

Lessons Learned Bulletin Special Issue

Chemical Accident Prevention & Preparedness

Pandemic measures and chemical process safety

The aim of the bulletin is to provide insights on lessons learned from accidents reported in the European Major Accident Reporting System (eMARS) and other accident sources for both industry operators and government regulators. JRC produces at least one CAPP Lessons Learned Bulletin each year. Each issue of the Bulletin focuses on a particular theme.

This special issue of the Lessons Learned Bulletin (LLB) is intended to raise awareness of risks associated with shutdown and startup of industrial sites where dangerous substances are present.

Protective measures imposed by governments around the world to control the spread of the Covid-19 virus have necessitated the temporary closure of thousands of sites and substantial reduction in personnel remaining onsite. As these protection measures are relaxed, site operations are restarted, but may also be shut down again if the pandemic resurges. During this time, it is important that all operators of hazardous sites remain mindful of the elevated risks associated with abnormal operations, such as shutdown, start up, and unforeseen staff reductions.

This issue has been produced with substantial contributions from Mark Hailwood and Torill Tandberg and input from exchanges within the EU's Technical Working Group for Seveso Inspections (TWG 2).

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Introduction

The Covid-19 pandemic has had a global impact and continues to influence the lives of people throughout the whole world. Many industrial facilities have been shut down following the measures to reduce the spread of infection. Even though an industrial facility is not actively manufacturing it may still have hazardous substances on site. Following the shut down, operations will restart at some point. Both shut down and start-up are process conditions, which need special attention to prevent the occurrence of chemical accidents. Two recent accident cases illustrate why special considerations should be taken when restarting a plant after shutdown due to the Covid-19 pandemic.

Case studies

The following reports are of accidents that are very recent and are based on media information. It is not possible at this stage to determine the specific causes of these accidents. This will be the responsibility of the site operator and the public authorities in the region concerned.

Leak of hazardous gas from a polymer plant, Visakhapatnam, Andhra Pradesh India 7th-8th May 2020

A leak of hazardous gas led to the death of at least 11 people and injuries to hundreds more. The authorities have reported that a release of gas from styrene tanks occurred in the early hours of the morning (around 3 a.m.) on 7th May 2020. The polymer plant was restarting following shutdown due to the Covid-19 pandemic. Media reports have suggested that the styrene had been stored for a long time.

Styrene monomer must be stabilised for storage. Over time, even stabilised styrene may polymerise in an exothermic (self-heating) reaction. This reaction can be accelerated through exposure to iron oxide (rust). An increase in temperature will lead to a large amount of vapour to be vented from the tank. Whilst styrene is not known to be toxic, it causes nausea and vomiting. Acute exposure to styrene gas causes respiratory and neurological symptoms and its action as an irritant can lead to lung oedema with fatal consequences.

The impact of this chemical release on the local medical services means that many people are seeking treatment in close proximity. There is concern that the influx of patients may lead to coronavirus being spread among victims and doctors since the area is already a containment zone.

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Explosion at a plastics factory, Ottaviano, Italy, 5th May 2020

An explosion at a plastics factory near Naples, Italy killed one person and injured two others on May 5. Local media reported that the blast could be heard from several kilometres away, while witnesses reported seeing a large plume of black smoke rising from the factory premises. The explosion occurred in the vicinity of the process ovens, destroying buildings and burying one of the employees in the rubble. The employee was freed, but died almost immediately of his injuries. The local population was recommended to close doors and windows and to avoid any unnecessary movement of people, particularly in the area close to the site. The factory had only reopened on May 4th after the Italian government eased the lockdown in the country following the coronavirus pandemic.

Shut down and start-up of facilities handling hazardous substances

Shut down and start-up of operations are dynamic processes that have particular hazards associated with them. In particular, shut down and start-up in connection with the Covid-19 pandemic brings specific issues, which need to be considered.

Shut down needs to be carried out in an organised and structured manner. If the shutdown is for a longer or undetermined period of time then the operator needs to be aware of measures which need to be taken to maintain a high level of safety over this period. For example:

- Some hazardous materials degrade over time. These inventories need to be minimised and their situation monitored.
- Nitrogen blanketing to protect against explosive atmospheres needs to be maintained.
- Any loss of electrical power during the period of shut down will affect any systems that need to be maintained in operation (cooling, ventilation, pumping, stirring, etc.).
- Some processes, such as the storage of refrigerated gases, depend on a regular rate of consumption to maintain safe operating pressures (e.g., LNG, cryogenic ammonia). Reduced consumption due to a shutdown must be assessed and appropriate measures taken. If tanks containing such gases are emptied and not refilled with cold gas during a temporary shutdown, the operator must ensure that a cooling procedure is effected before refilling the tank.
- Warehouses that are not opened regularly, and thus ventilated through the transfer operations, may heat up due to external temperatures and absorption of solar radiation. This can lead to the release of hazardous materials or the build-up of hazardous atmospheres within the warehouse.

Start-up also needs to be carried out in an organised and structured manner. The operator should not assume that everything has remained unchanged throughout the shutdown. Temperature and pressure changes in the process systems may mean that hazardous atmospheres have been created, where they previously did not exist. If it is unclear whether the electrical power supply has been uninterrupted, then the

conditions in some parts of the facility may not be well known. It is important that the plant is inspected and tested before restarting and that the start-up process is monitored.

Both shutdown and start-up in relation to the Covid-19 pandemic have the risk that management may become distracted. The priority of keeping the establishment safe may compete with other priorities. In particular, in the shutdown phase the management will need to demonstrate compliance with the requirements of the authorities. In doing so, they will have to ensure that all measures are in place to prevent infection of employees and the public, including possibly reducing the number of staff involved in the shutdown.

Moreover, the business interests of management will be a high priority during this time, potentially taking focus off plant safety. Operating under intense economic pressure can be detrimental to safety goals. Management may be more concerned about maintaining the supply chain, and the economic viability of the operation once restarting is possible. These concerns may influence the start-up phase, where the need to return to market may take precedence over starting the plant safely. In this case, the management may risk taking shortcuts in starting up operations such that they fail to do routine checks, e.g., ensuring critical safety equipment is intact, that substances are stable and in the right place, and conducting tests to confirm that safe process conditions are met before start-up, etc.

The competent authorities can also help support safe operation of hazardous facilities during a pandemic crisis. In particular, they can promote awareness of the potential risks through various types of communications. For example, competent authorities can consider conducting inspections at a distance, and asking questions about production and maintenance activities continuing onsite during shutdown as well as staffing and supervision. Authorities may also wish to send out a bulletin or information letter or guidance noting the potential for elevated risk during this period. Communication may include recommendations for keeping their employees and the public safe from infection. The competent authorities may also need to pay particular attention to any sites that might have been undergoing maintenance turnarounds or other abnormal situations when the pandemic shutdown was imposed. It is also very important to develop emergency plans and communication with the relevant authorities so as to be able to respond to a chemical accident during the restrictions of the pandemic crisis. The authorities should develop their own strategies and priorities based on their own knowledge and experience with the sites under their authority And take account of pandemic impacts on the availability of medical resources.

For hazardous sites, especially chemical processing sites and petroleum oil refineries, safe shut down of operations, maintaining safety during the shutdown period, and safe start-up are all keys to surviving the pandemic. Good corporate governance and risk management are essential. The chances of avoiding an incident, especially a serious accident, can be considerably reduced if the operator has a conscious strategy to keep plant safety at the forefront while addressing other pandemic-related concerns. The competent authorities can give support by spreading awareness, establishing measures to monitor the situation, and ensuring appropriate preparedness measures are in place.



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