

STORAGE & HANDLING OF MAGNESIUM HYDROXIDE SLURRIES

INTRODUCTION

This document provides general guidelines for the effective storage, handling, and application of Magnesium Hydroxide slurry. Magnesium Hydroxide slurry is an effective, non-carbonate source of alkalinity. Due to its low solubility and reactive pH, Magnesium Hydroxide presents little or no hazard to people or to the environment. Magnesium Hydroxide is a responsible, safe alternative to many of the hazardous chemicals that are currently on the market. Magnesium Hydroxide offers a wide range of benefits for acid neutralization and water treatment; and often is the most economic alternative when all costs are considered. However, if the user is unfamiliar with the characteristics and unique handling properties of slurries, proper application can be unnecessarily troublesome. Slurries are a suspension of finely divided solids. Inadequate mixing, improper piping and/or incorrect pump selection can potentially lead to problems with slurry plugging and solids accumulation. The following outlines several recommendations and suggestions, based on many years of experience, for the handling of Magnesium Hydroxide slurry. If problems still persist after following these guidelines, Premier Magnesia can provide direct, on-site technical assistance.

TANK SPECIFICATIONS

Magnesium Hydroxide slurries must be shipped in containers that conform to the Department of Transportation classification 103W, 111A60W1 or 111A100W-1. These are 4,000-gallon tank trucks (MC 303, 304, 306, 307) and 10,000 or 16,000-gallon tank cars constructed of mild steel, lined or unlined. All shipping containers must be inspected for cleanliness prior to filling. Dedicated Magnesium Hydroxide equipment is recommended - but not always practical. For this reason, containers, unloading pumps, hoses, and filters should be thoroughly inspected and flushed if necessary prior to loading. Be careful to avoid cross-contamination from any residual Magnesium Hydroxide slurry in slurry containers, hoses, and plumbing. Different Magnesium Hydroxide slurries may contain trace amounts of different dispersants (used in the manufacture of the slurry) which may be incompatible with one and other. These dispersants adversely react when mixed together, causing the Magnesium Hydroxide slurry mixture to congeal and become extremely difficult to apply. Therefore, one must avoid the cross-contamination of different Magnesium Hydroxide slurries, in order to ensure proper slurry viscosity and stability.

UNLOADING

Magnesium Hydroxide tanker trucks are unloaded by pumping or pressurizing the truck. A customer-furnished pump or self-unloading tank truck equipped with its own pump can exacerbate the unloading process. The pumping method is preferred when unloading Magnesium Hydroxide slurry through a raise in 150 feet or more in height. The customer must provide a pump for unloading rail

cars. One can use the same rail car pump to re-circulate the slurry into the neutralization or chemical process. Ideally, one should filter all slurry deliveries to the storage tank through a strainer with 1/8" holes. Premier Magnesia recommends that a strainer be included in the equipment design. When pump and valve inlet ports measure less than 1", an inline dual basket strainer will prevent plugging.

STORAGE TANKS

Carbon steel, fiberglass and poly are the preferred materials for storage tanks and auxiliary equipment. *One should install all storage tanks as close to the application point as possible in order to prevent plugging.* Vertical tanks are preferred over horizontal tanks since they're less spacious, and easier to agitate in a uniform manner. In general, the tank should have a capacity of 1.5 times the required amount to accommodate the contents of the tank car or truck, plus rinse water.

Vertical tanks with a height-to-diameter ratio between 1.0 and 1.2 are preferred. All tanks should be fitted with baffles, set 90° apart in order to prevent a vortex from forming during mechanical agitation. Baffles should measure 1/10 the diameter of the tank in length, and should extend to one foot above the floor of the tank (although this can vary with different tank configurations and agitators).

No special tank insulation is necessary if the ambient temperature of the tank rarely drops below 40° F (4° C). If the tank is frequently exposed to lower temperatures, it should be insulated and/or heated to prevent the slurry from freezing. One can introduce heat to the tank by the direct infusion of steam or by using electrical tape, such as Chemelex, on the exterior of the tank.

In the presence of high ambient temperatures, water mist nozzles located inside the tank can prevent evaporative losses as well as internally cool the tank. Misting nozzles should only dilute the slurry by approximately 5% of the total volume of the tank.

