Ocean Water Desalination Water Quality Integration Study

Pipe Loop Design, Installation, and Testing Plan

Draft Submitted 2/28/13

Final Updated 5/8/13

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APPENDICES

I. Introduction and Technical Memorandum Objectives

West Basin Municipal Water District (West Basin) is leading a Desalinated Water Quality Integration Study in partnership with Metropolitan Water District of Southern California (MWD). The purpose of the study is to examine the impact of a new, desalinated water source introduced into distribution systems that have previously been exposed to MWD water and groundwater sources. The project consists of 8 tasks.

This memorandum provides a combined plan for pipe loop design (Task 5) and a water quality test plan (Task 6). This test plan documents the study design, specific procedures that will be carried out in preparing test waters (including blends), on site monitoring and collection of laboratory samples, and operating procedures for the pipe loops.

II. Approach

The pipe loop pilot system is designed to evaluate the impacts of stabilized desalinated water on typical pipe materials found in local distribution systems, compared to MWD water, local groundwater, and blends of the different waters. Testing will be conducted for a period of four months. A period of less than two months is expected for stabilization of the pipes, based on previous studies of a similar nature[1,2], then the remaining two months will allow for collection of data on the differences between water sources.

Pipe materials that will be tested include new cement mortar-lined (CML) steel pipes; unlined cast iron (UCI) pipes harvested from the local distribution system; and new copper pipes with lead solder joints and harvested brass meters. These pipes and materials represent the different types of potential materials in the distribution systems that are susceptible to corrosion if the desalinated water has corrosive tendencies. The rationale for the pipe materials selection and harvesting procedures are described in detail in Task 4 - Pipe Harvesting Plan (Appendix A).

[1] Blute, K.N., McGuire, M.J., West, N., Voutchkov, N., Maclaggan, P. and Reich, K., 2008. "Integration of Desalinated Seawater into a Distribution System". *J. AWWA*, 100:9:117.
[2] Zhang, Y., Tseng, T.J., Andrews-Tate, C., Cheng, R.C., and Wattier, K. 2012. "Pilot-Scale Evaluation of Blending Desalinated Seawater into a Distribution System", *J. AWWA*, 104:7:43.

UCI pipe and brass meters will be harvested from the City of Manhattan Beach distribution system. CML steel and copper pipe will be new. Pipe lengths, flow velocities, and the recirculation or stagnation/flow periods were selected to represent challenging conditions that will highlight corrosion issues if likely to occur when a desalinated source is introduced.

III. Pipe Loop Design Overview

To evaluate the effects of the desalinated water on the existing distribution system piping and residential copper plumbing, three separate pipe loop systems will be fabricated including:

- Six harvested 4-inch UCI distribution pipe segments
- Six new 4-inch CML steel pipe segments
- Six lead-soldered copper pipe loops with harvested brass meters

Details on the selection of materials can be found in the Task 4 Pipe Harvesting Plan (Appendix A). Figure 1 shows an updated schematic of the test loops.

The UCI and CML pipe loops will be tested with continuously recirculated water for 6 days with replacement of the water on the 7th day. This recirculation approach will result in the accumulation of metals for easier detection of corrosion should it arise, and the detention time is typical of distribution system detention times in this area (i.e., typically, they range from 2 days to one week). The new copper pipes with lead solder and brass meters will be tested with timed cycles of 30 minutes of flow through to waste, followed by 11.5 hours of stagnation time, to represent a diurnal household plumbing flow scenario. For lead and copper materials, stagnant conditions provide the most significant opportunity for leaching because a steady-state concentration is accumulated in the water. Cycles of water flow and stagnation are typical of corrosion studies for copper and lead release[3]. All test water will be replaced with fresh water once a week, and stored in dedicated tanks for each pipe loop.

[3] American Water Works Association Research Foundation. 1996. Internal Corrosion of Water Distribution Systems. 2nd Ed.

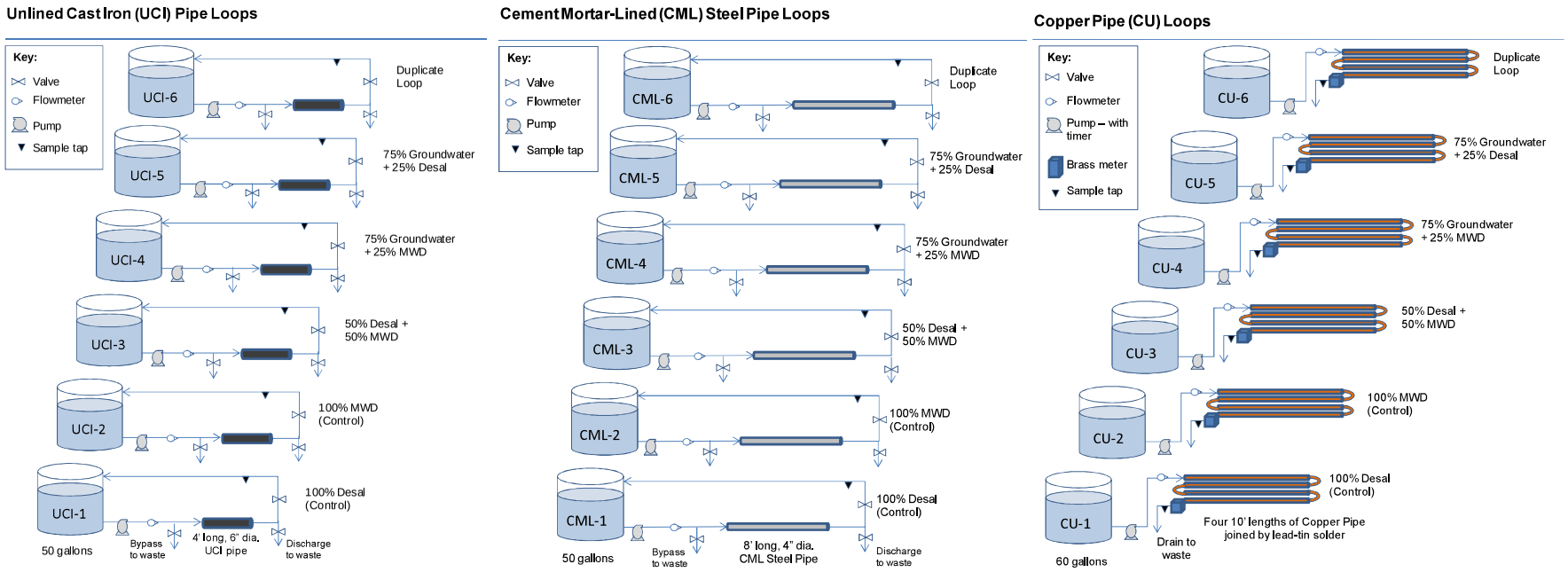


Figure 1. Integration Study Pipe Loops

Note: UCI and CML pipe loops will continuously recirculate water for 6 days, then the water will be replaced on the 7th day. Copper pipe will operate in a flow-through manner with 0.5 hrs of flow, 11.5 hours of stagnation, 0.5 hours of flow, etc. Additional water will be available in the copper loops to support the flow-through operation.

Pipe loops will be constructed at the SEA Lab site in Redondo Beach, California. The pipe loops will be placed onto racks to maximize access for staff activities onsite and to avoid disturbance of the pipe. Figure 2 shows a sketch of the planned rack configuration. The CML and CU racks will be approximately 10 feet long (with pipes and end caps), 5 feet high and 4 feet wide. The UCI rack will be approximately half of the length to accommodate the shorter pipe lengths. Figure 3 provides a preliminary plan view of the site, which may be modified during construction depending on the field conditions.

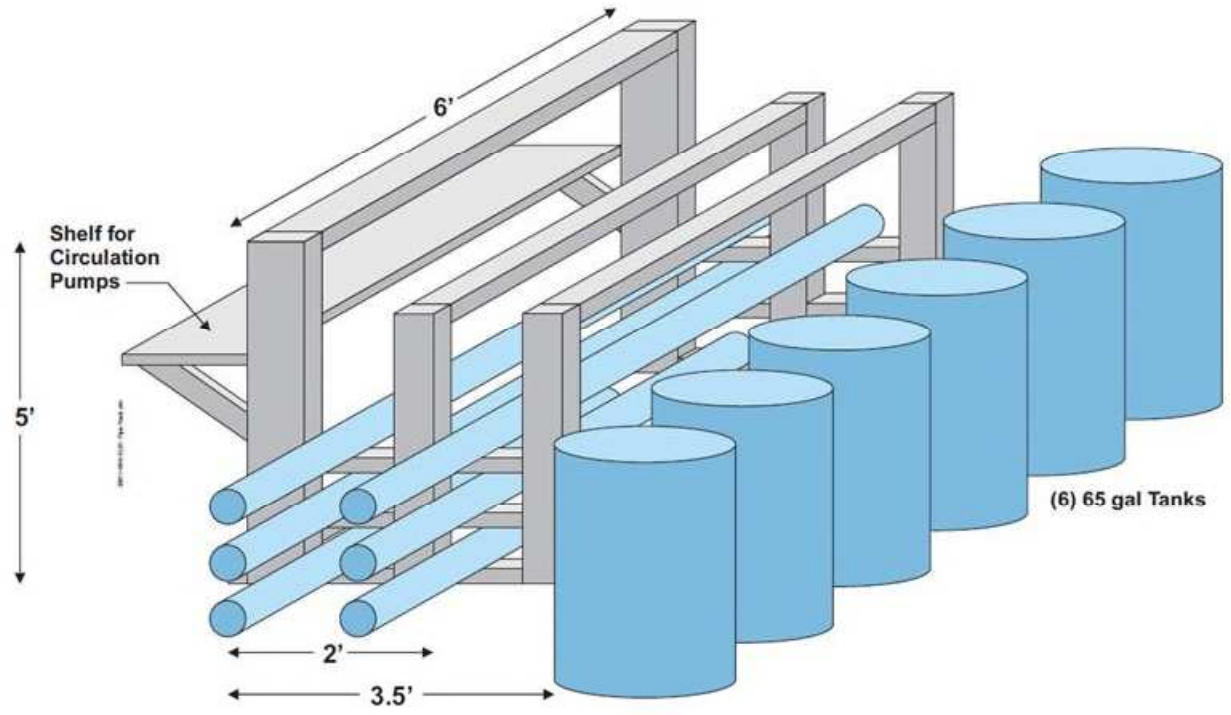


Figure 2. Schematic of Rack to Hold Pipe Segments

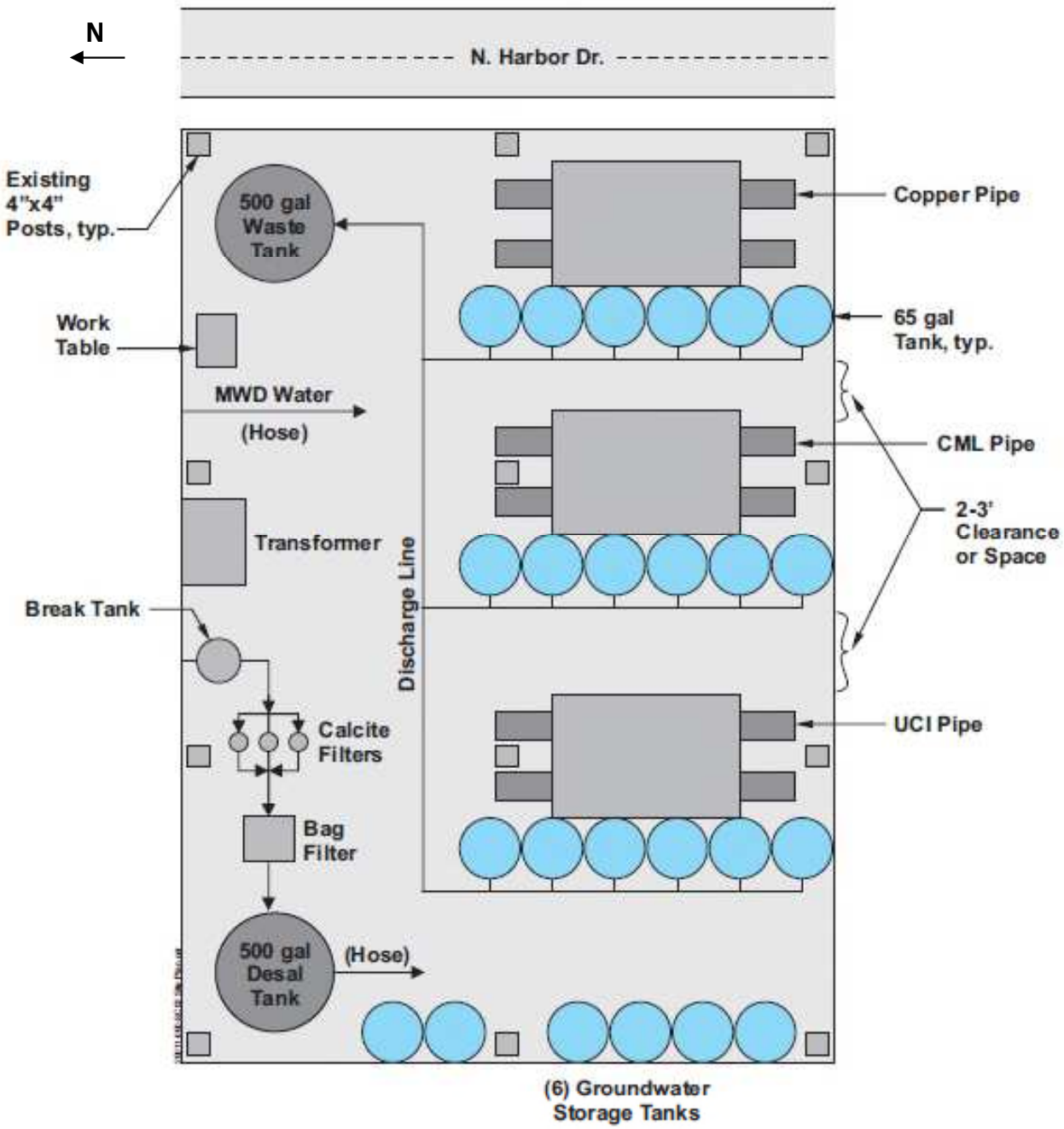


Figure 3. Preliminary Plan View

A. Unlined Cast Iron Pipe

UCI pipes will be harvested from the City of Manhattan Beach distribution system. Selection of materials and detailed harvesting procedures are provided in the Task 4 Pipe Harvesting Plan (Appendix A). In summary, UCI pipe will be harvested by Vido Samarzich Inc. (Alta Loma, California). The contractor will take measurements of the pipe outer diameter in advance of the pipe harvesting to determine the proper size fittings for the pipe ends and have the fittings available during harvesting. The fittings for each pipe end will be comprised of a mechanical joint with restraining gland and a blind flange that is tapped and threaded to receive 1" PVC pipe. Exposed fitting surfaces will be coated with bituminous tar lining, as they ordinarily are available from the manufacturer for use in drinking water distribution systems.

Hazen and Sawyer staff will ensure that the pipes are properly plugged or sealed during pipe harvesting to contain existing moisture in the pipes during the time of removal. The contractor will carefully deliver the harvested pipes to the site to minimize potential damage to the existing scale formation. The pipes will be placed onto the rack and water will be introduced into the pipes on the same day as harvesting. If the desalinated water stabilization process is not yet producing acceptable water quality, MWD water will be circulated in the harvested UCI pipe until the desalinated water is ready for introduction to maintain the integrity of the pipe scale. MWD water currently feeds the system (either with blends of groundwater or without) and is not expected to be corrosive toward the pipe.

The rack for the UCI pipes will contain two rows with three pipes stacked vertically, as shown in Figure 2. The recirculation pumps will be placed on a shelf located at the front of the rack. Sixty-five gallon capacity, black, food-grade polyethylene tanks will be placed behind the rack. One-inch Schedule 40 piping will be used to connect piping throughout the system and provide the return from the pipe to the recirculation tank. All glue will be NSF-certified for use in potable systems. The pumps, tanks, and circulation piping will be ordered and set up before the pipe harvesting so that assembly of the pipe loops can be completed on the pipe harvesting day.

The process flow diagram for the UCI pipe loop is shown in Figure 1. Each tank will contain desalinated water, MWD water, groundwater, or various blends of the three water sources. As indicated in the process flow diagram, a pump will be used to recirculate water through the pipe loop system. A duplicate loop will be provided in case of variability in the harvested pipe.

If results from one pipe loop are clearly different compared with the others, the duplicate loop will be substituted for the anomalous loop.

Sample taps and tank identification labels are provided in Figure 1. Each UCI and CML pipe loop will be sampled from a sample tap on the PVC recirculation line after 6 days of recirculation. The isolation valve will be closed after sampling to keep water in the pipe during changeout of the recirculation tank water, and the return PVC line will be built to an elevation greater than the tank to avoid draining the tank during the changeout. The volume of water held in the pipe will be sent to waste by measuring the quantity of water discharged, then the valve to waste will be closed and the fresh water recirculated for the next 6 days.

UCI pipe loops will be operated continuously at a velocity of approximately 0.05 fps, corresponding to a recirculation pump rate of 4.4 gpm. The selected velocity is within the range of average day demand for the City of Manhattan Beach pipelines[4] and is not expected to induce physical erosion of pipe deposits. A lower velocity was necessary compared with the CML pipes due to the increase in UCI pipe diameter and the pump operations to minimize sound impacts at the site. Table 1 provides design criteria for the UCI pipe loops.

Table 1. UCI Pipe Loop Design Criteria

Design Parameter	Design Value
Pipe Diameter	6 in.
Length	4 ft.
PVC Diameter for Return and Connecting Pipe	1 in.
Velocity	0.05 ft/sec
Flow rate	4.4 gpm
Volume of UCI Pipe	0.7 ft^3
Volume of PVC	0.04 ft^3
Total Volume in Pipe	6 gal
Recirculation Tank (initially filled at 50 gallons)	44 gal
Pipe Surface Area to Water Volume	0.11 cf surface area/ cf volume

[4] Hydraulic modeling of average day demand for the City of Manhattan Beach and the City of El Segundo was provided by AKM, showing a majority of pipes' average day demands were 0.00 – 0.25 fps.

B. Cement Mortar-Lined Steel Iron Pipe

Uncoated CML steel pipe with bituminous tar-coated fittings will be delivered to the pipe loop test location by Ferguson Waterworks, a local supplier. The CML pipe will be fabricated in accordance with AWWA C205 specifications. The CML pipes will be stored on site with other materials until ready to be placed onto the rack and will be protected from the elements by covering the open ends.

The construction methods for CML pipe loops are similar to the methods described for the UCI pipe loops except that the rack will be designed to hold six new CML pipes instead of six harvested UCI pipes. The process flow diagram for the CML pipe loops is illustrated in Figure 1. Operational conditions for the CML pipe are shown in Table 2. Given the smaller diameter CML compared with UCI pipe, the flow rates will vary but the velocities will be held constant at 0.1 fps. The same surface area will be provided by the longer length of smaller diameter CML pipe.

Table 2. CML Steel Pipe Loop Design Criteria

Design Parameter	Design Value
Pipe Diameter	4 in.
Length	8 ft.
PVC Diameter for Return and Connecting Pipe	1 in.
Velocity	0.1 ft/sec
Flow rate	3.9 gpm
Volume of CML Pipe	0.7 ft^3
Volume of PVC	0.04 ft^3
Total Volume in Pipe	6 gal
Recirculation Tank (initially filled at 50 gallons)	44 gal
Pipe Surface Area to Water Volume	0.12 cf surface area/ cf volume

C. Copper Pipe with Lead Solder and Brass Meters

Four 40-foot lengths of ¾" diameter copper pipe (type "L," representative of typical materials installed in Southern California households) will be joined with 50:50 lead-tin solder at 9 of the available 13 joints (the remainder being lead-free solder), with a technique of making neat joints to represent standard household plumbing. Forty feet of copper pipe was selected to hold enough water during the stagnant period to provide the necessary volumes for sampling, for the water quality parameters of interest. Harvested brass meters will be extracted from the City of Manhattan Beach distribution system and placed at the end of the copper pipe length.

The copper pipe loops will be equipped with a timer to operate intermittently with flow to waste for 30 minutes, followed by stagnation for 11.5 hours. This cycle will be repeated throughout the 4 month testing period. Samples will be collected after at least 6 hours of stagnation but less than 12 hours to mimic sampling requirements in the Lead and Copper Rule (LCR)[5]. The LCR establishes this stagnation window because previous research has shown that "near-equilibrium" lead concentrations are observed with this strategy[6]. To ensure consistency, samples will be taken from each pipe loop after the same stagnation period. This frequency was selected to provide at least 6 hours of stagnation along with a window to enable sampling (i.e., sampling could occur between 6 and 11.5 hours after stagnant conditions began). A velocity of 0.1 fps (corresponding to a flow of 0.14 gpm) for a flow through period of 30 minutes diurnally was selected due to constraints on the quantities of water available in the pipe loop tanks for the 6-day testing period. The period of time for flushing has been shown to be less critical with respect to the potential for copper and lead leaching, compared with the stagnation period, as described by Lagos et al.[7] and indicated by the stagnant sampling regime of the Lead and Copper Rule.

Figure 1 provides a process flow diagram for the copper pipe loops and Table 3 details the design criteria for the loops. Sixty-five gallon tanks will contain 60 gallons of water to provide the necessary volume of water for pipe loop operation during the 6 day period. At least 6 hours after the beginning of a stagnation period, samples for lead concentrations will be collected

[5] http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Lawbook/dwregulations-2012-06-21c.pdf
[6] American Water Works Association Research Foundation. 1996. Internal Corrosion of Water Distribution Systems. 2nd Edition.
[7] Lagos, G.E., Cuadrado, C.A., and M.V. Letelier. 2001. Aging of Copper Pipes by Drinking Water. *Journal of AWWA*, 93:11:94-103.

from the brass meter at the end of each loop. The remaining water contained in the copper pipe loops will be sampled for lead and other constituents at the end of the stagnation period. Additional details are provided in Testing Approach Section.

Table 3. Copper Pipe Loops – Design Criteria

Design Parameter	Design Value
Pipe Diameter	¾ in.
Length	40 ft.
Velocity	0.1 ft/s
Flow rate	0.14 gpm
Volume for Pipe	0.12 ft^3
Flowing Period	30 minutes twice per day
Total Volume in Pipe	0.92 gal
Total Volume in Pipe	3.47 L
Total Volume of Water Flowing in 1 Day	8.3 gal
Quantity of Water Flow through Pipe in 6 Days	50 gal
Quantity of Water Prepared in the Tank	60 gal

D. Duplicate Pipe Loops

For each pipe material, a duplicate pipe loop is included as a reserve loop, in consideration of the possibility that some pipe segments may be unrepresentative. For example, higher metal releases might occur in one loop compared with others. All duplicate pipe loops will initially be operated with 100% MWD water, since MWD water is not expected to cause corrosion. If one of the test pipe loops shows unexpected metal releases, the duplicate loop will be switched to the same test water as the anomalous pipe loop. At the same time, the problematic pipe loop will be switched to 100% MWD water to evaluate if unexpected metal releases are more likely due to unrepresentative pipe scale or impacts from water quality. MWD water is not expected to cause significant corrosion outcomes compared with regulatory limits.

IV. Test Waters

The test waters that will be evaluated in this integration study are listed in Table 4. Each is discussed in more detail in subsequent subsections.

Table 4. Test Waters for Pipe Loops

Test Water	UCI Loops	CML Loops	CU Loops
100% Stabilized Desalinated Water	✔	✔	✔
100% MWD Water	✔	✔	✔
50% Desalinated and 50% MWD	✔	✔	✔
25% MWD and 75% Groundwater	✔	✔	✔
25% Desalinated and 75% Groundwater	✔	✔	✔
Duplicate Loop*	✔	✔	✔

*Additional detail provided in the text that follows.

The test waters selected for this study will represent the range of impacts that varying water quality may have on the pipe materials. A blend of desalinated water and MWD water (50% each) will be tested to determine if the blend results in a water quality that has more significant corrosion outcomes. A full range of potential blends may be present in the distribution system when the full scale desalination plant comes online, so this test protocol is intended to span the potential range of water qualities and to investigate whether blending has any unanticipated impacts.

West Basin's Ocean Water Desalination Program Master Plan assumes that desalinated water from a full scale facility will be introduced to local distribution systems on the low pressure side of existing turnouts along the MWD West Coast and West Basin Feeders. One such system, the City of Manhattan Beach, was identified as having extensive lengths of unlined cast iron pipe. UCI pipes will be harvested from that system. Manhattan Beach is permitted by CDPH to use 25% MWD water and 75% groundwater in the system, with the groundwater percentage limited by blending needed to decrease manganese levels. This proportion of MWD to groundwater will be tested, along with the potential replacement of the 25% MWD water with 25% desalinated water that could occur with the introduction of desalinated water.

Logistically, all test waters will be introduced into 65-gallon pipe loop tanks for pipe loop testing, with 50 gallons used in the testing of UCI and CML pipes, and 60 gallons used in the

copper pipe loops (due to the flow-through operation, with an additional 10 gallons provided to ensure that the pipe will have a consistent flow of water at the end of the testing period). For blended waters, a totalizer will be used to monitor the water volumes added to the tanks. A Teflon-coated tank mixer will be used to mix the blended water thoroughly. Stabilized desalinated water, MWD water and groundwater will be tested to ensure that the water meets anticipated water quality parameters before blending, as described in the Testing Parameters and Frequency Section.

If steady-state water qualities are reached in the pipe loops with blended desalinated and MWD water and/or blended desalinated and groundwater in less than 4 months, different blending ratios may be tested to simulate changing water quality interfaces, which are likely to occur in the distribution systems. For example, the 50% desalinated water with 50% MWD water loop may be changed to a 75% desalinated water with 25% MWD water blend.

A. Desalinated Water Source

Unstabilized desalinated water (RO permeate) is by nature low in calcium and alkalinity, which can cause the water to be corrosive to pipes and plumbing materials. Desalinated water will be stabilized using calcite contactors with upstream acid addition to increase calcite dissolution into the water, followed by chlorine and ammonia addition, and caustic soda (sodium hydroxide) addition if necessary to adjust pH and achieve positive calcium carbonate precipitation potential (CCPP) and Langelier Saturation Index (LSI) values. Figure 4 shows a schematic of the stabilization approach. Appendix B provides the Task 3 – Literature Review and Survey findings, which form the basis for the water quality target goals for desalinated water stabilization.

Desalinated water will be produced at West Basin's Ocean Water Desalination Demonstration Facility (OWDDF) and piped to the integration testing area. Table 5 provides a characterization of representative water quality that is anticipated for the integration study based on the objective of achieving a boron level consistently less than 0.5 mg/L. In this study, a bromide level of approximately 0.3 mg/L will be targeted. This target range is similar, if slightly higher, than the MWD water from Jensen, as described later. Theoretically, 30% second pass is expected to yield about 0.3 mg/L (although this may vary depending on membrane performance). The amount of second-pass RO is not expected to affect the integration study except for chloramine residual stability (for example, other parameters such as chloride and

sulfate are lower than the MWD water). Minimal impact of bromamine degradation of the chloramines residual is expected below 0.3 mg/L[8]. MWD intends to select 0.3 mg/L bromide as the baseline testing condition for Task 7 Bench Scale Testing of DBP formation and residual stability.

Desalinated water will be piped from the OWDDF to a break tank, where it will be pumped into three calcite contactors operated in parallel. The pump is necessary due to the low pressure (~10 psi) of the RO permeate and the head loss in the calcite contactor resulting from small particle sizes.

[8] Zhang et al. 2012.

Table 5. Desalinated Water Quality before Stabilization*

Constituent	Units	1st Pass Permeate (Lead End)	2nd Pass Permeate	Water Quality with 37% 2nd Pass	1st Pass Permeate (Lead End)	2nd Pass Permeate	Water Quality with 33% 2nd Pass	1st Pass Permeate (Lead End)	2nd Pass Permeate	Water Quality with 28% 2nd Pass
Boron	mg/L	0.56	0.22	0.44	0.62	0.26	0.51	0.63	0.34	0.57
Bromide	mg/L	0.35	0.05	0.23	0.38	0.06	**0.28**	0.40	0.09	**0.31**
Chloride	mg/L	68	8.7	45	74	12	54	82	16	64
Conductivity	µS/cm	236	59	166	265	76	197	289	89	231
pH	pH units	8.6	10.3	9.4	8.5	10.5	9.4	8.6	10.4	9.3

Results provided by SPI on 3/25/13 for three different percentages of 2nd pass permeate in the blend.

Stabilization of Desalinated Water

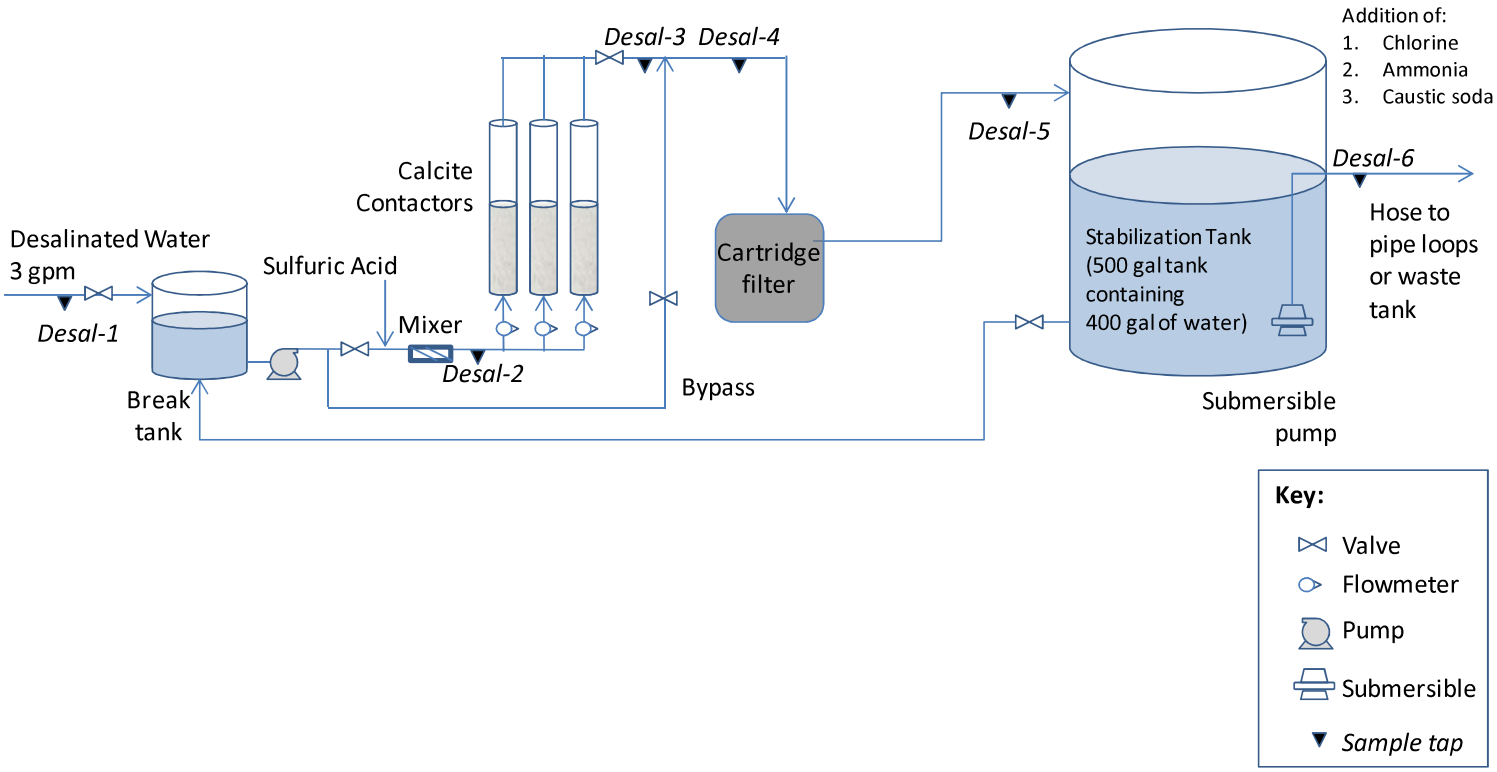


Figure 4. Desalinated Water Stabilization Process

Note: Chloramine addition and final pH adjustment are described in more detail in the text.

