

OPERATIONS SPECIFIC

SHAKER OPERATIONS

Hazards

High hydrocarbon mist and vapor exposure levels have been found in the shale shaker area when using oil based drilling muds (GS Oil-Based Mud Systems) or when water based muds (GS Water-Based Mud Systems) become contaminated with hydrocarbons. Hydrogen sulfide and production gases may also be absorbed in the drilling mud and be released when brought to surface. Workers may be exposed to drilling fluids either by inhaling mists and vapors or by skin contact. Higher chances of exposure occur when:

- » washing with high-pressure guns using a hydrocarbon-based fluid;
- » cleaning and changing screens; and
- » checking the shaker screens for wear (See Appendix A for more detail).

Things known to influence the risk of exposure to workers include: the use of enclosures and/or local exhaust ventilation, drilling fluid temperature; flow rate; well depth; well section; and the chemical composition of the drilling mud system used.

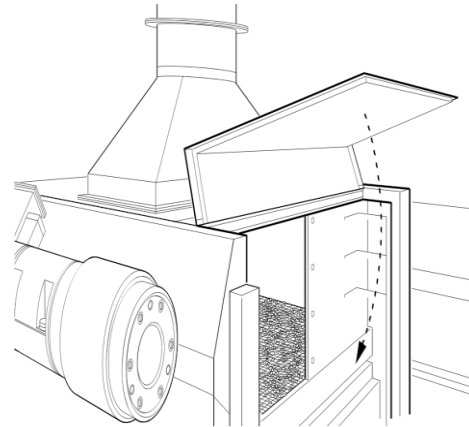
In addition to the chemical hazards, the risk fire and explosion will increase with the flammability of the fluids used or produced and the risk of slips and falls increase when surfaces get covered in drilling mud (GS Flammable Materials).

Access

Only allow access to the area by authorized staff that have been trained and equipped to work safely.

Equipment & Procedures

- » As far as possible, enclose the shaker in a local exhaust ventilation (LEV) enclosure.
- » Where open, fit canopy hoods with plastic strips to maximize enclosure.
- » The enclosure should have an inward air speed of at least 0.5 meters/second through gaps, to prevent mist escaping.
- » When retrofitting LEV, install a full enclosure.
- » Select the least hazardous drilling mud system required to complete the work. Ensure it has a flash point of 610 C or higher and few volatile and toxic components (i.e. a water based fluid or a hydrocarbon based one with an aniline point greater than 650 C).
- » Maintain equipment regularly to eliminate leaks and clean spills promptly to reduce exposure to mud.
- » Consider if the drilling mud can be contaminated with production fluids. If the formation or reservoir has a history of producing hydrogen sulfide or natural gas condensates, small amounts of contamination can quickly produce high concentrations in air above unenclosed or unventilated shakers.
- » Consider the need to position gas detection (e.g., hydrogen sulfide, explosive gases) equipment at shale shakers to detect contamination from production fluids.
- » Eliminate all ignition sources from area.
- » If using flammable drilling fluids monitor mud operating temperature to ensure it stays 100 C below flash point of fluids used (GS Flashpoints).
- » Every effort should be made to reduce the generation of airborne mist by spray or splashing, etc.
- » The use of a high-pressure wash gun with oil should be kept to a minimum and only oils with a high flashpoint (GS Flashpoints) and minimum light end components should be used. Mineral oil is recommended. The use of diesel fuel as a washing fluid in pressure wash guns is not recommended.
- » Wash guns should be equipped with triggers to minimize air contamination and wasted fluids when wash guns are unattended.
- » Ventilation fans should be used when necessary to prevent the build-up of hydrocarbon vapors in enclosed or semi-enclosed areas. Fan motors should be explosion-proof, and fan blades should be made of a non-sparking material.



Personal Protective Equipment

Respiratory Protective Equipment:

- » Self-Contained Breathing Air: To be used when H₂S may exceed 10 ppm (GS H₂S and GS Respiratory Protective Equipment).
- » NIOSH approved P-95 (or P-99 or P-100) with combination organic vapor cartridge required for oil based mud systems while cleaning and changing screens, checking screens for wear and when using wash guns using hydrocarbon-based fluid.
- » NIOSH approved P-95 (or P-99 or P-100) with combination organic vapor cartridge required for work around unenclosed or unventilated shakers if contamination with production fluids is suspected until occupational hygiene monitoring demonstrates mist and vapor concentrations are less than 50% of occupational exposure limit.

