CONTROLLING CHEMICAL HAZARDS

Guidance Sheet

SUBSTANCE SPECIFIC **OIL-BASED MUD SYSTEMS**

What are Oil-Based Mud Systems

Oil and gas drilling operations depend on a system to circulate mud (drilling fluid) in and out of a wellbore.

An oil-based mud (OBM) uses a petroleum product (rather than water) as its base fluid. These are used under certain conditions as they offer better shale inhibition, increased lubricity, greater cleaning abilities with less viscosity, withstand greater heat without breaking down and other potential benefits. However, cost and environmental considerations limit their use as compared to water-based mud. A synthetic-based mud (SBM) uses synthetic oil as the base fluid. Vapours from these fluids are typically less toxic than those of standard oil-based muds.

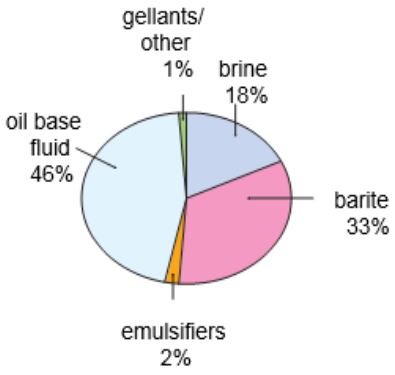

Figure 1: Typical Components in Oil Based Mud

Where are they Found

It is common practice to use both water-based muds and oil-based muds when drilling various sections of the same well. Water-based fluids are generally used in the upper hole sections of the well, while oil-based muds tend to be used in the more technically demanding hole sections. Workers performing tasks in and around oil based mud systems may be exposed to drilling muds either by inhaling vapours or oil mist or by skin contact. The potential for inhalation of dust is mainly in association with mixing operations. The highest potential for inhaling mist and vapour exists along the flow line from the bell nipple on through the solids-control equipment including the shale shakers, desanders, desilters, centrifuge discharge and the mud tanks. Workers on the drill rig floor working on or around the drill stem also face a possible risk of inhalation and skin contact. Maintenance operations such as washing the shakers or surfaces covered with oil based mud with a high-pressure gun may also create a hydrocarbon mist and vapour exposure risk to workers.

The Risks

Health Effects

The health effects of a particular mud system vary depending on the composition of the initial fluid. The composition may also change if production fluids mix with the mud. The more hazardous muds have higher percentages of aromatic hydrocarbons which can vary from <0.5 % to 35%. Older oil-based mud systems used diesel as their main component and had higher fractions of aromatic hydrocarbons including benzene, toluene, ethyl benzene and xylene (BETX). All drilling muds, even more modern drilling fluids, can become contaminated with aromatics and hydrogen sulphide (H2S) while down hole; increasing their toxicity. The most commonly observed health effects of drilling fluids in humans are skin irritation and contact dermatitis (redness and swelling of skin tissue).

Workers exposed to oil mist for prolonged and repeated periods may suffer from cough and phlegm and may have an increased risk of lung fibrosis (scarring and thickening of lung 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). Hydrogen sulphide is both an irritant (a material that causes redness and swelling) and a chemical asphyxiant (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.

Primary Routes of Exposure

Skin Absorption: With the handling of drilling equipment on the rig floor and the circulation of oil based mud in an open system, skin exposure to the mud is likely. The potential skin exposure is not limited to the hands and forearms, but extends to all parts of the body. Actual exposure depends on the drilling fluid system and the use of personal protection equipment (GS PPE, GS Skin Contact and GS Gloves).

Inhalation: As oil-based mud is circulated in an open system, with agitation, at elevated temperatures, oil mist and vapours can develop wherever the system is open, such as near the shakers or above the mud tanks. The mist contains droplets of all the hydrocarbons in the mud. Hydrocarbons in the mud mixture with a low boiling point will evaporate forming vapours. Vapours from oil-based mud may additives, sulphur, mono-aromatics and/or polycyclic aromatics, depending on the mud system components. While the mud may contain very small amounts of known hazardous components such as BTEX, these will evaporate at relatively higher rates. This often results in higher concentrations in the air than expected. Hydrogen sulfide gas may be absorbed into the mud down hole and then released when the mud returns to the surface.

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 the worker comes in direct contact with fluids containing the chemical. Since all oil based mud systems become unique mixtures as drilling progresses, 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 gas and crudes 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.enform.ca to gain assistance with controlling chemical hazards for your specific operation.

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