The calcite contactors will consist of granular calcium carbonate ($CaCO_3$), which will dissolve into the water when the desalinated water pH is depressed. Sulfuric acid[9] will be added to the water to target an initial pH of 5.5, which can be adjusted based on field measurements of the resulting alkalinity. The pilot stabilization system will be designed to treat part of the flow (i.e., with the ability to bypass RO permeate) while achieving the water quality targets (listed in Table 6). Adjustment of pH to values lower than 5.5 may offer increased dissolution of calcite and an increased amount of bypass. Experience in operating the calcite contactor with a portion of the flow bypassed will be gained in this testing, as this approach can offer significant savings in footprint and capital equipment at full-scale.

Table 6. Stabilized Water Quality Targets

Constituent	Concentration
Alkalinity	65 – 80 mg/L as $CaCO_3$
Calcium≠	> 65 mg/L as $CaCO_3$
pH	8.2 ± 0.2
CCPP	> 0
LSI	> 0
Total Chlorine Residual	2.5 mg/L*
Total Ammonia	0.5 mg/L as N

≠ The calcium level is of secondary importance to the CCPP.

* Initial chlorine target of 3.0 mg/L will be tested to account for chlorine demand/decay.

After sulfuric acid addition to the water, the pH-adjusted water will flow into the bottom of calcite contactors operated in an upflow mode. Three calcite contactors will be operated in parallel to provide sufficient water conditioning within a reasonable time frame of approximately 2 hours for 400 gallons (stored in a 500 gallon tank). The contactors will be made of translucent plastic to allow visual inspection of the calcite beds in operation, and to determine if more calcite needs to be added when the bed depth decreases. When not being inspected, the contactor columns will be covered with opaque material to avoid algae growth.

[9] One concern investigated was that gypsum, $CaSO_4$, might precipitate if sulfuric acid is used for pH depression due to high concentrations of calcium and sulfate. Calculations of gypsum solubility confirmed that gypsum is unlikely to precipitate and clog the calcite contactors for the calcium and sulfate concentrations that will be present in solution in the contactors.

Table 7 presents the design criteria for the pilot calcite contactor. According to two models[10] for calcite contactor design, an empty bed contact time (EBCT) of 5 minutes at a hydraulic loading rate (HLR) of 5 gpm/sf is expected to provide sufficient calcite dissolution to increase alkalinity from 3 mg/L to 65 - 80 mg/L as $CaCO_3$. If a 5-minute EBCT is not sufficient to achieve the target alkalinity and calcium as expected, the contactors will have the flexibility to be reconfigured for operation in series to provide a longer EBCT. In addition, the calcite contactors will provide sufficient freeboard in case a longer calcite bed depth is necessary.

As the pH-adjusted desalinated water flows through the calcite contactors, the calcite will dissolve and increase calcium, alkalinity and pH. After the calcite contactors, the water will be filtered using a 20-30 micron bag filter to capture any calcite that may be carried over. This water will flow into the 500 gallon tank. Water from the stabilized water tank will be recirculated at a rate of approximately 40 gpm through the bag filters and then back into the tank, allowing for mixing and chemical addition directly into the tank.

Chloramines will be formed in the stabilization tank by first adding chlorine, mixing for the amount of time necessary to achieve CT for 0.5-log *Giardia* and 4-log virus inactivation (i.e., approximately 7 minutes at 3 mg/L and pH 7.5), then adding ammonia. If necessary, caustic soda will be added for final pH adjustment. The water will be stabilized the day before use, and a disinfectant residual of 2.5 mg/L total chlorine and 0.5 mg/L ammonia as N will be targeted for the day of use.

Four hundred gallons of stabilized, chloraminated water will be stored in the 500 gallon tank until needed for transfer into the pipe loop tanks. A hose bib connection will be provided from the 500 gallon tank, and the 40 gpm pump (which has turndown capacity) will be used to transfer the water to each tank using a hose equipped with a flow totalizer.

[10]The DESCON model developed by Letterman and Kothari (1995) and the program developed by Schott (2002) named Limestone Bed Contactor: Corrosion Control and Treatment Process Analysis Program Version 1.02.

Water stabilization will be conducted the day prior to the planned change-out of water in the pipe loop tanks, to provide an extra day in case unexpected challenges arise (e.g., OWDDF offline, water quality not meeting specifications, etc.).

Table 7. Water Quality Stabilization Design Criteria

Design Parameter	Design Value
Flow Rate (gpm)	3
Sulfuric acid dose (mg/L)[1]	9
Volume of 1% sulfuric acid (mL/min)	10
Influent water pH	5.5
Calcite product	Puri-Cal™ C from Columbia River Carbonates[5]
Calcite particle size (mm)	1
Calcite contactor diameter (inch)	6
Calcite contactor bed depth (feet)	3.3
Calcite contactor volume (cf)	0.66
Hydraulic loading rate (gpm/sf)	5
Empty bed contact time (minutes)	5
Bag filter size (micron)	20-30
Chloramine concentration[2]	2.5 mg/L as Cl_2, 4.5:1 Ratio of Cl_2:NH_3-N
Volume of NaOCl[3] (mL) added to 400 gallons	87 mL
Volume of $(NH_4)_2SO_4$ (mL) added to 400 gallons	9.2 mL
Caustic soda (mg/L)[4]	As needed to achieve target pH
Final pH after caustic soda	8.2 ± 0.2
Final alkalinity after caustic soda	65 – 80

[1] Estimated using the TetraTech Rothberg Tamburini and Winsor (RTW) model based on assumed alkalinity of 10 mg/L as $CaCO_3$, calcium of 10 mg/L as $CaCO_3$ and temperature of 20 °C.
[2] Chloramines will be formed by adding chlorine to water, mixing, then adding ammonia.
[3] An additional 0.5 mg/L of chlorine is included in this quantity to yield an applied dose of 3 mg/L, anticipating some decay to yield a final total chlorine concentration of 2.5 mg/L.
[4] According to the DESCON model developed by Letterman and Kothari (1995), pH in the calcite effluent with the design in Table 1 is estimated to be 8.4 once the water is equilibrated with atmospheric carbon dioxide. Therefore, caustic soda may not be needed. If pH in calcite effluent is below the target of 8.2, the caustic soda dose can be estimated using the Tetra Tech RTW model and applied.
[5] Product data sheet attached (Appendix C).

B. MWD Water Source

MWD water will be supplied to the pipe loops testing location from a connection at the OWDDF using a hose with a flow totalizer. Typical MWD water quality from the Jensen Water Treatment Plant, which serves the Redondo Beach area, is provided in Table 8. Initial startup

testing will determine if the MWD water line requires flushing prior to use to check that the water is fresh and characterized by typical MWD residuals (i.e., at least 1.8 mg/L total chlorine at the turnouts; lower concentrations may be encountered at the site, in which case the disinfectant residuals will be increased). Water from the MWD water line will also be tested for conductivity to ensure it is primarily MWD water, as the connection might be occasionally supplied by a mix of MWD water and groundwater from California Water Service Company Hermosa-Redondo wells. Typical conductivity of MWD water is 500 µS/cm from Jensen and approximately 800 µS/cm, while typical groundwater conductivity is much higher (approximately 1,400-1,800 µS/cm). If conductivities and bromide levels are higher than that expected by MWD at the site, indicating a significant influence of the wells at the pilot site, then Hazen and Sawyer will obtain water from a WB turnout in tanks, similar to how groundwater will be obtained.

C. Groundwater Source

Groundwater is available from two wells in the City of Manhattan Beach (final selection of the well is pending, but the Consumer Confidence Report from 2011 indicates a relatively tight range of water quality parameters for their wells). Hazen and Sawyer field engineers will use dedicated 65-gallon tanks to collect the groundwater from the well selected for the 4-month study. Seven tanks will be sufficient to collect groundwater for one week of testing. The tanks will be transported to the pilot site using a truck with a lift gate. The route for tank delivery is shown in Figure 5 and will occur between 9 am and 3 pm to avoid SEA Lab activities. Hazen and Sawyer staff will use a dolly to move the tanks from the parking lot behind the SEA Lab to the pilot testing location.

Raw groundwater will be mixed with MWD water or stabilized desalinated water at the pilot test location in the pipe loop tanks. Total chlorine will be increased in the blend to achieve a chloramine residual target of 2.5 mg/L.

Figure 5. Route for Groundwater Transportation

D. Summary of Anticipated Source Water Quality

Table 8 provides a summary of expected water quality, including the stabilized desalinated water, MWD water from the Jensen Water Treatment Plant, and groundwater from one of the City of Manhattan Beach groundwater wells. MWD water and stabilized desalinated water will be similar with respect to the key parameters impacting corrosion control for most distribution system materials, including alkalinity, pH, and calcium; which contribute to CCPP and LSI corrosion indices. The different source waters are expected to vary in chloride and sulfate concentrations, with chloride and sulfate being lower for the stabilized desalinated water and higher for the groundwater compared with MWD water. TDS is much higher in the groundwater for the Manhattan Beach system. Manhattan Beach has a permit to blend its groundwater with 25% MWD water to dilute the high manganese concentrations of the groundwater below the secondary maximum contaminant level (MCL) of 50 μg/L.

Blends of the various water sources are expected to have these positive corrosion indices. TDS will be higher for blends of groundwater compared with the 100% desalinated water or 100% MWD water. Chloride is expected to be approximately 215 mg/L in the blends and sulfate concentrations approximately 109 - 123 mg/L, both of which are higher than the stabilized

desalinated water and the MWD water. The testing of these groundwater loops, therefore, provides a test of the impact of the higher TDS, chloride, and sulfate manganese levels that are common in local groundwater.

Table 8. Expected Source Water Quality

Constituent	Stabilized Desalinated Water	MWD Water[1]	Groundwater
Alkalinity (mg/L as $CaCO_3$)	65 – 80	76 – 93 (ave. 85)	180 – 230 (ave. 205)
Boron (mg/L)	< 0.5	0.19	Not reported
Bromide (mg/L)	< 0.3	0.11 – 0.2 (ave. 0.18)[2]	0.17[8]
Calcium (mg/L as $CaCO_3$)	> 65	65 – 70 (ave. 68)	228 – 275 (ave. 253)
CCPP (mg/L as $CaCO_3$)	> 0	1.5[3]	33[3]
Chloride (mg/L)	62	59 – 69 (ave. 64)	240 – 290 (ave. 265)
Chlorine, Total (mg/L)	2.5[4]	1.8 – 2.5[5]	N/A
Conductivity (µS/cm)	TBD	420 – 530 (ave. 500)	1,400[7]
Copper (mg/L)	ND	ND (<0.05)	See note[6]
Iron (µg/L)	ND	ND (< 100)	ND – 180 (ave. 90)
Lead (µg/L)	ND	ND (<5)	See note[4]
LSI	> 0	0.2[3]	1.1[3]
Manganese (µg/L)	ND	ND (< 20)	67 – 80 (ave. 59)
pH	8.2 ± 0.2	8.1 – 8.4 (ave. 8.2)	8.1 – 8.2 (ave. 8.2)
Sulfate (mg/L)	0.3	54 – 58 (ave. 56)	110 – 180 (ave. 145)
Total Organic Carbon (mg/L)	0.2	1.6 – 2.1 (ave. 1.9)	1.9[8]
Total Dissolved Solids (mg/L)	96	280 – 290 (ave. 280)	840 – 930 (ave. 885)
Turbidity (NTU)	TBD	0.03 – 0.09 (ave. 0.03)	0.2 – 0.94 (ave. 0.57)

TBD – to be determined during desalinated water post-treatment.
ND – non-detect.
Unless noted, groundwater data is from the 2011 Consumer Confidence Report for the City of Manhattan Beach.
[1] MWD water quality is based on the Jensen Water Treatment Plant effluent reported in the 2011 Water Quality Report to MWD Member Agencies – The Metropolitan Water District of Southern California.
[2] West Basin Municipal Water District. Ocean Water Desalination Program Master Plan (PMP), September 2012.
[3] Estimated using the Tetra Tech RTW model based on average water quality in the table and temperature of 20 °C.
4 Initial chlorine target of 3.0 mg/L will be tested to account for chlorine demand/decay.
[5] Communications with Sun Liang and Karen Scott of MWD on 2/13/2013.
[6] LCR 90th percentile values (representing a mix of MWD and groundwater) for copper is 0.12 mg/L and lead is 7.22 µg/L according to the Manhattan Beach 2011 Consumer Confidence Report.
[7] Reported for one sample from Well 11-A collected 2/26/13.
[8] Measured in one sample collected 3/21/13 by MWD.

V. Additional Design Considerations

A. Electrical Supply

Power at 480V will be supplied from an existing welder's outlet. A 480V/120V transformer and distribution panel will be installed at the pilot plant and connected to the welder's outlet. The transformer will supply power to a distribution panel, which will subsequently power each of the three pipe racks and the pretreatment skid. Individual recirculation pumps will be driven by variable frequency drives (VFD) to allow the speed of the pumps to be adjusted to change the flow rate. Each VFD will have a fuse to protect the circuit. This will allow the other pumps to keep running if one pump fails. The VFDs for the copper pipe loops will be wired to a timer to allow them to run intermittently. Hazen and Sawyer and a United Water subcontractor will perform all electrical work on site.

B. Wastewater Discharge

Piping will be added from the pilot test 500-gallon wastewater tank to the Neutralization Tank (T-520) and the Equalization Tank (T-500) in the overhead pipe rack by United Water, as depicted in Appendix D. All wastewater from the pipe loops will be pumped to the Neutralization Tank located in the desalination process area, which discharges to the sewer. Approximately 970 gallons of wastewater will be generated from the pipe loop study once a week, including approximately 200 gallons of water for flow-through in the copper pipes, 650 gallons from the recirculating loops, and an additional 120 gallons from extra water remaining in the copper pipe tanks. The Neutralization Tank has a capacity of 2,000 gallons and is operated in batch mode. The maximum discharge rate for T-520 to the sewer is 250 gallons per day, so the water sent to the tank can be metered to the sewer over four days to ensure compliance with the discharge quantity restrictions (Appendix E). Hazen and Sawyer has confirmed that all conditions of the OWDDF Los Angeles County Sanitation District sewer permit will be met during these discharge events.

During commissioning of the desalination stabilization skid, fine tuning will be necessary to ensure that the target water quality goals are achieved. If off-spec water is produced, this water will be discharged to a smaller 65-gallon wastewater tank. The stabilized water that has not been in contact with the pipe loops can be sent to the Equalization Tank and subsequently discharged to the ocean in accordance with the OWDDF NPDES permit. This operation will help

to minimize the amount of water sent to the sanitary sewer via the Neutralization Tank should water that does not meet the target stabilized water quality parameters be produced.

C. Secondary Containment

Secondary containment will be added to prevent discharge of chloraminated water and any other wastewater to the storm drain. Berms will be placed on the ground surrounding the pipe loop test area, constructed of 2" x 4" lumber and sealed with latex caulking. This approach will serve as a temporary barrier 4" high from the ground during the study period. Based on the size of the pilot station, the berms can hold approximately 1,570 gallons of water. In case of a spill of study water, a sump pump will be used to transfer spilled water to the waste tank.

D. Site Conditions and Decommissioning

Before Hazen and Sawyer begins construction on the pilot testing site, photographs will be taken of the concrete pad and shade structure to document existing site conditions. The site will be returned to its preexisting condition once the study is complete. Any water remaining in the pipe loops will be drained and discharged into the wastewater line. Hazen and Sawyer staff will disassemble all pipes, pumps, and racks and remove them from the pilot testing site. All storage tanks will also be transported off site. Used pipe segments will be disposed through a recycling facility nearby (e.g., Corridor Recycling or Gardena Recycling Center).

A shade cover is required to keep the pipe loops out of direct sunlight as well as to provide a comfortable work area for staff working at the pilot site. The existing shade cover owned by SEA Lab will be amended to provide additional shading using a tighter weave of mesh. The cover will be returned to the original condition when testing is complete unless SEA Lab desires the new cover remain in place.

VI. Testing Approach

This section describes the testing approach, sampling locations, water quality parameters of interest and sampling frequency that will occur within the duration of the 4-month test. This approach was developed as a result of the Task 4 – Literature Review and Survey to answer key objectives about the potential for corrosion with the introduction of desalinated water into typical distribution system piping.

The testing approach focuses on a number of categories into which parameters fall. Reasons for evaluating these parameters are provided below:

1. Water quality parameters indicative of water stability for corrosion control that will be used to calculate LSI and CCPP (alkalinity, calcium, pH, temperature, TDS, chloride and sulfate)
2. Metals release into the water as they relate to regulatory standards (for UCI pipe – iron and manganese; for CML pipe – aluminum and other metals from mortar lining; for copper pipe with lead solder and brass meters – copper, lead, and zinc),
3. Other water quality parameters that may impact corrosion or DBP formation (conductivity, dissolved oxygen, turbidity, ORP and TOC)
4. Disinfectant concentrations (total chlorine, total ammonia) and nitrite (by-product from nitrification)
5. Disinfection by products (total trihalomethanes, TTHM, and haloacetic acids, HAA5, and NDMA)
6. Water quality parameters that can impact disinfectant residual stability (bromide)
7. Characterization of desalinated water membrane operations (boron)
8. Characterization of taste and odor.

Corrosion-related outcomes will be assessed with regulatory standards in mind, including primary and secondary maximum contaminant levels (MCLs; listed in Table). However, loop results will provide a "worst-case" scenario and do not directly indicate that regulatory limits will be exceeded. Instead, potential impacts in changes in water quality (including further stabilization of desalinated water and blends of water sources) will be investigated through this project to identify potential strategies to avoid problems when the desalinated water is introduced into the distribution system.

A. Sampling Locations

Stabilized desalinated water, MWD water and groundwater will be monitored as source waters for water quality variations over the entire study period. Once a week, the pipe loop tanks will be filled using the three source waters based on blends described Section IV and as illustrated in the pipe loop design diagram (Figure 1). Water in the pipe loop tanks will be sampled three times a week: once the tanks are freshly filled (Day 1), once in the middle of the week (Day 5) and once at the end of the week (Day 7). The freshly filled water will serve as a baseline for the weekly testing, and will also ensure proper blending is achieved in the pipe loop tanks that require blended water. Samples from the middle of week will be monitored to characterize chloramine degradation. Samples from the end of week will be monitored for corrosion. The copper pipe loops will be operated in a flow-through manner with 30 minutes of flow followed by 11.5 hours of stagnation. First flush samples at least 6 hours into the stagnation period will be collected from the copper pipe loops on Day 7.

Table 9 summarizes the sampling locations and rationale for selecting the locations.

Table 9. Sampling Locations and Rationale

Sampling Location Category	Testing Purpose
Source Waters: Stabilized desalinated water, MWD water, and groundwater	Monitor source water qualities each week
Pipe Loop Tanks – Day 1 Freshly Filled Water (All Pipe Loops)	Provide baseline water qualities for pipe loop testing comparison with water recirculated for 6 days; ensure proper blending in loops with blended water
Pipe Loop Tanks – Day 5 Recirculating Water (All Pipe Loops)	Monitor chloramine degradation for the first month of operation; consider boosting chloramines residual in subsequent months.
Pipe Loop Tanks - Day 7 Recirculating Water (UCI and CML Pipe Loops)	Monitor metal releases accumulated over the week from UCI or CML pipes
First Flush of Stagnant Water – Day 7 (CU Pipe Loops Only)	Monitor metal releases after at least 6 hours of stagnation

UCI – Unlined cast iron pipe; CML – Cement mortar-lined steel pipe; CU – Copper pipe

Stabilized desalinated water will be sampled from the sample tap at the bottom of the 500-gallon tank (shown in Figure 6). MWD water will be sampled from a water line provided from

the Cal Water Hermosa-Redondo system at the pilot site. Groundwater will be sampled from one of the 65-gal tanks that will be used for transporting groundwater to the pilot site. Groundwater samples will be drawn from the top of the tanks using a hand pump since these tanks are for transit of water and are not connected to the pipe loops.

Pipe loop tanks will be sampled from the top of the tanks on Day 1 (prior to introduction of water into the loops) and from the sample tap on Days 5 and 7 (Figure 1). For copper pipe loops only, stagnant water will be collected from the sample tap next to the brass meter (Figure 1) at the end of the stagnation period on Day 7. A first flush sample of the stagnant water will be collected for lead, copper, and zinc to evaluate leaching from the brass meter (right next to the sampling tap). The volume of the brass meters will be tested after harvesting and that volume will be collected as the first flush sample from the water in contact with the meters. The remaining water held in the copper pipe will then be collected and analyzed for all parameters of interest, including lead, copper, zinc and manganese.

B. Testing Parameters and Frequency

Tables 10 through 13 summarize the water quality parameters and testing frequencies for field and lab analysis. In general, the planned field and lab analyses evaluate the following:
Key parameters indicating corrosion or contributing to corrosion index stability will be analyzed once a week to characterize the initial and final water qualities from the pipe loops, with the exception of chloride, sulfate and TOC. Chloride, sulfate, TOC, boron and bromide concentrations are not expected to change within the pipe loops, and will therefore be analyzed once a month in the freshly filled pipe loop tanks to characterize the water sources. A weekly frequency for metals and key stability indicators matches the operational strategy of changing out water sources and water in contact with the pipe loops each week. This approach also allows for development of a reasonable number of data points during four months of operation to enable that conclusions can be drawn.

Task 7 Bench Testing will explore DBP formation potential (TTHM, HAA5, and NDMA). Based on the results generated Task 7, one pipe loop from each of the sets of pipe loops will be sampled for DBPs to evaluate whether any differences appear between the bench top testing and pilot testing. In addition to DBPs, one set of samples will be collected for taste and odor analysis by Hazen and Sawyer staff.

Table 10. Field Testing for All Pipe Loops

	Unblended Source Waters			Pipe Loop Tanks (18 loops)			First Flush of Stagnant Water
Analyte	**Stabilized Desalinated Water**	**MWD Water**	**Ground-water**	**Day 1 - Freshly Filled Water***	**Day 5 - Recirculation (All Pipe Loops)**	**Day 7 - Recirculation (UCI and CML Pipe Loops)**	**Day 7 - (CU Pipe Loops Only)**
Alkalinity, Total	1/W	1/W	1/W	1/W	-	1/W	1/W
Ammonia, Total	1/W	1/W	1/W	1/W	1/W	1/W	1/W
Calcium	1/W	1/W	1/W	1/W	-	1/W	1/W
Chlorine, Total	1/W	1/W	1/W	1/W	1/W	1/W	1/W
Conductivity	1/W	1/W	1/W	1/W	-	1/W	1/W
Dissolved Oxygen	1/W	1/W	1/W	1/W	-	1/W	1/W
Nitrite	1/W	1/W	1/W	1/W	1/W	1/W	1/W
ORP	1/W	1/W	1/W	1/W	-	1/W	1/W
pH/Temperature	1/W	1/W	1/W	1/W	-	1/W	1/W
Turbidity	-	-	-	1/W	-	1/W	1/W

1/W – Once per week; ORP –Oxidation Reduction Potential
*For pipe loop tanks filled with blended source waters only, as the pipe loop tanks filled with 100% stabilized desalinated water or 100% MWD water are analyzed under the unblended source waters.

Tables 11 through 13 show the sample collection frequency for laboratory analyses, separated into UCI, CML, and CU loops. In addition, one set of bromide samples will also be collected weekly on the desalinated water and groundwater prior to chloramination.

Table 11. Laboratory Testing for Unlined Cast Iron Pipe Loops

Analyte	Raw Source Waters (pre-chloramination)	Day 1 - Freshly Filled Water in Pipe Loop Tanks*	Day 7 of Recirculation in Pipe Loop Tanks
Iron	-	1/W	1/W
Manganese	-	1/W	1/W
Boron	-	1/M	-
Bromide	1/W≠	1/W	-
Chloride	-	1/M	-
Sulfate	-	1/M	-
Total Organic Carbon (TOC)	-	1/M	-
Total Trihalomethanes (TTHM)	-	Once^	Once^
Haloacetic Acids (HAA5)	-	Once^	Once^
Taste and Odor	-	Once^	Once^
NDMA	-	Once^	Once^

*Only one set of samples from the freshly filled water out of the three groups of pipe loops (UCI, CML, and CU).
≠ Samples collected prior to chloramination for desalinated water (post-calcite, pre-chloramines) and groundwater (pre-chloramines).

Table 12. Laboratory Testing for Cement Mortar Lined Steel Pipe Loops

Analyte	Day 1 - Freshly Filled Water in Pipe Loop Tanks*	Day 7 of Recirculation in Pipe Loop Tanks
Aluminum	1/W	1/W
Iron	1/W	1/W (only CML-4 and CML-5)
Manganese	1/W	1/W (only CML-4 and CML-5)
Bromide	1/W	-
Boron	1/M	-
Chloride	1/M	-
Sulfate	1/M	-
TOC	1/M	-
TTHM	Once^	Once^
HAA5	Once^	Once^
Taste and Odor	Once^	Once^
NDMA	Once^	Once^

*One set of freshly filled water out of the three groups of pipe loops (UCI, CML, and CU).
^Once during the pipe loop study, collected on the same day.

Table 13. Laboratory Testing for Copper Pipe Loops

Analyte	Day 1 - Freshly Filled Water in Pipe Loop Tanks*	Stagnant Water Collected on Day 7 of Run
Copper	1/W	1/W#
Lead	1/W	1/W#
Zinc	1/W	1/W#
Bromide	1/W	
Boron	1/M	-
Chloride	1/M	-
Sulfate	1/M	-
TOC	1/M	-
TTHM	Once^	Once^
HAA5	Once^	Once^
Taste and Odor	Once^	Once^
NDMA	Once^	Once^

*One set of samples from the freshly filled water out of the three groups of pipe loops (UCI, CML and CU loops).
Lead, copper, and zinc will be sampled for both first flush of the stagnant water to evaluate lead leaching from water contained within the brass meter and the rest of the water in contact with copper pipes and lead solder.
^Once during the pipe loop study, collected on the same day from one loop in each set.

VII. Sampling Procedures

This section describes analytical methods and logistics for sampling. The Hazen and Sawyer Project Manager or Field Coordinator will ensure that all staff are properly trained in appropriate sampling methodologies, including:

- Sample filling strategies (flushing sample taps; avoiding wash-out of preservatives; preparing headspace free bottles for DBP samples)
- Avoidance of cross-contamination during sample collection,
- Sample labeling procedures
- Chain of custody preparation and sample holding

Following a sample collection demonstration of good techniques, the Project Manager or Field Coordinator will observe staff technique and correct any improper techniques.

A. Analytical Methods

Tables 14 and 15 summarize the field and lab analytical methods, including sample volumes, method reporting level (MRL), minimum detection level (MDL) and required preservatives. For field analysis (Table 14), the MRL equals the MDL. Field and laboratory measurements will conform to accepted drinking water test methods, including EPA approved methods, methods

described in Standard Methods for the Examination of Water and Wastewater (2012), and Hach field test methods. Although sample results below the MRL and above the MDL will be requested from the laboratory (as "J" flagged values), the MRL will be used for reporting purposes. Levels below the MRL are not always accurate values.

Table 14. Field Analytical Methods

Analyte	Analytical Method / Instrument	Sample Volume Required (mL)	Method Reporting Limit
Alkalinity	Hach 8203 (Digital Titration)	100	10 mg/L as $CaCO_3$
Ammonia, Total	Hach 8155 (Salicylate Method) / DR-890 colorimeter	10	0.02 mg/L as N
Calcium	Hach 8204 (Digital Titration)	100	10 mg/L as $CaCO_3$
Chlorine, Total	Hach 8167 (DPD Method) / DR-890 colorimeter	10	0.02 mg/L
Conductivity	SM 2510B (Conductance) / DO610: ExStik® II DO/pH/Conductivity Kit	30	N/A
Dissolved Oxygen	DO Probe / DO610: ExStik® II DO/pH/Conductivity Kit	100	0.1 mg/L
ORP	ORP Probe / RE300: ExStik® ORP Meter	30	-2000 mV
Nitrite	Hach 8507 (Diazotization Method)	10	0.005 mg/L as N
pH/Temperature	SM 2550 (Thermometric)/ SM 4500H-B (Electrometric) DO610: ExStik® II DO/pH/Conductivity Kit	30	N/A
Turbidity	SM 2130B (Nephelometric) / Hach 2100Q	30	0.02 NTU

N/A – Not Applicable

Table 15. Laboratory Analytical Methods

Analyte	Analytical Method	Sample Volume (mL)	Preservatives	Method Reporting Limit	Method Detection Limit	Holding Time (days)	California MCL	California SMCL (or Notification Level*)
Aluminum	EPA 200.8	250	HNO_3	5.0 ug/L	2.1 ug/L	180	1 mg/L	0.2 mg/L
Copper	EPA 200.8	250	HNO_3	0.5 ug/L	0.27 ug/L	180	1.3 mg/L^	1.0 mg/L
Lead	EPA 200.8	250	HNO_3	0.20 ug/L	0.035 ug/L	185	0.015 mg/L^	N/A
Iron	EPA 200.7	250	HNO_3	0.010 mg/L	0.0011 mg/L	180	N/A	0.3 mg/L
Manganese	EPA 200.8	100	HNO_3	0.2 ug/L	0.15 ug/L	180	N/A	50 ug/L
Zinc	EPA 200.8	100	HNO_3	5 ug/L	1.1 ug/L	180	N/A	5 mg/L
Boron	EPA 200.8	250	HNO_3	1.0 ug/L	0.28 ug/L	180	N/A	1 mg/L*
Bromide	EPA 300.1	250	None	10 ug/L	1.7 ug/L	28	N/A	N/A
Chloride	EPA 300.0	250	None	0.5 mg/L	0.10 mg/L	28	N/A	250 mg/L
Sulfate	EPA 300.0	250	None	0.50 mg/L	0.10 mg/L	28	N/A	250 mg/L
TOC	SM 5310B	80	HCl	0.10 mg/L	0.016 mg/L	28	N/A	N/A
TTHM	EPA 524.2	120	$Na_2S_2O_3$	0.5 ug/L	N/A	14	80 ug/L	N/A
HAA5	EPA 552.2	250	NH_4Cl	1.0 ug/L	0.41 ug/L	14	60 ug/L	N/A
Taste & Odor	FPA (SM 2170)	500	None	N/A	N/A	1	N/A	N/A
NDMA	EPA 521	1000	$Na_2S_2O_3$	0.002 ug/L	0.00050 ug/L	7	N/A	0.010 ug/L*

N/A – Not Applicable
^Action level under the Lead and Copper Rule.
*Notification level

B. Sample Amounts Required for Analyses

Weck Laboratories is the current laboratory used for OWDDF operations and will be used as the contract laboratory for all samples in this study except NDMA; NDMA will be analyzed by Eurofins Eaton Analytical due to cost savings. For samples shipped to the contract laboratory, the sample volumes required are listed in Table 13. The potential for combining analytes measured by the same method will be determined based on the contract laboratory's standard practices to minimize the number of bottles collected and sample volumes needed.

