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**OCCUPATIONAL SAFETY AND HEALTH
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Occupational Safety and Health Standards Board
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Subject: Protecting California Refineries and Oil and Gas Facilities from Explosions by expanding Current Regulation, Subchapter 15. Petroleum Safety Orders-Refining, Transportation and Handling Article 21. Gas Compressors and Engines

Critical Issue: Diesel engines that are not properly controlled or protected are a dangerous source of ignition when used in areas where combustible gas, vapor or dust may exist. The resulting fire or explosion can lead to significant adverse consequences for people, refineries and the environment. Diesel engine runaway is a serious problem that has resulted in 18 deaths, 180 injuries and catastrophic refinery damage in just two recent accidents in Texas. There has been a significant increase in the number of stationary, mobile and vehicular diesel engines in the oil and gas and refineries. This will result in a higher probability of diesel engine runaway explosions and must be addressed.

DISCUSSION

An engine runaway can be described as an engine running out of control from an external fuel source, such as hydrocarbon vapors or mist from gasoline, aviation fuel, distillate fuel and residual fuel. Specifically, the engine draws in the surrounding combustible mixture and uses this as fuel, increasing the engine speed. This situation is classically unstable and uncontrollable. The engine draws in the vapor through the air cleaner into the aspiration system, usually a turbocharger, and into the engine. At this point, the engine only has control over the onboard diesel fuel supply via the engine's governor or the engine's microprocessor. As the engine speed increases due to the vapor ingestion, the governor attempts to limit the onboard fuel supply to the engine. Normally this would reduce the speed and keep the engine under control. However, the engine continues to increase the speed by drawing in more vapors. Once enough vapors have collected in the intake system, the column of volatile vapors can explode.

Simply turning off the engine ignition switch, shutting off the solenoid or disengaging the engine's load does not address the engine runaway problem and is often a waste of valuable escape time.

According to OSHA, there have been 36 reportable incidents related to the release of highly hazardous chemicals in the refining industry since 1992, causing 52 deaths and 250 injuries. Per Wall Street Journal article (attached) dated June 19, 2008, research suggests the federal OSHA figures capture less than half of actual injuries. If this is true, then the actual number of fatalities is much higher.

Numerous engine runaway accidents have been reported by different agencies including:

- Chemical Safety Board (CSB) - BP Texas City Refinery Explosion, March 23, 2005
- U.S Chemical Safety and Hazard Investigation Board – MFA Marshall, Missouri, January 2005
- U.S. Chemical Safety & Hazard Investigation Board (BLSR, Rosharon, Texas, January 2003). CSB identified absence of engine over speed protection caused the explosion.
- ICI fatal accident in UK, May 1969 –G. Nash, ESSO Chief Fire Officer, Esso Refinery, Fawley, UK
As a result of this accident, Esso Research –UK developed an Air Intake Valve and licensed the technology to a UK company called Chalwyn.

These and other accidents and the general awareness of this risk led several oil companies to implement their own standards in Europe such as BP 200 and OCMA MEC 1. This was followed by British Standard 1834 for engines working in defined hazardous areas. Additionally, please note that major oil and gas producers such as BP, ESSO, Conoco, Chevron, Stat Oil and others have had diesel engine safety programs in place for many years in their U.K. facilities but not in their U.S. facilities, compromising the safety of people, equipment and the environment. In 1986, Statoil in Norway built a new refinery in Mongstad and required all vehicles entering the facility to have an air intake shut off valve. In 1990, Qatargas LNG production plant in Qatar (one of the largest producers of natural gas) started the diesel engine safety program and in 2002 expanded the program to include all stationary and vehicular engines. This comprises a few examples where companies have made great efforts to reduce the risk of this serious issue.

Other regulators and industries have also taken critical measures to address this issue. The U.S. Minerals and Management Service (MMS), the U.S government agency that regulates the offshore oil industry implemented MMS Reg. 250.405 (b) after identifying the cause of 3 incidents that killed more than 20 people and injured 190. In 1984, The American Petroleum Institute (API) Publication 2001 section 4.2.10 states that “consideration should be given to the use of spark arrestors on exhaust pipes and rapid shutoff valves on air inlets to diesel vehicles”. In 1985, the U.S. Department of Labor, Mine Safety and Health Administration (MSHA) established and enforced regulation 250.510 of 30 CFR 36, titled Diesel Safety Component. This regulation states that, “No later than May 31, 1989, diesel engine air intakes shall be equipped with a device to shut down the diesel engine in the event of runaway”. These are reiterated in 250.610 and §250.803(ii) of same 30 CFR 36. Canadian (Alberta Regulation 151/71 Oil and Gas Conservation Regulations 8.100) and European regulators (regulation EN 1834) have had similar regulations since 1971 that require that all vehicular and stationary diesel engines working in a hazardous area must have an air intake shut off valve to prevent the engine runaway condition. ISO 3046-6:1990 standard titled Reciprocating Internal Combustion Engine also requires an over speed protection device to prevent engine runaway. In addition, the US government requires that diesel engines used for refueling government vehicles have air intake shut off valves.

Implication:

The State of California has 23 refineries processing approximately 2 million barrels of oil per day. Many of these refineries are 50 to 80 years old and it is not unusual to have hydrocarbon release incidents. Some of these refineries like Chevron Richmond are going through major upgrades and expect more than 2,000 contractors using their diesel engines in the refinery. This greatly increases the risk of diesel engine runaway. One incident in a major refinery can result in death, destruction, wide spread environmental damage and significant revenue loss for the state.

Solution:

Engine manufacturers like Caterpillar, Cummins, MTU Detroit Diesel and International are now offering air intake shut off valves to prevent engine runaway for the engines operating in the oil and gas, refining and mining industries.

The State of California has a regulation (subchapter 14 - Petroleum Safety Orders – Drilling and Production Article 35 Drilling and Well-Servicing Machinery and Equipment) which specifies that “For a diesel engine, a quick closing valve or equivalent device that will shut off the air into the engine’s air intake manifold, a means of releasing the engine compression, provided it is done in a manner that will not produce an open flame or spark or other safe means, will be acceptable.”

Subchapter 15. Petroleum Safety Orders-Refining, Transportation and Handling - Article 21. Gas Compressors and Engines

§6874. Stationary Internal Combustion Engines.

(f) "An effective over speed device shall be installed and maintained in an operative condition on internal combustion engines driving gas compressors."

These regulations are a great start but do not include mobile and vehicular engines operating in and around refineries. Secondly, based on our informal survey, we have found that oil and gas companies including refineries are not aware of these regulations. Per diesel engine subject matter experts (paper attached), with all varieties of diesel engines, the common denominator is combustion air. Diesels have a multitude of fuel control schemes but utilize air the same way. Therefore, controlling combustion air is the key to absolute engine control during an emergency.

Oil is a precious commodity and we must do everything to protect every drop of it and avoid another explosion like the one at the BP Texas City refinery. California is a progressive state and has always taken the lead in setting the standard for the rest of the country to follow. We request the state to once again take the lead on this strategic safety issue, and expand the current regulation to include all stationary, mobile and vehicular diesel engines.

Best regards,

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