CONTROLLING CHEMICAL HAZARDS

Guidance Sheet

SUBSTANCE SPECIFIC **CONDENSATE**

What is Condensates

Condensate is a natural gas by-product. Hydrocarbons are dissolved in natural gas at high pressure underground. When the gas expands during production, where pressure is reduced to near-atmospheric levels, or the temperature falls below its dew point, some of the hydrocarbons condensate out of the gas as a liquid.

Condensate composition varies greatly from field to field and with temperature but typically ranges:

- Butanes (C4) – up to 10 % by weight
- Pentanes (C5) - 40-70 % by weight
- Hexanes (C6) - 30-60 % by weight
- Heptane's (C7) and Octanes (C8) - 10-30% by weight
- Aromatics - 3-15% by weight

Condensates may also contain high levels of hydrogen sulfide as a contaminant. If the condensate is under pressure or at low temperature it may also contain ethane and propane.

Where is it Found

Condensates are part of the normal production fluids found in most natural gas wells. Drilling muds and well servicing chemicals injected into the well may become contaminated down hole with condensates and become a risk to workers when they are brought to surface. Producing wells will often have onsite separators to divide the mixture coming to surface into produced water, raw natural gas, and natural gas condensate. Sometimes this process is done partially or entirely offsite at a gas treatment plant. Workers involved in the transportation, treatment or upgrading of these production fluids may be exposed either to concentrated condensate or as a contamination in other fluids. Incidents involving condensate are often related to unplanned production that results in large sudden release (e.g., condensate carryover because of undersized separators, condensate production from a formation thought to be hydrocarbon free). Condensates are highly volatile and float on water so even small amounts of spilled contaminated fluid can result in high levels of hydrocarbon vapors in air.

The Risks
Health Effects

The health effects of particular condensates vary depending on composition. The most toxic components typically found are hydrogen sulphide, n-hexane and aromatics like benzene, toluene, ethyl benzene and xylene (BETX). The most commonly observed health effects of drilling fluids in humans are skin irritation and contact dermatitis (redness and swelling of skin tissue). Breathing in of high concentrations of hydrocarbon vapor may result in headache, nausea, dizziness, a feeling of tiredness, lack of coordination, and problems with attention and memory. Long-term exposure to benzene can result in serious blood disorders such anemia (a low blood count that can make you tired and short of breath) and leukemia (a form of cancer). Damage to the nervous system may be caused by repeated exposure to high levels of n-hexane. The initial symptoms are tingling and cramps in the arms and legs, followed by general muscular weakness. In severe cases, muscle size decreases, along with a loss of coordination and problems of vision. Hydrogen sulphide is both an irritant (a material that causes redness and swelling) and a chemical asphyxiate (a material that prevents oxygen from getting to the brain). High concentrations can cause shock, seizures, inability to breathe, extremely rapid unconsciousness, coma and death. Effects can occur within a few breaths, and possibly a single breath. In situations of high exposure such as tank gauging and thieving, exposure to the lighter hydrocarbons such as propane and butane can displace enough oxygen to result in loss of consciousness and subsequent death.

Condensates are highly flammable and float on water; producing a risk of fire or explosion.

Primary Routes of Exposure

Skin Absorption: When contaminated drilling fluids are circulated in an open system with mixing, there is a high likelihood of skin exposure. Also staff involved in maintaining separators, gathering condensate samples for analysis or other direct contact with condensate may be exposed. Actual exposure depends on the degree systems enclose production fluids and the use of personal protection equipment. (GS PPE, GS Skin Contact and GS Gloves)

Inhalation: Drilling fluids are often circulated in an open system at elevated temperatures with mixing that can result in a combination of vapors, mists and/or dust above the mud pit. If there have been no contamination from production fluids the vapors will largely be steam and dissolved additives. However If condensate contamination occurs even small amounts of known volatile hazardous constituents such as BTEX or hydrogen sulfide will evaporate or be released quickly resulting in

higher concentrations in air than expected. Similarly any uncontrolled release, particularly in poorly ventilated areas, is likely to quickly result in high concentrations of these volatile hydrocarbons.

Actions

Steps to Evaluate Risk

The risk to worker health increases with length of time exposed to chemicals, the concentration in air, and the amount of worker contact with production fluids containing the chemical. Since all wells have unique production characteristics, it is important to know how much of each different chemical is present before you begin work. This information can usually be estimated from information found on the Safety Data Sheet and from previous chemical analysis done of fluids from the same production field or area. 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.EnergySafetyCanada.com to gain assistance with controlling chemical hazards for your specific operation. In addition to the health risk there is a potential fire and explosion risk when working with any flammable materials. (GS Flashpoints, GS Flammable Materials and GS Flame Resistant Clothing)

Procedures

- Whenever possible, enclose operations (e.g., mixing and storage) as much as possible and ensure the equipment is vapor-tight.
- Can you reduce the need for people to be there by using automated systems to monitor the process?
- Can you time certain operations (e.g., maintenance) for a time when less people will be present?
- Have you prepared for unexpected condensate production (i.e., equipment sizing, emergency and spill remediation procedures, equipment and training)

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 (GS Respiratory Protective Equipment and GS PPE). All or just some of the approaches may be required to control worker exposures. You need to evaluate the specific risks associated with the work you wish to complete and to develop a specific chemical management process based on this risk assessment.

Facilities

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

Information Training and Supervision

Employer responsibilities:

- Providing information on the materials that will be present at the workplace (i.e. Safety Data Sheets, previous analysis of fluids from the same or similar production fields).
- Using the Controlling Chemical Hazards Guideline to define the required chemical management process for the work you wish completed.

Supervisor responsibilities:

- Ensuring the availability of the required Guidance Sheets for chemical management.
- Organizing the work to limit the time workers are exposed to chemicals.
- Educating workers about the hazards of chemicals they will be exposed to.
- Ensuring availability of required respiratory protective and personal protective equipment

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 use respiratory protective and personal protective equipment if required.

PRECAUTIONS YOU SHOULD TAKE

- ❒ Ask your employer about the risks, what precautions to take and what to do in an emergency.
- ❒ Follow the safe working procedures laid down by your employer.
- ❒ Read and understand safety data sheets for all chemicals you will be working with.
- ❒ Use the personal protective equipment provided, i.e. respiratory protection and impervious clothing.
- ❒ Don't enter any area that may contain H2S before it has been tested.
- ❒ Report to your employer or safety representative any damaged or defective ventilation systems or protective equipment