C. Sample Containers

All field samples will be collected using clean polyethylene bottles, except total chlorine, total ammonia, and nitrite, which will be added directly to the glass Hach sample vials. The contract laboratory will provide pre-cleaned bottles for laboratory analysis that will include the necessary preservative(s) for sample holding.

D. Sample Preservation Methods and Holding Times

Table 15 lists whether samples must be analyzed immediately or if they can be preserved and for what length of time. Field measurements will be conducted the same day as collected, thereby eliminating the need for sample preservation. As a contingency plan, alkalinity and calcium could be analyzed on the following day but same day analysis is preferred.

E. Sample Identification

Samples will be identified using a standardized code that imparts all relevant sampling information. Each pilot-testing loop and sampling point will be assigned a code as shown in Table 16. Samples collected from the stabilization skid will be labeled "Desal." Samples collected from the MWD connection will be coded as "MWD." Groundwater samples collected from the 65-gal tanks for groundwater transportation will be coded as "GW." The sampling date and time will be recorded for each sample collected. Finally, the analyte(s) to be measured in that sample will be recorded on the bottle label, along with any preservatives.

Table 16. Sampling Codes for Laboratory Samples

Source Water	Code		
Stabilized Desalinated Water	Desal-1 (Raw water) Desal-2 (Raw water after sulfuric acid addition) Desal-3 (Raw water after calcite, before bypass) Desal-4 (Raw water after calcite, after bypass) Desal-5 (Water entering stabilization tank) Desal-6 (Water leaving stabilization tank fully adjusted)		
MWD Water	MWD		
Groundwater	GW (before chloramines are added)		
Pipe Loop	Code for UCI Pipe Loops	Code for CML Pipe Loops	Code for CU Pipe Loops
100% Stabilized Desalinated Water	UCI-1	CML-1	CU-1m, CU-1p
100% MWD Water	UCI-2	CML-2	CU-2m, CU-2p
50% Desalinated and 50% MWD	UCI-3	CML-3	CU-3m, CU-3p
25% MWD Water and 75% Groundwater	UCI-4	CML-4	CU-4m, CU-4p
25% Desalinated and 75% Groundwater	UCI-5	CML-5	CU-5m, CU-5p
Duplicate	UCI-6	CML-6	CU-6m, CU-6p

Notes:

-Add "F" for samples collected on Day 1 after filling of tank, e.g. UCI-1-F.
-Add "D" for samples collected on Day 5 after recirculation for a check of disinfectant residual, e.g., UCI-1-D.
-Add "R" to represent samples collected on Day 7 after recirculation, e.g., UCI-1-R.
- "m" refers to water collected first from the water stored within the brass meter. "p" refers to the subsequent flush of water from the copper pipe.

F. Sample Shipment

All field samples will be collected and measured onsite by Hazen and Sawyer or SPI staff. Laboratory sample courier pickup will be coordinated with pickups from United Water when possible.

G. Chain-of-Custody

Samples will be considered "in custody" when they are in someone's physical possession or view, locked up, or stored in a secure area accessible only by authorized personnel. A minimal number of persons participating in sample handling and custody is preferable, although all custody transfers will be recorded through signatures on the chain of custody sheets.

H. Sample Archives

After completion of the analytical testing, samples will be retained and stored at the laboratory until personnel at the laboratory and Hazen and Sawyer review sample data and associated quality control analyses. In general, samples will be retained by the laboratory for up to 4 months. Unless directed otherwise, samples will then be disposed of by the laboratory in accordance with appropriate environmental health and safety regulations for hazardous chemical waste. Field samples will be disposed in accordance with environmental health and safety regulations. Where appropriate with respect to discharge limitations, field samples may be disposed in the 500 gallon wastewater tank leading to the Neutralization Tank. No field samples will be discharged into the smaller 65 gallon tank leading to the Equalization Tank.

I. Testing Log

Samples collected for analyses will be recorded in a standardized sampling field log using waterproof, permanent ink. The log will contain the following information: Sample ID, date and time, results of field measurements, descriptions of incidents that may have affected pilot plant operation, and instrument calibrations and standard checks.

VIII. Quality Assurance/Quality Control

Quality assurance objectives will be assessed as detailed in this plan. Field measurements will be tested for accuracy by calibration checks of equipment; for precision by duplicate analyses of parameters; and for any contamination that may occur during sample handling and transfer by analyzing blanks and collecting replicate samples. Additional details are in Section VIII.

Method sensitivities for chemical analytes in the field (e.g. alkalinity, calcium, total chlorine, and nitrite) have been determined by researchers and are reported by Hach for the tests that will be used. For these field tests, the method detection limits are equivalent to the method reporting limits (Table 14). Samples found to be less than these values will be reported as "below MRL." Samples that are measured as higher than the highest calibration standard will be diluted with distilled water and re-run. The Relative Percent Difference (RPD) on replicate

samples should generally be less than 20% (except for blanks)[11]. If this guideline is exceeded in field samples, an instrument calibration or standard check will be executed to determine if the instrument is operating properly.

Laboratory analyses will be subjected to numerous procedures to assess quality assurance objectives. The contract laboratory used in this testing will be a California Accredited Lab certified by the Environmental Laboratory Accreditation Program (ELAP). Sample accuracy will be tested by comparing sample concentrations to spiked matrix concentrations. Relative standard deviations on repeat analyses will be used to determine instrument precision. The examination of QA/QC parameters including accuracy, precision, and sample contamination will build confidence in data and trends observed throughout the pilot testing.

Results from the QA/QC analyses performed in the field and laboratory will be reviewed with each monthly summary of data provided by Hazen and Sawyer to West Basin. Any data values falling outside of acceptable ranges for QA/QC will be noted.

IX. Data Reporting, Data Reduction and Data Validation

A. Data Reporting Requirements and Deliverables

Field data measured by Hazen and Sawyer will include alkalinity, calcium, pH, temperature, conductivity, dissolved oxygen, turbidity, ORP, total chlorine, and nitrite. The measurements will be recorded in a field log book and entered into Microsoft Excel each week.

Laboratory data that will be reported to Hazen and Sawyer include metals, bromide, boron, chloride, sulfate, TOC, TTHM, HAA5, and NDMA. Weck Laboratories provides results with normal turnaround times of 10 to 15 working days.

Hazen and Sawyer will gather all data and prepare summary tables and graphics to characterize the findings of the pilot tests on a monthly basis. Pre-established quality assurance procedures in the following section will be used to validate and confirm the data.

[11] USEPA, 2010. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review. USEPA-540-R-10-011.

B. Data Validation Procedures

The types of QA/QC samples include the following:

- **Duplicate samples:** Used to assess sample representativeness and analytical precision (5% of all samples sent to the laboratory and performed in the field).
- **Field blank samples:** Used to determine the practical method detection limit of the analytical procedure and to detect potential problems in the sample collection and preservation methods (5% of all samples)
- **Matrix spike samples:** Used to assess the accuracy of laboratory procedures in at least 5% of the samples.

QA/QC duplicate, field blank, and matrix spike or calibration frequencies are shown in Table 17. Duplicate samples will be collected for "R" samples (i.e., water that has recirculated in the loops as of Day 7) at the same time as the samples are collected for regular loop testing. Loops with duplicates taken will be systematically varied from week to week (e.g., for iron, UCI-1 then UCI-2, etc.). The number of QA/QC samples will be planned before samples are collected to ensure that 5% of total samples are tested for quality assurance.

Pipe loop field data will be routinely collected on-site using standardized log sheets. Log sheets will then be entered into the main project database.

Table 17. QA/QC Sampling Frequencies for Each Analysis

Analyte	Analytical Method	Analysis Location	Duplicate Sampling Frequency	Field Blank Frequency	Spike Analysis (%) or Calibration Frequency
Alkalinity	Hach 8203	Field	5% of samples	Once per analysis day	Monthly checks
Ammonia, Total	Hach 8155	Field	5% of samples	Once per analysis day	Monthly checks
Calcium	Hach 8204	Field	5% of samples	Once per analysis day	Monthly checks
Conductivity	SM 2510B	Field	5% of samples	Once per analysis day	Weekly calibration
Dissolved Oxygen	DO Probe	Field	5% of samples	Once per analysis day	Weekly calibration
Nitrite	Hach 8507	Field	5% of samples	Once per analysis day	Monthly checks
ORP	Hach 10228	Field	5% of samples	Once per analysis day	Weekly calibration
pH/Temperature	SM 2550/ SM 4500H-B	Field	5% of samples	Once per analysis day	Weekly calibration
Total Chlorine	Hach 8167	Field	5% of samples	Once per analysis day	Monthly checks
Turbidity	SM 2130B	Field	5% of samples	Once per analysis day	Monthly checks
Aluminum	EPA 200.8	Lab	5% of samples	Once per analysis day	5% of samples
Copper	EPA 200.8	Lab	5% of samples	Once per analysis day	5% of samples
Lead	EPA 200.8	Lab	5% of samples	Once per analysis day	5% of samples
Iron	EPA 200.7	Lab	5% of samples	Once per analysis day	5% of samples
Manganese	EPA 200.8	Lab	5% of samples	Once per analysis day	5% of samples
Boron	EPA 200.8	Lab	5% of samples	Once per analysis day	5% of samples
Bromide	EPA 300.1	Lab	5% of samples	Once per analysis day	5% of samples
Chloride	EPA 300.0	Lab	5% of samples	Once per analysis day	5% of samples
Sulfate	EPA 300.0	Lab	5% of samples	Once per analysis day	5% of samples
TOC	SM 5310B	Lab	5% of samples	Once per analysis day	5% of samples
TTHM	EPA 524.2	Lab	5% of samples	Once per analysis day	5% of samples
HAA5	EPA 552.2	Lab	5% of samples	Once per analysis day	5% of samples
Taste and Odor	Flavor Panel Analysis	H&S	5% of samples	Once per analysis day	N/A
NDMA	EPA 1625M	Lab	5% of samples	Once per analysis day	5% of samples

N/A – Not Applicable

Field data entered manually will be internally validated through Project Manager review compared with field sheets (at least 5% of entries). Calculations performed in a spreadsheet will be carefully examined by the Project Manager to ensure the accuracy of the formulas, data input, and results. After data has been validated and reduced, the files will be reviewed to ensure that the data are not suspect. Any QA/QC data that do not meet the acceptance criteria, either in the field or in the laboratory, will be flagged and either reported with an explanatory note or excluded from the data reduction if acceptable to the West Basin project manager.

C. Data Storage Requirements

Project data will be generated and duplicated in several locations for backup. Operational data, including flow rates and total volumes added to each tank, will be recorded on standardized log

sheets. Water quality data generated on-site will also be recorded on standardized log sheets. Water quality samples will be clearly identified on chains-of-custody to ensure correct identification of sample results returned from the contract laboratory. The standardized log sheets for water quality samples will include: sample identification number, name of person who collected the sample, date, time, sample volume, any pretreatment procedures, and sample preservation method. Project data on standardized log sheets and on contract lab reports will be entered into and will reside in the main project database. This file will serve many purposes including validation of data entry, central storage of all project data, and routine reduction and reporting of operational and water quality data. The weekly project data sheets will also be scanned and stored electronically. The main project database will be hosted on the data server at the Hazen and Sawyer office, which is routinely backed up and protected from viruses.

D. Data Interpretation and Statistical Analysis

Corrosion-related outcomes will be assessed by quantifying metals released to the water and water quality changes such as pH. The data will be evaluated by characterizing water quality changes over time in a single loop and by comparing loops to one another. In parallel with pipe loop water quality, baseline water qualities will be characterized in the source waters to allow evaluation of increases in constituents. Duplicate loops will also be useful in assessing the reproducibility of the loops and impacts of water quality.

The Tetra Tech RTW model will be used to calculate the CCPP and LSI from the water quality data collected in the pilot study. The CCPP and LSI calculations will use the following data collected during testing: temperature, pH, alkalinity, calcium, and ionic strength (monitored by conductivity and TDS). CCPP and LSI can be useful predictors of the tendency of calcium carbonate to precipitate. Positive CCPP and LSI values are indicative of precipitation rather than dissolution. The CCPP estimates the degree of oversaturation in mg/L as $CaCO_3$ of potential precipitation under equilibrium conditions. The calculations of CCPP and LSI will be conducted throughout the pilot study to observe changes over time.

X. Schedule

A. Pipe Loop Construction and Installation

The pipe loop system installation is planned for the first three weeks in March 2013. Once the pipe samples are harvested and placed in the pipe racks, water flow through the pipes will begin immediately as previously described.

Installation logistics include finalizing plans for site preparation; locating and accessing electrical supply and connection on site; carpentry and rack building; plumbing and pipe connections between the racks and pipes; setting up the pumps, tanks, and circulation piping; building the treatment skid to stabilize the desalinated water; setting up piping for the desalinated water; and configuring piping for discharge of waste.

Site preparation was complete by the end of February and includes relocation of the existing plants and the existing shade cover to clear the concrete pad (to be conducted by the LA Conservation Corps), assembly of temporary storage units for the control panel and chemicals, and storage and inventory of all delivered equipment and materials. The rest of the activities including woodwork, plumbing, and wiring began the first week in March. It is anticipated that during the design and installation period, approximately 3 weeks will be needed to complete the plumbing and woodwork. Hazen and Sawyer staff will complete all installation by the third week of March 2013.

The major tasks and responsible parties are listed in Table 18. Hazen and Sawyer will install the pipe loops, stabilization system, and secondary containment. United Water will contract with an electrician to provide power in a panel at the north side of the pilot testing site. United Water will also provide desalinated water and MWD water to the testing pad, and piping from the testing pad back to the neutralization tank.

Table 18. Tasks and Responsibilities

Task	Responsible Party
Order and set up pipe loop systems, including pumps, racks, tanks, and desalinated water stabilization	Hazen and Sawyer, with assistance from West Basin and United Water in receiving ordered items
Install and test secondary containment to prevent chloraminated water discharge to the storm drain	Hazen and Sawyer
Provide water from the RO system and MWD, and discharge piping overhead to the neutralization tank	United Water (subcontracting)
Install a transformer to provide an electrical panel	United Water (subcontracting to an electrical firm through existing West Basin contract)
Request that LA Conservation Corps clear the pad and a pathway to the pad from the driveway	West Basin

B. Weekly Schedule

The pipe loop testing is planned to be conducted for four months (from April 1 to August 1, 2013). Pipe loop testing activities are scheduled on a weekly basis (Table 19). Stabilized desalinated water will be prepared on Tuesdays. Groundwater will be collected on Wednesday mornings. Day 7 samples will be collected and analyzed on Wednesdays. Pipe loop tanks will be filled with fresh water and tested on Thursdays. Every effort will be made to complete field analyses on the day of sample collection. Chlorine residuals and nitrification parameters (ammonia and nitrite) will be monitored on Mondays.

Hazen and Sawyer or SPI staff will be onsite 4 days a week. At the beginning and the end of each shift when Hazen and Sawyer or SPI staff is not onsite, United Water will visit the pilot site and check for the following (notifying Nicole Blute or Lynn Grijalva should any be observed):

- Any leaks of water
- Pumps are all operation (flows are at desired set points)

Water flow rates in the pipe loops will be monitored by flow meters and recorded by Hazen and Sawyer engineers each of these days. All tanks, pipe segments and pumps will be inspected for water leakage, abnormal noise and malfunction by Hazen and Sawyer, SPI, or United Water

staff. Any problems noted should be reported to the Hazen and Sawyer Project Manager or Field Coordinator. All information will be recorded in a Pipe Loop O&M log that will be kept onsite.

Table 19. Logistics of Pipe Loop Testing on a Weekly Basis

	Monday (Day 5)	Tuesday (Day 6)	Wednesday (Day 7)	Thursday (Day 1)	Friday (Day 2)
Preparation of Water Sources		• Empty remaining water from stabilization tank • Prepare fresh desal. water in stabilization tank	• Collect groundwater • Contingency day for preparing desal. water	• Check & adjust stabilization tank • Isolate, drain & refill pipe loop tanks • Field & lab sampling of freshly filled tanks • Adjust residual in pipe loop tanks if necessary	
Recirculated Water	• Field sampling for residuals & nitrification		• Sampling of recirculated water in tanks, including field and laboratory analysis	• Open tanks to start recirculation, divert first flush (volume of pipes) to waste, then begin closed loop recirculation • Contingency day for field analyses	
Stagnant Water	• Field sampling for residuals & nitrification		• Between 6 and 12 hours after stagnation began, collect samples from brass meter then copper pipe	• Contingency day for field analyses	
Data Analysis	• Planning and coordination for the week				• Data analysis & QA/QC

Appendix F contains a master schedule for the project.

XI. Health and Safety

Personal protection gear will be stored on site. Any person who deals with chemicals should wear the proper personal protection gear, including goggles, nitrile (non-talc) gloves, face shield, and an apron, depending on the chemical. Limited quantities of chemicals will be stored in labeled and locked cabinets with secondary containment, including 1% sulfuric acid

(up to 4 Liters), 6% sodium hypochlorite solution (up to 1 gallon), and 10% ammonia solution (up to 1 Liter) and 20% caustic soda (up to 1 Liter). Acid will be stored separately from sodium hypochlorite, ammonia and caustic soda. Any chemical waste resulting from field analysis shall be disposed to the 500 gallon wastewater tank and subsequently to the sanitary sewer via the Neutralization Tank. Hazardous waste shall be disposed separately through the existing United Water OWDDF hazardous waste program. United Water's health and safety plan for the OWDDF and Materials Safety Data Sheets (MSDS) for the reagents and chemicals that will be used are included in Appendix G.

The OWDDF site has a safety shower and eye wash facility at the locations depicted in Figure 6. Additional eye wash bottles will be provided to Hazen and Sawyer and SPI staff within reach whenever chemicals are being used. The route to the nearest hospital emergency room is shown in Figure 7.

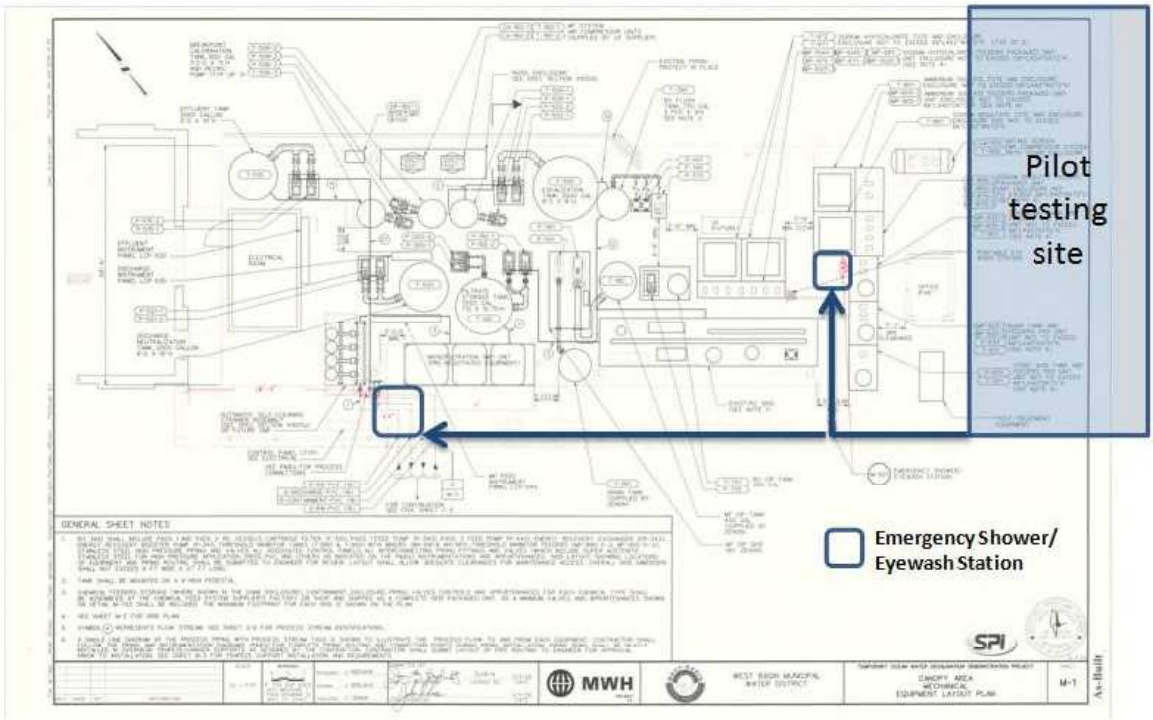


Figure 6. Location of Safety Shower and Eye Wash in Relation to the Pilot Testing Site

XII. Responsibilities and Contacts

Table 20 summarizes the tasks and responsibility for the pipe loop testing. Contact information for all key staff is included in Table 21.

Table 20. Tasks and Responsibilities for Pipe Loop Testing

Task	Responsible Party	Contact
Overall Project Management	West Basin and Hazen and Sawyer	Justin Pickard and Nicole Blute
RO permeate generation	United Water	Kevin Tirado
RO stabilization	SPI	Sylvana Ghiu
Groundwater collection and delivery	Hazen and Sawyer	Kenny Chau
Coordinate groundwater collection	City of Manhattan Beach	Brian Wright
Pipe loop operations	Hazen and Sawyer	Ying Wu & Kenny Chau
Water quality testing, including field analysis and lab sampling.	Hazen and Sawyer	Ying Wu & Kenny Chau
Wastewater discharge from the neutralization tank to the sewer	United Water	Kevin Tirado
Laboratory analysis	Weck Laboratories	Marilyn Romero
Data analysis and management	Hazen and Sawyer	Ying Wu & Kenny Chau

Table 21. List of Contacts for Integration Study Implementation

Name	Title and Organization	Project Involvement	Contact
Justin Pickard	West Basin	Project manager	Cell – 310-418-5654, Office – 310-660-6219, JustinP@westbasin.org,
Diane McKinney	West Basin	Oversight	Cell – 310-892-8230, Office – 310-660-6226, dianem@westbasin.org
Marc Serna	West Basin	Oversight	Cell – 213-500-1919, Office – 310-660-6213, MarcS@westbasin.org
Sun Liang	MWD	MWD representative	Office – 909-392-5273, sliang@mwdh20.com
Karen Scott	MWD	Bench testing manager	Office – 909-392-5075, kscott@mwdh2o.com
Monica Tirtadidjaja	MWD	Bench testing engineer	mtirtadidjaja@mwdh2o.com
Lynn Grijalva	Hazen and Sawyer	Principal in charge	Cell - 213-505-6723, Office – 213-765-0251, lgrijalva@hazenandsawyer.com
Nicole Blute	Hazen and Sawyer	Project manager	Cell – 310-266-6212, Office – 213-765-0251, nblute@hazenandsawyer.com
Gary Iversen	Hazen and Sawyer	Pipe loop design and construction	Cell – 919-219-7744, giversen@hazenandsawyer.com
Ian Mackenzie	Hazen and Sawyer	Pipe loop design and engineering	Cell – 213-248-8465, Office – 213-765-0251, imackenzie@hazenandsawyer.com
Ying Wu	Hazen and Sawyer	Field operations manager	Cell – 310-280-6143, Office - 213-765-0251, ywu@hazenandsawyer.com
Kenny Chau	Hazen and Sawyer	Field operations	Cell – 626-592-5113, Office – 213-765-0251, kchau@hazenandsawyer.com
Kevin Tirado	United Water	Desalination water provider	Cell – 310-901-4535, Office – 310-426-6149, kevin.tirado@unitedwater.com
Gerry Filteau	SPI	Integration planning	Cell – 619-981-1100, Office – 760-400-3650 ext. 219,gfilteau@spi-engineering.com
Silvana Ghiu	SPI	Field operations for RO stabilization	Cell – 813-928-2962,Office – 760-400-3650 ext. 230,sghui@spi-engineering.com
Marilyn Romero	Weck Laboratories	Lab analysis	Office - 626-336-2139, marilyn.romero@wecklabs.com
Brent Scheiwe	SEA Lab	Site coordination	bscheiwe@lacorps.org
Brian Wright	City of Manhattan Beach	Coordination of groundwater collection	bwright@citymb.info

Highlighted staff cell phone numbers should be used as the primary contacts for emergencies on site.

In case of emergencies on site, please call 911 if in need of medical assistance. The nearest hospital is Little Company of Mary at 4101 Torrance Blvd, Torrance, CA. A map is provided on the subsequent page.

mapquest

Trip to:

Providence Little Company of Mary
4101 Torrance Blvd
Torrance, CA 90503
(800) 618-6659
2.94 miles / 7 minutes

Notes

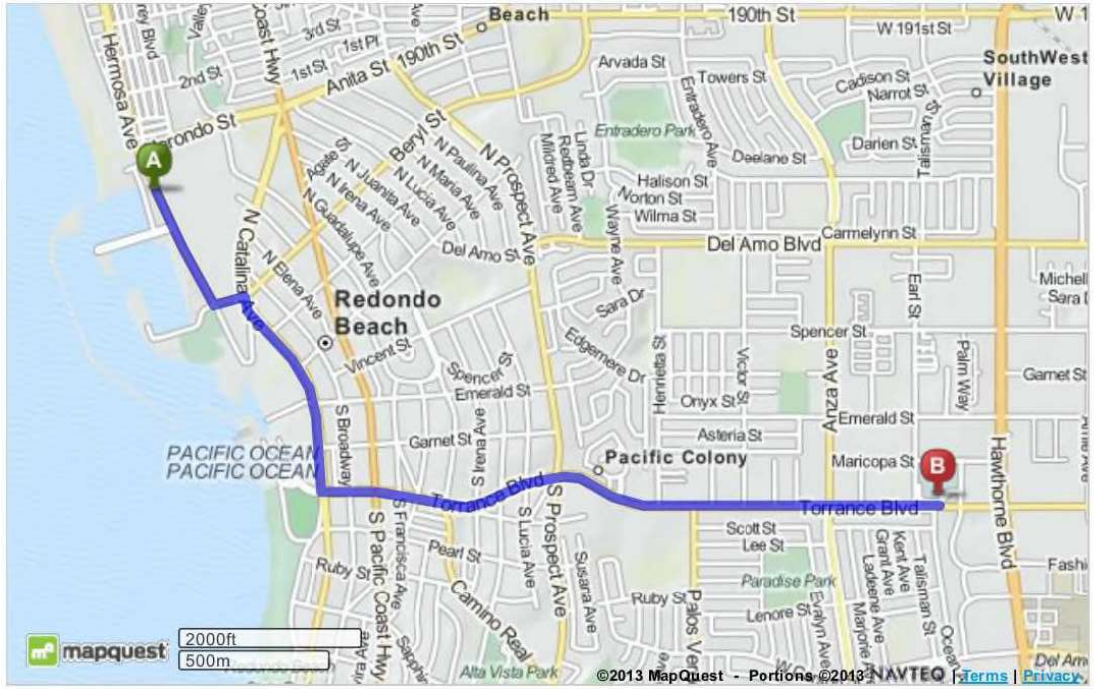


Figure 7. Driving Directions to the Nearest Hospital Emergency Room

HAZEN AND SAWYER
Environmental Engineers & Scientists

Appendix A

Task 4 – Pipe Harvesting Plan

April 15, 2013

HAZEN AND SAWYER
Environmental Engineers & Scientists

Technical Memorandum

To: **West Basin** – Justin Pickard, Diane McKinney, Frank Fuchs, and Marc Serna

cc: **MWD** – Sun Liang; **Cal Water –** Ron Sorensen

From: **Hazen and Sawyer** – Lynn Grijalva, Nicole Blute, Ying Wu, Kenny Chau, Bill Becker, and Brian Porter

Reviewers: **Technical Experts –** Frank Baumann, Michael J. McGuire, and Michael Schock

Task 4 - Pipe Harvesting Plan –

Draft submitted January 31, 2013
Updated Draft submitted February 28, 2013
Final April 15, 2013

Introduction

West Basin Municipal Water District (West Basin) is conducting a Desalination Water Quality Integration Study in partnership with Metropolitan Water District of Southern California (MWD). The study examines the effects of introducing a new water source using desalinated water into distribution systems that have been exposed to MWD water and local groundwater sources (e.g., California Water Service Company (Cal Water), City of Manhattan Beach, City of El Segundo, and Golden State Water Company Southwest District). The Integration Study is comprised of 8 tasks and is anticipated to be completed by December 2013. This memorandum provides the deliverable for Task 4, which is the Integration Study Pipe Harvesting Plan.

Task Objectives

The objective of Task 4 is to determine the pipe materials that currently exist in the potable water distribution systems of interest and to outline the procedures for extracting and transporting pipe to the study site at the SEA Lab in Redondo Beach. This pipe harvesting plan includes the selection of pipe materials and sources; pipe handling and transportation

requirements; and a schedule for pipe harvesting and pipe loop construction. Pipe harvesting will be performed by a contractor with oversight provided by Hazen and Sawyer.

Identification of Materials for Testing

A number of potential conveyance and desalinated water introduction alternatives have been identified in the West Basin Ocean Water Desalination Program Master Plan (September 2012). The location that the desalinated water will enter the distribution system will depend on the location of the desalination facility, the size of the facility, and other decision points that are described in the Master Plan, including preliminary pipe alignments, sizes, lengths, and pump requirements. The primary conveyance schemes identified include connection into the West Basin Feeder (West or East Ends) or West Coast Feeder. Potential distribution systems likely to receive the desalinated water supply at the West Basin Feeder or West Coast Feeder (depending on the selected conveyance scheme) include Cal Water's Hermosa-Redondo system, the City of Manhattan Beach, the City of El Segundo, and Golden State Water Company's Southwest District (Gardena).

The first step of this task was an investigation of predominant pipe materials in the recipient distribution systems. Table1 shows the distribution of materials, indicating that the systems are comprised primarily of cast iron pipe and asbestos cement lined pipe (including transite, a type of asbestos-cement). Other less significant quantities of piping include ductile iron, PVC, steel, and others.

