Remediation Services Company
11 Whirlwind Ct, Valley Center 67147

Chemical Cleaning Groundwater Remediation Systems

Specification:

The chemical cleaning of groundwater system foulants is an effective way to restore the efficiency of remediation equipment. Deposits of calcium carbonate, iron, and hydrocarbons can be effectively cleaned from the packing, trays, nozzles, and piping of fouled air strippers or diffusers. This procedure which can be done in place, with minimal system modification, is often more efficient and cost effective than replacement or mechanical cleaning of the fouled media.

1.0 Scope

1.01 Remediation Services Company will provide the analyses of the deposits and cleaning recommendations, equipment setup, all necessary chemical cleaning equipment, chemicals for the cleaning procedure, supervision and labor (see 1.04)for the cleaning process, and monitoring of the cleaning process, neutralization of acidic wastes, recommendations for the disposal of the neutralized wastes(see 1.05), and a followup report of the process.

1.02 The chemicals will include all necessary acid or caustics for solubilizing deposits, antifoam,and alkaline products for neutralizing wastes and passivating equipment.

1.03 The monitoring will include regular percent acid tests, determination of pounds of contaminant removed, determination of the completion of the cleaning process and monitoring pH of neutralized wastes before disposal.

1.04 Remediation Services Company will provide supervision and labor for the cleaning process. The supervisor will have 40-hour Hazwoper training certification. The customer or his consultant will need to provide one assistant to assist Remediation Services Company once the cleaning process begins. This assistant will also need to have 40-Hr Hazwoper training or equivalent and have level C personal protective equipment. The personal protective equipment will include acid resistant splash protective clothing, acid resistant gloves and boots, hard hat, and either a half-mask respirator and goggles or a full face respirator. The respirator cartridges should give protection for organic vapors and inorganic acid vapors.

1.05 Remediation Services Company will neutralize all acidic wastes. Remediation Services Company will dispose of the neutralized wastes if the neutralized cleaning wastes can be discharged to the sanitary sewer or to an on-site industrial waste treatment facility. Most municipalities allow the disposal of this waste if it is neutralized to within their specified pH levels. In all cases the appropriate approval for the disposal of the waste will be obtained either by Remediation Services Company or the customer before beginning the cleaning process. Any other arrangements for the disposal of the neutralized wastes will be the responsibility of the customer or their consultants.

1.06 The acidizing procedure is inherently corrosive. Remediation Services Company will follow proper procedures and carefully monitor the process to minimize corrosion. These procedures include evaluating the types of acids used, the percent acid used, and the metallurgy present. Proper corrosion inhibitors or inhibited acids will be used when required. Specific procedures are available from Remediation Services Company for review upon request.

1.07 The customer agrees to release Remediation Services Company from liability for any damage caused by the procedure.

2.0 Procedures

2.01 Deposit Analyses. Before chemical cleaning the foulant of the system should be determined. It is recommended that the deposit be analyzed. A complete analysis is preferred. At a minimum a field analysis is required. This is necessary to determine the best possible cleaning procedure. Deposits with hydrocarbon content, calcium carbonate content, and or iron or manganese content each require different cleaning procedures. The analyses is also important to asses the time and materials required for the cleaning operation.

The analyses will also provide valuable information regarding the effectiveness of preventative maintenance treatment programs, or may indicate the need for a pretreatment program if none exists.

2.02 When the deposit is sampled the amount of the deposit in the system should be calculated or estimated. To calculate the amount of deposit on a packed column air stripper the amount of deposit per unit of packing media is

determined. It is important to take representative media samples from the main flow area of the system. The total number of packing media can be determined from the system specifications or estimated. The total amount of deposit in the column can then be estimated.

2.03 The amount of acid required for the cleaning process can then be determined. For calcium carbonate it requires 2.6 pounds of hydrochloric acid (28%) to dissolve 1.0 pound of deposit. For iron it takes 4.8 pounds of hydrochloric acid (28%) to dissolve 1.0 pound of deposit. The specific gravity of 28% Hydrochloric acid is 1.139. Therefore the number of gallons of concentrated hydrochloric acid can be determined.

2.04 A chemical cleaning system diagram is available from Remediation Services Company. Some variations are necessary depending on the design and mechanical limitations of the system.

