Example: Finding the cause of a fire in a precipitator

Situation:

A fire started at a precipitator resulting in the loss of several important pieces of hardware and losses that exceeded $40 million. The subsequent litigation extended for years with significant costs for all parties. The manufacturer faced the charge of negligence in the design of the precipitator. The two main charges were:

- The flammable casing was the origin of the fire.
- The absence of an automatic suppression system lead to the large damages. In the presence of a sprinkler system the damage would have been only local and the losses much smaller.

Background:

The refinement process required the use of a precipitator. To run the refining process in an optimal manner it is required to have high oxygen concentrations, high-energy electrical discharges and highly corrosive compounds. The use of a new material for the construction of the casing of the precipitator is the optimal choice due to cost and physical constraints of the process.

Approach:

As part of the litigation a risk analysis was conducted on this process that identified the mechanisms that lead to the fire. The problem was divided in two parts, an analysis of cause and origin and an evaluation of damage.

- Evaluation of the process and potential failure modes.
- Evaluation of the consequence of each failure mode including a flammability assessment of all the products generated after each failure mode.
- Determination of safety measures.
- Establishment of the outcome when safety measures are implemented.

Analysis:

The analysis of cause and origin showed that the ignition sequence was as follows:

- Operator error resulted in an important reduction of the humidity level.
- The reduction in the humidity level lead to the production of powders flammable under reduced humidity.
- Electrical discharge ignited the powder.
- The energy released by the particles was sufficient to ignite the case of the precipitator.

The electrical discharge alone was not capable of igniting the casing, thus the material choice was not a problem. The high oxygen concentration resulted in a very fast flame spread and the subsequent destruction. This will have occurred despite the new casing material due to the presence of other combustible materials in the chemical process. An internal sprinkler system would have been rapidly overwhelmed because of the high oxygen concentrations and the damage result would have been equal.

Conclusions:

The chosen material was not inappropriate if the system could guarantee shut-down in the event that humidity was loss. The energy available from the electrical discharge was sufficient to ignite the casing but the delivery period was too short for ignition to occur. The consequence analysis shows that the high oxygen concentration within the precipitator will

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result in a complete loss in the event of a fire. Therefore, safety needs to concentrate on preventing ignition not in introducing automatic suppression systems. The adequate improvements represent, compared to the original suggestions, a very small additional cost and very minor modifications to the system.

The suggested changes implied a total redesign of the precipitator that would have resulted in no major improvement to its safety. The re-design would have aligned this manufacturer with its competitors and drastically reduced the market share.

A proper risk analysis of the product would have clearly shown the need for a safety element that will immediately stop the process in the event of a reduction in humidity. This safety system would have prevented all the associated losses for all parties.

If you feel that you have to deal with a similar or other fire related issue please do not hesitate to contact us.

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