Installation Considerations With
Sodium Hypochlorite

General
Many water and wastewater treatment plants are converting from chlorine gas to sodium hypochlorite solutions either purchased in bulk or generated on-site for their disinfection requirements. On the surface, this appears to be a logical step. When compared to chlorine gas, sodium hypochlorite is considered to be a relatively easy chemical to handle and safer to use. Sodium hypochlorite is a chemical solution that is relatively non-toxic compared to chlorine gas, and is subject to certain handling procedures. If these procedures are not followed, problems will develop in its handling and feeding.

Piping
Piping systems must be designed specifically for sodium hypochlorite. All piping must be rigid PVC or CPVC, schedule 80. Metal piping and fittings (e.g. carbon steel or stainless steel) must never be used. Sodium hypochlorite is an aggressive chemical and will attack and corrode all metal including metal pipe and fittings. In fact, the use of metal anywhere in a hypochlorite system is not recommended as corrosion will occur and the metals will permeate the hypochlorite solution. The presence of metals in solution will contribute to the decomposition of the hypochlorite solutions and the development of chlorates.

Piping must be carefully assembled to protect against leaks at connections. If a leak develops, the leaking material is a solution, and the solvent (water) will soon evaporate and leave a white salt. This can occur at even the smallest of leaks. Chlorine in the salt deposits can be released to the atmosphere and, upon reaction with moisture in the air, cause corrosion of metallic parts in the area.

Threaded connections do not provide as good a pipe joint as those using solvent welded connections. Threaded connections, if used, should be clean, free of burrs and any other restrictions to the mating of the threads. Teflon™ tape may be used to secure the joint as long as the quality of the tape is good, for example Mil Spec grade. Teflon paste is not recommended because it may have solvent carriers that can prevent a good joint. The best method to protect against leaks is to use solvent welded connections.

Fittings and some pipe have been known to allow the seepage of hypochlorite through the wall of the fitting, usually at a seam line. When this happens, a white deposit will appear along the line.

Flexible braided PVC tubing has been reported to give satisfactory results. The tubing used must be of a good quality and the fittings barbed. The tubing must have a sufficient pressure rating for the application. Nylon fittings are not recommended for hypochlorite use. PVC fittings are suggested.

Gasification
Sodium hypochlorite is not a static solution. It is highly active and starts to decompose as it is produced, and over time, gas is released. The gas released is usually oxygen and the rate of release is dependant upon the solution concentration, temperature, length of storage, exposure to light and the presence of metals.

It is not unusual to find gas collecting at high spots in any piping. In addition, tanks must be vented to the exterior of the storage building or they can become over pressurized. Tank vents. in some areas, must have a scrubber system provided on the vent. This is particularly important when an on-site storage tank is being filled and the space above the liquid is to be displaced to the atmosphere. Local regulations such as building and fire codes must be reviewed.

The larger the pipe diameter, the greater the possibility that gas will form since the larger volume will take longer to reach the application point. Distribution distances should be considered before piping size is chosen to minimize gas formation. Also, extreme care should be taken so that excess glue is not applied to the joints. The excess glue can reach the interior of the pipe, reducing diameter, restricting flow and even plugging the line.

Often times the pipeline that carries sodium hypochlorite collects released gas. The pressure can build up in isolated or closed pipe and cause pipeline failure and blowout.

Valves used in hypochlorite systems should be chosen to allow pressure buildup to be relieved outside of the valve housing.

The provision of connections at several points in the system for flushing is a practical idea. If used, flushing with a soft water is recommended to maintain the condition of the piping.

Pumping
Most hypochlorite solutions are pumped with positive displacement chemical feed pumps and gasification can occur. The pump action can cause a vacuum to develop and can cause any dissolved gases to vaporize and bind the pump. Systems shut down or pumps that are not in use should contain methods to relieve any pressure.

The facility design must have a positive head on the pump suction to aid in the prevention of gasification. The chemical feed pump intake must always be below the tank liquid level. Pump manufacturers can provide devices for use with the pump to prevent or minimize hypochlorite gasification.
Storage
Based upon the chemical makeup of sodium hypochlorite, storage tanks must be of plastic construction. Typical hypochlorite storage tanks are of such a size that they must be fiberglass reinforced. When adding fiberglass for reinforcement, the fibers must be protected from the hypochlorite with a sufficient and proper coating to prevent wicking of the solution through the tank walls. Coatings of at least 20 mils are common. The coating choice must be reviewed with your supplier to ensure the proper chemical resistance. Some facilities have used a double-wall tank with success. If double-walled tanks are used, there should be drain valves provided to check for leakage.

Scaling
When sodium hypochlorite is produced, the pH is increased due to the presence of sodium hydroxide. In fact, some manufacturers will add excess caustic to reduce hypochlorite decomposition and increase stability. If the water used in the process has any carbon dioxide present, calcium carbonate will settle out in piping systems, pumps, and flowmeters. The presence of the carbonate scale can reduce pipe diameter and lower flow rates, reduce pump capacities, cloud glass flowmeters and can cause the pluggage of diffuser holes at the points of addition to the water. Iron and manganese laden waters used in the manufacture of the hypochlorite or for other purposes such as dilution of the hypochlorite at water and wastewater treatment plants have been known to develop iron and manganese oxidation deposits on flowmeters. The use of a softened water or the use of a water with no dissolved iron or manganese is recommended when dilution is required. The carbonates present have been known to settle at points of addition including in the mixing system housings (CHLOR-A-VAC® or similar vacuum injection units) currently in use.

Decomposition
Sodium hypochlorite decomposition leads to the presence of chlorates in the hypochlorite solutions reducing the strength of the solution. Chlorates do not aid in disinfection, and their presence in drinking water can lead to development of blood problems (blue baby syndrome). To prevent decomposition, some facilities dilute the solution upon receipt from the supplier, lower the storage temperature with chillers, or schedule deliveries more frequently. This generally reduces the decomposition of the solutions but increases the cost and care. Decomposition problems must be considered in the use of hypochlorite.

Safety
Facilities that have sodium hypochlorite must prepare their personnel for the proper handling of this chemical. Gloves, face masks and eye goggles are recommended for use when handling, pumping or working around the chemical. Rubber aprons or suits to prevent attack on the clothing are good considerations and rubber boots will protect the operator.