SLURRY AGITATION

Some agitation is needed to keep solids in suspension while the slurry is in storage. One can accomplish this by a top-entering, pitch blade turbine or rake-type agitator. Agitator shaft speed will vary depending upon the impeller size and length of the shaft. Top-mounted agitators are more efficient (i.e. use less horsepower) and are easier to service. Below are the horsepower requirements for agitators used in cylindrical tanks that have a 1:1 height-to-diameter ratio:

Slurry concentration.....	50-65%
Pounds per gallon.....	12-13.4
HP/1000 gal.....	0.7

It is not necessary to operate an agitator continuously. Intermittently mixing Magnesium Hydroxide slurry for 1 out of 3 hours can effectively agitate the slurry (i.e. keep the solids in suspension). Short shutdown periods due to power outages will not adversely affect the slurry; but 4-8 hours of continuous agitation should follow such incidents. One should avoid longer shutdown periods. However, if such periods are unavoidable, one should air-sparge the slurry around the agitator's

propeller before restarting the mixer. This will help reduce the power surge upon the mixer restart. Agitator manufacturers can provide advice on the proper selection of suitable equipment for an agitator's intended purpose.

PIPING

Seamless carbon steel piping is adequate for most applications. A variety of other piping materials are also suitable, including PVC and reinforced rubber hoses. Whenever possible, one should install piping above ground and with easy access for servicing.

All process pipes must be heated and/or insulated if they are located in areas where temperatures are extreme (below 32° F or above 95°F.) This can be done using self-regulating heating tape, such as Chemelex, or its equivalent. Steam tracing is not recommended; the high temperatures generated by the steam can dry Magnesium Hydroxide onto the sides of the pipes. It is important to maintain adequate velocity through all piping to prevent plugging. Branch runs to metering pumps should be supplied by a continuous recirculation loop wherever possible. Piping should be horizontal or below the valve or pump entrance. This configuration discourages Magnesium Hydroxide particles from settling in the valve or pump entry port. Since friction and pressure loss in slurry pipelines are higher than those of water, a minimum pipe diameter of 1.25 times the discharge size of the pump is recommended. Suction lines from the storage tank to the feed pump should be kept as short as possible. Suction lines should be at least two times the size of the inlet of the feed pump. The minimum valve inlet diameter of the feed pump is only ½" (which would make the minimum suction line diameter only 1"). Piping from the tank and pump should be installed in the following manner: from the storage tank, start with a close nipple → valve → close nipple → tee → nipple (one foot or less) → pump → close nipple → T-connection, then continue with discharge piping. On the T-connections install an additional close nipple and ball valve for water flushing.

PROCESS VALVES

Plug, full port ball and pinch valves allow straight-through flow and a larger port to minimize turbulence and pressure loss. This reduces the potential for solids to collect. Minimum valve size is ½"; the 1" valve size is preferred.

DRAIN VALVES

Premier Magnesia recommends ball valves over gate valves, since ball valves minimize the potential for plugging.

FLOW CONTROL VALVES

Premier Magnesia recommends pinch-type control valves. These valves close positively even when solids are present inside the tube.

PUMPS

Slurry pumps fall into two general categories - centrifugal pumps and positive displacement pumps. Centrifugal pumps have the highest capacity, and are useful when pumping or recirculating large volumes of slurry when high pressures and metering are not required. Centrifugal pumps, in conjunction with control valves, are often used for a wide variety of slurry applications.

Premier recommends positive displacement pumps, such as peristaltic or progressing cavity pumps, for applications that require high pressures and metering. Since progressing cavity pumps cannot operate dry, Premier Magnesia prefers peristaltic or hose pumps. Natural rubber is the preferred hose and lining material, and all hoses and rotors must be lubricated in order to ensure proper pump operation.

Check the manufacturer's specifications for maximum RPMs and recommendations for pumping abrasive slurry. The solids concentration and viscosity of a slurry will have a direct impact on pump component life. All major pump and valve manufacturers can provide assistance with product selection for pumping and controlling Magnesium Hydroxide slurry.

MAINTENANCE

Handling a slurry requires routine maintenance. All slurries have a tendency to settle and plugging is generally a sign of incorrect equipment or piping configurations. Proper storage and slurry feed system installation will reduce plugging and system maintenance. One should inspect the storage tank for leaks and clean any slurry residues from the sidewalls of the tank on a weekly basis. Pumps and mixers should be regularly checked for proper operation.

One should flush suction and discharge lines as needed. When flushing from the pump to the tank through the discharge line, be careful not to add too much water. Excess water will affect the stability of all slurries and exacerbate settling.

Inspect the pump on new installations on a monthly basis for wear. This will prevent leakage and feed problems. It will also help determine the replacement schedule for the hose or stator.