In general the requirements for the equipment is as follows:

A. Hydrochloric acid resistant chemical transfer pumps. ARO 6661AX-XXX-C or Gorman-Rupp 81 1/2 P47A-E2-3P or equivalent have proven effective. The chemical pump capacity is determined by the system size. A 30 GPM pump has proven adequate for packed column air strippers up to 4 feet in diameter.

B. PVC or CPVC gate or ball valves are recommended for the recirculation lines.

C. Industrial grade, chemical (hydrochloric acid, caustic)resistant hose is recommended. Polyethylene quick connect fittings are recommended.

D. The valve nests and chemical recirculation pump should be placed in secondary containment.

E. An external storage tank of either polyethylene or RFP polyethylene is recommended. This will allow quick draining of the system if necessary as well as provide a holding tank of wastes prior to neutralization. Some systems may require a chemical solution tank be placed in the recirculation circuit for convenience of chemical addition.

2.05 The cleaning procedure is as follows:

A. Dilute the acid to a 3% concentration. Assuming the use of Hydrochloric acid for the process.

B. As this solution is pumped over the air stripper column add antifoam to the pump suction. Add approximately 200 ml antifoam to 50 Gallons of acid solution. The antifoam should be metered slowly as the acid is pumped.

C. Slowly recirculate the acid solution to prevent the tower from "belching" due to the large amounts of carbon dioxide being formed. Add more antifoam as needed.

D. The acid content of the recirculating acid should be checked every 30 minutes. As the acid content drops below 2.5% more acid is added to bring the content up to 5%. Once the acid content remains stable at 3-4% without any further addition the procedure can be discontinued and the acidic wastes neutralized and disposed.

E. The acid wastes can be neutralized with caustic soda or soda ash. The pH of the neutralized wastes should be monitored to so that the final pH is within the specified ranges necessary to meet the discharge requirements of the receiving waste treatment facility. Note the addition of caustic soda to acid wastes is a vigorous chemical reaction and creates heat and possibly splashing.

F. The equipment should be passivated with a solution of 10% soda ash and or flushed with system water to remove any residual chemical.

2.06 Analytical

A. The cleaning process is monitored with a percent acid test. The test should be run every 30 minutes on the recirculating acid. This test procedure is available from Remediation Services Company.

B. At the end of the cleaning procedure it is recommended that calcium and or iron concentration of spent acid solution be determined to determine the amount of deposit removed from the system. These procedures are available from Remediation Services Company.

C. PH determination is necessary on the neutralized wastes prior to disposing of the waste.

D. A Log sheet of the process should be maintained. It should contain the following information. A sample log sheet is available from Remediation Services Co.

-Date and time of the beginning of the procedure
-Preinspection, Conditions prior to procedures, Notes
-Chemical additions: Time, chemical added, amount added
-Percent acid concentration: Time, Percent acid
-Results monitoring:Time, calcium, iron, inspection
-Neutralization: Time, final pH, where disposed
-System Passivation, Time, chemical added, procedure

E. A final report of the process, including the initial inspection and the post procedure inspection will be provide to the customer. The report will summarize the information contained in the log sheet. (See D Above)

3.00 Safety

3.01 If the site has an existing "Site Safety Plan" which addresses the handling of acids or caustic that plan will be followed.

3.02 The area including the chemical storage area, chemical addition area and the cleaning operation area should all be isolated with barricade or caution tape barricade prior to beginning the cleaning procedure.

3.03 Before beginning the chemical addition the system should be tested by recirculating water and filling the system with water to check all fittings for leaks.

3.04 The personal protective equipment required for the cleaning process, within the barricaded area is Level C. Outside of the barricaded area Level D PPE is acceptable. Either full-face shield respirators or half-mask respirators with chemical goggles are acceptable if in an area where vapors can accumulate. If There is adequate venting a full face shield or chemical Goggles may be adequate.

3.05 Fresh water for eyewash and dilution water should be immediately available.

3.06 During the cleaning operation one trained worker should be at the site at all times. The additional trained worker should be in the immediate area and in constant communication during the cleaning process.

3.07 Caustic soda and soda ash will be immediately available for neutralizing any spills or leaks of the chemical solution.

3.08 Material Safety Data Sheets will be reviewed by both workers any other supervisory or attendant personnel prior to adding chemical to the system.
Material Safety Data Sheets will be available at the site during the cleaning operation.