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Operational Readiness and Process Startup

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PSM Element # 13, Operational Readiness and Process Startup

What is Operational readiness and process startup?

The operational readiness and process startup element ensures that shut down processes are verified to be in a safe condition for re-start. This element addresses startups from all types of shut down conditions and considers the length of time the process was in the shut down condition.

The readiness element in AIGA Process Safety Management guideline (AIGA 099) defined more broadly than the OSHA process safety management pre-startup safety review element in that it specifically addresses startup from all shutdown conditions - not only those resulting from new or changed processes.

Note: The term 'Operational readiness and process startup' and 'Prestart up Safety Review (PSSR)' are used synonymously in many publications.

Why is Operational readiness and process startup Necessary?

Experience from numerous process industries have shown that the frequency of incidents is higher during process transitions phases. These incidents have often resulted from the physical process conditions not being exactly as they were intended for safe operation. Thus, it is important that the process status be verified as safe to start.

Who does it?

Simple readiness reviews and process startup may involve only one operator, maintenance person or engineer.

More complex startups, such as those for new units, entire plants, or a large unit after an extended shutdown, may involve many people, from all the disciplines that are typically a part of a large capital project.

How to do it?

A written program that documents the intentions of the readiness element is key to the long-term success of readiness activities. Defining roles and responsibilities, where and when readiness activities should be carried out, the technical issues that should be addressed, and the necessary technical expertise of personnel are critical to having an effective readiness system. Records should be maintained concerning readiness activities so that performance and efficiency can be periodically evaluated.

What can go wrong? Example of incidents in the process industry & Learning points

On 28 August, 2008, a runaway chemical reaction occurred inside a 4,500 gallon pressure vessel, causing the vessel to explode violently at one pesticide manufacturing facility. Highly flammable solvent sprayed from the vessel and immediately ignited, causing an intense fire that burned for more than 4 hours. The incident occurred during the restart of the Methomyl unit after an extended outage to upgrade the control system and replace the original residue treater vessel. The incident resulted in one employee died from blunt force trauma and burn injuries sustained at the scene; the other one died 41 days later at hospital. Six volunteer firefighters who assisted in the fire suppression activities and two contractors working at the facility were treated for possible toxic chemical exposure.

Gap in PSSR was deemed as key findings including:

- The PSSR did not include a formal process involving multiple disciplines.
- The PSSR did not verify the completion of modifications in the field, including:
- Toxic gas monitoring system was not in service.
- Project engineers did not verify the functionality of critical DCS control and indication circuits.
- Operating equipment and instruments were not installed before the restart, some of which were discovered to be missing after the startup began.
- Valve lineups were incomplete or incorrect.
- Control system training was inadequate. The operators were not formally trained on the DCS and were not familiar with some of the changed units of measure used on the DCS displays.



Information Source: USCSB

Learnings from the Incidents

The following is a list of guidelines for Operational readiness and process startup from AIGA 099, Process Safety Management

- A systematic process for checking operational readiness and the integrity of systems before they are brought into service.
- Checking process addresses:
 - New or modified plant, processes, and equipment
 - Major equipment returned from maintenance and

- Restart after a trip or a planned shutdown of the full plant or a part of the plant;
- There are defined criteria for operational readiness. The criteria should cover, but are not limited to:
 - Equipment.
 - Control system and software.
 - Operating procedures and documentation and.
 - Human and organizational factors
- Selected criteria should address the following items:
 - Construction is in accordance with specifications.
 - Risk management recommendations have been addressed and required actions taken.
 - Regulatory and permit requirements are met and.
 - Emergency and operations procedures are in place and adequate.
- Maintenance procedures are assigned for development:
 - Required training of personnel and communication related to process safety management aspects has been accomplished and
 - Necessary process safety documentation is readily available to those who need to use it;
- System checks are carried out and documented by competent personnel.
- There are defined criteria for categorizing and handling identified issues and outstanding work items.
- Completed system checks are reviewed, approved, and accepted by specific levels of management appropriate to the magnitude of the risk; and
- Commissioning and startup procedures have defined stages, hold/check points, and progression criteria and review authorities.

References:

- AIGA 099, *Process Safety Management*, www.asiaiga.org
- Guidelines for Risk Based Process Safety, Center for Chemical Process Safety, AIChE, www.aiche.org/
- Guidelines for Performing Effective Pre-Startup Safety Reviews, Center for Chemical Process Safety, AIChE, www.aiche.org/
- Pesticide Chemical Runaway Reaction Pressure Vessel Explosion, U.S. Chemical Safety and Hazard Investigation Board. <https://www.csb.gov/bayer-cropscience-pesticide-waste-tank-explosion/>

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