Guidelines should be observed. Regular training on the operational guidelines should be organized and it must be supervised so that the employees become acquainted with and comply with the guidelines. Important operational guidelines in terms of safety include organizational responsibilities, identification and assessment of hazards, change management, work instructions and management of deviations. • Procedures and guidelines based on quality, and environmental and occupational health and safety standards presented in the operating system should be specified from the viewpoint of industrial handling and storage of hazardous chemicals and process safety. The (major accident) hazards related to them should be identified and managed in a systematic way. The functionality of the management system should be ensured and the development needs should be systematically identified also in terms of the industrial handling and storage of hazardous chemicals and process safety. • The organization's functionality should be ensured in connection with organizational, personnel and process changes and when responsibilities

	change. The operating system should be kept up-to-date. • The persons in charge at the production plant and those planning and implementing the changes should be acquainted with the organization's change management procedures, which should be followed when changes are made in the production plant. • The protection plan should be developed in line with preventive risk management; the current nature of the protection plan is to react strongly to accidents. • In hazard identification and risk assessment, chemical safety should also be taken into account with the same degree of importance as explosives safety. The assessment team must include members with expertise in chemicals and the production process, and employees at the work site must be consulted. • It must be ensured that the employees are familiar with the work instructions and risk factors in their workplace and are able to identify them. Guidelines should be provided for the supervision of compliance with the safety and work instructions. • The processing of safety observations must have a follow-up procedure that motivates the employees to make safety observations. • Guidelines are to be drawn up for health and safety know-how and training procedures, and it should be ensured that the training needs for the personnel at the production plant are identified and determined in safety-related issues as well. Safety training should also be maintained and recorded. • The flow of information between contract partners operating in the plant area and the plant's personnel should be ensured. • Guidelines concerning the reaction to alarms are to be specified further. The causes of and reasons for alarms and the measures carried out should be recorded. The frequency of alarms should be monitored and the reason for recurring alarms should be tackled. • The monitoring of ongoing requirements by the authorities should be included as part of the systematic monitoring of deviations so that the requirements issued by the authorities are met within the specified time, or additional time can be applied for if necessary. Recommendations for the inspection body: • The validity of the area classification should be verified in connection with electrical inspections. Recommendations for focusing and developing Tukes's supervision and communication: • During periodic inspections, the functionality of the operating system and the awareness and observance of guidelines should be verified at all organizational levels.

	• Risk management regarding the industrial handling and storage of hazardous chemicals and the special characteristics of process safety compared with the safety systems related to quality control, environmental and occupational health should be emphasized in supervision and communications. Recommendations for the development of legislation: • The application of chemical legislation in the manufacture of explosives is to be clarified. The legislation should also support chemical safety in the explosives industry. • The area classifications concerning explosive air mixtures and explosives applied in the explosives industry are to be clarified.
Criterion for investigation	Act on the safety of handling of dangerous chemicals and explosives 390/2005, 99 §; Decree on Explosives 473/1993, 99 – 101§.
Date of investigation report	28 September 2012
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