

## SUBSTANCE SPECIFIC

## PRODUCED WATER

**What is Produced Water**

Produced water is mainly salty water trapped in the reservoir rock and brought up along with oil or gas during well production and servicing. Produced waters usually contain some subset or mixture of: dissolved inorganic salts, dispersed oil droplets, dissolved organic compounds (dissolved "oil"), treatment and workover chemicals, dissolved gases (particularly hydrogen sulfide and carbon dioxide), bacteria and other living organisms, and dispersed solid particles. However, the particular concentrations of these components vary over an extremely wide range depending on production field they come from and the treatments the well has received.

**Where is it Found**

Almost all gas and oil wells produce some water along with the hydrocarbons that are brought to surface. Produced water may also be used as part of the production process; hydraulic fracturing involves injecting clean or recycled (produced) water into the well and results in a mixture of flow back and produced water coming to the surface. Workers involved in loading and transporting produced water for recycling or treatment may also be exposed to it. The mixture of contaminants in the water can change if: treatment or workover chemicals are added to a well; if it picks up left-over chemicals from the truck used to transport it; or with changes to the operating conditions of the well (i.e., temperature, pressure and flow rate).

**The Risks****Health Effects**

The effects on your health depend on how much chemical contamination is in the water. Salty water by itself is non-toxic but some of the contaminants can be. The effect on health depends on how much and for how long you are exposed to these contaminants. Immediate effects of high exposure to some hydrocarbons can include headache; nausea; and dizziness. Unconsciousness may occur if exposure is very high. One of the potential hydrocarbon contaminants is benzene. Long-term exposure to benzene can result in serious blood disorders such as anemia (a low blood count that can make you tired and short of breath) and leukemia (a form of cancer). If the produced water comes from a well that has hydrogen sulfide, the gas may have been dissolved in the water underground and become free when it is brought to surface. 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). At lower exposure levels symptoms include: headache; dizziness; nausea and vomiting; coughing and breathing difficulty. High concentrations can cause shock, seizures or spasms, inability to breathe, extremely rapid unconsciousness, coma and death. Effects can occur within a few breaths, and possibly a single breath. Some produced waters contain methanol from hydrate inhibition either at the wellhead during the hydraulic fracturing or during production. Methanol is a water-soluble hydrocarbon that can damage the eyes and cause headaches and nausea. Methanol can also be absorbed through intact skin. If the methanol content is high enough such as ~10% the water can be classified as flammable.

Most hydrocarbons are flammable and many float on water; producing a risk of fire or explosion for produced water that have these chemicals.

**Primary Routes of Exposure**

Contaminants in produced water can be absorbed into your body:

- » if you breathe in air containing vapor; or gases;
- » through your skin; and
- » if you swallow material containing the contaminant

**Actions****Steps to Evaluate Risk**

The risk to worker health increases with quantity and type contaminants in produced water, the length of time exposed and the amount of worker contact with the material. The first step is to determine if the produced water you will be working with is contaminated with hazardous chemicals. This information can usually be estimated from information found on the Safety Data Sheet and from previous chemical analysis done of produced water 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](http://www.enform.ca) 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 and GS Working with Flammable Materials).

### Procedures

- » Monitor for hydrogen sulfide (GS H2S Gas Monitors) and flammable vapors (LEL/H2S meters) if either is suspected in the produced water you are working with.
- » Provide impervious clothing and gloves for direct contact with contaminated produced water. (GS Skin Contact and GS Gloves)

### Control Approaches

#### Does not contain hydrocarbons

- » If you are sure that the produced water you are working with does not contain hydrocarbons or hydrogen sulfide no special controls are required other than good hygiene practices.

#### May contain hydrocarbons

- » If you suspect that hydrocarbons or hydrogen sulfide may be present, process streams involving produced water must be completely contained to prevent exposure to workers (GS Breaking Containment).
- » If you cannot ensure containment of all contaminated produced water an occupational hygiene specialist must be called to evaluate the risk to workers and to define specific control measures.
- » If a specialist is not available to evaluate the risk to uncontained contaminated produced water Self Contained Breathing Apparatus (SCBA) must be used if hydrogen sulfide may be present or for work environment's with limited to no ventilation (confined spaces) and a half-face respirator equipped with organic vapour cartridges must be used when hydrogen sulfide is not present and adequate ventilation is present (GS Respiratory Protective Equipment).

### Information Training and Supervision

#### Employer responsibilities:

- » Provide information on the specific produced water that will be present at the workplace (i.e. Safety Data Sheets, previous analysis of fluids from the same or similar production fields)
- » Use the Chemical Hazards Management System to define chemical management for the work you wish completed.
- » Modify equipment to ensure complete containment of contaminated produced water, provide occupational hygienist and/or SCBA.
- » Provide clean facilities: a washroom, showers, storage for clean and contaminated work clothing and a refreshment area.

#### Supervisor responsibilities:

- » Provide the required Guidance Sheets for chemical management.
- » Organize the work to limit the time workers are exposed to produced water.
- » Educating workers about the hazards of the produced water they will be working with and on proper chemical management.
- » Implementing good hygiene practices and storage policies regarding hazardous materials.
- » Ensuring that unprotected workers are not in areas where contaminated produced water is present.
- » Implementing spill response policies including the use of appropriate protective equipment and clothing.

#### Worker responsibilities:

- » Workers must participate in training and monitoring programs in the workplace.
- » Workers must not eat, drink or use tobacco products in areas where contaminated produced water is present. The hands and face should be washed before eating, drinking or smoking.
- » Workers must use and maintain all controls and equipment used to reduce exposure properly.
- » Workers must clean up of spills quickly and properly, using appropriate protective equipment and clothing.

### 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 getting liquids containing hydrocarbons on your skin.
- Use the personal protective equipment provided, i.e. SCBA, gloves, masks, goggles (GS PPE).
- Gloves should be made from materials which resist penetration by hydrocarbons. Natural rubber gloves should not be worn as rubber absorbs many hydrocarbons (GS Gloves).
- Report to your employer or safety representative any damaged or leaking equipment or protective equipment.