Initially, Cal Water's Hermosa-Redondo distribution system was targeted for pipe harvesting of cast iron distribution mains, but a closer analysis revealed that the Hermosa-Redondo system cast iron pipe is clay-lined. The nature of this clay lining (including whether it was still coating the pipes) was not known. To provide a worst case condition of the pipes (i.e., full degradation of clay lining) and also represent unlined cast iron in this study, the City of Manhattan Beach distribution system was investigated by West Basin to determine if unlined cast iron mains were present.

The City of Manhattan Beach's distribution system consists primarily of cast iron pipe, followed by smaller quantities of ductile iron, steel, transite and plastic piping materials as shown on Table 1. Most of the system pipe sizes are 6", followed by 8" and 4". The City of Manhattan Beach is currently replacing cast iron mains as a part of its Water Master Plan Capital

Improvement Program. A section of 6" cast iron main was extracted from the distribution system to investigate the pipe lining and tuberculation. Figure 1 shows the significant orange and black deposits in the pipe, indicating iron and manganese compounds.

Figure 1: Interior of 6" Unlined Cast Iron Pipe from the Manhattan Beach Distribution System

The other three potential recipient customers, Cal Water Hawthorne, El Segundo, and Golden State Water Company's Southwest District (Gardena), were comprised of similar piping materials found in Manhattan Beach and Cal Water Hermosa Redondo.

MWD's distribution system consists primarily of cement mortar-lined welded steel pipe. New cement mortar-lined pipe offers a good representation of the corrosivity potential of a water source toward mortar lining.

Table 1: Characteristics of Potential Desalination Water Recipient Distribution Systems

	Manhattan Beach[1]	Cal Water Hermosa Redondo	Cal Water Hawthorne	Golden State Gardena	El Segundo	Metropolitan Water District of Southern California
Linear Feet of Pipe	558,000	1,103,000	300,000	2,429,000	303,400	-
Predominant Size Pipe	4 – 8"	4 – 8"	4 – 8"	4 – 12"	6 – 10"	-
Composition of Pipe Materials*	72% Cast Iron 22% Ductile Iron 2% Unknown 1% A-C 1% Steel 1% Other	55% A-C 24% Cast Iron 5% Ductile Iron 5% PVC 10% Other	35% A-C 31% Cast Iron 23% Transite 10% Other 1% Unknown	47% Cast Iron 31% A-C 13% Ductile Iron 19% PVC and Steel	Information not available	Cement mortar-lined welded steel
Age of Pipe	Mainly 1950s or earlier	*Uncertain*	*Uncertain*	33% built in 1950s; 21% pre-1950s; Remainder post-1950s	35% built in 1950s; 16% pre-1950s; 18% in 1960s; 15% in 1970s	-
Water Sources	2 wells (manganese levels blended down with a minimum of 25% MWD water), 1 WB turnout (WB-4)	3 groundwater wells (with greensand treatment) of which 2 are active, 4 WB turnouts	1 groundwater well (with aeration, coagulation, greensand), 2 WB turnouts	9 groundwater wells (*unknown status of treatment,if any*) and 13 WB turnouts	2 WB turnouts	State Water Project and Colorado River
Notes	MB is undergoing a campaign to replace cast iron pipe with CML ductile iron	This system plans to put treatment (NF) on the wells due to high TDS	The majority of 4" pipe is cast iron; pipe 6" and larger is predominantly A-C	None	None	None

* Pipe materials comprising less than 5% of system materials are included in "Other" category.

[1] Source: AKM Consulting Engineers. October 2010. City of Manhattan Beach Water Master Plan.

Materials for the pipe loop testing were selected to represent the different types of piping materials likely to be found in the recipient distribution systems described above. Pipe and distribution materials, including harvested pipe and some new materials, identified for testing are listed in Table 1.

Table 2: Materials to be Tested in the Integration Study and Rationale for Selection

Materials	Source	Rationale
Cement Mortar-Lined (CML) Steel Pipe	New pipe	Cement mortar-lined pipe will reflect water corrosivity toward cement, concrete and asbestos cement pipe. New pipe will be most susceptible to corrosion as the pores are open and no scale has been deposited to protect the mortar lining; evaluation of pitting and cracking will also be possible for the new pipe.
Unlined Cast Iron Pipe	Harvested from the distribution system	Tuberculated, old iron pipe is susceptible to causing colored water if water is corrosive. New iron pipe is lined, so testing is needed on unlined pipe harvested from the distribution system.
Copper Pipe	New pipe	Copper pipe is commonly used in household plumbing. Evaluation of copper corrosion will be possible for new pipe, and copper release from new pipe is expected to present a worst-case leaching scenario if the water is not properly stabilized.
Lead Components, including Lead Solder and Brass Meters	New solder, Harvested brass meters	Lead solder may be present in older distribution systems, although harvesting of household plumbing can be logistically difficult. As a result, newly soldered joints will provide surfaces to test susceptibility of joints to lead release in this study. Harvested brass meters will also be tested to investigate corrosivity of the water with materials in the distribution system, which are expected to have a higher lead content than new brass materials.

Overall Testing Plan Approach

Figure 2 presents a schematic of the pipe loops that will be tested. Multiple pipe loops will be used for each type of pipe/material to test the impact of water quality changes in a side-by-side test. Additional detail will be provided in a forthcoming Task 5 Pipe Loop Design and Installation Technical Memorandum and the Task 6 Water Quality Testing Plan.

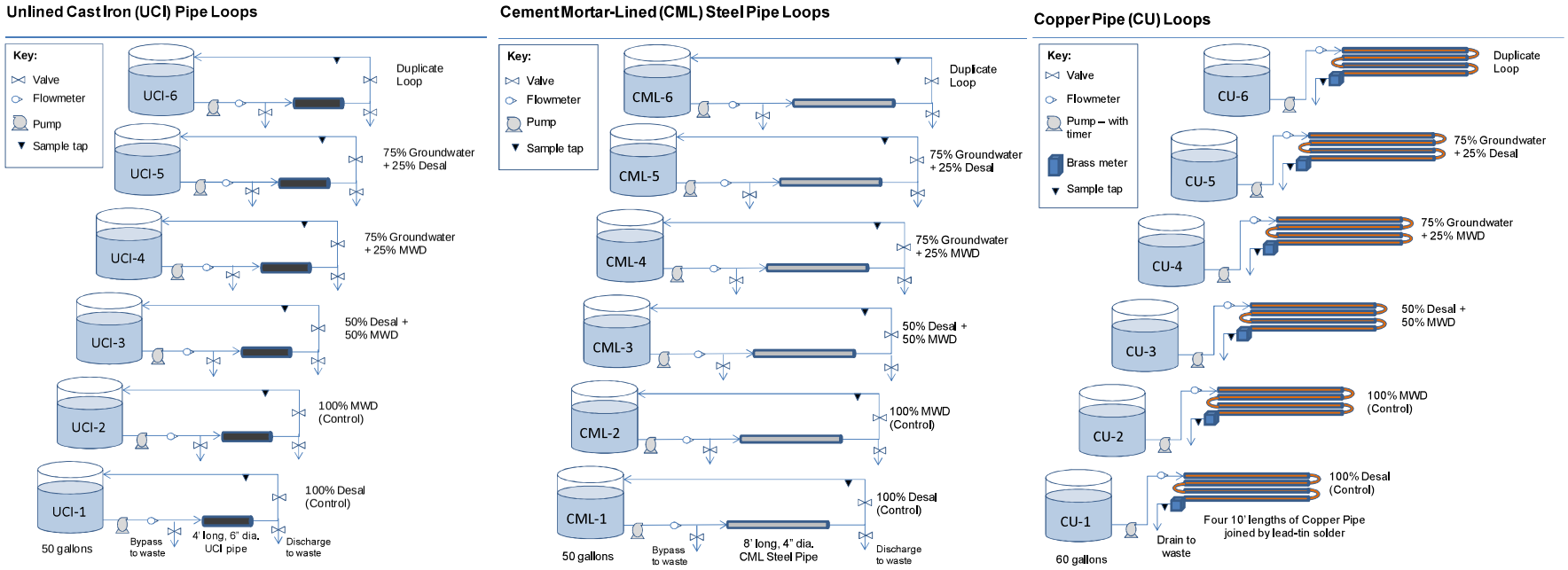


Figure 2: Integration Study Pipe Loops

Note: UCI and CML pipe loops will continuously circulate water for 6 days, then the water will be replaced on the 7th day. Copper pipe will operate in a flow-through manner with 0.5 hrs of flow, 11.5 hours of stagnation, 0.5 hours of flow, etc. Additional water will be available in the copper loops to support the flow-through operation.

Sources of Pipe and Meters

Specific piping types and size were selected by balancing the study objectives with study testing site constraints and project budget. As presented in Table 2, a mix of new and harvested materials will be used. Pipe diameters representative of typical system components (on the low end of the range due to site size constraints) were selected, with 4" cement mortar-lined steel pipe, 6" unlined cast iron pipe, and ¾" copper pipe. Using information gained from a prior pipe loop study[1] , lengths of pipe sections were chosen to simultaneously (1) provide sufficient pipe surface area to water volume to be able to observe build up constituents representing corrosion occurrence (e.g., aluminum from CML pipe, iron and from UCI), (2) provide sufficient surface area so that the impact of variability from pipe surfaces is minimized, and (3) enable testing on the available space at the pilot site for the number of pipe loops desired.

Cement Mortar-Lined Pipe:

New 4" internal diameter cement mortar-lined (CML) steel pipe will be purchased from a local supplier, Ferguson Waterworks. The pipe will meet AWWA C104 specifications for cement mortar-lining, consisting of a minimum of 1/16" thickness. In some systems, sealant is applied to cement mortar-lining if water is expected to be corrosive; however, no sealant will be used in this testing since pipe in the ground is unlikely to have the sealant and MWD does not use sealant on their concrete pipes.

Blute et al. (2008) found that use of 20' of CML pipe with 200 gallon water tanks revealed leaching of aluminum when the desalinated water was not sufficiently stabilized. Smaller site availability at West Basin necessitated decreasing the length of piping, so the volume of water was also scaled down. A direct scaling of 50 gallons of water would translate to 5' of pipe. The length of pipe selected for this study was increased from 5' to 8' since pipe since the CML pipe is available in 18' lengths, resulting in two 8' segments that can be obtained from one piece of pipe when the ends are removed.

[1] Blute, K.N., McGuire, M.J., West, N., Voutchkov, N., Maclaggan, P. and Reich, K., 2008. "Integration of Desalinated Seawater into a Distribution System". *J. AWWA*, 100:9:117-131.

The 8' long 4" diameter CML pipes will be cut by Ferguson and delivered to the site. Hazen and Sawyer will connect the CML pipe to PVC piping on each end to enable water recirculation for the study. All work completed by the Ferguson will be billed through Hazen and Sawyer.

Unlined Cast Iron Pipe:

Based on the same rationale for CML pipe lengths, six 8-foot lengths of 4" diameter unlined cast iron (UCI) pipe will be harvested from the City of Manhattan Beach distribution system. Hazen and Sawyer will contract with the contractor currently providing services to the City of Manhattan Beach for pipe replacement – Vido Samarzich Inc. (Alta Loma, California).

Figure 3 provides the location where the harvesting will occur. A 6" pipe length extracted from 8th Street near Sepulveda Blvd confirmed that pipe unlined and contains corrosion deposits.

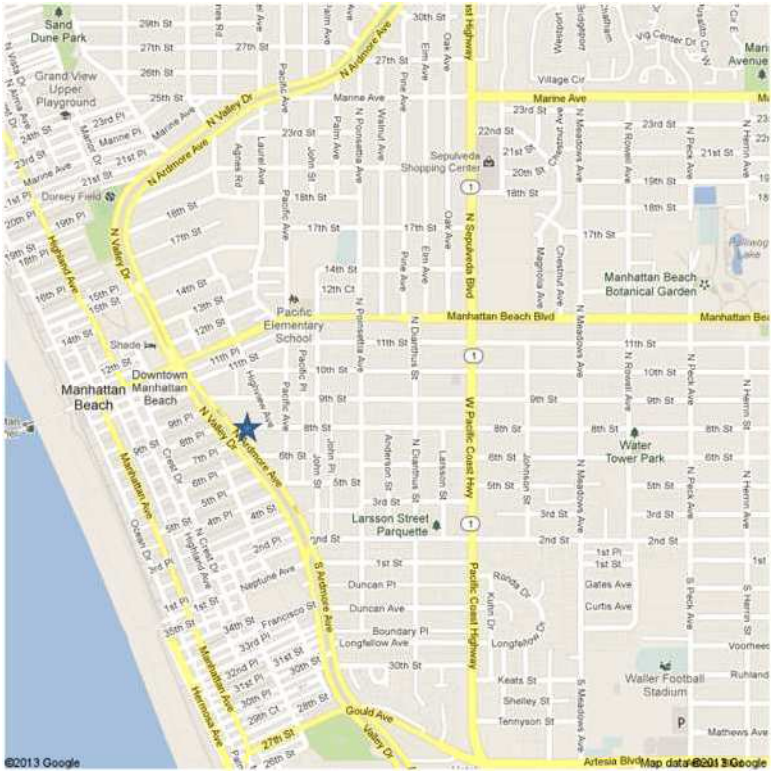


Figure 3: Preliminary Location Identified for Unlined Cast Iron Main Harvesting

Hazen and Sawyer will be present during the harvesting to ensure that the pipes are handled in accordance with the harvesting procedures to minimize scale disruption. Hazen and Sawyer

will also confirm that the contractor has available the couplings needed to cap and connect the harvested pipe to the pipe loops, and will perform the capping in the field at the time of harvesting. The steps for harvesting the pipe are outlined in the Harvesting Procedures section of this memorandum.

Copper Pipe with Lead Solder and Harvested Brass Meters:

The final set of pipe loops will consist of 40' of ¾" diameter new copper pipe with 6 lead-tin soldered joints and a brass meter. A total of 40' of piping was selected to provide sufficient water for analytical testing. Type "L" copper pipe will be used for testing since this type of pipe is representative of typical household plumbing materials. All types will have the same surface properties, but thickness varies based on type. For a short duration study of 6 months, long-term pitting corrosion will not be evaluated so thickness is not of importance in testing materials selection.

New copper pipe was selected for testing rather than harvesting the pipe for a number of reasons. First, new copper pipe will allow for the observation of any changes on the pipe surfaces. Second, extraction of household plumbing can be problematic for a water utility since it would involve access to a home. Third, the use of lead soldered joints is not assured in existing households and may not be comparable between households. For these reasons, new copper pipe with lead solder was selected for testing.

Lead and leaded plumbing materials will also be tested. Prior to 1990, lead solder was common in joining copper pipes, and "lead free" brass such as that used in brass meters and faucets could contain up to 8 percent lead by weight under the 1996 Amendments to the Safe Drinking Water Act[2]. The rationale for including six lead-tin soldered joints in 40' of piping is that this configuration typifies household installations. Nine lead-tin soldered joints out of the 13 joints in the pipe loop will be included, with the balance prepared from inert solder to avoid over-representing the potential for lead leaching[3].

[2] USEPA 2003. Revised Guidance Manual for Selecting Lead and Copper Control Strategies.
[3] Note that no guidance was found on "typical" household installations, but hard copper pipe is sold in 10 or 20 foot lengths, and our pilot plant constructor's experience is that households commonly have about 6 to 10 joints in a 40 foot length of copper pipe.

A harvested brass meter will be included in each pipe loop, since pipe loop testing at Carlsbad showed that brass meters can release more lead into the water than soldered joints[4,5]. Brass meters will be harvested from the Manhattan Beach distribution system rather than purchased new since older installed meters will have a higher lead content given the new lead-free regulations on brass drinking water system components. California passed a law effective in 2010 that requires wetted surfaces of pipes, fittings, or fixtures to have less than 0.25 percent lead (and solder less than 0.2 percent lead).[6]

Preparation for Pipe Harvesting

A number of steps must be performed in preparation for the pipe harvesting. The City of Manhattan Beach has agreed to waive the typical plan check and permitting process for the pipe harvesting work as it is anticipated that the pipe removal will be incorporated into the City's CIP water main replacement project, for which permits have already been issued. The City has installed replacement PVC pipe with the intention of abandoning the UCI in place, and plan to begin use of the new pipe in approximately one month. These events offer the chance to rapidly execute the pipe harvesting if the efforts piggyback on the City's existing program.

Prior to the pipe harvesting, Hazen and Sawyer will begin constructing the pipe loops (with the exception of the harvested materials) to allow for quick installation of the UCI and brass meters following the pipe harvesting. The loops will be prepared so that the pipe remains without water for as short of a time as possible to minimize disruption to the existing scale.

Harvesting Procedures

The following procedure will be used to extract existing pipe segments from the City of Manhattan Beach for the purpose of a pipe loop study through pilot-scale testing:

- Six 4' segments of 6-inch UCI pipe will be harvested from the distribution system, with advance testing to ensure that the pipe is unlined. The pipe will be visually inspected to

[4] Blute, K.N., McGuire, M.J., West, N., Voutchkov, N., Maclaggan, P. and Reich, K., 2008. "Integration of Desalinated Seawater into a Distribution System". *J. AWWA*, 100:9:117-131.
[5] American Water Works Association Research Foundation. 1996. Internal Corrosion of Water Distribution Systems. 2nd Edition.
[6] California Department of Toxic Substances Control. 2011. Fact Sheet: Requirements for Low Lead Plumbing Products in California. http://www.dtsc.ca.gov/PollutionPrevention/upload/lead-in-plumbing-fact-sheet.pdf

ensure that pipe is fairly uniform in appearance with respect to tuberculation, and is not leaking. Photographs will be taken of all phases of the pipe harvesting work.

- Any shock or disturbances to the pipe sections shall be prevented or mitigated during the excavation process to ensure that existing scale buildup within the pipe is kept intact. Hand shovels shall be used when clearing soil in the surrounding area of the pipe sections to minimize these impacts.

- The pipe order, orientation (e.g. up, down) and flow direction will be labeled on the pipe prior to pipe excavation. The outer crust of the pipe will be carefully scraped off, which will allow duct tape to adhere onto the pipe surface.

- The harvested pipe shall be drained and cut into six 4-foot long segments on the site by the contractor. Each section shall be handled with care to prevent any bending or flexing during transport to the pilot plant site.

- After cutting, the contractor will immediately cap pipe segments on both ends to maintain humid conditions within the pipe to keep the scale damp. Layers of scale will slough off if the scale dries out, which is to be avoided.

- While harvesting the UCI pipe, existing copper connections shall be visibly inspected to determine if scale formation or corrosion is present.

- The pipes will be placed onto a flatbed truck or trailer and transported to the pilot plant site. Precaution shall be taken to limit any vibration on the pipes by securing each segment down. Water will be completely drained from the pipes to prevent potential sloshing of residual water which could destroy the scale structure.

- Upon arrival at the pilot plant site, the pipes shall be immediately assembled and the pipe loop study shall commence to ensure that the scale formation in the pipes is preserved. If fully conditioned desalinated water is not yet available, MWD water will be circulated in the pipes for 6 days then replaced with fresh MWD water, until the desalinated water is available for testing.

- Six brass meters will be harvested the same week as the UCI pipe by the City of Manhattan Beach. These meters will be all of the same decade and approximate water meter reading, if possible.

Harvesting Schedule

To maintain the overall project schedule, the harvesting is planned for the third week in March 2013. Hazen and Sawyer and West Basin are currently working with the City of Manhattan Beach to coordinate the pipe harvesting work with the ongoing CIP water main replacement project.

HAZEN AND SAWYER
Environmental Engineers & Scientists

Appendix B

Task 3 – Literature Review, Survey of Desalination Plants and System Integration

May 13, 2013

HAZEN AND SAWYER
Environmental Engineers & Scientists

Technical Memorandum

To: **West Basin** – Justin Pickard, Diane McKinney, Frank Fuchs, and Marc Serna

cc: **MWD** - Sun Liang, Karen Scott, and Monica Tirtadidjaja

From: **Hazen and Sawyer** – Lynn Grijalva, Nicole Blute, Ying Wu, and Kenny Chau

Reviewed by: Subconsultants and Technical Advisors – Bill Becker (Hazen and Sawyer), Gerry Filteau (SPI), Michael McGuire (Michael J. McGuire, Inc.), Frank Baumann (FJB Water Technology), Michael Schock (USEPA)

Task 3 - Literature Review, Survey of Desalination Plants and System Integration

Draft submitted February 1, 2013
Final submitted May 13, 2013

Introduction

West Basin Municipal Water District (West Basin) is leading a Desalinated Water Quality Integration Study in partnership with Metropolitan Water District of Southern California (MWD). The purpose of the study is to examine the impacts of a new, desalinated water source introduced into distribution systems that have been exposed to MWD water and groundwater sources. The project consists of 8 tasks and is anticipated to be completed by December 2013. This memorandum summarizes the findings of Task 3: Literature Review and Survey of Desalinated Plants and System Integration.

Prior to introduction into a drinking water distribution system, desalinated water requires post-treatment. This treatment involves the addition of some minerals back into the water to provide a water quality that is non-corrosive toward the various materials that can comprise a distribution system. In particular, desalinated water requires the addition of alkalinity (buffer capacity), calcium, and pH adjustment. Without post-treatment, the water can extract metals or cement from pipes, which can result in regulatory level exceedances, aesthetic concerns, and

infrastructure issues. With proper stabilization, full-scale experience has shown that a desalinated source can be integrated into a distribution system without incident.

This integration study will build upon prior work, described in this Technical Memorandum, by investigating not only stabilized desalinated water compared with Metropolitan Water District of Southern California (MWD) water, but also blends of the two waters and blends with local groundwater.

Task Objective

The objective of Task 3 is to review key literature on desalinated water post-treatment in terms of water quality targets for corrosion control. Findings were then explored in more detail by surveying a number of utilities to better understand their stabilization methods, target water quality, and effectiveness of post-treatment for corrosion control in full-scale plants and distribution systems. The results of this task were used to choose primary water quality parameter operating target ranges for the integration study's desalinated water supply. The ultimate purpose is to demonstrate post-treatment water quality that provides effective corrosion control in piping/plumbing types found in communities that might receive desalinated water.

For context, the current supply provided by West Basin to its customers, via Metropolitan Water District of Southern California, practices corrosion control through adjustment of pH, alkalinity and calcium primarily to achieve a positive Langelier Saturation Index (LSI) and Calcium Carbonate Precipitation Potential (CCPP). Surrounding purveyors of groundwater, such as the City of Manhattan Beach and the California Water Service Company (Hawthorne and Hermosa Redondo Districts), do not specifically alter the water for corrosion control purposes.

Approach

This task consists of two components: a literature review and a survey of desalination installations to answer questions that arose in the literature review.

Literature Review:

A literature review was conducted through search of publications on desalinated water post-treatment or stabilization, including, but not limited to text books, journal articles and published guidelines (desalinated water stabilization and guidance specific to applicable regulations, such as the Lead and Copper Rule). Specifically, the publications were identified by utilizing internet search engines (e.g. Google), online databases (e.g. Google Scholar, Web of Knowledge) and scientific libraries (e.g., AWWA Water Library and UCLA libraries). Search criteria focused on stabilization of desalinated water.

The publications identified in the literature search were screened and selected for detailed review if they provided specific water quality targets or data for desalinated water post-treatment or stabilization, or described corrosion experiences of existing desalination treatment plants. In addition, a report provided by MWD entitled "Assessment of Existing Seawater Desalination Integration Practices," which summarizes a survey of ten desalination plants and utilities around the world, was also reviewed.

A summary table was developed to characterize key water quality parameter targets found through the literature review to potentially impact corrosion of various distribution system materials. The water quality parameters related to corrosion control that were inventoried included alkalinity, calcium, Calcium Carbonate Precipitation Potential (CCPP), Langelier Saturation Index (LSI), pH, total dissolved solids (TDS) and chloride. Other water quality parameters were also summarized including boron, bromide, chlorine, since they can dictate the membrane operating strategy or desalinated water disinfectant stability and byproducts. Other information collected from the literature included post-treatment strategies for stabilization and disinfection, corrosion issues, and actions to mitigate corrosion. Additional discussion of disinfectant stability and potential byproduct formation will be provided in Task 7 Bench Scale Testing.

The following provides some additional information regarding corrosion control for specific materials:

Iron-Based Materials

Water quality parameters reported to have significant impacts on iron corrosion include pH, alkalinity and buffer capacity, dissolved oxygen (DO), and disinfectant residual (Sarin et al., 2003; Kashinkunti et al., 1999; Clement and Schock, 1998; Raad et al., 1998; Van Der Merwe, 1988; Pisigan and Singley, 1987; Stumm, 1960). While not as great in magnitude, salts such as chloride and sulfate can have an impact on iron corrosion.

pH, alkalinity, and buffer intensity are interdependent (Sarin et al, 2003), contributing to the maintenance of high pH at the pipe surface (Benjamin et al., 1996). Buffer intensity has been found to affect iron corrosion rates particularly for iron scales on pipe. Iron corrosion generally decreases as pH increases due to lower iron solubility and higher potential precipitation $CaCO_3$ (Burlingame et al., 2006; Sarin et al., 2003). Conversely, iron corrosion can be accelerated by a decrease in pH. Although higher pH waters demonstrated less iron release into the water, other indicators of iron corrosion of pipe, such as degree of tuberculation and pipe weight loass, have been shown to increase as pH increased (McNeill and Edwards, 2001; Stumm, 1960; Larson and Skold, 1958; Rice, 1947).

DO and disinfectant residual can also impact iron corrosion and release into solution. At equilibrium, measurable levels of DO and disinfectant residual provide driving force to minimize iron dissolution (Benjamin et al., 1996). Stagnant conditions in pipelines can yield red water, due to depletion of DO at the pipe surface followed by reduction of iron scale, release of ferrous, Fe(II), iron, and oxidation of the ferrous to red ferric, Fe(III), iron in the bulk water. As an electron acceptor, DO can increase corrosion rates (McNeill and Edwards, 2001), although DO can also oxidize ferrous iron such that iron release can be minimized because released iron can build up in tuberculation. Disinfectants, such as free chlorine, can also contribute to higher corrosion rates, but this can be balanced by control of microbially induced corrosion and oxidation of ferrous iron (McNeill and Edwards, 2001). On balance, oxidants usually minimize iron release (Burlingame et al., 2006).

LSI has been used as an indicator for corrosion. However, the AWWA manual on corrosion states, “In light of much empirical evidence contradicting the presumed connection between the [Langelier Index] and corrosion, this practice should be abandoned” (AWWARF and DVGW, 1996). The use of LSI for corrosion prediction has been gradually replaced by CCPP. The importance of CCPP specifically in predicting iron corrosion is not definitive (Benjamin et al.,

1996), although positive CCPP values indicate that pH and alkalinity values are relatively high, which minimize iron corrosion.

The literature is fairly sparse on the potential impacts of salts, such as chloride and sulfate, on iron corrosion. Changes in water quality, such as increases in chloride and sulfate have been reported to increase iron release (Benjamin et al., 1996). A study by Lytle et al. (2005) showed that an increase in chloride concentration by 100 mg/L significantly increased iron release from harvested 90-years old cast-iron pipes. The Larson Ratio has been invoked as a guide for minimizing iron corrosion from salts, described as:

LR = ([Chloride] + [Sulfate]) / [Bicarbonate]

With concentrations expressed as milliequivalents per liter (meq/L). In general, LR values of 5 have been recommended to limit corrosion (Lahav et al., 2012; WHO, 2008; Delon et al., 2004; Loewenthal et al., 2004), although limited information is available on mechanisms of corrosion in the presence of an elevated LR. In addition, Blute et al. (2008) showed that minimal iron corrosion was observed even in the presence of a high LR (i.e., LR = 8; calculated from chloride of 145 mg/L, sulfate of 3 mg/L, and alkalinity of 59 mg/L as $CaCO_3$, converted to meq/L). For West Basin desalinated water, stabilized desalinated water quality is expected to yield a LR of approximately 5, for a desalinated water containing 60 mg/L chloride, 50 mg/L sulfate, and 65 mg/L alkalinity as $CaCO_3$. By comparison, MWD water from Weymouth plant results in a LR of approximately 5, which does not yield reported issues with iron corrosion in the distribution system. Site specific testing is recommended if the balance of salts is in question with respect to corrosivity of the water.

Cement-Based Materials

Cement mortar linings on pipes are generally useful for the prevention of corrosion and leaching of unwanted metals from the pipe. $CaCO_3$ deposits form on the surface and in the pore structure of new cement mortar-lined pipe when the water has sufficient alkalinity. The formation of these deposits in the pore structure is necessary to protect the pipe from dissolving the calcium hydroxide component of the cement mortar (Douglas et al., 1996). New cement mortar linings can initially leach lime (calcium hydroxide), resulting in increased pH and calcium levels. The length of time required for this initial period depends on the aggressiveness of the water.

Degradation of cement-based materials can occur when water quality is aggressive toward calcium carbonate (indicated by a negative LSI or CCPP), which results from a combination of low alkalinity, calcium, and/or pH (Schock et al., 1996). Leaching of calcium hydroxide and aluminum can occur from cement mortar-lined pipe if $CaCO_3$ deposits are dissolved (AWWA and EES, 2002; Berend and Trouwborst, 1999; Douglas et al., 1996). Increases in pH, aluminum, calcium, and alkalinity are indicators of cement mortar lining corrosion (Schock et al., 1996), which may be most obvious with extended contact time under low flow conditions (Douglas et al., 1996). Corrosion rates vary for different types of lining and cement composition (Douglas et al., 1996; Berend and Trouwborst, 1999), although how cement-based materials could impact water quality would be similar in nature.

Other constituents that can cause degradation of cement-based materials include other ions such as sulfate, if present in very high concentrations. However, many ions are likely to be lower in desalinated water than current water sources. In addition, while sulfate has been shown to react with calcium aluminates in cement, sulfate concentrations required are about 400 mg/L or more (Schock et al., 1996) – an unlikely concentration in drinking water systems since the secondary MCL for sulfate is 250 mg/L.

Asphaltic seal coatings are now commonly applied to cement mortar-lined pipe to minimize corrosion and to control the rate of cement mortar curing. Testing has shown that use of asphaltic seal coatings can minimize pH increases that can occur initially (Douglas et al., 1996).

Copper Pipe

Copper pipe is a commonly used material in household plumbing, primarily owing to its resistance to oxidation. Corrosion of copper pipe converts metallic copper to cuprous, Cu(I), or cupric, Cu(II) forms, which can be present in water-soluble or precipitate form depending on pH, concentrations, and oxidation-reduction potential (ORP). Copper corrosion can be categorized as uniform (generalized) or non-uniform (localized) corrosion types.

Major water quality parameters that can influence copper corrosion include pH, alkalinity, chloride, sulfate, DO, and disinfectant residual. The two parameters that are most highly correlated and influential to copper corrosion are alkalinity and pH (Xiao et al., 2007). In general, copper corrosion decreases with an increase in pH (Xiao et al., 2007; Edwards et al., 1996; AwwaRF and DVGW, 1996; Stone et al., 1987). Uniform corrosion can occur as a result of

low pH values (e.g., less than 6, or when most copper compounds become soluble. Previous studies have shown that increasing alkalinity and copper release were linearly correlated (Edwards et al., 1996; Xiao et al., 2007). An approach of increasing alkalinity to control copper corrosion with the goal of increasing LSI is not recommended (Edwards et al., 1996), since high alkalinity can result in a positive LSI but also copper release. Alkalinity, pH, and calcium all contribute to $CaCO_3$ scale formation, which can help to prevent copper corrosion (Ferguson et al., 1996). Thus, a balance in water quality (e.g., positive CCPP, but not excessive alkalinity) must be attained to minimize copper release.

