



Astron Energy Management of Safety Critical Equipment

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Purpose of identification of SCE

- To identify barriers/ safeguards to prevent catastrophic events
- That their failure could result in a catastrophic events, such as loss of containment of hazardous substances and energy
- To ensure the integrity of such equipment through focused preventative maintenance strategies
- To provide assurance to their integrity controls which include maintenance strategies, inspection and testing programs
- To achieve process integrity through inherent design, asset management and operations discipline

Definition of Safety Critical Equipment

- SCE is any hardware equipment whose failure could result in, or allow, or contribute to the release of, or exposure to hazardous substances or energy that could result in death (one or more fatalities) and/ or catastrophic events or irreversible health effects, or significant property damage or environment impact
- SCE categories: SCE is a subset of equipment (instrumentation, Process Containing Equipment, Mitigating equipment) and it is divided into eight IOGP 544 categories as “hardware barriers” for the purpose of compiling the list of SCE
- Hardware barriers are Primary Containment, Process equipment and Engineered Systems. They are designed and managed to prevent LOPC and other types of asset integrity or process safety events and mitigate any potential consequences of such events

Definition of Safety Critical Equipment

- **Instrumentation loops or Safety Instrumented Functions** that have been SIL rated for safety reasons, i.e. where the SIL review risk assessment process has identified it as critical by assigning a SIL rating
- **Process containing equipment**, (i.e. equipment such Pressure Vessels, Heat Exchangers, Rotating Equipment, Piping Systems, Pipelines, Relief Systems, containing hydrocarbons, hazardous chemicals or energy) that has the potential to cause a catastrophic events (Process Safety incidents) if it fails and hydrocarbons, hazardous chemicals or energy are released, and where there is a known mechanism of degradation of failure, and
- **Equipment that is designed to mitigate the impact of equipment of the above two groups**, i.e. mitigating equipment that protects process containing equipment identified as SCE such as Deluge Systems, Firewater Pumps, Sprinkler System, Fixed Foam System , etc.

