

Investigation report abstract

Accident	Death of an employee in the yard area of Talvivaara Sotkamo Ltd
Time of accident	15 March 2012 between 8.45 and 9.20
Place of accident	Talvivaara Sotkamo Ltd's metal recovery plant in Sotkamo
Summary of the accident and the results of the investigation	<p>One person died in the accident. The cause of death was found to be exposure to hydrogen sulphide.</p> <p>The investigation team has come to the conclusion that the fatal hydrogen sulphide discharge and other high levels of hydrogen sulphide in the area were due to deficient process planning and operational process safety management. The probable technical reason for the accident was a discharge of hydrogen sulphide from a line 1 pre-neutralisation storage tank. The limestone slurry pumped from the floor drain into the line 1 pre-neutralisation storage tank reacted with the stored liquid, creating carbon dioxide. Carbon dioxide increased the volume of gas above the surface of the liquid inside the storage tank. As the volume of gas increased, the hydrogen sulphide gas and the carbon dioxide discharged into the bund through the spill pipe. This caused a lethal level of hydrogen sulphide in the bund and its vicinity. The victim was discovered close to the bund. He had a phone on him, but no self-rescue device or multi-gas monitor.</p> <p>During the two weeks prior to the accident, raised levels of hydrogen sulphide had been recorded several times in the vicinity of the scene of the accident. The hazards in the area had been observed to an extent, for example, when granting a work permit for the area. The contractor had been warned about high hydrogen sulphide levels and the area had been cordoned off with a yellow and red ribbon several times. However, systematic and efficient measures had not been taken to discover the reason for the raised hydrogen sulphide levels. The information about high hydrogen sulphide levels and markings had not reached all of those traversing the outdoor area.</p> <p>During the plant planning stage, the production process risks had been analysed using a HAZOP study. The danger of high hydrogen sulphide levels had been noted during these analyses. However, the technical deficiencies resulting in the accident had not been identified or processed in the risk analyses.</p> <p>The plant, which is new in Finland in terms of its dimensions and process, has encountered process disturbances and technical operational problems. Solving these operational problems has largely absorbed the planning resources at the plant.</p> <p>The investigation also discovered deficiencies in the specification of responsibilities, flow of information, organisational procedures, and working methods.</p>
Measures proposed by the investigation team to prevent similar accidents	<p>The investigation team recommends the following measures to prevent similar accidents. The recommendations are general, concerning the entire industry.</p> <p>Recommendations for the purposes of supervision and the industry</p> <p><u>Process safety risks and their management</u></p>

	<ul style="list-style-type: none"> • The significance of process safety must be understood as it is a key issue in accident prevention and continuity of production. • The risks of a new technology must be identified in advance, using the best possible expertise and systematic risk assessment. • Process planners and the operation and maintenance personnel must be included in risk assessment. • The maintenance of safety-critical equipment must be included in preventive maintenance. • The safety significance of operational disturbances must be assessed and an effort must be made to investigate such disturbances. <p><u>Safety responsibilities and flow of information</u></p> <ul style="list-style-type: none"> • The management's perspective on safety issues must be clear. In addition to providing instructions, it is important to listen to employees and set an example. The management must take part in the handling of issues that are significant in terms of safety. • Responsibility for safety must not be separated from the operational organisation. The development of process safety requires knowledge of the production technology and the risks related to hazardous chemicals. • The responsibilities and tasks of the person responsible for the operating principles and the operational supervisor must be clearly defined and they must be able to manage their tasks from the point of view of their organisational position. • The operator must have a clear means of providing information in the event of hazardous situations so that information about the hazard is disseminated quickly and reliably to all those in the area at the time. • Responsibility for decision-making about process shutdowns due to hazardous conditions must be assigned and guidelines should be drawn up. At major hazard installations, the primary nature of safety in decision-making must be emphasised. • The processing of safety observations must have a follow-up procedure that motivates the employees to make such observations.
Criterion for investigation	Act on the safety of handling of dangerous chemicals and explosives 390/2005, 99 §.
Date of investigation report	19 June 2012
Signatures of the investigation team and names in block capitals	<div style="display: flex; justify-content: space-between;"> Heikki Penttinen Aki Ijäs </div>