Anions can also affect copper solubility. An increase in the copper corrosion rate has been observed due to higher sulfate, nitrate, or perchlorate concentrations, independent of pH (Xiao et al., 2007; Edwards et al., 2001; AwwaRF and DVGW, 1996; Edwards et al., 1994). Sulfate has been implicated in pitting style corrosion. Solubility of copper can be increased as a result of higher chloride concentrations, with the impact of chloride on copper corrosion generally decreasing above pH 7. Bicarbonate ion increases corrosion rates after aging for waters with a pH of 7 or less, and decreases corrosion rates for waters with a pH of 8.5 or greater (Edwards et al., 1994).

Copper corrosion can be influenced by changes in DO (Stone et al., 1987). As DO increases, copper corrosion has been shown to increase in both new and aged copper pipes (Stone et al, 1987; Xiao et al, 2007). Oxygen or disinfectant residual can play the role of the primary electron acceptor, such that increasing concentrations can increase the copper corrosion rate (Stone et al., 1987; Ferguson et al., 1996). Conversely, the actual release of copper to the water (rather than the corrosion of copper and build up of copper precipitates on the pipe) has been shown to occur during stagnant periods typical of household use, when depletion of DO is occurring (Ferguson et al., 1996).

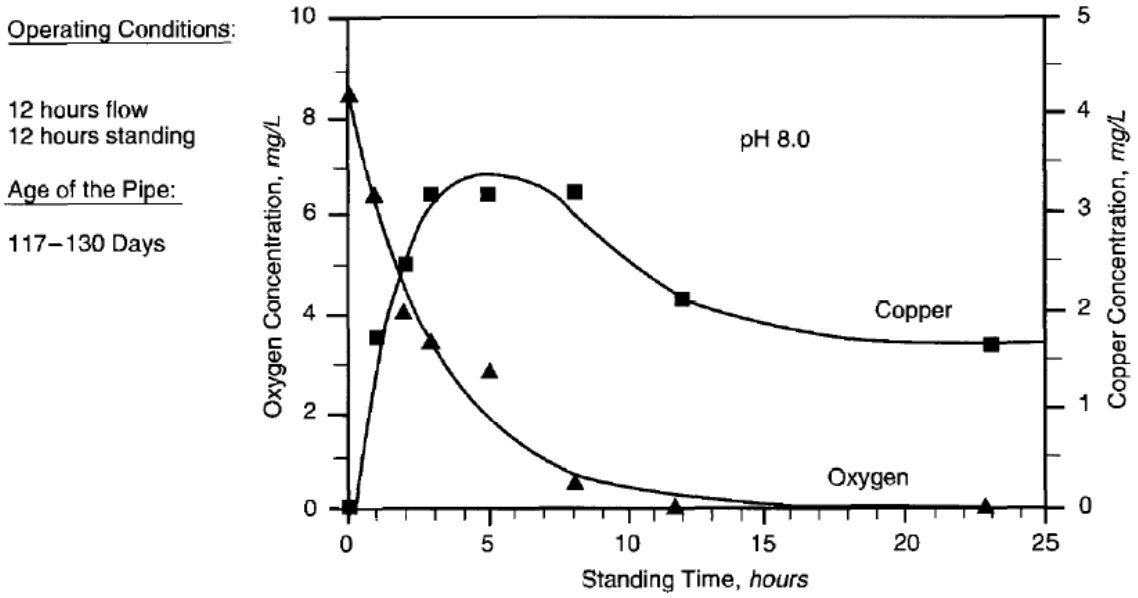


Figure 1. Ferguson et al. 1996

Other water quality parameters such as ammonia and natural organic matter might also affect copper corrosion (Schock, 1999). Ammonia can increase the solubility of copper compounds through complexation of Cu(I), even for ammonia concentrations of 0.5 mg/L above a pH of about 7.5; however, reports are mixed on whether copper-ammonia complex formation is significant with respect to copper release from pipes (Ferguson et al., 1996). Natural organic matter can complex copper, although studies have indicated that complexation with hydroxides or carbonates has a greater impact on copper speciation.

Finally, copper can also be impacted by erosion corrosion, which results from high velocities of water flow. This type of impingement corrosion prevents formation of protective scale and promotes pitting. Guidance for household plumbing is an upper limit of 6 feet per second in cold water pipes and 1.5 feet per second in hot water pipes that continuously circulate (Ferguson et al., 1996), although the presence of solids or gases in the water can reduce this safe velocity.

The cumulative effect of all of the possible impacts of anions and other constituents on copper corrosion is clearly complex. Testing is hence of significant use in assessing likely outcomes in copper corrosion and release to the water.

Lead Solder

Lead chemistry in a drinking water distribution system and in households involves the interaction of soluble complexes and an array of lead and non-lead precipitates (typically lead carbonates in drinking water systems). Release of lead into drinking water is generally controlled through the formation of a "passivating film" on lead surfaces that limits solubility of the lead compounds into the water as well as oxidation of the lead surfaces by DO or disinfectant (Schock et al., 1996). pH is a critical water quality parameter for lead leaching from lead-tin solders (Lee et al., 1989). pH below 8 has been correlated with greater lead leaching from lead-tin solders (Schock, 1999; Lee et al., 1989), whereas lead leaching is reduced at pH values between 8 and 8.5 (Lee et al., 1989; Trussell 1985). Alkalinity is another important factor affecting corrosion (Lee et al., 1989), in that the passivating film formation is enabled with sufficient alkalinity, pH, and calcium.

Anions such as sulfate, chloride, and nitrate, are not expected to significantly impact the formation of the passivating film. In addition, lead carbonate complexation is much stronger and likely compared with complexation of lead with sulfate, chloride, or nitrate (1996). However, some work has shown that high chloride values relative to sulfate (chloride to sulfate mass ratio, CSMR) may increase lead release for lead solder connected to copper pipe, which is hypothesized to be due to a less protective configuration of corrosion products formed on lead surfaces (Edwards and Triantafyllidou, 2007). The impact of a high CSMR (>1) may be overcome with sufficient buffer capacity to minimize localized pH changes at the pipe surfaces. For example, a high CSMR (>20) in a desalinated water supply was not found to leach lead from solder or brass in excess of LCR limits (Blute et al., 2008). For systems with high lead leaching yet sufficient passivating film formation, orthophosphate addition can help to minimize lead solubility by promoting the precipitation of lead phosphate solids.

The release of oxidized, aqueous lead has also been related to DO and possibly ammonia (Schock et al., 1996; Schock, 1999; Trussell, 1985), although these mechanisms are not well understood.

As with copper, lead concentrations can increase in standing water held in pipes during a period of stagnation. Consequently, the Lead and Copper Rule requires collection of a stagnant sample held for at least 6 hours in the pipes.

Brass Meters

Brass is comprised primarily of copper and zinc, and historically up to about 6% lead (Oliphant and Schock, 1996). Use of lead in brass has been minimized or eliminated in recent years for drinking water systems, although many systems or households still have leaded brass components in service. Brass components in the distribution system have been shown to be a significant source of lead and copper to water, and leaching depends in part on the type of brass (Kimbrough, 2007; Kimbrough, 2001; Lytle and Schock, 1996; Lee et al, 1989; Schock and Neff, 1988). Brass components in homes otherwise comprised of all-plastic pipe have been shown to contribute substantially to lead and copper concentrations for LCR compliance, even when compared to traditional homes consisting of copper pipe and lead solder (Kimbrough, 2007). Newer installations of brass components typically have higher rates of brass corrosion (Kimbrough, 2007; Kimbrough, 2001). Higher lead percentages in brass have been linked to higher lead leaching in the pH range of 7 to 8.5 (Lytle and Schock, 1996). Overall, brass leaching can be significantly variable and testing is useful in predicting lead leaching from materials.

Compared with lead solder, galvanic connection of brass to copper has been seen to decrease lead leaching (Edwards and Triantafylidou, 2007). Another study reported chlorine had a lesser effect on brass corrosion (Schock and Neff, 1988).

Copper leaching from brass can also be a significant source to the water rivaling pure copper (Lytle and Schock, 1996). The previous analysis of the key constituents impacting copper release in pipe applies to brass meters as well, where pH and alkalinity are key factors.

Desalination Plant Survey:

A survey of desalination plants was conducted after the literature review to supplement findings and the extensive survey previously conducted by MWD (2012). The goal of the survey was to identify target finished water quality for the desalination integration study from and ultimately the proposed full-scale facility, from a corrosion standpoint. The desalination plants were selected to investigate five criteria, as listed in Table 1.

Table 1. Criteria Used to Select Utilities for the Desalination Plant Survey

	Characteristic	Reason for Survey
1	Finished water quality similar to MWD water, i.e. alkalinity between 80 and 100 mg/L as $CaCO_3$ and pH slightly above 8	Assess whether corrosion issues have been observed for systems that target alkalinity and pH in desalinated water that are similar to MWD water
2	Calcite filter post-treatment	Gather information about practical experiences in applying calcite filtration, which will be used in this study
3	Reported corrosion issues	Understand factors contributing to corrosion outcomes and strategies found to be effective in solving the problems
4	Negative CCPP or LSI targets	Query whether the system experiences corrosion outcomes under these conditions to understand lower target threshold water quality parameters
5	Alkalinity target below 40 mg/L or above 80 mg/L as $CaCO_3$	Query whether the system experiences corrosion or scaling outcomes under these conditions to understand lower or higher target threshold water quality parameters compared with MWD water

Plants that met at least one of the criteria were selected for the survey. Of the 18 plants contacted, 14 responded to the survey. The survey questionnaire and detailed responses are attached as Appendix A. A discussion of the overall findings is presented below.

Results and Discussion

Table 2 summarizes the literature review findings for desalinated water post-treatment (stabilization). In addition, notable survey results are included in the table, such as key water quality data that differs from information gained in the literature review. The literature review revealed general guidelines for stabilized desalinated water quality including alkalinity at a minimum level of 40 mg/L as $CaCO_3$ to provide sufficient buffering capacity, calcium concentrations similar to alkalinity, and positive CCPP (often between 4 and 10 mg/L as $CaCO_3$). The guidelines do not provide a specific LSI value; however, a positive CCPP correlates with positive LSI. CCPP is primarily determined by alkalinity, calcium and pH and is also affected by water temperature and TDS.

Reported post-treatment processes described in the literature include addition of hydrated lime (calcium hydroxide or $Ca(OH)_2$), carbon dioxide (CO_2), sodium hydroxide (caustic soda or NaOH), sodium bicarbonate (baking soda or $NaHCO_3$), sodium carbonate (soda ash or Na_2CO_3), use of a calcite filter (also called calcite contactor or limestone contactor, $CaCO_3$), pH adjustment using acid or caustic soda, air stripping, or blending with raw water (for groundwaters) or another water source. Additionally, corrosion inhibitors are also used in some systems for corrosion control. Typically, two or three treatment processes are combined to add calcium, alkalinity (inorganic carbon) and adjust pH for stabilization. The literature review suggests lime and CO_2 combined are the most often used treatment processes, which is not surprising as they are relatively inexpensive (compared to sodium bicarbonate for example) and require less footprint (compared to calcite filter, unless water can be bypassed and blended to reduce the footprint).

Literature and full-scale experience has shown that calcite filters can be used to provide alkalinity values of more than 40 mg/L and calcium concentrations greater than 60 mg/L as $CaCO_3$ (Table 2; Shih et al., 2012; Blute et al., 2008). Caustic soda may be required to adjust pH to achieve positive CCPP and LSI values. The study by Shih et al. (2012) reported a contact time of 1.5 to 2.0 minutes and a loading rate of 9.5 gpm/sf in upflow configuration for optimum

operational conditions, including efficient calcite dissolution and minimal turbidity in the calcite filter effluent. Additional alkalinity and calcium can be imparted to the water through the use of a lower pH, which can minimize footprint if only a partial stream is treated through the calcite filter.

Post-Treatment Water Quality Targets

The literature review and survey showed that most stabilized desalinated waters target alkalinity levels above 40 mg/L as $CaCO_3$. Four systems have alkalinity close to or above 80 mg/L as $CaCO_3$, similar to MWD, including Paris Water Utility, Tampa Bay Seawater Desalination Plant, Water Treatment Plant Heemskerk in Netherlands, and Irvine Desalter Primary Treatment Plant. For these four systems, no significant corrosion issues have been reported in the literature or revealed by the survey. Most stabilized desalinated waters also have calcium target levels at or above 40 mg/L as $CaCO_3$. The study conducted by Blute et al. (2008) suggests that water quality with alkalinity and hardness of 40-45 mg/L as $CaCO_3$ is not likely to trigger corrosion problems in the distribution system as long as the CCPP value is positive.

Limited CCPP and LSI target information was reported in the literature. When alkalinity, calcium and pH targets were available, CCPP and LSI values were estimated using the Tetra Tech Rothberg Tamburini Windsor (RTW) model based on these parameters. Most stabilized desalinated waters had calculated positive CCPP values between 0 and 10 mg/L as $CaCO_3$, and/or slightly positive LSI values between 0 and 1. Tampa Bay Water and Irvine Desalter Primary Treatment Plant were estimated to have negative CCPP values based on the water quality targets reported in the literature. However, our survey revealed that their CCPP values are actually slightly positive, indicating that the literature reports did not reflect actual operational targets and levels achieved.

pH targets reported in the literature ranged from 6.5 to 9.5. Several systems have a pH target close to MWD water (slightly above 8), including Tampa Bay, Water Treatment Plant Heemskerk in Netherland, the Town of Jupiter Utilities, Ashkelon Desalination Plant, and the Irvine Desalter Primary Treatment Plant. No corrosion issues have been reported for most of these systems with exception to the Heemskerk system and the Ashkelon system. The Heemskerk system reports corrosion in a cement pipeline carrying un-stabilized RO permeate before blending was performed for stabilization, and Ashkelon reports corrosion in all types of pipes ranging from carbon steel to Super Duplex throughout the system.

Among the systems reported in the literature and the survey, the Tampa Bay Seawater Desalination Plant, the Paris Water Utility (Nanofiltration) in France, and the Sultanate of Oman have stabilized water quality close to MWD water in terms of alkalinity together with pH (alkalinity approximately 80 to 100 mg/L as $CaCO_3$ and pH 8.0 to 8.2). According to the Water Quality Assurance Officer of the Tampa Bay system, alkalinity has been the key for desalinated water stabilization, while chloride and sulfate did not have negative impacts on corrosion. A pilot study conducted by University of Central Florida (UCF) using Tampa Bay water suggested that alkalinity between 100 and 110 mg/L as $CaCO_3$ was likely to minimize iron and copper corrosion. The Paris Water Utility revealed that alkalinity above 80 mg/L as $CaCO_3$, calcium above 80 mg/L as $CaCO_3$ and pH above 8, are their general guidelines for membrane treated water. No corrosion issues have been reported in the Paris distribution system. Oman's RO post-treated water quality achieved an alkalinity range of 90 - 100 mg/L as $CaCO_3$, calcium range of 80 - 90 mg/L as $CaCO_3$, and pH range of 7.8 - 8.0 (slightly lower pH than MWD's target) and have yet to report any corrosion issues.

Previous corrosion studies suggest that iron corrosion decreases with increased alkalinity due to additional buffering capacity with sufficient pH and calcium; however, high alkalinity can result in increased copper release (as shown in Figure 1). Therefore, the alkalinity target should be selected to provide enough protection of iron surfaces without causing significant copper corrosion. Tampa Bay's experience indicates that alkalinity of approximately 100 mg/L as $CaCO_3$ is feasible for corrosion control of these two materials, although a lower alkalinity may be possible as shown by Blute et al. (2008).

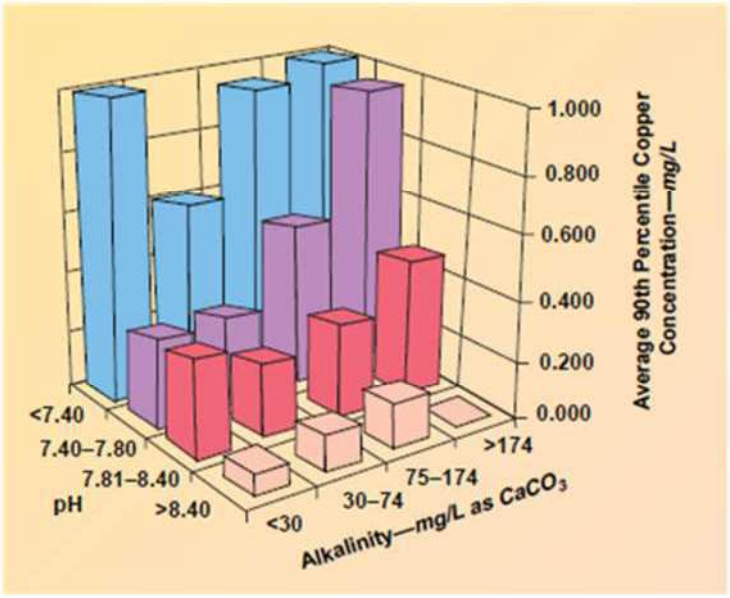
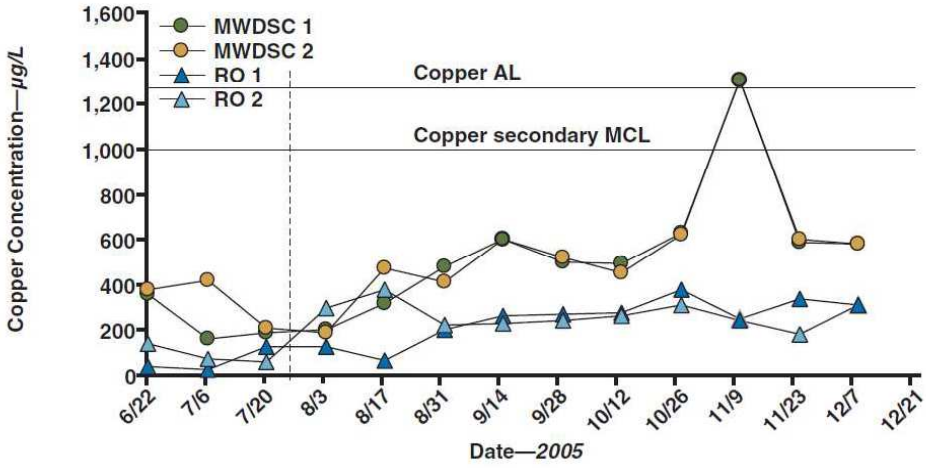


Figure 1: Average 90th Percentile Copper Release for Utilities that are not Adding Phosphate Inhibitors

Source: Dodrill, D.M. and Edwards, M., 1995. Corrosion Control on the Basis of Utility Experience. *J. AWWA*, 87:7:74-85. Figure 6, part I.

A demonstration-scale study conducted by at Carlsbad, California (Blute et al., 2008) observed higher copper releases from new copper pipes when exposed to MWD water compared to stabilized RO permeate (Figure 2). It was hypothesized that higher alkalinity levels in the MWD water (101 to 109 mg/L as $CaCO_3$) may have contributed to the higher copper releases, compared to a lower alkalinity of 45 to 73 mg/L as $CaCO_3$ in the stabilized RO permeate, since the magnitude of the differences was similar to literature reports as shown in Figure 1.



AL—action level, CCPP—calcium carbonate precipitation potential, LSI—Langelier saturation index, MCL—maximum contaminant level, MWDSC—Metropolitan Water District of Southern California, RO—reverse osmosis

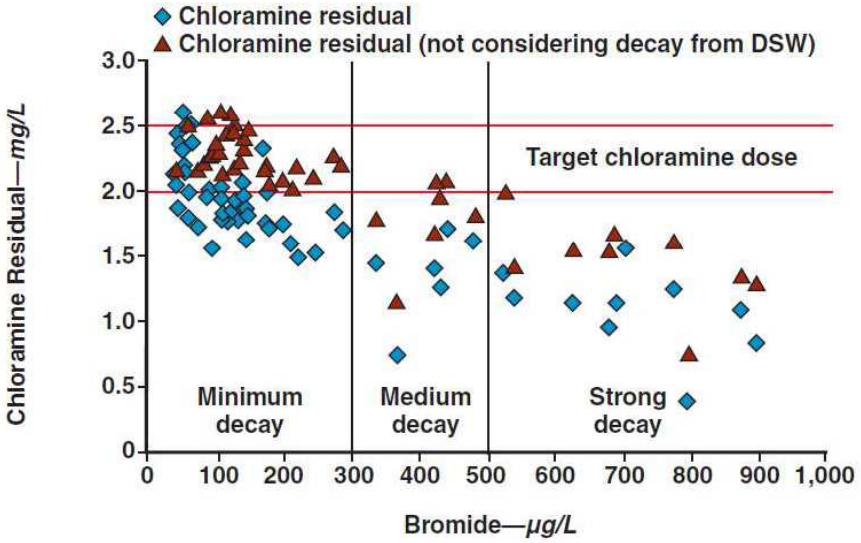
Dashed line shows the point after which the RO permeate was sufficiently conditioned to yield a positive LSI and CCPP.

Figure 2: Copper Leached from Copper Pipes (after 10-hour stagnation periods)

Source: Blute et al., 2008. Integration of Desalinated Seawater into a Distribution System. *J. AWWA*, 100:9:117-131.

Target bromide levels in desalinated water were also explored in this literature review and survey, as relatively high bromide levels in desalinated water are common compared to many surface waters. Elevated bromide levels can be a concern for desalinated water integration into a distribution system as bromide can accelerate chloramine decay in the system. The decay mechanisms include the direct substitution of bromide into the chloramines molecule (forming bromamine), or formation of hypobromous acid that can form bromamine with ammonia (Pope et al., 2006; Vikesland et al., 2001). Bromamines are more reactive and less stable than chloramines and quickly decay to bromide and ammonia.

According to the literature review and survey, typical bromide target levels are commonly between 0.1 and 0.5 mg/L. No specific bromide level is included in the desalinated water stabilization guidelines available in the literature (Lahav et al., 2012; WHO, 2008; Schutte, 2001; Lowenthal et al., 1986 and 2004; Van Der Merwe, 1988; Merrill and Sank, 1977). A recent study conducted by the City of Long Beach, California concluded that significant chloramine decay was caused by bromide levels above 0.3 mg/L (Figure 3). Additional study on this topic is planned in Task 7: Bench Testing, which will be conducted by MWD.



DSW—distribution system water

Chloramine residual data were data from trains 1 and 2 during phase 1 and 2 testing. Chloramine residual (not considering decay from DSW) was calculated by adding the corresponding chloramine decayed by DSW onto chloramine residual in trains 1 and 2 because they were the blending of DSW and desalinated water. By not considering decay from DSW, the effect of desalinated water on chloramine residual can be separated.

Figure 3: Effect of Bromide on Chloramine Residual after 8-hour Stagnation Time in CML Pipes

Source: Zhang et al. 2012. Pilot-Scale Evaluation of Blending Desalinated Seawater into A Distribution System. *J. AWWA*, 104:7:43-46.

Boron is another concern for desalinated water integration due to its detrimental impacts on some agricultural crops at high concentrations. Boron targets were found to vary in practice, often in response to specific agricultural requirements. For example, the Ashkelon desalination plant in Israel has a relatively low target of 0.4 mg/L to protect agriculture. By comparison, desalination plants in other countries have boron target levels ranging from 0.5 to 2 mg/L. The survey of Tampa Bay Water indicated an operating range of 0.8 to 1.3 mg/L, but feedback provided suggested that the lower end of the range would be preferred to minimize crop impacts. With respect to health concerns, the State of California has a Notification Level for boron of 1 mg/L, the EPA does not have a regulation, and the World Health Organization (WHO) recently revised its health-based guideline from 0.5 to 2.4 mg/L for boron.

Table 2. Summary of Literature Review and Utility Survey on Desalinated Water Post-Treatment and Water Quality Targets

Entry No.	Guidelines or Utility Name and Location	Facility Size (MGD)	Post Treatment Strategy for Stabilization and Disinfection	Notes (source of water quality target or other sampling locations)	Post-Treatment Water Quality Target										Corrosion Issues Reported	Corrosion Issues Remedy	Reference	Reasons for Survey
					Alkalinity	Calcium	CCPP	LSI	pH	Boron	Bromide	Chlorine	TDS	Chloride				
					mg/L as CaCO3	mg/L as CaCO3	mg/L as CaCO3			mg/L	mg/L	mg/L	mg/L	mg/L				
1	General Operational Guidelines for Corrosion Control, USA	N/A	N/A	General Operational Guidelines for Corrosion Control	>40	>40	4 to 10		6.8 to 7.3[&]								Lahav et al., 2012, Merrill & Sank, 1977[&], Cantor et al., 2000	
2	Guidelines, South Africa	N/A	N/A	Guidelines	>60	>55											Lahav et al., 2012, Van der Merwe, 1988	
3	General Guidelines for Drinking Water Quality, WHO	N/A	N/A	Guidelines	40	40	4 to 10		6.8 to 7.3	< 0.5*							Lahav et al., 2012, WHO, 2004	
4	General Guidelines for South Africa (Corrosion control), Cape Town, South Africa	N/A	N/A	Guidelines	>50	>50	2 to 5										Lahav et al., 2012, Loewenthal et al., 1986 & 2004	
5	Dept. of Water Affairs and Forestry, Dept. of Health, Water Research Commission, South Africa	N/A	N/A	Guidelines			>4										Lahav et al., 2012, Schutte, 2001	
6	Guidelines, Israel Ministry of Health	N/A	N/A	Guidelines	>80	80 to 120	3 to 10		<8.5								Birnhack and Lahav, 2007	
7	Three Wisconsin Utilities (Madison, Janesville, Monona), Missouri, USA	N/A	N/A	Polyphosphate Study			3 to 10										Lahav et al., 2012, Cantor et al., 1999	
8	Sidestream Stabilization Process, Johannesburg, South Africa	N/A	CO2, lime		>50		1 to 2		8.2								Lahav et al., 2012, De Souza et al., 2002	
9	Dhekelia Desalination Plant, Cyprus	11	Lime and CO2		>50			>0	6.5 to 9.5								Lahav et al., 2012, Marangou & Savvides, 2001	
10	Multiple Utilities, Sweden	N/A			>50	50 - 150			7.5 to 9.5								Lahav et al., 2012, Berghult et al., 1999	
11**	Paris Water Utility (NanoFiltration), France	37	Soda neutralization, chlorine disinfection		70 - 120	56 - 144		>0									Lahav et al., 2012, Plottu-Pecheux, 2001, Boireau, 1996	high alkalinity; which type of soda is used; pH target
11	Paris Water Utility (NanoFiltration), France	37	Degasification for CO2 removal, NaOH, blending with bypass, chlorine disinfection	Finished water after blending with bypass	>80	>80			8						No		H&S Survey	
12*	WaterSecure, Gold Coast, Australia	36	Lime and CO_2 addition, free chlorine				-5 to -3			1	0.1	0.2 to 0.5	220	50	None		MWD Assessment, 2012	Negative CCPP, any corrosion?
13*	Melbourne Water, Melbourne, Australia	117	Lime addition, free chlorine		50		-5 to 0		6.8 to 7.8	0.5	0.1	< 0.4	≤ 120 to 140	60			MWD Assessment, 2012	Negative CCPP, any corrosion? The plant was under construction at the time of MWD survey.
14	Water Corporation, Perth 1, Australia	38	Lime and CO2 addition, free chlorine			>50		> -0.5	7.5 to 8.0	2	0.1		200	250	None		MWD Assessment, 2012	
15	Sydney Water, Sydney, Australia	66	Lime and CO2 addition, chloramines (0.7 mg/L)							1	0.1		115	40	None		MWD Assessment, 2012	

Table 2. Summary of Literature Review Utility Survey on Desalinated Water Post-Treatment and Water Quality Targets (cont'd)

16a**	Water Desalination Administration, Ashkelon, Israel	85	Lime addition, free chlorine					0 to 0.5		< 0.4		0.2 to 0.5	< 40	< 20			MWD Assessment, 2012	
16b**	Water Desalination Administration, Ashkelon, Israel	85	Sulfuric acid, calcite, and caustic soda		45-48	100 to 110	0.3 to 0.8		8.15								Birnhack and Lahav, 2007	
16	Water Desalination Administration, Ashkelon, Israel				40-41	80-90		0 to 0.5	8.3-8.5			0.2 to 0.5	< 300	< 20	Yes	Cathodic Protection and coating	H&S Survey	
17*	Abu Dhabi Water & Electricity Authority, Fujairah 2, United Arab Emirates	36	Lime and CO2 addition, free chlorine					0 to 0.5	7 to 9.2	1		0.5	100 to 200	100	None		MWD Assessment, 2012	Clarify on alk, calcium levels. Any corrosioni issues?
18**	Sultanate of Oman's Ministry of National Economy, Sur (Oman)	21	Limestone contactors, free chlorine			<100			6.5 to 8.5	≤ 0.5		0.5	200 to 500	≤ 250	None		MWD Assessment, 2012	Calcite filter
18	Sultanate of Oman's Ministry of National Economy, Sur (Oman) **Current Water Quality**	21.16	Limestone contactor (CaCO3 granules) and NaOCl		90 -100	80 - 90	1 - 3.5	0.1 - 0.3	7.8 - 8.0	<0.5	< 1 µg/L as BrO3	0.5 - 0.6	120 - 140		None	LSI 0.1 - 0.3	H&S Survey	
19**	Singapore Public Utilities Board, Tuas 1, Singapore	84	Lime and CO2 addition, free chlorine						7 to 9	0.5				100	None		MWD Assessment, 2012	Clarify on alk, calcium levels. Any corrosioni issues?
19	Singapore Public Utilities Board, Tuas 1, Singapore	84	Lime and CO2 addition, free chlorine					0.2 - 0.5	7 to 9	0.5			250	100	None		H&S Survey	
20**	Ministerio Medio Ambiente y Medio Rural y Marino, Valdelentisco, Spain	53	Lime and CO2 addition		Monitored				9.5	1		1		250	Yes	Alkalinity adjustment	MWD Assessment, 2012	Clarify on the corrosion issue and alkalinity adjustment
20	Ministerio Medio Ambiente y Medio Rural y Marino, Valdelentisco, Spain	53	Lime and CO2 addition		60 to 65		2.0^ (Alk = 65; Ca = 65; pH=8.5)	0.5	7.5 to 8.5				≤ 500	<250	No		H&S Survey	
21	City of Long Beach (Double-pass NF), California, USA	N/A	Aerated, pH adjustment with NaOH or H2SO4, NaHCO3, chlorine and ammonia	Pilot study (phase 1)	81 to 84	42.5 to 45	-0.7 and -1.2	-0.4 and -0.5	8.1		< 1	2.1 to 2.2	242 and 333	58 and 124	Higher lead releases from solder than control		Zhang et al., 2012; MWD WQ Criteria, 2012	Get water quality objectives
				Pilot study (phase 2)	124	40 to 42.5	1.6 and 2.5	-0.18 and 0.24	8.2 to 8.3		< 0.1	1.8 and 2.1	219 to 220	34 to 35	No		Zhang et al., 2012; MWD WQ Criteria, 2012	Not surveyed
22	West Basin MWD, California, USA	N/A	N/A - No work was done at the time					0.1		≤ 0.5	≤ 0.3		≤ 500	≤ 100			MWD WQ Criteria, 2012	
23**	City of Santa Cruz, California, USA	2.5	Calcite and lime contactors (both with and without CO2)		30 to 60				7.4								MWD WQ Criteria, 2012	Effectiveness of calcite contactor
23	City of Santa Cruz, California, USA	2.5	Calcite contactor with CO2	Full-scale design	30 to 60	30 to 60			7.3	< 1	< 0.5	~1.0	< 300	< 150		corrosion inhibitor of 0.5 to 1.0 mg/L	H&S Survey; CDM Smith, 2012	
24	Poseidon Resources, Corp. , Carlsbad, USA	N/A	Chloramination	Pilot	> 45	> 40	> 0	> 0	8.0 to 9.0	0.75 to 1.0	0.5 to 0.8	1.5 to 4	350 to 600	180 to 210			Blute et al. 2008; MWD WQ Criteria, 2012	Clarify on the upper level of alkalinity target

