CONTROLLING CHEMICAL HAZARDS

Guidance Sheet

SUBSTANCE SPECIFIC **WATER-BASED MUD SYSTEMS**

What are Water-Based Mud Systems

Drilling mud is a mixture of clays, chemicals and water; pumped down the drill pipe to lubricate and cool the drilling bit and to flush out the cuttings and to strengthen the sides of the hole. Muds are called water based if the major component is water and oil based if the major component is some other non-aqueous fluid. Although the most primitive systems used water only, drilling performance is improved by using other mater ails, e.g. clays as filtrate reducers, viscosifying agents and dispersants.

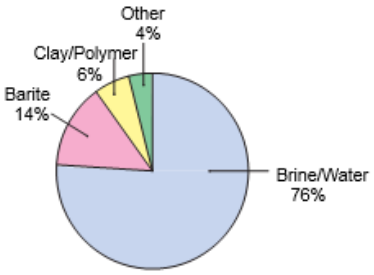

Figure 1:
Typical Components in Water Based Mud

Where is it Found

More than one water based system is typically used when drilling the same well because various formulations of fluids are required to be able to accurately meet the technical properties required in each section of the well. The fluid mixture may also need to be continually changed within each hole section, as shown in Figure 2. Workers may be exposed to drilling muds either by breathing in mists and vapors or by skin contact. The preparation and use of drilling mud systems may generate airborne contaminants, dust, mist and vapor in the workplace. The likelihood of breathing in dust is mainly during mixing operations. The most likely spots for breathing in mist and vapor exists along the flow line from the bell nipple to the solids-control equipment, which can include the shale shakers, desanders, desilters, centrifuges and the fluid pits. The vapor from water based systems should contain only steam and dissolved additives unless the mud becomes contaminated with production fluids. Oil, raw natural gas, condensate and hydrogen sulphide may contaminate the mud either from the formation being drilled or from the production reservoir.

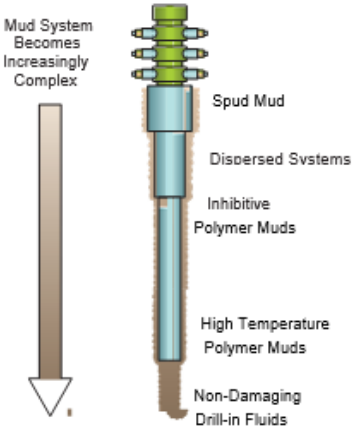

Figure 2: Water Based Mud Composition Requirements

The Risks
Health Effects

The health effects of particular mud systems vary depending on the chemicals in the initial fluid and the degree it gets contaminated with production fluids. While brine and water are non-hazardous, the additives used in mud systems may raise the pH and make the mud irritating to skin and eyes. Barite and the clays used to make the mud may have high fractions of crystalline silica which has been associated with silicosis (buildup of scar tissue in the lung resulting in loss of lung function) and lung cancer when the dust is inhaled over prolonged periods. Once wet, the risk of inhalation and to health is greatly reduced. If the mud becomes contaminated with condensate or other hydrocarbons the risk to health increases if the hydrocarbons have high percentages of 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). 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: When drilling fluids are circulated in an open system with mixing, there is a high likelihood of skin exposure. Actual exposure depends on the drilling fluid system and the use of personal protection equipment (PPE). (GS PPE)

Inhalation: Drilling fluids are often circulated in an open system at elevated temperatures with mixing that can result in a combination of vapors, aerosol 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 contamination occurs even small amounts of known volatilize hazardous constituents such as BTEX or hydrogen sulphide will evaporate or be released quickly resulting in higher concentrations in air than expected. Crystalline silica inhalation is dependent on the amount in the barite and clays used and on the rig's mixing systems.

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 mud systems become unique mixtures as production 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?
- Can you use less hazardous drilling mud system (e.g., low silica barite) to do the work?

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 chemical management process based on this risk assessment.

Information Training and Supervision

Employer responsibilities:

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

Supervisor responsibilities:

- Ensuring the availability of the Guidance Sheets required by the Safety Protocol 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.
- ❒ Avoid breathing in vapors containing benzene.
- ❒ Avoid getting liquids containing benzene on your skin.
- ❒ Use the ventilation equipment and personal protective equipment provided, e.g., gloves, respirators, goggles (GS PPE).
- ❒ Gloves should be made from materials which resist penetration by benzene. Natural rubber gloves should not be worn as rubber absorbs benzene (GS Gloves).
- ❒ Report to your employer or safety representative any damaged or defective ventilation systems or protective equipment.