CONTROLLING CHEMICAL HAZARDS

Guidance Sheet

SUBSTANCE SPECIFIC **FLAMMABLE MATERIALS**

What are Flammable Materials

Flammable materials are substances that can ignite easily and burn rapidly. They are common materials that can be found at most work sites in gas, liquid and solid forms.

- Gases — Flammable gases are usually defined as gases with a lower explosive limit of less than 13% in air, or have a flammable range while mixed in air. Common oilfield examples include: natural gas, propane, butane, methane, acetylene, carbon monoxide and hydrogen sulphide.
- Liquids — Flammable liquids are usually defined as those liquids which have a flashpoint equal to or less than 60 o C. (GS Flashpoints) Common oilfield examples include crude and natural gas condensates, gasoline, diesel and many solvents and some well servicing and treatment chemicals.
- Solids — Flammable solids are materials which can readily catch fire and continue to burn vigorously and persistently. This may occur from friction, absorbing moisture, from unplanned chemical change, or by retaining heat from manufacturing or processing.

Where are they Found

Flammable gases are produced as part of the oilfield production cycle both as an intended product and as a by-product of production. Crude oil and natural gas condensates are flammable liquids that are by-products of the production cycle. Sometimes flammable liquids are used as part of the blending process for well servicing fluids. Any enclosed or unventilated area that houses production fluids or gases will have the possibility of producing a flammable or explosive atmosphere in the area. Some oilfield solids such as lubricants, sealants and packing materials may become flammable if heated.

The Risks

Fire: The main hazard from flammable and combustible chemicals is fire. For a fire to occur, there are three elements that must come together at the same time and in the right mixture: fuel, heat (ignition source) and oxygen. Remove any of the elements and the fire will go out. Certain chemicals such as organic peroxides (e.g. benzoyl peroxide) contain both fuel and oxygen.

Flash-back: Once the vapors from a flammable liquid have ignited, the flames may “flash-back”. This means the flames travel back, through the vapor-air mixture, to the container or source of the flammable liquid. This can create an explosion. Most flammable liquids produce vapors that are heavier than air. Many flammable gases are also heavier than air. These gases and vapors can spread a long distance along the ground or floor and be ignited by a distant spark or flame or source of heat.

Toxicity: Many flammable and combustible chemicals are also toxic. They can be toxic at air concentrations well below those needed to create a fire hazard. Flammable gases such as carbon monoxide and hydrogen sulfide are toxic at very low concentrations.

Asphyxiation: Most flammable gases and vapors from flammable liquids can be heavier than air and will gather near the ground. They can displace the air. When there is not enough air or oxygen, there is a hazard of asphyxiation (death caused by lack of oxygen).

By-products from Combustion: Toxic gases and vapors are released when flammable and combustible products burn. Combustion products can include chemicals such as carbon monoxide, hydrogen cyanide and nitrogen oxides. If the chemical burning contains chlorine, other toxic chemicals such as acrolein and hydrogen chloride can be produced.

Spontaneous Combustion: Spontaneous (unplanned) combustion occurs when a material in contact with air can heat up enough on its own to burn. The oils in some wastes can slowly react with oxygen in the air. This reaction creates heat that can build up over time if the wastes are not disturbed. When the heat level in a "self-heating material" is high enough (the auto-ignition temperature) a fire may start.

Actions
Steps to Evaluate Risk

The defined task specifically related to possible flammable and explosive hazards must be identified. The process of identifying the hazards is best done on the work site and these should be physically inspected to determine the nature of the hazards. Conducting a hazard assessment will:

- Identify flammable and or toxic products in the facility.
- Identify if the work will release any flammable products from the contained systems.
- Assess the specific work site tasks as well as the overall work site tasks to determine the impact on each other.

The Controlling Chemical Hazards Guideline is designed to help you use this basic information to define the procedures and control approaches you need to follow to protect worker health and safety. Go to www.enform.ca to gain assistance with controlling chemical hazards for your specific operation (GS Flashpoints).

Equipment & Procedures

- Whenever possible, enclose operations that use flammable materials (e.g., mixing and storage) as much as possible and ensure the equipment is vapor-tight.
- If flammable materials must be exposed to air or other oxygen sources, ventilate to reduce vapor concentrations.
- Reduce the need for people to be there by using automated systems to monitor the processes.
- Store flammable materials away from oxygen sources.
- Eliminate ignition sources from the workplace by bonding and grounding equipment.
- Use combustible gas meters to measure concentrations of flammable gases present.
- Provide appropriate firefighting equipment and train workers on how to use it.
- Ensure all workers wear flame retardant clothing.

Control Approaches

In order of preference there are four basic hazard control approaches: elimination/substitution; engineering controls (e.g., enclosing/containing the material or ventilation); administrative controls (e.g., safe work procedures); and personal protective equipment (PPE) (GS General Guidance and GS Flame Resistant Clothing). All or some of the approaches may be required to control hazards associated with flammable materials. Your hazard assessment should identify the specific controls that are required for your work.

Facilities

Provide clean facilities: a washroom, showers, storage for clean and contaminated work clothing and a refreshment area.

Information Training and Supervision

Employer responsibilities:

- Provide information on the flammable and or toxic materials that will be present at the workplace
- Consider substitution for a less hazardous substance. (e.g., a water based well servicing fluid)
- Installation of ventilation, enclosures around work processes and automatic fire detection and suppression systems.
- Use the Controlling Chemical Hazards Guideline to define the required chemical management for the work you wish completed.

Supervisor responsibilities:

- Conduct a hazard assessment (GS Implementers - Hazard Identification and Control) for the work to be done with flammable materials
- Ensure the availability of the required Guidance Sheets and employer's hazard assessment.
- Organize the work to limit the time workers are exposed to flammable materials
- Educating workers about the hazards of flammable materials, the controls defined in the hazard assessment and on the required chemical management process.
- Implementing storage polices regarding hazardous materials
- Ensuring that unprotected workers are not in areas where flammable materials are used
- Ensure required equipment is available and that workers are trained in its use.

Worker responsibilities:

- Workers must participate in training and monitoring programs in the workplace.
- Workers must use and maintain all controls and equipment used to reduce exposure properly.
- Workers must clean up of spills quickly and properly, using protective equipment and clothing.
- Workers must keep product containers tightly sealed when they are not in use.

PRECAUTIONS YOU SHOULD TAKE

- ❒ Store flammables away from oxygen or heat sources.
- ❒ Do not place flammables where they may hinder escape in event of fire.
- ❒ Have procedures to prevent spills and excessive exposure.
- ❒ Ventilation should be in place to reduce vapor concentrations.
- ❒ Ensure all containers are clearly marked and labelled.
- ❒ Eliminate all ignition sources such as:
- ❒ No smoking or naked flames;
- ❒ Bond and ground all equipment
- ❒ Monitor and limit non-essential heating equipment; and
- ❒ Repair and maintenance work should be considered for fire/heat hazard.

OTHER CONTROLS TO CONSIDER

- ❒ Trained competent staff
- ❒ High levels of supervision
- ❒ Appropriate firefighting equipment
- ❒ Emergency procedures and plan