Table 2. Summary of Literature Review Utility Survey on Desalinated Water Post-Treatment and Water Quality Targets (cont'd)

25a**	Tampa Bay Seawater Desalination Plant, Florida, USA	20	CO2 and lime addition, free chlorine		≥ 100			> 0 to 0.5	> 7.4			3.6 to 4.4					MWD WQ Criteria, 2012	Clarify alkalinity target; any copper corrosion if alk is high? Conflicting info from the literature review. Clarify on calcium and pH targets.
25b**	Tampa Bay Seawater Desalination Plant, Florida	20	Saturated lime injection, CO2 addition, disinfection with free chlorine, blending	1. Permeate pre-stabilization	10	25	-120^	-4^	5.5		0.4			160	Iron and copper leaching	addition of bicarbonate alkalinity to mitigate leaching	Duranceau et al., 2011	
				2. Post-stabilization (GSW)		80												
				3. Point-of-Entry (POE)	60	50	-7^	-0.7^	7.5					175				
25c**	Tampa Bay Seawater Desalination Plant, Florida	20	Lime saturator, CO_2 addition, pH adjustment (as needed), free chlorine		> 40		>0	>0	6.5 to 8.5		0.45 (0.2-0.25)#	4	500	100	A concern	Alkalinity addition (>100)	MWD Assessment, 2012	
25d**	Tampa Bay Seawater Desalination Plant, Florida	20	Lime softening, chloramination		>80			>0									Lahav et al., 2012, Imran et al., 2005	
25	Tampa Bay Seawater Desalination Plant, Florida	20	Lime and CO2 addition		100 (post blending)		2.1^ (AlK = 100; Ca = 100; pH = 8.0)	0.2^ (AlK = 100; Ca = 100; pH = 8.0)	8.0 to 8.2	0.8 to 1.3	0.45	< 4	500	100	No		H&S Survey	
26**	Governor's Harbour Plant, Cayman Islands	2	pH adjustment, air stripping, caustic addition, calcium hypochlorite disinfection, corrosion inhibitor	Permeate/Point-of-Entry (POE)		70					0.4			107	Severe iron valve corrosion. Primary pipe is PVC.	Replacement of old valves with EPDM coated ones	Duranceau et al., 2011	Water quality targets and valve corrosion
26	Governor's Harbour Plant, Cayman Islands	2	Degassifying tower to remove H2S, pH adjustment, corrosion inhibition, and chlorination		WHO Standards										None		H&S Survey	
27**	Water Treatment Plant Heemskerk, Netherlands	20	Alkalinity recovery, blending, pH correction; caustic, disinfection	1. Permeate post-stabilization	44	< 1		slightly positive	9.9					3	Corrosive of pipeline used to transfer RO permeate to blend with another water	Blended with source water to maintain 60 mg/L as calcium	Duranceau et al., 2011	Any corrosion corrosion in the distribution system?
				2. Point-of-Entry (POE)	149	126	14^	0.7^	8.1					79				
27	Water Treatment Plant Heemskerk, Netherlands	20	At present, CO2 for pH and carbonate adjustments then blending	Stabilized RO permeate for blending with other water sources				0 to 1									H&S Survey	
28**	The Town of Jupiter Utilities	13.7	pH adjustment, degasification, chlorination, ammonization, blending	1. Permeate pre-stabilization	25	8	-65^	-3^	6.2		0.4			107			Duranceau et al., 2011	Low alkalinity
				2. Point-of-Entry (POE)	36	88	3^	0.7^	8.9					85				
28	The Town of Jupiter Utilities	13.7	Degasification, chlorination, blending with NF permeate, ammonia		90 to 95	Slightly below Alkalinity			7.9 to 8.1			3.5			Widespread corrosion issues in the past, mostly on copper and brass	Tried various blendings with other treated waters. Currently blending with NF permeate and add corrosion inhibitor.	H&S Survey	

Table 2. Summary of Literature Review Utility Survey on Desalinated Water Post-Treatment and Water Quality Targets (cont'd)

29	Irvine Desalter Primary Treatment Plant, Irvine, California, USA	2.8						0.1 to 0.2	7.9				420		No		H&S Survey	
30**	Kay Bailey Hutchison Desalination Plant	27.5	Blending, pH control, disinfection, corrosion control	1. Permeate pre-stabilization	10.6	< 25	< -10^	< -3^	6.8					107			Duranceau et al., 2011	Low alkalinity; likely negative CCPP level
				2. Point-of-Entry (POE)	24	37	-5^	-1^	7.5					179				
30	Kay Bailey Hutchison Desalination Plant	27.5			Uncertain of level			> 0	7.2			1	700 to 900		No		H&S Survey	
31	City of Pompano Beach Water Treatment Plant	7.5	Degasification, caustic addition, corrosion inhibitor addition, blending	1. Permeate pre-stabilization	18				7.5							Addition of corrosion inhibitors	Duranceau et al., 2011	
				2. Point-of-Entry (POE)	34	16								37				
32*	Barcelona Desalination Plant, Spain	53	Calcite contactor with CO2	Pilot study	> 60	> 60		> 0	8.0 to 8.5				< 400				Hernandez et al., 2009	
33**	Alicate II Plant, Valencia, Spain	18.5	Calcite contactor with CO2		56 +/- 3	68 +/- 4		+/- 0.15							None		H&S Survey	Calcite filter operation
34**	Mekorot, Israel	5.3	Degasifer, pH adjustment with caustic soda, blending with brackish well water. Planning lime stabilization for plant expansion.		> 80	> 40	3 - 10		Less than 8.5 (typically 7.5-8.3)						None		H&S Survey	

Blank cells indicate no information was reported.

Shaded cells indicate information was obtained through the Hazen and Sawyer survey.

* Selected for the survey

** Responded to the survey

& Data obtained from another reference, e.g., the original reference

^ Estimated using reported alkalinity, calcium, pH, TDS, chlorine values and RTW modeling; if not available, assuming temperature of 20 deg. C and TDS of 100 mg/L

Recommended range

N/A = Not applicable

Alk = Alkalinity

Conclusions and Recommendations

According to the literature review and survey performed in this task, general guidelines for desalinated water stabilization include alkalinity values above 40 mg/L as $CaCO_3$, positive CCPP and LSI values, and sufficient calcium and pH to achieve the positive CCPP values.

Figure 4 shows CCPP values as a function of alkalinity and pH in the range of 40 to 100 mg/L alkalinity as $CaCO_3$ and pH from 8.0 to 8.4. Calcium is assumed to be the same level as alkalinity in mg/L as $CaCO_3$, since a calcite filter will simultaneously add carbonate and calcium. For pH 8.0, the minimum alkalinity level to achieve a positive CCPP value is 80 mg/L as $CaCO_3$. For pH 8.2, an alkalinity of 65 mg/L as $CaCO_3$ yields a slightly positive CCPP (0.29 mg/L as $CaCO_3$) and positive LSI (0.05). For pH 8.4, alkalinity above 50 mg/L as $CaCO_3$ would yield a positive CCPP value. In practice, a pH range of 8.2 ± 0.2 would allow reasonable targets to achieve in the integration study for both pH and alkalinity compared with MWD water. At pH 8.2, an alkalinity of 65 to 80 mg/L for the pipe loop corrosion study will provide a positive CCPP value.

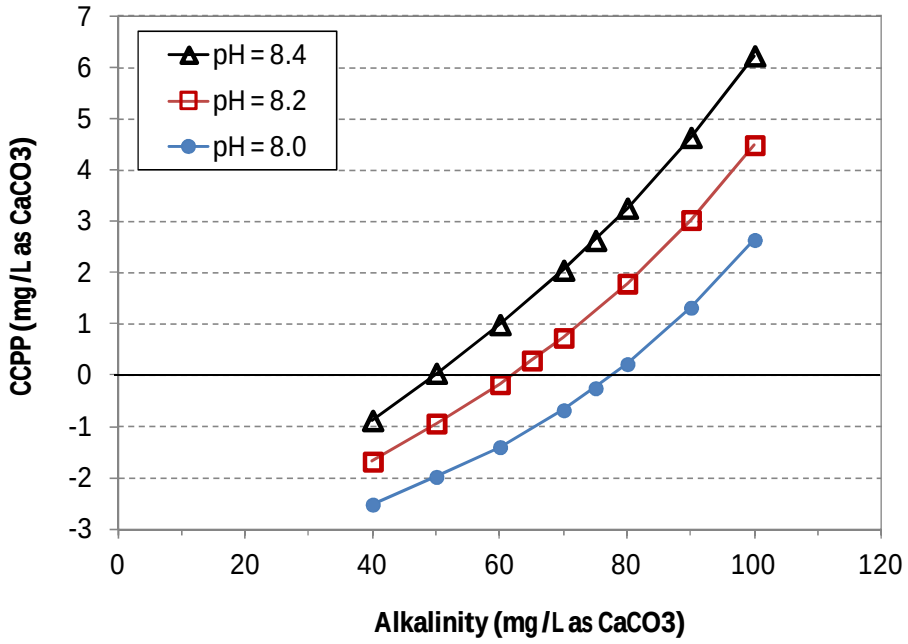


Figure 4: CCPP Values for Alkalinity above 40 mg/L as $CaCO_3$ and pH from 8.0 to 8.4

CCPP values are estimated using the Tetra Tech RTW model with calcium concentrations equal to alkalinity in mg/L as $CaCO_3$.

Boron and bromide are not expected to impact corrosion control; however, their targets affect the amount of water treated by the second stage of the RO process and bromide can impact residual stability. The general guideline for boron is 0.5 mg/L for agriculture protection and less than 1 mg/L for health concerns (i.e., the California Notification Level for drinking water), although some variability in this value was noted for operating RO systems. In a full scale desalination facility, the specific boron target selected will be determined by West Basin based on end user needs, and boron is anticipated to determine the amount of second stage treatment. For example, to achieve a boron target of 0.5 mg/L, bromide levels below 0.3 mg/L are expected. A recent study has shown that bromide concentrations below 0.3 mg/L have minimal impact on chloramines stability (Zhang et al., 2012). Alternate application methods can also decrease bromide-related effects on the residual. Bench-scale testing of bromide impacts on chloramines degradation and the chloramines addition strategy will be conducted by MWD.

Additional parameters, such as chloride, sulfate, disinfectant residual, and dissolved oxygen may have impacts on the potential corrosion of piping materials but the impact is less definitive than the aforementioned parameters. As a result, these additional parameters will be measured in the Task 6 pipe loop testing to directly observe if any other changes in water quality between desalinated water, MWD water, and groundwater, as well as blends, result in leaching of piping constituents.

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HAZEN AND SAWYER
Environmental Engineers & Scientists

Appendix C

Calcite Contactor Media Specifications

COLUMBIA RIVER CARBONATES
P.O. Box 2350 – 300 North Pekin Road
Woodland, Washington 98674
TEL: (360) 225 – 6505
FAX: (360) 225 – 5082
WATTS: (800) 735 – 6690

Puri-Cal ™

Puri-Cal ™

Typical Physical Characteristics

Mean Particle Size (µm)	550
Moisture (%)	< 0.2
Specific Gravity	2.7
Bulk Density (lb/cu. ft.)	89

Typical Chemical Analysis

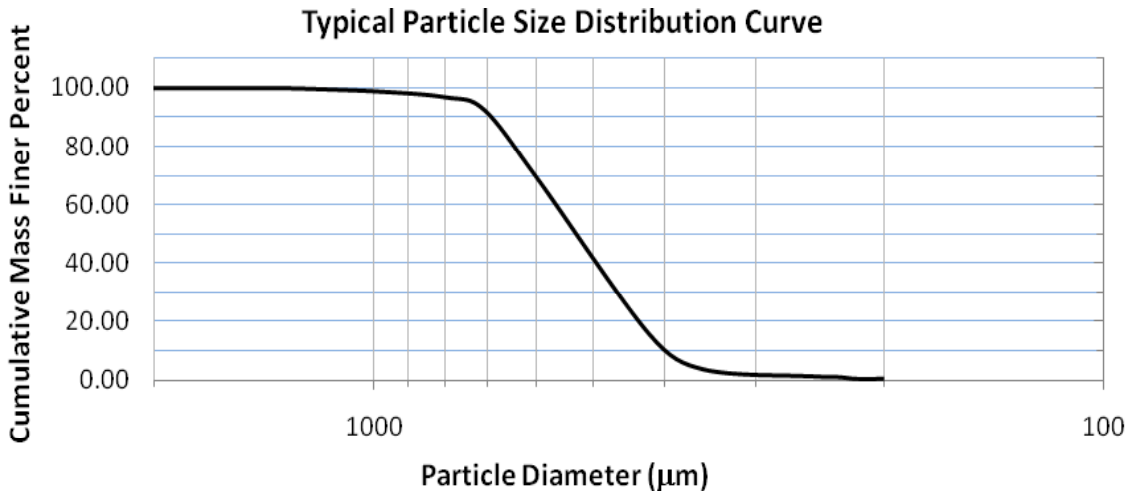
$CaCO_3$ (%)	> 95
$MgCO_3$ (%)	< 3
Acid Insoluble (%)	< 2

CAS# 1317-65-3

NSF®
Certified to NSF/ANSI 60
MUL 400 gm/L

Typical Size Distribution

0.1% Plus 16 mesh (U.S. Standard)
10% Minus 40 mesh (U.S. Standard)



DATA SHEET

Revised by Leif Backstrom
November 2010

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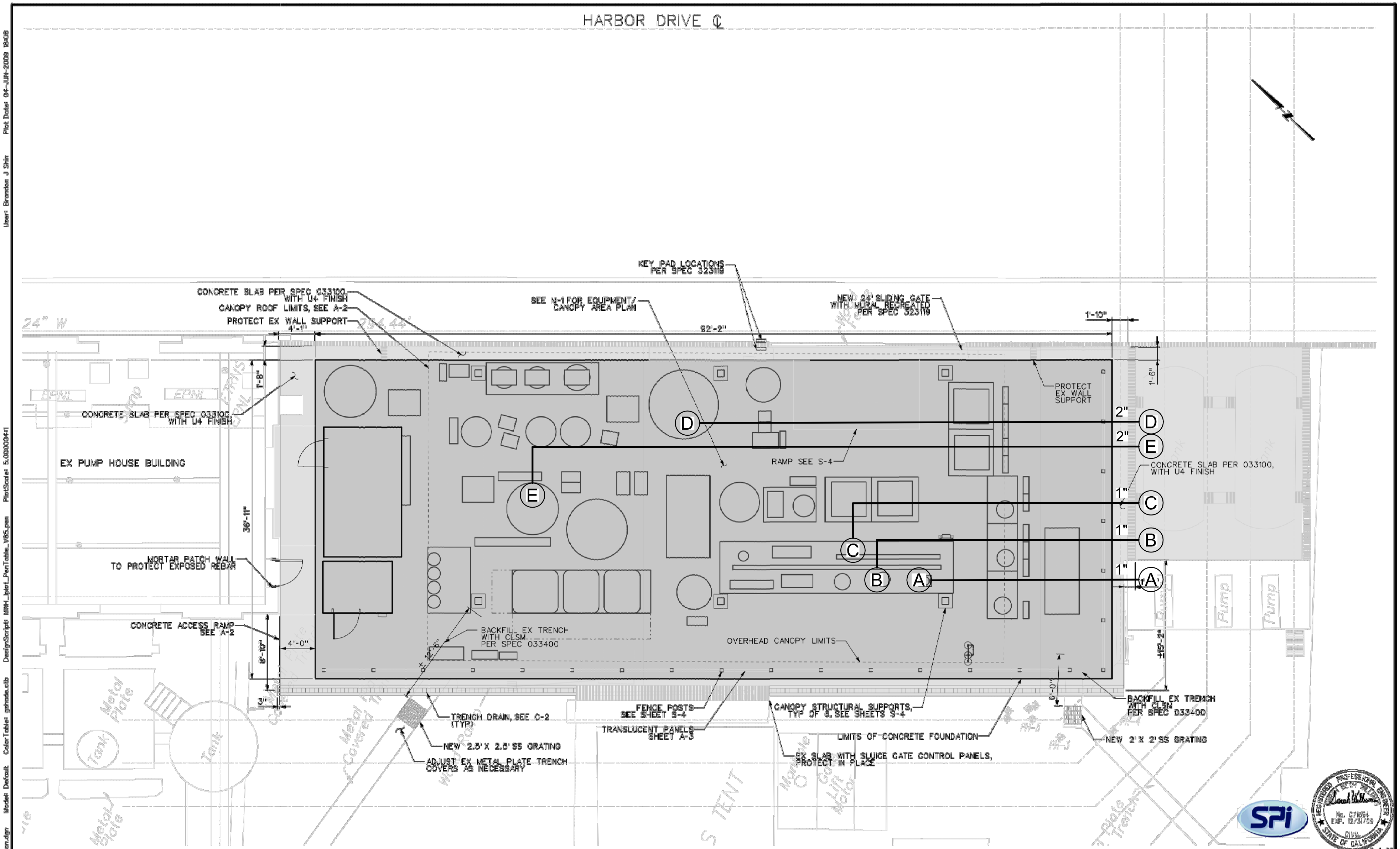
Environmental Engineers & Scientists

Appendix D

Piping to and from ODWWF

- Desalinated water supply lines to the pilot site
- Discharge piping to neutralization and equalization tanks



REV	DATE	BY	DESCRIPTION	SCALE	WARNING				
				1"=5'	0 ½ 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE	DESIGNED S WILLIAMS DRAWN S WILLIAMS CHECKED H DUNHAM	SUBMITTED BY JAMES H. BORCHARDT 36819 LICENSE NO. 6-4-09 DATE; JOHN ROBINSON 6-4-09 DATE	MWH ARCADIA CA	WEST BASIN MUNICIPAL WATER DISTRICT

TEMPORARY OCEAN WATER DESALINATION DEMONSTRATION PROJECT

CIVIL
HORIZONTAL CONTROL AND PAVING PLAN

SHEET C-1
1342583

West Basin Seawater Demonstration Project
Integration Study Tie-Ins

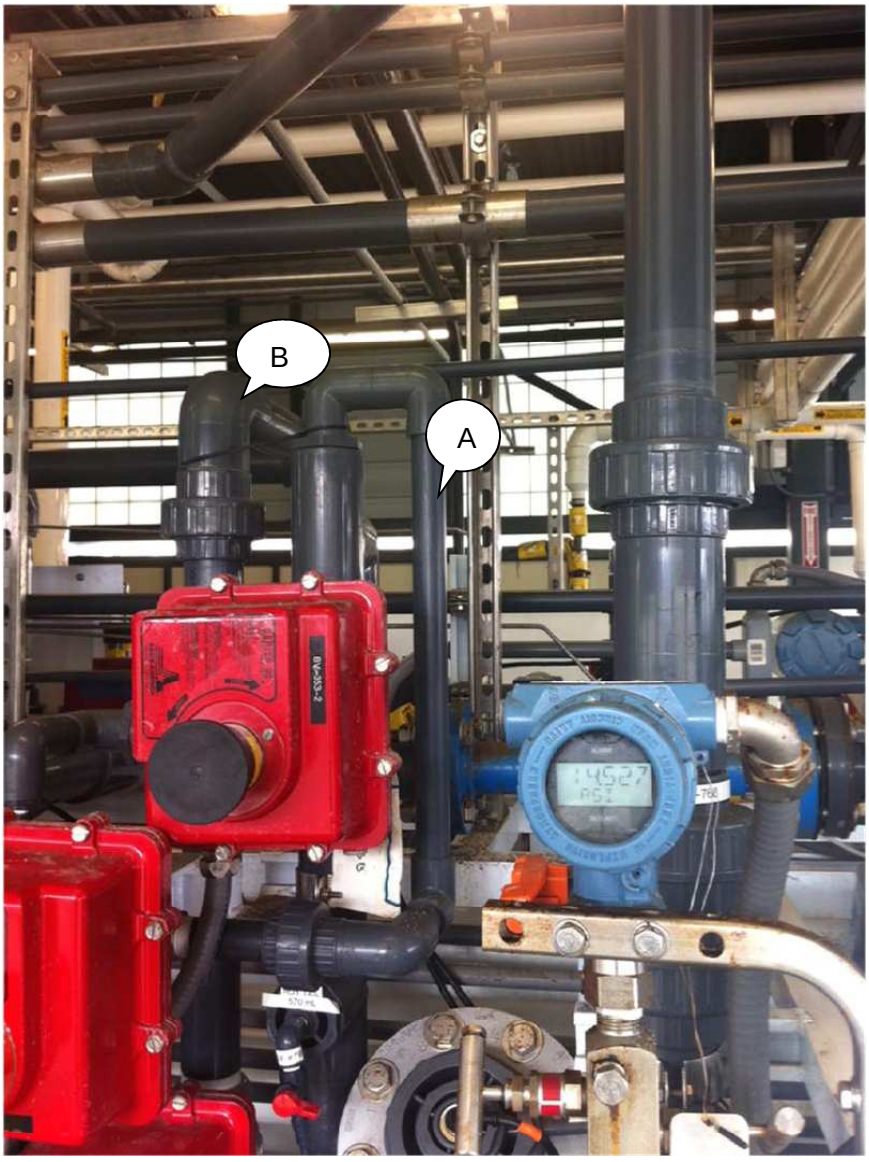
DESCRIPTION

Tie-ins to existing RO product and system waste lines are required between the existing seawater demonstration facility piping and the new integration study test pad. A layout drawing illustrating the new piping runs and connection points is provided on Sheet C-1 (attached).

SCOPE

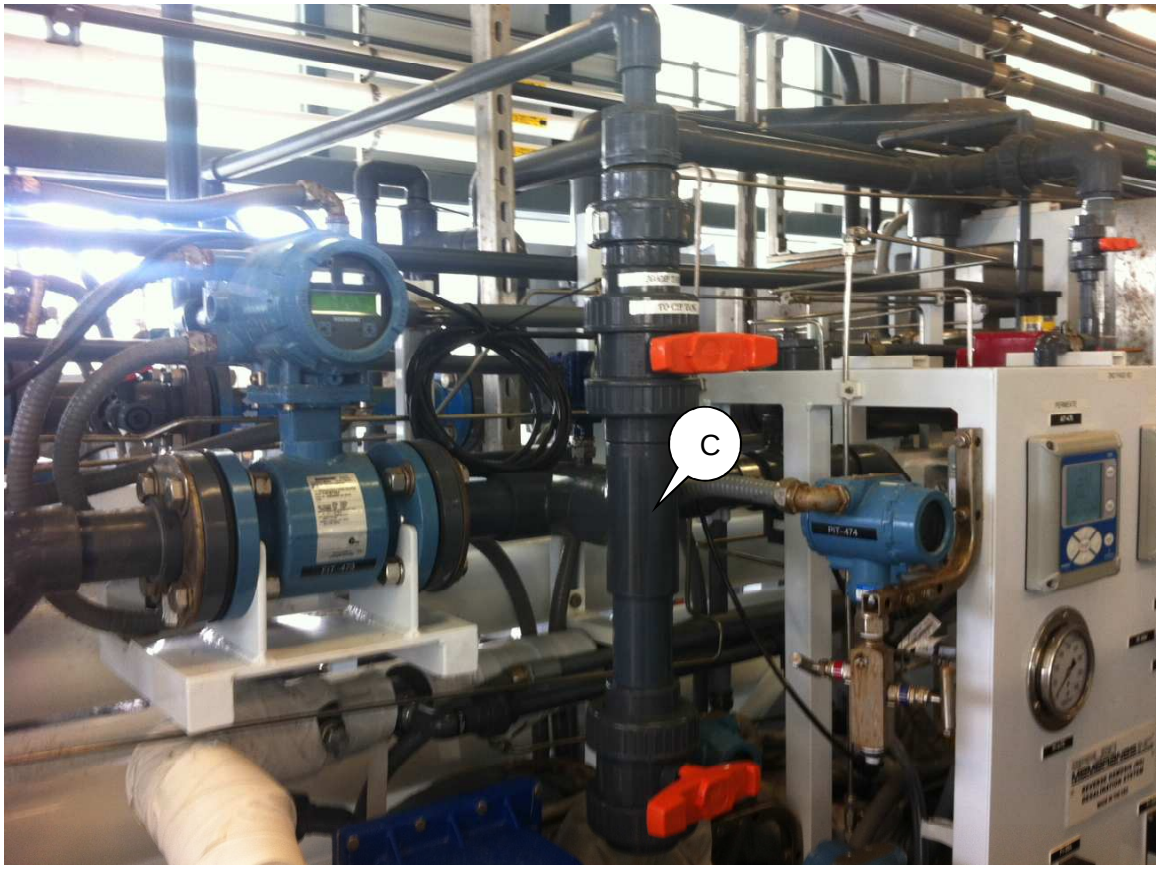
See pictures and descriptions on the following pages illustrating the proposed points of connection to the existing demonstration facilities piping. Contractor shall make the required connections and route new piping to the proposed integration study test pad. Terminate and cap all piping at the test at grade level. Support the new piping from existing channel support members.

Connections A & B
Two 1st Pass Permeate lines
PVC Tee Tie-ins at both A & B followed by isolation ball valves and 1” Sch 80 PVC lines to south boundary of site

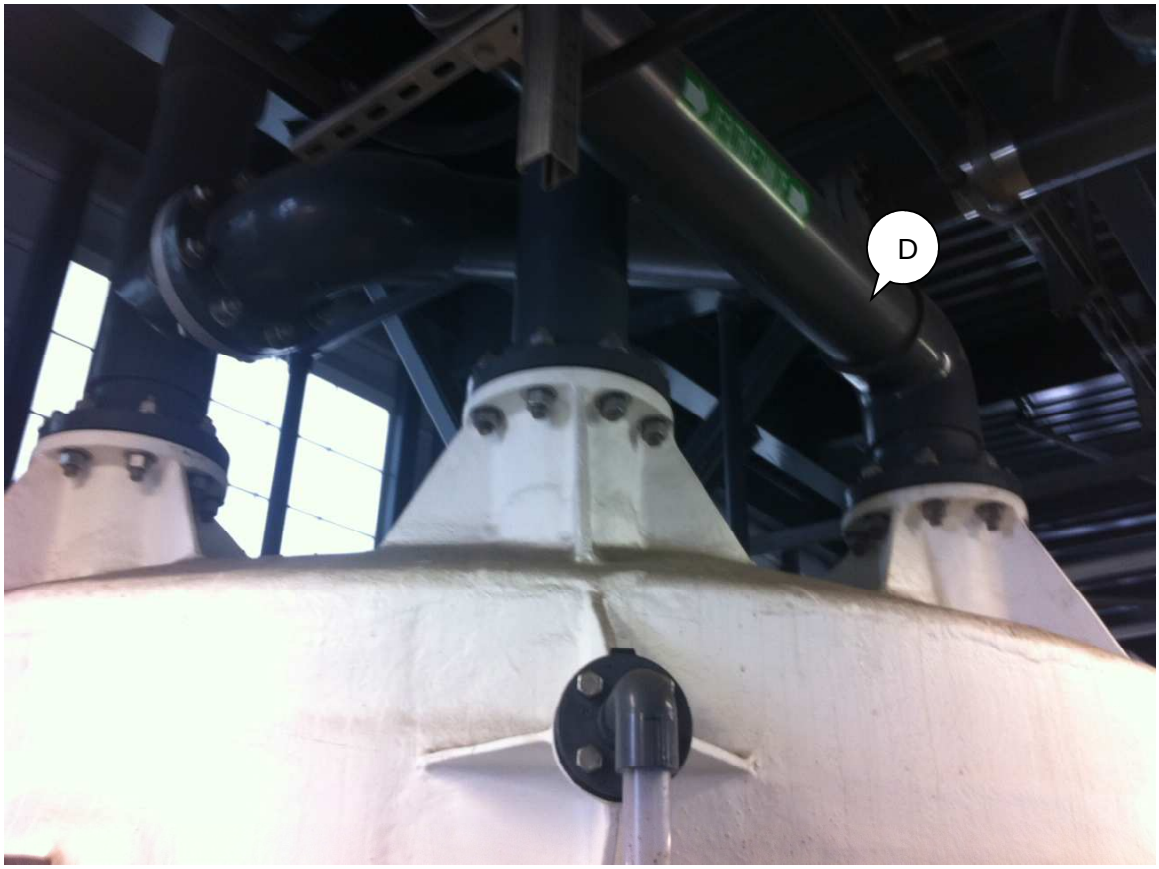



B
A
QUARTER MASTER
CHIEF

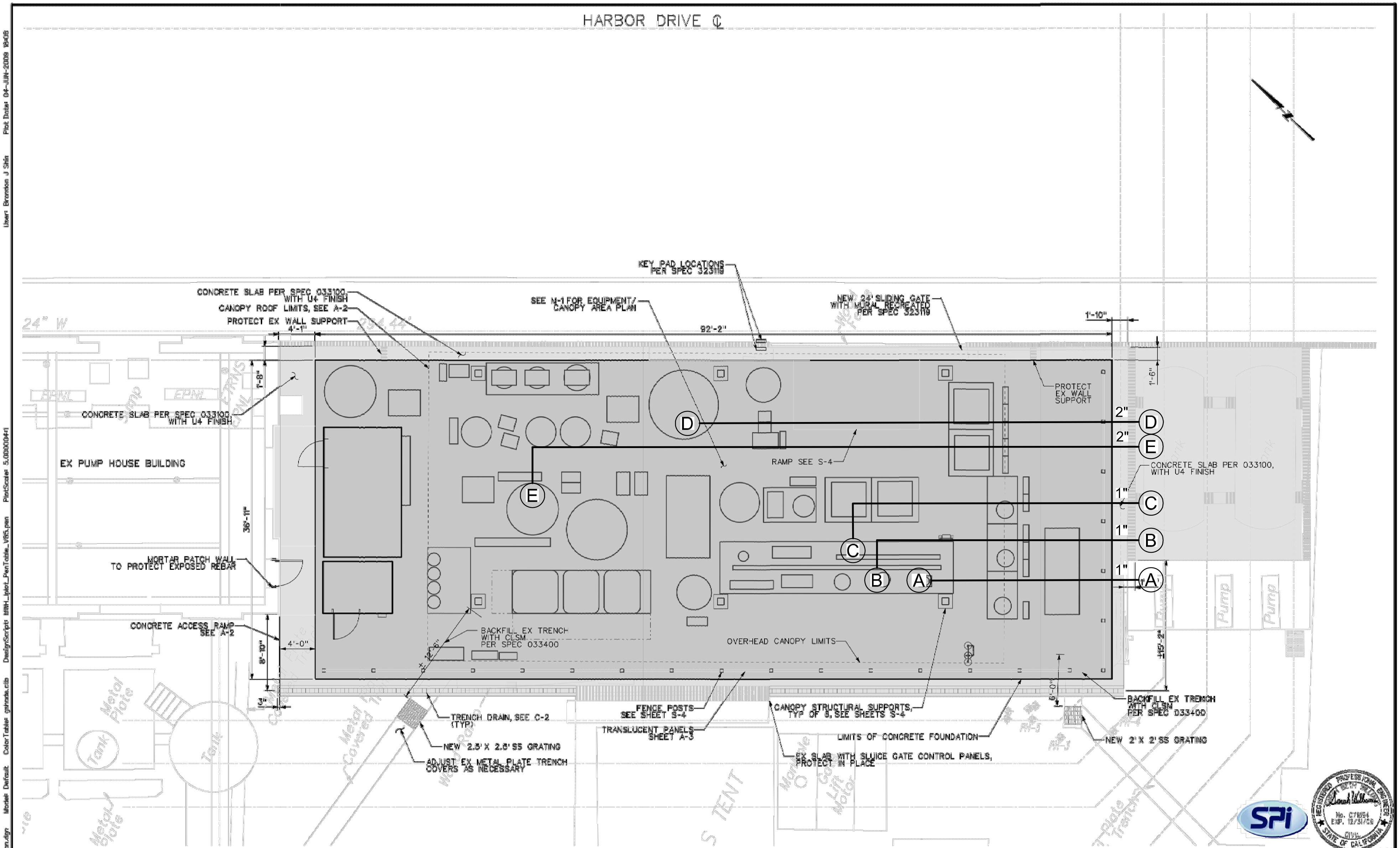
Connection C
One 2nd Pass Permeate
PVC Tee Tie-in on line “C” followed by isolation ball valve and 1” Sch 80 PVC line to south boundary of site. One connection somewhere along line shown here or in the other picture below. Whatever location is most convenient and functional.


