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## **Question 49: What testing procedures do you use for emergency shutdown valves? What are the parameters you measure and what are acceptable values?**

**Jim Johnson (Marathon Petroleum)**

The appropriate required testing of emergency shutdown valves is included in each Marathon refinery's Mechanical Integrity (MI) program, complying with OSHA's Process Safety Management regulation and EPA's Risk Management Plan regulation. Inspection, testing, and preventive maintenance (ITPM) plans are detailed for each equipment class, which includes Emergency Isolation Valves (EIV's), emergency shutdown valves associated with Emergency Shutdown Devices (ESD's) pre-ANSI/ISA S84.00.01, and Safety Instrumented Systems (SIS's) as defined by ANSI/ISA S84.00.01.

The minimum ITPM tasks for EIV's include a full stroke test, verification of DCS/HMI alarms, position indication, valve closure, and internal valve inspection. The testing will only be done off-line and include a full test of the driver. If the EIV is in a location that can be isolated on the run the valve will be tested bi-annually, except for the internal valve inspection which is only done during turnarounds. If the valve cannot be isolated on the run, all testing will be completed during turnarounds. Limit switches must be satisfied that the valve travels fully open and closed. The internal valve inspections are to be conducted by a qualified inspector and if internal damage is observed an appropriate repair plan will be developed which may include leak testing after repairs.

Emergency shutdown valves associated with ESD's are to undergo a full functional test on an annual basis if the ESD was designed for on-line testing or will be tested during turnarounds if not designed for on-line testing.

Valves associated with SIS's undergo testing detailed in the individual Safety Requirement Specification (SRS). An example of a notable additional requirement for SIS's is that heater shutdown valves (Class 6) are leak tested with the leak rate measured in bubbles per minute that must pass the leak test tolerance in accordance with ANSI B16.104-1976. These valves are leak tested on either a 5-year interval if available on-line, or the turnaround interval if not. We no longer perform partial functional tests on shutdown valves, only full tests.

**Frank Tracy (ConocoPhillips)**

ConocoPhillips have developed guidelines for emergency shutdown valve testing. The default frequency for testing emergency shutdown valves is one turnaround cycle. Testing frequency may be increased based on experience in a particular service or as necessary to achieve the safety integrity level (SIL) required by a layers of protection analysis (LOPA). For shutdown valves that require testing between turnarounds, a bypass must be provided.

Testing includes:

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-Leak test the plug / seat in as found condition

-Disassembly, inspection, repair of valve and actuator

-Reassembly and testing of valve and actuator including a final leak test the plug / seat

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