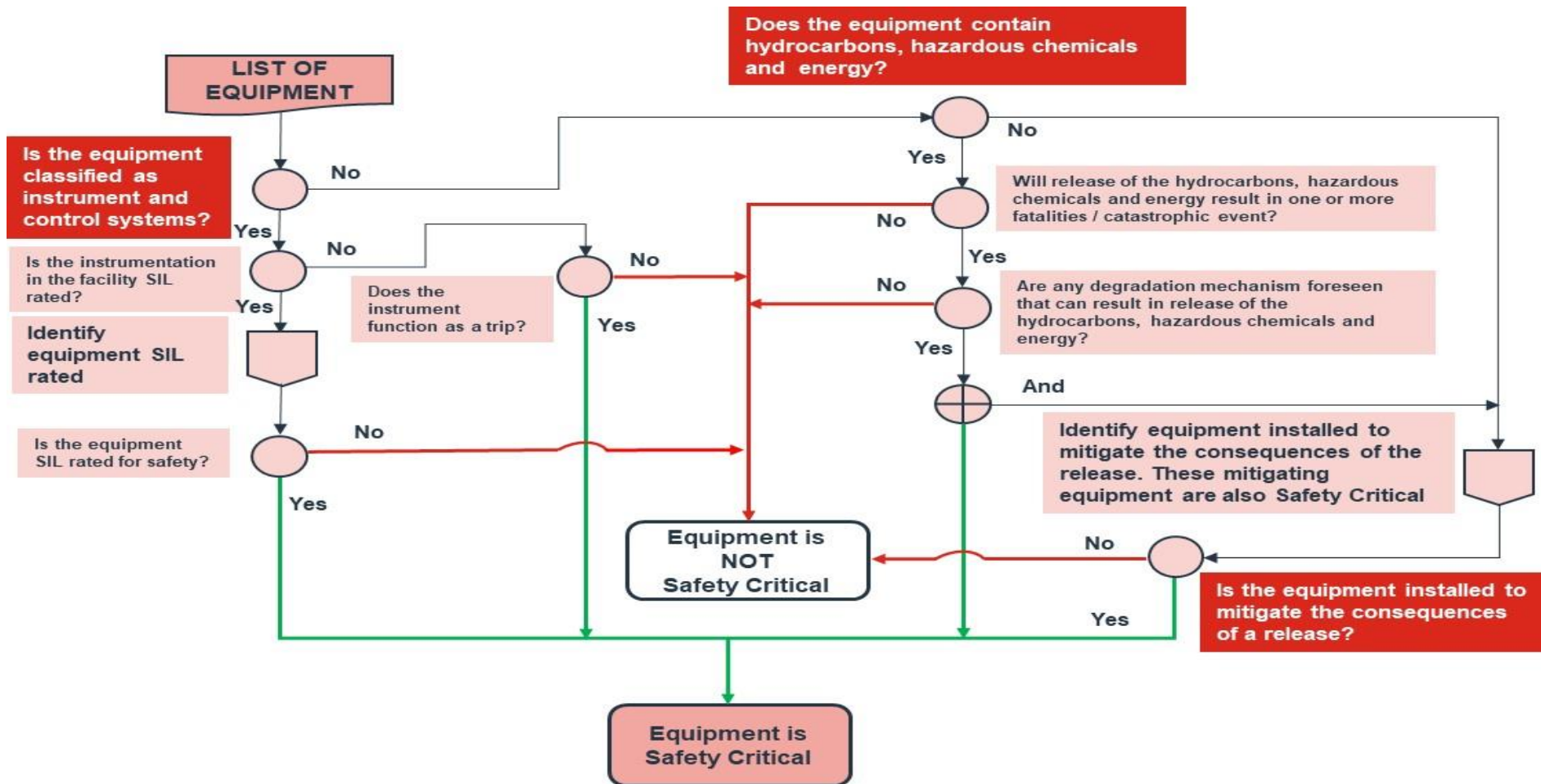
Process to identify SCE

1. **Identify** the hazardous substances and energy present in the process that have the potential to cause a fatality and/or catastrophic events or irreversible health effects, significant property damage or environment impact, if released
2. **List** all the equipment that may contain hazardous substances and energy. This step may be performed by marking up a set of P&IDs [*Refer to PHA (HAZOP-LOPA) study for instance*]
3. **Determine** whether or not failure of the process containing equipment thereby releasing hazardous substances and energy can result in one or more fatalities (Potential consequence). This step should consider the potential quantity and rate of the release
4. **Review** whether or not the degradation is expected and/ or has been detected which may cause the equipment to fail and lead to a release large enough to result in one or more fatalities (Probability of failure)

SCE list requirements

- **Be developed** as identified SCE and risk ranked from the PHA study or other safety studies according to the Risk Management process
- **Include the background** to the item that was identified as SCE and specific risks this manages
- **Indicate the maintenance strategy** for each piece of equipment or inspection system on the SCE list
- **Be flagged** as SCE in the asset management program to ensure that all planned tasks are performed as scheduled and to facilitate the generation of reports
- **Be reviewed** when projects or MOC change occurs or when the PHA cycle determines or after a major process safety incident
- **All active and passive mitigating systems** intended to reduce the consequences of a loss of containment shall also be added to the SCE list

SCE identification flow diagram



SCE KPIs: Tier-4 Leading indicators

Purpose

To determine:

- Whether all plants have identified the Safety Critical Equipment
- If the routine priority and preventative maintenance plans are aligned to the levels of criticality of the SCE for all plants

Note

- Maintenance includes inspections, testing, planned tasks and quality assurance activities, etc.
- Postponements are acceptable provided there is proper sign-off document and this document is signed-off by R&M Manager or the Appointee GMR 2.1 and Operations Manager

KPI 1: SCE schedule Adherence

$$\text{SCE Schedule Adherence} = \frac{A1}{A2} \times 100 (\%)$$

Where A1 and A2 are variables:

- A1 = Number of SCE maintained according to the reporting period to date
- A2 = Number of SCE due for maintenance for the reporting period to date

Note:

- For the scheduled maintenance of SCE to be defined as up-to-date, it should be based on what was planned for the reporting period being executed 100%
- The schedule maintenance adherence is reported as a percentage (%)

KPI 2: SCE Failure Before Scheduled Maintenance

$$\text{SCE Failure Before Scheduled Maintenance} = \frac{B1}{B2} \times 100 (\%)$$

Where B1 and B2 are variables:

- B1 = Number of SCE that failed before Scheduled Maintenance
- B2 = Total Number of SCE Equipment

Note:

- SCE failure before schedule refers to SCE that have failed prior to being tested and/ or inspected according to the maintenance schedule
- It measures the number of SCE that failed before scheduled maintenance
- It reveals:
- A measure of the confirmed weaknesses to SCE that do not meet their minimum performance requirements
- An indication of the weaknesses to maintenance strategies developed for specific SCE

KPI 3: EWO for SCE

1. EWO/Month
Target: 0
Actual = XXX

2. EWO (YTD)
Target = 0
Actual = XXX

Where

- EWO: Emergency Work Order (Priority 1)
- YTD: Year TO Date

Note:

- EWO (YTD) – Actual number will be cumulative
- This measurement gives an indication of the number of orders loaded as breakdown/ Emergency orders (Priority 1)



The End