Other Personal Protective Equipment:

- » Personal H₂S Monitor: To be worn at all times (including truck drivers) (GS H₂S Gas Monitors).
- » Fire Retardant Coveralls: To be worn at all times (GS Flame Resistant Clothing).
- » Chemical resistant gloves, clothing, boots and eye protection (goggles) are required if direct contact with drilling fluids that contain hydrocarbons.

Cleaning & Housekeeping

- » Keep all work areas neat and free from debris.
- » Clean up chemical spills promptly.

Information Training and Supervision

Employer responsibilities:

- » Gather and provide safety data sheets on the chemicals that will be present at the workplace
- » Use the Controlling Chemical Hazards Guideline to define the proper chemical management for the work you wish completed.

Supervisor responsibilities:

- » Ensure the availability of the required Guidance Sheets for proper chemical management.
- » Ensure the availability and use of appropriate protective equipment.
- » Complete and review with workers the Safety Protocol for Chemical Management and the Safety Data Sheets.
- » Review safe work procedures with workers before they start work.

Worker responsibilities:

- » Wear appropriate personal protective equipment.
- » Follow safe work procedures.
- » Ensure spills and leaks are quickly cleaned up.
- » Wash contaminated clothing before reuse.

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.

Appendix 1 Shaker house potential exposure to chemicals (excerpt from IPIECA Drilling fluids and health risk management)

General influencing factors: ambient temperature; indoors or outdoors; space and layout of the work area; general or local exhaust ventilation; Health and safety culture of the workforce, e.g. PPE discipline.

Task	Purpose	Exposure duration	Type of exposure	Influencing factors
Sampling	<ul style="list-style-type: none"> Mud weight and funnel viscosity measurements (before and after the shakers) 	<ul style="list-style-type: none"> Routine operation High frequency >15 minutes per hour 	<ul style="list-style-type: none"> Skin contact with fluid (hands) Inhalation of vapor/ mist 	<ul style="list-style-type: none"> Fluid flow-line temperature Fluid characteristics and composition
	<ul style="list-style-type: none"> Cuttings sampling/ collecting (sample taken from the shaker) for oil on cuttings or for geological analysis of the rock formations 	<ul style="list-style-type: none"> Intermittent routine operation Up to 15 minutes per hour when sampling required 	<ul style="list-style-type: none"> Splashes of fluid (face/ hands/ body) Skin contact with fluid (hands) Inhalation of vapor/ mist 	<ul style="list-style-type: none"> ROP and cuttings loading on screens Fluid flow-line temperature Fluid characteristics and composition
Maintenance	<ul style="list-style-type: none"> Changing shaker screens (shaker not operating) 	<ul style="list-style-type: none"> Intermittent routine operation; Up to 5 minutes per hour (guide only) 	<ul style="list-style-type: none"> Inhalation due to general work environment Skin contact with fluid contaminated surfaces 	<ul style="list-style-type: none"> ROP Shaker design Ergonomics Screen durability
	<ul style="list-style-type: none"> Routine maintenance of shakers 	<ul style="list-style-type: none"> Intermittent routine operation 	<ul style="list-style-type: none"> Inhalation due to general work environment Skin contact with fluid contaminated surfaces 	<ul style="list-style-type: none"> Shaker design Ergonomics
	<ul style="list-style-type: none"> Breakdown repair of shakers 	<ul style="list-style-type: none"> As required 	<ul style="list-style-type: none"> Inhalation due to general work environment Skin contact with fluid contaminated surfaces 	<ul style="list-style-type: none"> Shaker design and reliability Ergonomics
	<ul style="list-style-type: none"> Cleaning operations screens general workplace header box/ possum belly 	<ul style="list-style-type: none"> As required 	<ul style="list-style-type: none"> Inhalation due to general work environment and mist/ aerosol from cleaning methods/ materials Skin contact with fluid contaminated surfaces Splashes to face/ body/ hands 	<ul style="list-style-type: none"> Cleaning methods/ equipment/ agents Ergonomics
Inspection/ monitoring	<ul style="list-style-type: none"> Gas trap/ header box 	<ul style="list-style-type: none"> Routine operation High frequency >15 minutes/hour 	<ul style="list-style-type: none"> Inhalation due to general work environment Splashes to hands 	<ul style="list-style-type: none"> ROP dependent Ergonomics Design and layout of equipment
	<ul style="list-style-type: none"> Shaker operation or screens e.g. monitoring for screen blinding, damage to screen mesh 	<ul style="list-style-type: none"> Routine operation High frequency >5 minutes/ hour 	<ul style="list-style-type: none"> Inhalation due to general work environment Splashes to face/ body/ hands 	<ul style="list-style-type: none"> Ergonomics Design and layout of equipment Solids characteristics/ volume Screen selection