C

Connection D
Equalization Tank
Saddle tap to accept 2” Sch 80 PVC line from south boundary of site.
Include check valve on 2” line



Connection E
Neutralization Tank
Saddle tap to accept 2” Sch 80 PVC line from south boundary of site.
Include check valve on 2” line



REV	DATE	BY	DESCRIPTION

SCALE 1"=5'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED S WILLIAMS
DRAWN S WILLIAMS
CHECKED H DUNHAM

SUBMITTED BY
JAMES H. BORCHARDT — 35819 LICENSE NO. — 6-4-09 DATE
JOHN ROBINSON — 6-4-09 DATE

MWH ARCADIA CA

WEST BASIN MUNICIPAL WATER DISTRICT

TEMPORARY OCEAN WATER DESALINATION DEMONSTRATION PROJECT

CIVIL
HORIZONTAL CONTROL AND PAVING PLAN

SHEET C-1

1342583

HAZEN AND SAWYER
Environmental Engineers & Scientists

Appendix E

Wastewater Discharge Permits

- LA County Sanitation Districts Permit
- Ocean Outfall (Storm Drain) Limits

Q1 & Q2 2013

Constituent	Unit	Minimum Level from California Ocean Plan - Specified by SWRCB[8]	Limits in Ocean Plan					NPDES Effluent Limits				Freq.	RLs
			6-month median	Daily Maximum	Instant-aneous Maximum	Annual Average (Qrtly samples)	30-day Average	Average Monthly	6-month Median	Maximum Daily	Instant-aneous Maximum		
Raw Water													
Total Residual Chlorine	µg/L	-	2	8	60	-	-	-	22	88	660	M	20
Copper	µg/L	0.5	3	12	30	-	-	-	13	112	310	SA	0.01
Ammonia (as nitrogen)	µg/L	-	600	2400	6000	-	-	-	6600	26400	66000	Q	100
Beta/photon emitters (adjusted for K40)	pCi/L	-	-	-	-	< 50	-	-	-	-	-	Q	-
bis(2-ethylhexyl) phthalate	µg/L	5	-	-	-	-	3.5	38.5	-	-	-	Q	5
RO Concentrate													
Copper	µg/L	0.5	3	12	30	-	-	-	13	112	310	SA	0.01
Ammonia (as nitrogen)	µg/L	-	600	2400	6000	-	-	-	6600	26400	66000	Q	100
bis(2-ethylhexyl) phthalate	µg/L	5	-	-	-	-	3.5	38.5	-	-	-	Q	4.5
Beta/photon emitters (adjusted for K40)	pCi/L	-	-	-	-	< 50	-	-	-	-	-	Q	-
Ocean Water Discharge													
Total Residual Chlorine	µg/L	-	2	8	60	-	-	-	22	88	660	M	20
Copper	µg/L	0.5	3	12	30	-	-	-	13	112	310	M	0.01
Ammonia (as nitrogen)	µg/L	-	600	2400	6000	-	-	-	6600	26400	66000	M	100
Total Suspended Solids (TSS); composite sample	mg/l	60	-	-	-	-	-	-	60	-	-	M	5
bis(2-ethylhexyl) phthalate	µg/L	5	-	-	-	-	3.5	38.5	-	-	-	M	5
Beta/photon emitters (adjusted for K40)	pCi/L	-	-	-	-	< 50	-	-	-	-	-	Q	-
Receiving Water													
Total Residual Chlorine	µg/L	-	2	8	60	-	-	-	2	8	60	SA	20
Copper	µg/L	0.5	3	12	30	-	-	-	13	112	310	SA	0.01
Zinc	µg/L	1	20	80	200	-	-	-	-	-	-	SA	0.2
bis(2-ethylhexyl) phthalate	µg/L	5	-	-	-	-	3.5	38.5	-	-	-	A	5

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY

1955 Workman Mill Road, Whittier, CA 90601-1400
Mailing Address: P.O. Box 4998, Whittier, CA 90607-4998
Telephone: (562) 699-7411, FAX: (562) 699-5422
www.lacsd.org

STEPHEN R. MAGUIN
Chief Engineer and General Manager

August 12, 2010
Facility ID: 9245033

Mazin Azzawi
City of Redondo Beach
415 Diamond St.
Redondo Beach, CA 90277

Dear Mr. Azzawi :

Industrial Wastewater Discharge Permit No. 20738

West Basin Municipal Water District
1021 N Harbor Drive
Redondo Beach, CA 90277

Enclosed are approved plans and copies of the approved Industrial Wastewater Discharge Permit for the subject company. This permit application was submitted in accordance with Ordinance requirements. The approved permit consists of the approved permit application and plans, this approval letter, the Industrial Wastewater Discharge Permit Requirement List and the Industrial Wastewater Discharge Permit Data Sheet. Please review these for compliance with your requirements, and retain the copies you require for your files. The applicant's copy of the approved plans and Industrial Wastewater Discharge Permit, along with a copy of this letter and requirement list should be forwarded to the applicant. A copy of this letter is forwarded to the applicant as notification of the Districts' permit requirements, which are in force from the current date. If any additional permit requirements are issued to the applicant by your agency, copies should be forwarded to the Districts for our records.

Approval of the permit is subject to compliance with all applicable Ordinance requirements, upon any corrections shown in red on the drawings, and upon the items indicated on the attached requirement list. Failure to comply with all items on the requirement list, including the deadline for submittal of approvable plans, invalidates this approval and issuance. Invalidation of this permit will result in the permittee being deemed to be operating without a valid permit and subject to immediate discontinuance of sewer services for industrial operations.

SANITATION DISTRICTS OF LOS ANGELES COUNTY

INDUSTRIAL WASTE SECTION
1955 Workman Mill Road
Whittier, CA 90601
P.O. Box 4998
Whittier, CA 90607-4998
(562) 699-7411 Ext. 2900
FAX: (562) 908-4224

INDUSTRIAL WASTEWATER DISCHARGE PERMIT REQUIREMENT LIST

The approval and issuance of this permit is being made conditionally and subject to West Basin Municipal Water District being in compliance with all indicated items on this list and accompanying data sheet. Satisfactory evidence of compliance with these conditions should be supplied to the Districts where requested. Satisfactory evidence will consist of a minimum of written notification signed by a responsible company official, and in some cases may involve the submission of additional drawings and data, or verification by a Districts representative. Failure to comply with all items on the requirement list, including all deadlines specified, invalidates this approval and issuance. Invalidation of this permit will result in West Basin Municipal Water District being deemed to be operating without a valid permit and subject to immediate discontinuance of sewer services for industrial operations. Per Section 401 of the Districts' Wastewater Ordinance, this permit is not transferable to a new business location or to a new business.

FACILITY NAME	West Basin Municipal Water District
FACILITY ID	9245033
PERMIT NUMBER	20738
DATE OF APPROVAL	August 12, 2010
DATE OF EXPIRATION	

1. Approval NONSIG (Rev 01-01-2007)
This Industrial Wastewater Discharge Permit is issued only for the discharge of treated wastewater from the operations indicated with a Direction of Outgoing in Section 3 of the Permit Data Sheet. The discharge of any other wastewater will require prior approval from the Districts.

2. Local Limits (Rev 01-01-2007)
Numerical limits have been established by the Districts for the temperature, pH, flashpoint, and maximum concentrations of heavy metals and other toxic materials permissible in an industrial discharge to the public sewers. The limits are those shown in Section 6 of the Permit Data Sheet with the designation of Local in the Regulation column. In addition, applicable state and federal limits are shown in Section 6 of the Permit Data Sheet with the respective designations of State and Federal in the Regulation column. The permittee is advised that any discharge in excess of the limits shown in Section 6 of the Permit Data Sheet requires corrective action by the discharger. Penalties applicable to violations of these limits will be strictly enforced by the Districts.

3. Sample Point (Rev 01-01-2007)
The permittee's legal sampling point(s) are indicated in Section 4 of the Permit Data Sheet. The permittee is responsible for maintaining and cleaning the sampling point(s) to prevent any build-up of oil and grease, sediment or sludge; failure to do so does not invalidate sampling test results. Analytical results from samples taken from the location(s) according to accepted sampling procedures shall be accepted as binding. Safe and convenient access to the sampling point(s) must be provided for representatives of the Districts. Should Districts' staff determine that the sampling locations(s) are unsafe, difficult to access or require modification, the permittee must propose alternatives which will provide sampling point(s) acceptable to the Districts. If a locked security enclosure is necessary, a Districts' padlock shall be used to secure the sampling point area. The permittee must call (562) 699-7411, extension 2907 to make arrangements for installation of the lock.

9. Spill Containment Logbook (Rev 01-01-2007)

If the permittee has restricted materials which must be contained in spill containment areas, the permittee is required to maintain a log book that is available to Districts' employees upon request or during inspections. Any material that enters a spill containment area must be handled as a spill, including rainwater and any process wastewater that results from "normal" operations. All materials removed from spill containment areas, whether restricted or non-restricted as defined in the Districts' "Slug Discharge Control and Spill Containment Policy" (http://www.lacsd.org/info/industrial_waste/policies/slugdischarge.asp) must be included in the log book. The log book must contain the following information:

a) Date and time

b) Identity of material (an analysis is required if the spill is of unknown origin to determine the type of treatment or remediation for proper disposal)

c) Quantity (volume)

d) Cause

e) Method of disposal (includes transfer to off-site treatment system)

f) Corrective action implemented to prevent spills from reoccurring

10. Haul Untreated Spills (Rev 01-01-2007)

Under no circumstances shall process solution spills be discharged directly to the sewer. Unreclaimed or untreated process solution spills shall be hauled to a legal disposal site.

11. Manually Actuated Pump (Rev 01-01-2007)

Spills may be pumped from containment areas to pretreatment systems for treatment prior to discharge after determining their treatability and entering the information into the required log book. Pumps used for this purpose must be manually actuated and there must be no other available access to the sewer.

16. Capacity Unit Increase Advisory (Rev 01-01-2007)
If the wastewater flow rate and strength data indicate an increase in the sewerage capacity unit usage by 25% or more, the permittee may be required to revise its permit, and will be required to pay a corresponding connection fee should existing sewerage baseline capacity units be insufficient to accommodate discharge at that time.

17. Status Change Notification (Rev 01-01-2007)
The permittee is required to notify the Districts of any change in the status of the subject facility, if ownership or operating responsibility changes, or if the industrial waste connection is legally abandoned.

18. 25 Percent Increase - Rev Req (Rev 01-01-2007)
A new permit application must be submitted when there is a significant change in wastewater quantity (more than 25 percent) or quality from that given in the approved permit information. The completed application must be submitted to the local governmental agency for initial processing prior to Districts' review. Approval must be obtained prior to any construction of new facilities.

19. Waste Hauler Reports (Rev 01-01-2007)
Waste hauler reports must be obtained and kept on file for a period of at least four years for any solid wastes from the wastewater pretreatment system and liquid wastes leaving the plant other than in the sewer system. These reports must be made available to representatives of the Districts upon request.

20. Equipment Changes (Rev 01-01-2007)
Engineering drawings for changes in equipment or processes must be submitted to the Districts through the local agency for approval before implementation.

SANITATION DISTRICTS OF LOS ANGELES COUNTY

INDUSTRIAL WASTE SECTION
1955 Workman Mill Road
Whittier, CA 90601
P.O. Box 4998
Whittier, CA 90607-4998
(562) 699-7411 Ext. 2900
FAX: (562) 908-4224

SANITATION DISTRICTS OF LOS ANGELES COUNTY
INDUSTRIAL WASTEWATER DISCHARGE PERMIT DATA SHEET

SECTION 1: *General Information*

Permit Number	20738	Facility ID	9245033
Facility Name	West Basin Municipal Water District	Parcel Number	7503-003-900
Facility Address	1021 N. Harbor Drive Redondo Beach, CA 90277	District Number	SBC
		Thomas Bros. Grid	762/G3
Facility Permit Contact	Shivaji Deshmukh	Number of Employees	
Telephone Number	310-217-2411		
Local Agency	City of Redondo Beach		
Agency Address	415 Diamond St. Redondo Beach, CA 90277		

SECTION 2: *Permit Status*

ıtrial Waste Discharge

Permit Status	APPROVED
Application Received Date	June 08, 2010
Approval Date	August 12, 2010
Expiration Date	N/A

SECTION 3: *Flow Stream Information*

Name	Type	Direction	Federal Regulation	Local Regulation
Membrane cleaning system washwater, filter backwash and all other normal flows associated with a water desalination operation	Sewered Flow	Outgoing	403	IU Standard - All Others

Flow Stream Regulatory Notes:

Federal Regulation: 40 CFR Part 403 General Pretreatment Regulations

Local Regulation: IU Standard - All Others

al Detected Chlordanes	Local	Composite	0 ug/L			
otal Detected Chlordanes	Local	Grab	0 ug/L			
Arsenic, Total	Local	Composite	3 mg/L			
Arsenic, Total	Local	Grab	3 mg/L			
Cadmium, Total	Local	Composite	15 mg/L			
Cadmium, Total	Local	Grab	15 mg/L			
Chromium, Total	Local	Composite	10 mg/L			
Chromium, Total	Local	Grab	10 mg/L			
Copper, Total	Local	Composite	15 mg/L			
Copper, Total	Local	Grab	15 mg/L			
Lead, Total	Local	Composite	40 mg/L			
Lead, Total	Local	Grab	40 mg/L			
Mercury, Total	Local	Composite	2 mg/L			
Mercury, Total	Local	Grab	2 mg/L			
Nickel, Total	Local	Composite	12 mg/L			
Nickel, Total	Local	Grab	12 mg/L			
Silver, Total	Local	Composite	5 mg/L			
Silver, Total	Local	Grab	5 mg/L			
Zinc, Total	Local	Composite	25 mg/L			
Zinc, Total	Local	Grab	25 mg/L			

SECTION 7: ***Flow Limits***

Sample Location:	20738A (Sample spigot downstream of neutralization tank)				
nit Type	Flow Data Type	Start Time	End Time	Flow Limit Value	Flow Units
aily Average Flow Limit	Average			250	GPD
5-minute Peak Flow Limit	Maximum			50	gpm

SECTION 8: ***Pretreatment Equipment/Process***

Pretreatment Process Name:	Pretreatment
Equipment Name	Equipment Type
Equalization Tank	Pretreatment
Discharge Neutralization Tank	Pretreatment

SECTION 9: ***Program Requirements***

Program Name	Status	Due Date	Approved Date	Plan Name
Not Applicable				

SECTION 10: ***Submissions/Completions Requirements***

Required Submissions/Completions	Due Date
Not Applicable	

SELF-MONITORING REPORTING SCHEDULE

Permittees required to submit self-monitoring reports per Section 5 of this Permit Data Sheet are subject to the following schedule:

SELF-MONITORING REPORTING SCHEDULE[1]		
Analysis Frequency	**Reporting Period**	**Due Date[2]**
Annually	July 1 - June 30	July 15 (the following year)
Semi-annually	January 1 - June 30 July 1 - December 31	July 15 January 15
Quarterly	January 1 - March 31 April 1 - June 30 July 1 - September 30 October 1 - December 31	April 15 July 15 October 15 January 15
Monthly	Day 1 - Day 31 of the month	Day 15 (the following month)

[1]The laboratory data sheet(s) for each analysis performed during the reporting period must be included with the Self-monitoring Report form. However, only the results from the most recent sample collected during the reporting period should be recorded on the Self-monitoring Report form.

[2]The Self-monitoring Report form may be submitted before the due date as long as the sample is taken during the appropriate reporting period.

SURCHARGE TEST REQUIREMENTS

Industrial users participating in the Sanitation Districts' Surcharge Program may be subject to additional self-monitoring requirements besides those specified in the permit conditions. Surcharge testing parameters include Chemical Oxygen Demand (COD) and suspended solids (SS). For companies that file Long Form Surcharge Statements, the testing frequency for COD and SS is based on flow as shown in the table below. Surcharge wastewater analyses must adequately represent the average daily discharge to the sewer system and the results must be submitted annually with the wastewater treatment surcharge statement in accordance with each year's "Instruction for Filing a Long Form Wastewater Treatment Surcharge Statement." **Surcharge test requirements are independent of the self-monitoring report requirements.**

SURCHARGE TESTING FREQUENCY FOR COD AND SS (Must be 24-hour Composite Samples)	
Yearly Cumulative Flow from Each Outlet (in million gallons)	**Required Testing Frequency**
Less than 15.00	1 sample per 3 months
15.01 to 40.00	1 sample per 2 months
40.01 to 100.00	2 samples per month
100.01 to 250.00	1 sample per week
More than 250.00	2 samples per week

SANITATION DISTRICTS OF LOS ANGELES COUNTY

INDUSTRIAL WASTE SECTION
1955 Workman Mill Road
Whittier, CA 90601
P.O. Box 4998
Whittier, CA 90607-4998
(562) 699-7411 Ext. 2900
FAX: (562) 908-4224

SANITATION DISTRICTS OF LOS ANGELES COUNTY
INDUSTRIAL WASTEWATER DISCHARGE PERMIT DATA SHEET

SECTION 1: *General Information*

Permit Number	20738	Facility ID	9245033
Facility Name	West Basin Municipal Water District	Parcel Number	7503-003-900
Facility Address	1021 N. Harbor Drive Redondo Beach, CA 90277	District Number	SBC
		Thomas Bros. Grid	762/G3
Facility Permit Contact	Shivaji Deshmukh	Number of Employees	
Telephone Number	310-217-2411		
Local Agency	City of Redondo Beach		
Agency Address	415 Diamond St. Redondo Beach, CA 90277		

SECTION 2: *Permit Status*

Industrial Waste Discharge Permit Status	APPROVED
Application Received Date	June 08, 2010
Approval Date	August 12, 2010
Expiration Date	N/A

SECTION 3: *Flow Stream Information*

Name	Type	Direction	Federal Regulation	Local Regulation
Membrane cleaning system washwater, filter backwash and all other normal flows associated with a water desalination operation	Sewered Flow	Outgoing	403	IU Standard - All Others

Flow Stream Regulatory Notes:

Federal Regulation: 40 CFR Part 403 General Pretreatment Regulations

Local Regulation: IU Standard - All Others

tal Detected Chlordanes	Local	Composite	0 ug/L			
al Detected Chlordanes	Local	Grab	0 ug/L			
Arsenic, Total	Local	Composite	3 mg/L			
Arsenic, Total	Local	Grab	3 mg/L			
Cadmium, Total	Local	Composite	15 mg/L			
Cadmium, Total	Local	Grab	15 mg/L			
Chromium, Total	Local	Composite	10 mg/L			
Chromium, Total	Local	Grab	10 mg/L			
Copper, Total	Local	Composite	15 mg/L			
Copper, Total	Local	Grab	15 mg/L			
Lead, Total	Local	Composite	40 mg/L			
Lead, Total	Local	Grab	40 mg/L			
Mercury, Total	Local	Composite	2 mg/L			
Mercury, Total	Local	Grab	2 mg/L			
Nickel, Total	Local	Composite	12 mg/L			
Nickel, Total	Local	Grab	12 mg/L			
Silver, Total	Local	Composite	5 mg/L			
Silver, Total	Local	Grab	5 mg/L			
Zinc, Total	Local	Composite	25 mg/L			
Zinc, Total	Local	Grab	25 mg/L			

SECTION 7: ***Flow Limits***

Sample Location:	20738A (Sample spigot downstream of neutralization tank)				
mit Type	Flow Data Type	Start Time	End Time	Flow Limit Value	Flow Units
ly Average Flow Limit	Average			250	GPD
5-minute Peak Flow Limit	Maximum			50	gpm

SECTION 8: ***Pretreatment Equipment/Process***

Pretreatment Process Name:	Pretreatment
Equipment Name	**Equipment Type**
Equalization Tank	Pretreatment
Discharge Neutralization Tank	Pretreatment

SECTION 9: ***Program Requirements***

Program Name	Status	Due Date	Approved Date	Plan Name
Not Applicable				

SECTION 10: ***Submissions/Completions Requirements***

Required Submissions/Completions	Due Date
Not Applicable	

SELF-MONITORING REPORTING SCHEDULE

Permittees required to submit self-monitoring reports per Section 5 of this Permit Data Sheet are subject to the following schedule:

SELF-MONITORING REPORTING SCHEDULE[1]		
Analysis Frequency	**Reporting Period**	**Due Date[2]**
Annually	July 1 - June 30	July 15 (the following year)
Semi-annually	January 1 - June 30 July 1 - December 31	July 15 January 15
Quarterly	January 1 - March 31 April 1 - June 30 July 1 - September 30 October 1 - December 31	April 15 July 15 October 15 January 15
Monthly	Day 1 - Day 31 of the month	Day 15 (the following month)

[1]The laboratory data sheet(s) for each analysis performed during the reporting period must be included with the Self-monitoring Report form. However, only the results from the most recent sample collected during the reporting period should be recorded on the Self-monitoring Report form.

[2]The Self-monitoring Report form may be submitted before the due date as long as the sample is taken during the appropriate reporting period.

SURCHARGE TEST REQUIREMENTS

Industrial users participating in the Sanitation Districts' Surcharge Program may be subject to additional self-monitoring requirements besides those specified in the permit conditions. Surcharge testing parameters include Chemical Oxygen Demand (COD) and suspended solids (SS). For companies that file Long Form Surcharge Statements, the testing frequency for COD and SS is based on flow as shown in the table below. Surcharge wastewater analyses must adequately represent the average daily discharge to the sewer system and the results must be submitted annually with the wastewater treatment surcharge statement in accordance with each year's "Instruction for Filing a Long Form Wastewater Treatment Surcharge Statement." **Surcharge test requirements are independent of the self-monitoring report requirements**.

SURCHARGE TESTING FREQUENCY FOR COD AND SS (Must be 24-hour Composite Samples)	
Yearly Cumulative Flow from Each Outlet (in million gallons)	**Required Testing Frequency**
Less than 15.00	1 sample per 3 months
15.01 to 40.00	1 sample per 2 months
40.01 to 100.00	2 samples per month
100.01 to 250.00	1 sample per week
More than 250.00	2 samples per week

EDEX 7935 8602 3647

PERMIT FOR INDUSTRIAL WASTEWATER DISCHARGE
COUNTY SANITATION DISTRICTS OF LOS ANGELES COUNTY
1955 Workman Mill Road / Whittier, CA
Mailing Address: P.O. Box 4998 / Whittier, California 90607-4998
Stephen R. Maguin, Chief Engineer and General Manager
(562) 699-7411

PERMIT NO: 20738

Facility ID: 9245033

01 CHECK ONE: New Sewer Connection ☒ Existing Sewer Connection ☐

02 Applicant West Basin Municipal Water District
(Legal Company Name)

03 Check one and fill in appropriate information

☒ Corporation Name West Basin Municipal Water District
Year Incorporated 1947 State of Incorporation CA ID# _____

☐ Partnership Name _____ Partners _____

☐ Sole Proprietor Name _____ Business Names _____

04 Situs Address 1021 North Harbor Drive (Street) Redondo Beach (City) CA (State) 90277 (Zip)

05 Mailing Address 17140 South Avalon Blvd, Ste 210 (Street) Carson (City) CA (State) 90746-1296 (Zip)

06 Point of Discharge Latitude N: 33.850300-33 51' 1.1", Longitude W: 118.396200- 118 23' 46.3"

07 Number of years applicant has been in business at present location 0 (yrs) _____ (months)

08 Name of Property Owner AES
Address of Property Owner 1100 North Harbor Drive, Redondo Beach, CA 90277 (Street) (City) (Zip) 310-318-7491 (Telephone Number)

09 Assessors Map Book No. 7 5 0 3 Page No. 0 0 3 Parcel No. 9 0 0

10 Type of Industry Special District Government - Water Resources (General Description) 9 5 1 1 , ☐ ☐ ☐ ☐ (Federal SIC No.)

11 Number of Employees (Full Time) 2 (Part Time) 2

12 Raw Materials Used Ocean Water
(General Description -- Add Additional Sheets as Needed)
580,000 gallons per day
(Daily Amount Used)

13 Products Produced Desalinated Product Water; Byproducts: seawater concentrate, washwater and backwash
(General Description -- Add Additional Sheets as Needed)
50,000 gpd; 50,000 gpd, and 20,000 gpd combined.
(Daily Amount Produced)

14 Wastewater Producing Operations Membrane cleaning system washwater and backwash up to 50 gpm (usually less) for up to 40 min, 136 times per year creating approximately 2000 gallons to be discharged to sanitary sewer.
(Full Description -- Add Additional Sheets as Needed)

15 Time of Discharge 11:59 AM☐ PM☒ 12:39 AM ☒ PM☐, Shifts per day 1 Days per Week M☒ T☒ W☒ Th☒ F☒ Sa☒ Su☒

16 Wastewater Flow Rate 250 (Average) Gallons per Day 50 (Peak) Gallons per Minute

17 Constituents of Wastewater Discharge FeCl3, sodium hydroxide (neutralized), sodium hypochlorite (neutralized), citric acid (nuetralized), Discharge 136 times per year, but days of week could vary.
(General Description -- Attach Chemical Analysis Results to the Application)

18 Person in company responsible for industrial wastewater discharge
Shivaji Deshmukh (Name) Assistant General Manager (Position) 310-217-2411 (Telephone Number)

I affirm that all information furnished is true and correct and that the applicant will comply with the conditions stated on the back of this permit form.

Date May 12 20 10

19 Signature for Applicant Shivaji Deshmukh (Company Administrative Official) (Name) Assistant General Manager (Position)

20 Approved/Reviewed by City or County Official
Date 5/24/2010
For L.A. County Dept. of Public Works . . . ☐
City of Redondo Beach
Name M. Logdus
Position Civil Engineer

Approved by Sanitation Districts of Los Angeles County
Date 08-12-2010
Expiration Date 12-31-2050
Stephen R. Maguin, Chief Engineer and General Manager
By _____
Position Sr Engineer

Note: Please submit application first to the applicable City or County agency in which the point of discharge is located. Please contact the local agency for the required permit-processing fee. Submit the original application (Do not send copies).

CONTINUED ON NEXT PAGE

MAY 28 2010 AM10:49

DOC # _____

Wienke S

STEPHEN R. MAGUIN
Chief Engineer and
General Manager

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY
1955 Workman Mill Road P. O. Box 4998
Whittier, California 90607 - 4998
(562) 699-7411

INDUSTRIAL CONNECTION FEE
NOTICE OF CHARGES

FOR DISTRICTS USE ONLY	
Payment Received $4,623.00	
Postmark Date	Date Received 6/24/10
Group No.	Received By

Status As Of June 17, 2010

Account Number 9245033 Permit Number 20738 X2927

Company Name: West Basin Municipal Water District
17140 South Avalon Blvd., Suite 210
Carson, CA 90746-1296

for property located at 1021 No Harbor Drive
Redondo Beach, CA 90277

Please return the green copy of this form with payment within 45 days of the date of this invoice. Payments received after 45 days are considered delinquent and are subject to penalty and interest penalty charges.

TOTAL CAPACITY USAGE AT SITE	**1.38 CU'S**
LESS CREDIT	**0.00 CU'S**
ADDITIONAL CAPACITY UNITS REQUIRED	**1.38 CU'S**
COST PER CAPACITY UNIT FOR DISTRICT 30/SBC	**$3,350.00**
TOTAL NOW DUE	**$4,623.00**

Upon receipt and verification of payment (approximately three weeks) the total number of capacity units at the above address will be **1.38** CU's.

