# ISC Safety Lore

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## Key lessons from incidents - inadequate hazard identification

### Introduction

Hazard identification is part of hazard analysis which involves the identification of hazards at a facility and evaluating possible accident scenarios leading to unwanted consequences. Without a good system of hazard identification, it is possible for a hazard to be overlooked and the assessment of risk will be incomplete; as such, it is a very important part of the risk management process. A hazard not identified is a potential accident waiting to happen. If hazards are identified early in a project, it is easier and cheaper to put a suitable risk control measures in place.

### Case 1 – Oil refinery

On 6 August 2012, an oil refinery experienced a catastrophic pipe rupture in the crude distillation unit, releasing flammable hydrocarbon process fluid that partially vaporized into a large vapor cloud engulfing nineteen employees. Approximately two minutes after the release, the flammable portion of the vapor cloud ignited. Nobody was injured in the incident.

### Key findings

Subsequent testing determined that the rupture was due to pipe wall thinning caused by sulphidation corrosion. Over a period of nearly 35 years, the piping component in question had lost on average, 90 percent of its original wall thickness in the area near the rupture. Technical staff within the company had considerable knowledge of sulphidation corrosion. Personnel had access to details of in-house incidents resulting from sulphidic corrosion. Inspection data obtained during the 2011 Crude Unit turnaround identified that components of an identical, 12-inch (30 cm) portion of a 4-sidecut piping had become so thin due to sulphidation corrosion that much of it had to be replaced during the turnaround. Even though the 12-inch 4-sidecut piping was manufactured from the same specification of carbon steel, contained the same process fluid, and experienced similar process conditions as the 8-inch (20 cm) 4-sidecut piping that suffered the incident, the company turnaround management did not consider that components in the 8-inch 4-sidecut piping could also be too thin to allow the piping to continue in operation. The crude distillation unit of the pipe in question was a result of sulphidation corrosion that was a hazard that apparently had been overlooked for a long period of time.

### Case 2 – Chemical plant

On 25 January 2005, an explosion occurred at a chemical factory. The company generated and packaged acetylene for use in multiple industries. Three workers were killed in the explosion, and one other was injured. The explosion destroyed a storage shed at the facility, and windows were shattered in other buildings. The explosion also heavily damaged a building at a nearby manufacturing site. Acetylene produced in the generator flowed back past the check valve through the recycled water line into the shed by way of the open drain valve. The acetylene gas accumulated inside the shed, ignited, and exploded.

### Key findings

The check valve did not prevent back flow as it should have done, and the check valve design was susceptible to failure, according to the investigation. There were no other safeguards other than the check valve to prevent back flow. The company did perform a hazard analysis in 1996, but that analysis failed to identify hazards created by the location of the water line drain in the shed. The hazard analysis was required to be updated in 2001 by the regulation, but it did not happen. It was normal practice to leave the decant water line open at night to drain to the shed floor through a low-point valve. This protected the outside section of the line from damage due to freezing during cold weather. The open valve created a potential pathway for acetylene to flow from the generator into the shed; an enclosed space that was not designed for the presence of acetylene. This potential hazard was not recognized by the company.


The ISC believes that leadership across six key functional elements is vital to achieve good process safety outcomes. These elements are:

- systems & procedures
- engineering & design
- assurance
- knowledge & competence
- human factors
- culture

In the *What can I do* section below you can see how each of these elements plays a part.

**Figure 1**: The ISC Framework

| **What can I do?** | |
|---|---|
| **Management** | |
| | • When carrying out hazard identification, make sure to adopt a structured, systematic approach and ensure that the hazards identified reflect the current process or system or operation. |
| | • Make sure to apply a team-based approach to hazard identification involving people with a range of knowledge, skills, expertise, and experience. |
| | • Adequate level of competency in hazard identification and risk assessment is required at all levels of the organisation; make sure that it is part of their training plan. |
| | • Ensure that the hazard analysis includes both routine or planned and non-routine (e.g., emergency or maintenance) activities. |
| | • When changes are made review the modifications to ensure the hazard analysis covers both original and new hazards. |
| | • Ensure hazard identification is addressed in both technical and organisational changes. |
| | • There are different hazard identification methods, applicable to different stages of the plant lifecycle. Make sure to adopt the technique most appropriate to the current phase of the facility. |
| | • Hazard identification is not one-shot process, it is a good practice to continually update it to make sure that it is current for the operations/plant/organisation etc. as it is today. Make sure to periodically review the hazard identification in addition to the review in case of changes are made to the system either on technical or organisational level. |
| | • Make sure to keep the hazard identification documents and records available and archive the old versions as they can aid in identifying creeping changes. |
| | • Hazard identification studies raise actions to ensure controls are implemented or further study is required. Make sure that these actions are recorded and closed out to make improvements. |
| | • External hazards, such as natural hazards triggering technological disasters, known as Natech events can impact industrial facilities; make sure to consider such events in the hazard identification. |
| **Process Engineer/Supervisor** | |
| | • Ensure you are trained on hazard identification techniques related to the job function you are involved in. |
| | • When during hazard identification brainstorming that you identify as many hazards as possible. |
| | • When facilitating a hazard identification workshop, a template containing guidewords is often used. The guidewords in the template are business specific – for example, for an offshore facility there would be guidewords concerning shipping and transportation not relevant for an onshore facility. A batch chemical plant might have guidewords on typical reaction hazards. Make sure to use guidewords that are most appropriate to the business. |
| | • When a change is made to the facility and the hazard identification needs to be re-done, ensure that the hazard register is updated to include any new hazards, or to remove hazards no longer relevant. |
| **Operator** | |
| | • Make sure that you are aware and understand the hazards associated with your job and the equipment you use |
| | • Make sure that you have received training in all hazards identified with the unit you work on. |