

TerranearPMC Safety Share

Week of September 6, 2016 – The Seveso Disaster and TCDD

It is said that necessity is the mother of invention (for which Frank Zappa got the idea to name his original group: *The Mothers of Invention* – aka “The Mothers”). In the world of safety and health, one could proclaim a proverb which parallels this platitude with “it takes tragedy to create controls.” Such is the story behind the Seveso II Directive. OK, what is the Seveso II Directive? While we, in America are quite aware of such international tragedies as the sinking of the Titanic, the Bhopal disaster and Chernobyl, the event that occurred in July, 1976 in the Italian village of Seveso, marks a significant event that resulted in the European Economic Community (later becoming the European Union in 1992) to create laws aimed at improving the safety of facilities where large quantities of dangerous substances are either used or stored.

The incident involved an industrial plant, located in Meda, Italy where the disinfectant, Hexachlorophene, was manufactured. As part of this process, 2,3,7,8-tetrachlorodibenzo-p-dioxin or simply, TCDD, was produced as an intermediary, which would then be used to produce the final product. Meda is approximately 20 kilometers north of Milan in the Lombardy region of Italy. The plant had been built many years earlier and the local population did not perceive it as a potential source of danger.

The factory was a subsidiary of Hoffmann-La Roche (Roche Group) and while the unfortunate event occurred in the town of Meda, the event, has always been referred to as the Seveso disaster, as that was the name of the neighboring village that was most affected by the factory’s release of hazardous materials.

The specific manufacturing process comprised a number of intricate techniques where specific temperatures, pressures, as well as the formation of intermediate chemicals were integral. These intermediate materials were then changed into other materials, which in turn, at later stages, gave the final product: hexachlorophene. This process used the exhaust steam from the plant’s turbine which supplied additional heat needed to achieve crucial chemical reactions. Unfortunately, readouts of the steam temperature were not available to the plant operators (a practice that was ongoing since plant start-up). In addition, right before the weekend, an intermediate step was interrupted prior to the completion of the final step. This was due to conformance with an Italian law requiring shutdown of plant operations over the weekend. Other parts of the site had already started to close down as the processing of other batches reached completion. This reduced power consumption across the plant caused a dramatic drop in the load on the turbine which, in turn, created an increase in the temperature of the exhaust steam to around 300 °C (this occurred because the normal distribution of steam was not necessary and therefore, heat exchange operations were minimized, resulting in generated steam to continue to consume energy). This much hotter steam then proceeded to heat the reactor that was still in operation. Not having a readout of the steam temperature available, operators of the reactor were unaware that the process was being heated above the intended temperature. The reactor relief valve eventually ruptured, causing the aerial release of 6 tons of TCDD, which settled over 18 km² of the surrounding area.

Within days a total of 3,300 animals, mostly poultry and rabbits, were found dead. Emergency slaughtering commenced to prevent TCDD from entering the food chain, and within two years, over



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80,000 animals had been slaughtered. 15 children were quickly hospitalized with skin inflammation. A month after the incident the immediate area of the reactor was completely evacuated and fenced. 1,600 people of all ages had been examined and 447 were found to suffer from skin lesions or chloracne.

This event led to the Seveso Directive. It is a European law that is integrated with other EU policies for the purpose preventing hazardous material events such as what happened at the Hoffmann-La Roche facility. The directive includes the following such policy areas as:

- Classification, labelling and packaging of chemicals;
- The Union's Civil Protection Mechanism;
- Protection of critical infrastructure;
- Policy on environmental liability and on the protection of the environment through criminal law;
- Safety of offshore oil and gas operations.

TCDD is one of the many chemical compounds that falls within the family of "dioxins" which are classified as environmental pollutants. They belong to the so-called "dirty dozen" - a group of chemicals known as persistent organic pollutants or POPs. Dioxins are of concern because of their highly toxic potential. Experiments have shown they affect a number of organs and biologic systems. Currently, there are 419 types of dioxin-related compounds identified but only about 30 of these are considered to have significant toxicity, with TCDD being the most toxic.

Short-term exposure of humans to high levels of dioxins may result in skin lesions, such as chloracne and patchy darkening of the skin, and altered liver function. Long-term exposure is linked to impairment of the immune system, nervous system, the endocrine system and reproductive functions.

Chronic exposure of animals to dioxins has resulted in several types of cancer. TCDD was evaluated by the International Agency for Research on Cancer (IARC) in 1997 and 2012. Based on animal data and on human epidemiology data, TCDD has is classified (by IARC) as a "known human carcinogen." However, TCDD does not affect genetic material and there is a level of exposure below which cancer risk would be negligible.

Due to their ubiquitous presence throughout the world, all persons have background exposures as well as a certain level of dioxins in their body. The developing fetus is most sensitive to dioxin exposure. Newborns, with rapidly developing organ systems, may also be more vulnerable. Some people or groups of people may be exposed to higher levels of dioxins because of their diet (e.g., high consumers of fish in certain parts of the world) or their occupation, such as workers in the pulp and paper industry, or in incineration plants and at hazardous waste sites.

Note: Neither OSHA nor the ACGIH has published an occupational exposure limit for TCDD.

The only man who never makes a mistake is the man who never does anything - Theodore Roosevelt

