



SERVICE PROFILE

Chemical Cleaning

Chemical Cleaning Services

The two major categories of chemical cleaning are **pre-operational** chemical cleaning—part of pre-commissioning or commissioning activities—and **post-operational** or maintenance chemical cleaning, which is part of regular shut down work.

Pre-operational

Pre-operational chemical cleaning is performed to remove any foreign material remaining from construction activities during either the pipe or system fabrication. Major considerations in

the pre-operational phase include mill scale, corrosion products, weld scale, oil, grease, sand, dirt, temporary protective coatings, and other construction debris.

Post-operational

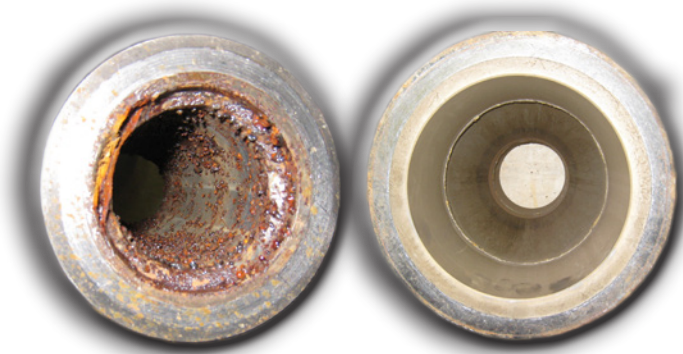
Post-operational cleaning is performed for a number of reasons, including reduced heat transfer, reduced flow, safety (e.g., H₂S, pyrophoric iron, LELs, ammonia, etc.), reduced surface area (e.g., catalyst), access to full inspection, and more.

FourQuest Energy offers numerous methods to chemically clean your system. These methods are outlined on the opposite page.



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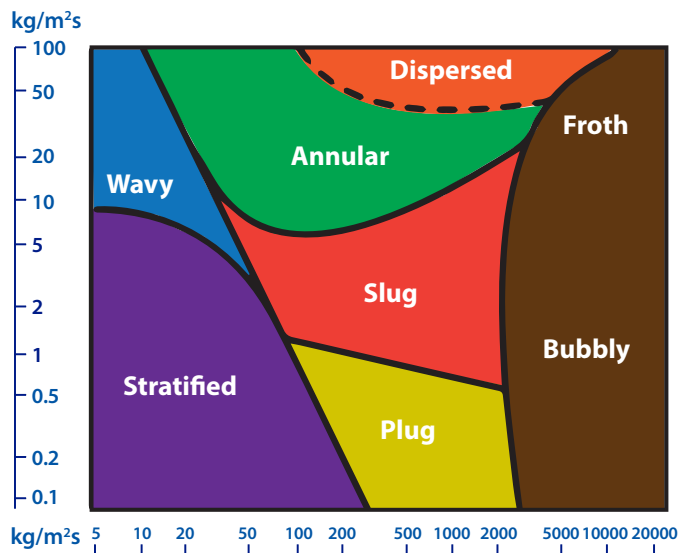
Cascading Cleaning Method

When large volume vessels are not designed to sustain full liquid levels, the cascading method is the best cleaning option. Adding chemicals at the top of the vessel and maintaining a liquid level at the bottom is commonly used in tower cleaning.

Two-Phase Flow Cleaning Method

Two-phase flow cleaning can be applied to reduce the cost and amount of waste generated. Several different patterns can be used in two-phase flow.

Two Phase Flow Diagram



Fill and Soak Method

This method is used when circulation is not feasible, e.g., heat exchangers, vessels, boilers, etc. The system is filled with a chemical cleaning solution and drained after a predetermined period of time.

Fill and Circulate Method

This method is often used for internal surface cleaning of large volume vessels and pipes. The system is filled with a chemical cleaning solution, which is then circulated by a pump. This is the most common chemical cleaning method in the industry.

Slug Flow Cleaning Method

This method is specially designed for pipeline cleaning. The method involves a slug of liquid chemicals sent between two separator pigs.

Boiler Boil Outs

For a safe and efficient start up of steam generating equipment, it is recommended to remove any organic matter from the internal surfaces by performing a caustic boil out.

Foam Cleaning Method

Instead of using a large volume of chemical solution, this method uses a gas mixed with undiluted chemicals and a foaming agent. It is applicable for systems that are characterized by a large volume to surface area ratio. Foam cleaning offers the same or very similar results while significantly reducing the amount of chemicals used and waste generated.

Nozzle Cleaning Method

Nozzle cleaning is another method used with large volume to surface area ratios. Instead of filling the entire system with costly chemicals, one or more 360° rotating head nozzles may be used to spray the walls of the vessel, keeping the volume of chemicals used relatively low.



EDMONTON, AB

9304 39 Avenue Northwest
Edmonton, AB T6E 5T9
Office: +1 780-485-0690

CALGARY, AB

Suncor Energy Centre, West Tower
#5100, 150 6th Avenue, S.W.
Calgary, AB T2P 3Y7
Office: +1 403-538-2140

FORT MCMURRAY, AB

136 Macmillan Road
Fort McMurray, AB T9H 5L4
Office: +1 780-750-2829

FORT ST. JOHN, BC

Graywest Office Centre Ltd.
10704 97 Avenue
Fort St. John, BC V1J 6L7
Phone: +1 250-785-1706



Connect with us:



fourquest.com