

FRANKLIN

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Start-up Shutdown Malfunction Plan Development and Implementation

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Why do we Prepare Startup, Shutdown, and Malfunction Plans (SSMP)?

SSMPs are required under General Provisions for MACT standards (40 CFR Part 63), specifically §63.6(e)(3)(i), which states:

The owner or operator of an affected source must develop a written startup, shutdown, and malfunction plan that describes, in detail, procedures for operating and maintaining the source during periods of startup, shutdown, and malfunction; and a program of corrective action for malfunctioning process, air pollution control, and monitoring equipment used to comply with the relevant standard.

Sections that address SSM requirements are:

- §63.6(e)(3) - Requirements to develop SSMP
- §63.10(b)(2) - Recordkeeping
- §63.10(d)(5) - Reporting

Note...CFR citations are from e-CFR at <http://ecfr.gpoaccess.gov>.

The purpose of the SSMP is to minimize emission during startups, shutdowns, and malfunctions.

- Ensure proper operation and maintenance to satisfy the general duty clause to minimize emissions
- Ensure that malfunctions are addressed as soon as practicable after they occur in order to minimize emissions
- Reduce the reporting burden associated with SSM events

Definitions

- **Startup** means the setting in operation of an affected source or portion of an affected source for any purpose.
- **Shutdown** means the cessation of operation of an affected source or portion of an affected source for any purpose.
- **Malfunction** means any sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes, or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions.

How do we develop an SSMP?

Contents of the Document

- General description of affected system
 - Block diagram or P&ID of affected system
 - What is covered and what isn't covered
- Regulatory checklist
 - Lists all SSM requirements in 63.6 and 63.10, as well as any in the specific MACT standard
 - Specify where the requirement is documented (SSMP section, SOP #, etc.)
- Procedures
 - Incorporate existing procedures by reference to the extent possible

How do we develop an SSMP? (Cont'd)

Contents of the Document

- General descriptions of events (SSM)
 - Define when startup and shutdown events start and are completed from an SSMP standpoint
 - Define what can and can't be done during startup and shutdown
 - Include (or reference) flowcharts if appropriate
 - Discuss startup, shutdown and malfunctions checklists and include as attachments to SSMP
 - Discuss and include emergency shutdown procedures
- Malfunctions and Correctives Measures
- Recordkeeping and Reporting Requirements
 - Clearly define requirements
 - Include example forms to use in reports

Startup and Shutdown

- Most facilities have existing startup and shutdown procedures
- Do not reinvent the wheel ... reference existing procedures if applicable

Malfunctions

Our approach is similar to a Hazard and Operability (HAZOP) review approach used for Process Hazards Analysis (PHA), except that the evaluation is focused on events that can cause potential excess emissions instead of events that can result in a safety hazard.

Participants should include:

- Coordinator
- Scribe
- EHS Staff
- Operations Staff
- Maintenance Staff
- Engineering

SSMP Malfunctions Analysis

The SSMP should define:

- Potential causes of malfunctions
- Potential malfunctions (only as specific as necessary)
- Measures to minimize the frequency of malfunctions
- Measures to minimize the severity of malfunctions

First Define Potential Causes of Malfunctions

Examples:

- Failure of plant utility (steam, air, water, power, etc.)
- Mechanical failure of rotating equipment
- Electrical failure of instrumentation
- Plugging of lines/nozzles
- Mechanical or electrical failure of actuated valves or dampers
- Failure of control system
- Physical failure of internal equipment

Define Major Category Items for Review

- Each unit operation needs to be shown on flow diagram
- General facility events (e.g., loss of plant electrical supply or loss of steam supply)
- Specific unit operations, both emission source and control equipment, for example:
 - Tank
 - Combustion chamber
 - Baghouse
 - Scrubber

Define Unit Operation-Specific Malfunctions

- Use causes identified above, and identify whether the cause is applicable to the unit operation (using the flow diagram or P&ID)
- For each identified potential cause, how can the cause manifest as a malfunction? (complex process will require a P&ID)
- Do not consider mitigating factors at this point
- For each identified potential cause, can the identified malfunctions result in an emissions excursion? If not, it should not be addressed in the SSMP.

Define Unit Operation-Specific Malfunctions (Cont'd)

Example – Packed Column Scrubber:

- A loss of city water results in a loss of makeup water to the packed column scrubber
- The loss of makeup water results in less efficient acid gas scrubbing
- Less efficient acid gas scrubbing could result in an emissions exceedance

Define Measures to Minimize Frequency of Malfunctions

- Well trained and qualified operations and maintenance personnel
- System design consistent with good engineering practice
- Appropriate operating and maintenance practices and procedures
- Appropriate setpoints for alarms and interlocks
- Failure positions for critical equipment

Define Measures to Minimize Severity of Malfunctions

- Well trained and qualified operations and maintenance personnel
- Design of system (i.e., redundant equipment and instrumentation)
- Alarms and interlocks
- Failure positions for critical equipment

Develop a Program of Corrective Action for Malfunctions

For each malfunction identified, provide a list of corrective steps to be taken

Example:

5.1 Loss of Plant Water Flow to Scrubber

5.1.1 In case of loss of plant water supply, see item 1.6.

5.1.2 In case of plugging/mechanical failure of line or line component:

5.1.2.1 Identify the location of plugging or line failure.

5.1.2.2 Clear line plugging and/or service/replace faulty line components, as needed.

5.1.3 In case of mechanical/electrical failure of actuated valve:

5.1.3.1 Identify cause of actuation failure.

5.1.3.2 Service/replace electrical and/or pneumatic components, as needed.

5.1.3.3 Service/replace actuator and/or valve components, as needed.

5.1.4 In case of physical/electrical failure of control system component:

5.1.4.1 Identify faulty control system component.

5.1.4.2 Service/replace control system components, as needed.

Implementation

USE CHECKLISTS FOR SSM EVENTS!

Startup checklist items

- Date, time, and duration
- List of operational steps with a checkbox for each step
- Statement as to whether actions were consistent with procedure(s)
- If actions were not consistent with procedure(s), what actions were taken
- Signature of operator(s)

Implementation (Cont')

USE CHECKLISTS FOR SSM EVENTS!

Shutdown checklist items

- Same as startup checklist except that operational steps are for shutting the equipment down

Malfunctions checklist items

- Date, time, and duration
- Description of the malfunction and the cause, if known
- Description of the operator's response and corrective actions taken
- Statement as to whether actions were consistent with procedure(s) and SSMP
- If actions were not consistent with procedure(s) and SSMP, what actions were taken

Recordkeeping

- Occurrence and duration of startup/shutdown if an emission exceedance occurs
- Occurrence and duration of each malfunction
- Maintenance records for air pollution control and monitoring equipment
- Actions taken during SSM inconsistent with SSMP
- Records to demonstrate conformance with SSMP
- Use checklists for SSM events to meet these requirements

Reporting

- Periodic SSM Reports are required semi-annually and must include a summary of the records collected for SSM events during the previous 6 months.
- Immediate SSM Reports are required within 2 days (verbal or fax), followed by a letter within 7 days, if actions during startup or shutdown are inconsistent with SSMP and excess emissions occurred.
- Immediate SSM Reports are also required any time actions during a malfunction are inconsistent with the SSMP.

Final Thoughts

- SSMP is a living document and needs to be revised as process changes are implemented
- SSMP should be reviewed regularly by operations staff and EHS staff for correctness and completeness (once a year may be sufficient)
- If facility uses a Management of Change (MOC) program, consider including SSMP as an item in MOC reviews to ensure that it is updated when a process change is made