E

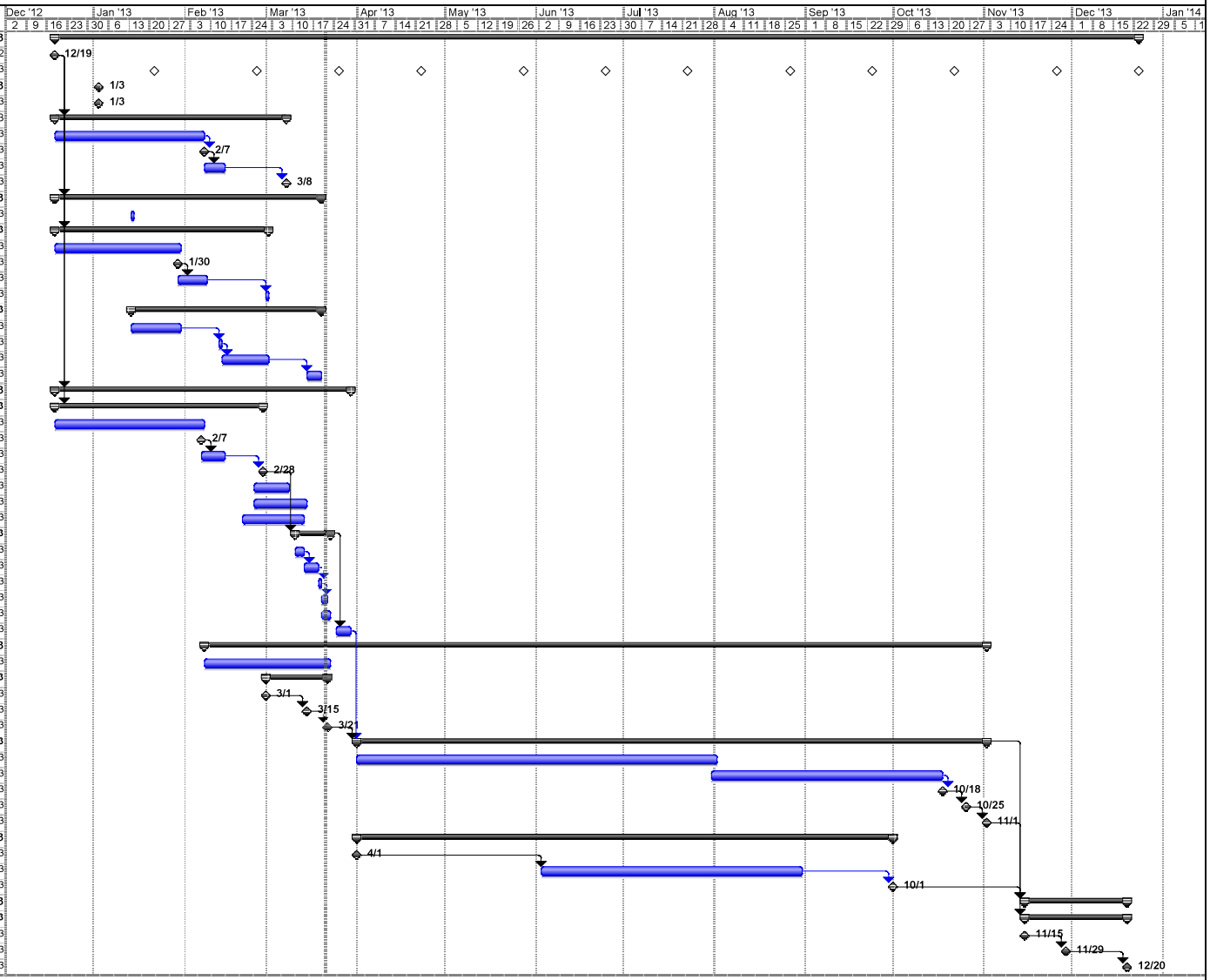
HAZEN AND SAWYER
Environmental Engineers & Scientists

Appendix F

Master Project Schedule

West Basin's Ocean Water Desalination
Water Quality Integration Study
Schedule

Task Name	Start	Finish
Task 1 - Project Management	**Wed 12/19/12**	**Tue 12/24/13**
Kickoff Meeting	Wed 12/19/12	Wed 12/19/12
Progress Meetings	Tue 1/22/13	Tue 12/24/13
Task 2 - Site and Facility Investigation	**Thu 1/3/13**	**Thu 1/3/13**
Site and Facility Visit	Thu 1/3/13	Thu 1/3/13
Task 3 - Literature Review and Survey	Wed 12/19/12	Fri 3/8/13
Conduct Literature Review and Survey	Wed 12/19/12	Thu 2/7/13
Draft Deliverable	Thu 2/7/13	Thu 2/7/13
Comments from West Basin	Fri 2/8/13	Thu 2/14/13
Final Deliverable	Fri 3/8/13	Fri 3/8/13
Task 4 - Pipe Harvesting	**Wed 12/19/12**	**Tue 3/19/13**
Meet with Cal Water	Mon 1/14/13	Mon 1/14/13
Prepare Pipe Harvesting Plan	**Wed 12/19/12**	**Fri 3/1/13**
Prepare Pipe Harvesting Plan	Wed 12/19/12	Wed 1/30/13
Draft Deliverable	Wed 1/30/13	Wed 1/30/13
Comments from West Basin	Wed 1/30/13	Fri 2/8/13
Final Deliverable	Fri 3/1/13	Fri 3/1/13
Pipe Harvesting	**Mon 1/14/13**	**Tue 3/19/13**
Identify Unlined 4-inch CI Pipe in Distribution System	Mon 1/14/13	Wed 1/30/13
Pothole to Confirm Pipe Material	Wed 2/13/13	Wed 2/13/13
H&S Contract with Vido Samarzich	Thu 2/14/13	Fri 3/1/13
Pipe Harvesting	Fri 3/15/13	Tue 3/19/13
Task 5 - Pipe Loop Design and Installation	**Wed 12/19/12**	**Fri 3/29/13**
Prepare Pipe Loop Installation Plan	**Wed 12/19/12**	**Thu 2/28/13**
Prepare Pipe Loop Design and Installation Plan	Wed 12/19/12	Thu 2/7/13
Draft Deliverable	Thu 2/7/13	Thu 2/7/13
Receive Comments from West Basin	Thu 2/7/13	Thu 2/14/13
Final Deliverable	Thu 2/28/13	Thu 2/28/13
Transformer Installation by United Water	Mon 2/25/13	Fri 3/8/13
Water Sources and Discharge Plumbing by United Water	Mon 2/25/13	Thu 3/14/13
H&S Procurement	Thu 2/21/13	Wed 3/13/13
H&S Construction	**Mon 3/11/13**	**Fri 3/22/13**
Build Racks, including Plumbing	Mon 3/11/13	Wed 3/13/13
Electrical Work on Pipe Loops	Thu 3/14/13	Mon 3/18/13
Build Secondary Containment and Test	Tue 3/19/13	Tue 3/19/13
Install Harvested Pipes in Racks	Wed 3/20/13	Thu 3/21/13
Build Desalination Stabilization Process	Wed 3/20/13	Fri 3/22/13
Shakedown Period for Water Conditioning	Mon 3/25/13	Fri 3/29/13
Task 6 - Water Quality Testing	**Fri 2/8/13**	**Fri 11/1/13**
Obtain Groundwater Water Quality	Fri 2/8/13	Fri 3/22/13
Prepare Pipe Loop Test Plan	**Fri 3/1/13**	**Thu 3/21/13**
Draft Deliverable	Fri 3/1/13	Fri 3/1/13
Comments from West Basin	Fri 3/15/13	Fri 3/15/13
Final Deliverable	Thu 3/21/13	Thu 3/21/13
Pipe Loop Testing and Memo	**Mon 4/1/13**	**Fri 11/1/13**
Pipe Loop Testing	Mon 4/1/13	Thu 8/1/13
Preparation of Pipe Loop Technical Memorandum	Wed 7/31/13	Thu 10/17/13
Draft Deliverable - Technical Memorandum	Fri 10/18/13	Fri 10/18/13
Comments from West Basin	Fri 10/25/13	Fri 10/25/13
Final Deliverable - Technical Memorandum	Fri 11/1/13	Fri 11/1/13
Task 7 - Bench Scale Testing	**Mon 4/1/13**	**Tue 10/1/13**
Review of MWD Draft Test Plan	Mon 4/1/13	Mon 4/1/13
Bench Scale Testing	Mon 6/3/13	Fri 8/30/13
Review of MWD Report	Tue 10/1/13	Tue 10/1/13
Task 8 - Final Report	**Fri 11/15/13**	**Fri 12/20/13**
Prepare Draft Final Report	**Fri 11/15/13**	**Fri 12/20/13**
Deliverable - Draft Final Report	Fri 11/15/13	Fri 11/15/13
Receive Comments from West Basin and MWD	Fri 11/29/13	Fri 11/29/13
Deliverable - Final Report	Fri 12/20/13	Fri 12/20/13



Project: West Basin
Date: 3/18/2013

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

HAZEN AND SAWYER
Environmental Engineers & Scientists

Appendix G

MSDS Sheets for Reagents and Chemicals

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00128

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Ammonia Cyanurate
Catalog Number: 2653199

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00128
Chemical Name: Not Applicable
CAS No.: Not Applicable
Chemical Formula: Not Applicable
Chemical Family: Not applicable
Hazard: Causes burns.
Date of MSDS Preparation:
Day: 11
Month: August
Year: 2012

2. COMPOSITION / INFORMATION ON INGREDIENTS

Sodium Dichloroisocyanurate
CAS No.: 2893-78-9
TSCA CAS Number: 2893-78-9
Percent Range: 1.0 - 5.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 1400 mg/kg; Oral human LDLo = 3570 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: Oxidizer. Causes eye burns.

Lithium Hydroxide, Anhydrous
CAS No.: 1310-65-2
TSCA CAS Number: 1310-65-2
Percent Range: 1.0 - 5.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 225 mg/kg
LC50: Inhalation rat LC50 = 980 mg/m^3/4H
TLV: 3mg/m^3 Respirable Particles; 10 mg/m^3 Inhalable particles
PEL: 5 mg/m^3 Respirable Fraction; 15 mg/m^3 Total Dust
Hazard: Toxic. Causes severe burns. Harmful if swallowed

Sodium Citrate
CAS No.: 68-04-2
TSCA CAS Number: 68-04-2
Percent Range: 80.0 - 90.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 >8 g/Kg
LC50: None reported

TLV: Not established
PEL: Not established
Hazard: May cause irritation.

Sodium Tartrate
CAS No.: 868-18-8
TSCA CAS Number: 868-18-8
Percent Range: 5.0 - 15.0
Percent Range Units: weight / weight
LD50: Oral rabbit LD50 = 5290 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: White powder
Odor: Chlorine
CAUSES BURNS HARMFUL IF SWALLOWED
MAY CAUSE KIDNEY OR LIVER DAMAGE BASED ON ANIMAL DATA
HMIS:
Health: 3
Flammability: 1
Reactivity: 1
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 2
Flammability: 1
Reactivity: 1
Symbol: Not applicable
Potential Health Effects:
Eye Contact: Causes eye burns.
Skin Contact: Causes burns.
Skin Absorption: None reported
Target Organs: None reported
Ingestion: Causes: burns May cause: dizziness nausea kidney damage liver damage
Target Organs: Liver Kidneys Central nervous system Bone marrow
Inhalation: Causes: burns May cause: shortness of breath coughing
Target Organs: None reported
Medical Conditions Aggravated: Pre-existing: Eye conditions Skin conditions Respiratory conditions
Chronic Effects: Lithium compounds have been implicated in development of aplastic anemia. Signs of lithium poisoning include dehydration, extreme weight loss, fine tremor of hands, nausea, vomiting and diarrhea, Chronic overexposure may cause central nervous system effects kidney damage liver damage
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.
This product does NOT contain any IARC listed chemicals.
This product does NOT contain any NTP listed chemicals.
Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with soap and plenty of water for 15 minutes. Remove contaminated clothing. Call physician immediately.
Ingestion (First Aid): Do not induce vomiting. Give 1-2 glasses of water. Call physician immediately. Never give anything by mouth to an unconscious person.
Inhalation: Remove to fresh air. Give artificial respiration if necessary. Call physician.

5. FIRE FIGHTING MEASURES

Flammable Properties: During a fire, irritating and highly toxic gases may be generated by thermal decomposition.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not determined
Hazardous Combustion Products: May emit toxic and corrosive fumes.
Fire / Explosion Hazards: Not combustible.
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Dry chemical. Carbon dioxide Water.
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.
Containment Technique: Cover spilled solid material with sand or other inert material. Stop spilled material from being released to the environment.
Clean-up Technique: Scoop up spilled material into a large beaker and dissolve with water. Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Flush reacted material to the drain with a large excess of water. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate local area (15 foot radius or as directed by your facility's emergency response plan) when: any quantity is spilled. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: 154

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin clothing Do not breathe dust. Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Protect from: heat moisture Store away from: acids / acid fumes.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Have an eyewash station nearby. Have a safety shower nearby. Use a fume hood to avoid exposure to dust, mist or vapor. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves In the EU, the selected gloves must satisfy the specifications of EU Directive 89/686/EEC and standard EN 374 derived from it. lab coat
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes skin clothing Do not breathe: dust Wash thoroughly after handling. Keep away from: acids/acid fumes metals
TLV: 3mg/m^3 Respirable Particles; 10 mg/m^3 Inhalable particles
PEL: 5 mg/m^3 Respirable Fraction; 15 mg/m^3 Total Dust

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: White powder

Physical State: Solid
Molecular Weight: Not applicable
Odor: Chlorine
pH: of a 5% solution = 12.33
Vapor Pressure: Not applicable
Vapor Density (air = 1): Not applicable
Boiling Point: Not applicable
Melting Point: >240 °C, >464 °F
Specific Gravity/ Relative Density (water = 1; air =1): 1.783
Evaporation Rate (water = 1): Not applicable
Volatile Organic Compounds Content: None reported
Partition Coefficient (n-octanol / water): Not applicable
Solubility:
Water: Soluble
Acid: Soluble
Other: Not determined
Metal Corrosivity:
Steel: 0.00 in/yr
Aluminum: 0.803 in/yr

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Heating to decomposition. Extreme temperatures Excess moisture
Reactivity / Incompatibility: Incompatible with: acids
Hazardous Decomposition: Contact with acids releases toxic and/or corrosive fumes of: chlorides nitrogen oxides
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: Sodium Citrate Oral rat LD50 > 8 g/k; Sodium Tartrate Oral rabbit LD50 = 5290 mg/kg; Lithium Hydroxide Oral rat LD50 = 225 mg/kg; Sodium Dichloroisocyanurate Oral rat LD50 = 1400 mg/kg

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
Do not release into the environment. Mobility in soil: No data available
Ingredient Ecological Information: Sodium dichloroisocyanurate: Oncorhynchus mykiss 96 h LC50 = 0,25 mg/l; Daphnia magna 48 hr LC50 = 0,28 mg/l.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Dilute to 3 to 5 times the volume with cold water. Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Open cold water tap completely, slowly pour the reacted material to the drain. Flush system with plenty of water.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:

D.O.T. Proper Shipping Name: Lithium Hydroxide Mixture
--
DOT Hazard Class: 8
DOT Subsidiary Risk: NA
DOT ID Number: UN2680
DOT Packing Group: II

I.C.A.O.:
I.C.A.O. Proper Shipping Name: Lithium Hydroxide Mixture
--
ICAO Hazard Class: 8
ICAO Subsidiary Risk: NA
ICAO ID Number: UN2680
ICAO Packing Group: II

I.M.O.:
I.M.O. Proper Shipping Name: Lithium Hydroxide Mixture
--
I.M.O. Hazard Class: 8
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: UN2680
I.M.O. Packing Group: II

Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Delayed (Chronic) Health Hazard Immediate (Acute) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.
--
302 (EHS) TPQ (40 CFR 355): Not applicable
304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable
RCRA: Contains no RCRA regulated substances.
C.P.S.C.: Not applicable

State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): Not applicable
California Perchlorate Rule CCR Title 22 Chap 33: Not applicable

Trade Secret Registry: Not applicable

National Inventories:
U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).
TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Laboratory Use Reagent for ammonia test
References: NIOSH Registry of Toxic Effects of Chemical Substances, 1985-86. Cincinnati: U.S. Department of Health and Human Services, April, 1987. Patty, Frank A. Industrial Hygiene and Toxicology, 3rd Revised Edition. Volume 2. New York: A Wiley-Interscience Publication, 1981. Gosselin, R. E. et al. Clinical Toxicology of Commercial Products, 5th Ed. Baltimore: The Williams and Wilkins Co., 1984. Technical Judgment. In-house information. Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992.

Revision Summary: Substantial revision to comply with EU Reg 1272/2008, Reg 1907/2006 and UN GHS (ST/SG/AC.10/36/Add.3).

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00127

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Ammonia Salicylate Reagent
Catalog Number: 2653299

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00127
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: May cause irritation. Harmful if swallowed
Date of MSDS Preparation:
Day: 06
Month: August
Year: 2012

2. COMPOSITION / INFORMATION ON INGREDIENTS

Sodium Salicylate
CAS No.: 54-21-7
TSCA CAS Number: 54-21-7
Percent Range: 40.0 - 50.0
Percent Range Units: weight / weight
LD50: Oral rat LD_{50} = 1200 mg/kg; Oral mouse LD_{50} = 540 mg/kg; Oral rabbit LD_{50} = 1700 mg/kg.
LC50: None reported.
TLV: Respirable particles: 3 mg/m^3; Inhalable particles: 10 mg/m^3
PEL: Total dust: 15 mg/m^3; Respirable fraction: 5 mg/m^3
Hazard: May cause irritation. Experimental teratogen. Experimental mutagen. May be embryotoxic.

Sodium Nitroferricyanide
CAS No.: 14402-89-2
TSCA CAS Number: 14402-89-2
Percent Range: < 1.0
Percent Range Units: weight / weight
LD50: Oral rat LD_{50} = 99 mg/kg (anhydrous).
LC50: None reported.
TLV: 5 mg/m^3 as CN^-
PEL: 5 mg/m^3 as CN^-
Hazard: Toxic. May be harmful if inhaled or swallowed

m - Nitrophenol
CAS No.: 554-84-7
TSCA CAS Number: 554-84-7
Percent Range: < 0.5
Percent Range Units: weight / weight
LD50: Oral rat LD_{50} = 328 mg/kg; Oral mouse LD_{50} = 1070 mg/kg.
LC50: None reported.

TLV: Not established.
PEL: Not established.
Hazard: Toxic. Causes severe eye irritation. Causes irritation.

Sodium Citrate
CAS No.: 68-04-2
TSCA CAS Number: 68-04-2
Percent Range: 40.0 - 50.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 >8 g/Kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

Sodium Tartrate
CAS No.: 868-18-8
TSCA CAS Number: 868-18-8
Percent Range: 10.0 - 20.0
Percent Range Units: weight / weight
LD50: Oral rabbit LD50 = 5290 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Tan powder
Odor: None
HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN MAY CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION
CONTACT WITH ACIDS FORMS TOXIC FUMES
HMIS:
Health: 3
Flammability: 1
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 3
Flammability: 1
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: May cause irritiation
Skin Contact: May cause irritiation
Skin Absorption: Harmful if absorbed through the skin Effects similar to those of ingestion Sodium nitroferricyanide produces a delayed cyanide poisoning reaction.
Target Organs: Central nervous system Blood
Ingestion: Sodium nitroferricyanide produces a delayed cyanide poisoning reaction. May cause: headache nausea vomiting central nervous system effects
Target Organs: Central nervous system Blood
Inhalation: Sodium nitroferricyanide produces a delayed cyanide poisoning reaction. May cause: headache nausea, vomiting central nervous system effects
Target Organs: Central nervous system Blood
Medical Conditions Aggravated: Allergies or sensitivity to aspirin or salicylates.
Chronic Effects: Chronic overexposure may cause confusion diarrhea fatigue weakness death Salicylates may cause ringing in the ears (tinnitus), abnormal bleeding, gastric ulceration, mental deterioration, skin eruption, temporary vision loss, and other optical effects.
Cancer / Reproductive Toxicity Information:

This product does NOT contain any OSHA listed carcinogens.
This product does NOT contain any IARC listed chemicals.
This product does NOT contain any NTP listed chemicals.
Additional Cancer / Reproductive Toxicity Information: Contains: an experimental mutagen. an experimental teratogen.
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with soap and plenty of water for 15 minutes. Remove contaminated clothing. Call physician immediately.
Ingestion (First Aid): Never give anything by mouth to an unconscious person. Call physician immediately.
Inhalation: Remove to fresh air. Give artificial respiration if necessary. Call physician.

5. FIRE FIGHTING MEASURES

Flammable Properties: During a fire, this product decomposes to form toxic gases.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not determined.
Hazardous Combustion Products: May emit acrid smoke and fumes.
Fire / Explosion Hazards: This product will not burn or explode.
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Dry chemical. Carbon dioxide Alcohol foam.
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear. Evacuate area and fight fire from a safe distance.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.
Containment Technique: Releases of this material may contaminate the environment. Stop spilled material from being released to the environment.
Clean-up Technique: Avoid contact with spilled material. Sweep up material. Dilute with a large excess of water. Flush the spilled material to the drain with a large excess of water. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate local area (15 foot radius or as directed by your facility's emergency response plan) when: a pound or more of loose powder is spilled. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Mixture contains a component which is regulated as hazardous waste in the U. S. .
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin clothing Do not breathe dust. Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Store between 10° and 25°C. Keep away from: acids / acid fumes. oxidizers
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Use a fume hood to avoid exposure to dust, mist or vapor.

Personal Protective Equipment:

Eye Protection: safety glasses with top and side shields

Skin Protection: lab coat disposable latex gloves In the EU, the selected gloves must satisfy the specifications of EU Directive 89/686/EEC and standard EN 374 derived from it.

Inhalation Protection: laboratory fume hood

Precautionary Measures: eyes skin clothing Do not breathe: dust Wash thoroughly after handling. Use with adequate ventilation. Keep away from: acids/acid fumes oxidizers

TLV: Not established.

PEL: Not established.

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Tan powder

Physical State: Solid

Molecular Weight: Not applicable

Odor: None

pH: 7.84 (5% solution)

Vapor Pressure: Not applicable

Vapor Density (air = 1): Not applicable

Boiling Point: Not applicable

Melting Point: 97°C (206.6°F)

Specific Gravity/ Relative Density (water = 1; air =1): 1.689

Evaporation Rate (water = 1): Not applicable

Volatile Organic Compounds Content: None.

Partition Coefficient (n-octanol / water): Not applicable

Solubility:

Water: Soluble.

Acid: Soluble.

Other: Not determined.

Metal Corrosivity:

Steel: Not applicable

Aluminum: Not applicable

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.

Conditions to Avoid: Heating to decomposition. Extreme temperatures

Reactivity / Incompatibility: Incompatible with: acids iodine iron salts lead acetate organic materials oxidizers Silver Nitrate sodium phosphate

Hazardous Decomposition: Heating to decomposition releases toxic and/or corrosive fumes of: cyanide nitrogen oxides sodium oxides

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:

LD50: None reported.

LC50: None reported.

Dermal Toxicity Data: None reported.

Skin and Eye Irritation Data: None reported.

Mutation Data: None reported.

Reproductive Effects Data: None reported.

Ingredient Toxicological Data: Sodium Salicylate: Oral rat LD_{50} = 1200 mg/kg; Sodium Citrate: Oral rat LD_{50} > 8 g/kg; Sodium Tartrate: Oral rabbit LD_{50} = 5290 mg/kg; Sodium Nitroferricyanide: Oral rat LD_{50} = 99 mg/kg.

12. ECOLOGICAL INFORMATION

Product Ecological Information: --

No ecological data available for this product. Mobility in soil: No data available

Ingredient Ecological Information: Sodium salicylate: Pimephales promelas 96 hr. LC50 = 1370 mg/l; sodium citrate: crustea 48h EC50 = 736 mg/l.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Dilute to 3 to 5 times the volume with cold water. Flush system with plenty of water.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard Delayed (Chronic) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product contains a chemical(s) subject to the reporting requirements of Section 313 of Title III of SARA.
Sodium Nitroferricyanide.
302 (EHS) TPQ (40 CFR 355): Not applicable
304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable
RCRA: Contains no RCRA regulated substances.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): Not applicable
California Perchlorate Rule CCR Title 22 Chap 33: Not applicable
Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).

TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Laboratory Use Reagent for ammonia test

References: TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Technical Judgment. Sixth Annual Report on Carcinogens, 1991. U.S. Department of Health and Human Services. Rockville, MD: Technical Resources, Inc. 1991. Sax, N. Irving. Dangerous Properties of Industrial Materials, 7th Ed. New York: Van Nostrand Reinhold Co., 1989. List of Dangerous Substances Classified in Annex I of the EEC Directive (67/548) - Classification, Packaging and Labeling of Dangerous Substances, Amended July 1992. In-house information. IARC Monographs on the Evaluation of the Carcinogenic Risks to Humans. World Health Organization (Volumes 1-42) Supplement 7. France: 1987. Gosselin, R. E. et al. Clinical Toxicology of Commercial Products, 5th Ed. Baltimore: The Williams and Wilkins Co., 1984. Cassaret and Doull's Toxicology, 3rd Ed. New York: Macmillan Publishing Co., Inc., 1986. Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor).

Revision Summary: Substantial revision to comply with EU Reg 1272/2008, Reg 1907/2006 and UN GHS (ST/SG/AC.10/36/Add.3).

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

ISO9001:2000 Certified

Material Safety Data Sheet

Ammonium sulfate, 10%

Section 1 - Chemical Product and Company Identification

MSDS Name:

Ammonium sulfate, 10%

Catalog Numbers:

LC11300, LC17890

Synonyms:

Company Identification:

LabChem, Inc.
200 William Pitt Way
Pittsburgh, PA 15238

Company Phone Number:

(412) 826-5230

Emergency Phone Number:

(800) 424-9300

CHEMTREC Phone Number:

(800) 424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name:	Percent
7732-18-5	Water	balance
7783-20-2	Ammonium sulfate	0.53-10

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: Colorless
May cause irritation by all exposure routes.
Target Organs: None known.

Potential Health Effects

Eye:

May cause eye irritation.

Skin:

May cause skin irritation.

Ingestion:

Ingestion may cause irritation to gastrointestinal tract, nausea, vomiting, diarrhea.

Inhalation:

May cause irritation to respiratory tract, sore throat, cough.

Chronic:

May cause dermatitis and conjunctivitis.

Section 4 - First Aid Measures

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids until no evidence of chemical remains. Get medical aid at once.

Skin:

Get medical aid. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes.

Ingestion:

Get medical aid at once. If vomiting occurs, keep head lower than hips to prevent aspiration.

Inhalation:

Give artificial respiration if necessary. Get medical aid. Keep victim warm, at rest. Move victim to fresh air.

Notes to Physician:

Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information:

Negligible fire and explosion hazard when exposed to heat or flame. Move container if possible, avoid breathing vapors or dust.

Extinguishing Media:

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.

Autoignition Temperature:

No information found.

Flash Point:

No information found.

NFPA Rating:

CAS# 7732-18-5: Not published.
CAS# 7783-20-2: Not published.

Explosion Limits:

Lower: Upper:

Section 6 - Accidental Release Measures

General Information:

Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spills with absorbent (vermiculite, sand, fuller's earth) and place in plastic bags for later disposal.

Section 7 - Handling and Storage

Handling:

Wash thoroughly after handling. Avoid breathing dust, vapor, mist, or gas.

Storage:

Store capped at room temperature. Protect from heat and incompatibles.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls:

Provide local exhaust or general dilution ventilation.

Exposure Limits

Chemical Name:	ACGIH	NIOSH	OSHA
Water	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.
Ammonium sulfate	None of the components are on this list.	None of the components are on this list.	None of the components are on this list.

OSHA Vacated PELs

Personal Protective Equipment

Eyes:

Do not wear contact lenses when working with chemicals. An eye wash fountain should be available in the immediate work area. Wear splash-proof safety goggles.

Skin:

Wear appropriate protective gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Not required for normal use. Firefighting-- any self-contained breathing apparatus with full facepiece operated in pressure-demand mode.

Section 9 - Physical and Chemical Properties

Physical State: Clear liquid
Color: Colorless
Odor: Odorless
pH: 5.5
Vapor Pressure: No information found.
Vapor Density: No information found.
Evaporation Rate: No information found.
Viscosity: No information found.
Boiling Point: No information found.
Freezing/Melting Point: No information found.

Decomposition Temperature: No information found.
Solubility in water: Soluble.
Specific Gravity/Density: No information found.
Molecular Formula: No information found.
Molecular Weight No information found.

Section 10 - Stability and Reactivity

Chemical Stability:

Stable under normal temperatures and pressures.

Conditions to Avoid:

None reported.

Incompatibilities with Other Materials

None.

Hazardous Decomposition Products

Oxides of sulfur, ammonia.

Hazardous Polymerization

Has not been reported

Section 11 - Toxicological Information

RTECS:

CAS# 7732-18-5: ZC0110000.
CAS# 7783-20-2: BS4500000.

LD50/LC50:

CAS# 7732-18-5:
Oral, rat: LD50 = >90 mL/kg.
CAS# 7783-20-2:
Inhalation, mouse: LC50 =51 mg/m3/2H
Oral, mouse: LD50 = 640 mg/kg
Oral, rat: LD50 = 2840 mg/kg
Skin, mouse: LD50 = 110 mg/kg.

Carcinogenicity:

CAS# 7732-18-5: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.
CAS# 7783-20-2: Not listed as a carcinogen by ACGIH, IARC, NIOSH, NTP, OSHA, or CA Prop 65.

Epidemiology:

Teratogenicity:

Reproductive:

Mutagenicity:

Neurotoxicity:

Section 12 - Ecological Information

No information found.

Section 13 - Disposal Considerations

Dispose of in accordance with Federal, State, and local regulations.

Section 14 - Transport Information

US DOT

Shipping Name: Not regulated.

Hazard Class:
UN Number:
Packing Group:

Section 15 - Regulatory Information

US Federal

TSCA

CAS# 7732-18-5 is listed on the TSCA Inventory.
CAS# 7783-20-2 is listed on the TSCA Inventory.

SARA Reportable Quantities (RQ)

None of the components are on this list.

CERCLA/SARA Section 313

None of the components are on this list.

OSHA - Highly Hazardous

None of the components are on this list.

US State

State Right to Know

Ammonium sulfate can be found on the following state Right-to-Know lists: New Jersey, Florida, Pennsylvania, Massachusetts.

California Regulations

European/International Regulations

Canadian DSL/NDSL

CAS# 7732-18-5 is listed on Canada's DSL List.
CAS# 7783-20-2 is listed on Canada's DSL List.

Canada Ingredient Disclosure List

CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.
CAS# 7783-20-2 is listed on Canada's Ingredient Disclosure List.

Section 16 - Other Information

MSDS Creation Date: September 14, 1998
Revision Date: March 6, 2007

Material Safety Data Sheet

Ammonium sulfate, 10%

Information in this MSDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this MSDS. The user must determine suitability of this information for his application.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00009

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Bromcresol Green-Methyl Red Indicator Powder
Catalog Number: 94399

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00009
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: May cause irritation.
Date of MSDS Preparation:
Day: 06
Month: March
Year: 2012

2. COMPOSITION / INFORMATION ON INGREDIENTS

Other components, each
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: < 1.0
Percent Range Units: weight / weight
LD50: Not applicable
LC50: Not applicable
TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Potassium Chloride
CAS No.: 7447-40-7
TSCA CAS Number: 7447-40-7
Percent Range: >98
Percent Range Units: weight / weight
LD50: Oral rat LD_{50} = 2600 mg/kg
LC50: None reported.
TLV: Not established.
PEL: Not established.
Hazard: May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Red-brown to green powder
Odor: None

MAY CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION

HMIS:

Health: 1
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.

NFPA:

Health: 1
Flammability: 0
Reactivity: 0
Symbol: Not applicable

Potential Health Effects:

Eye Contact: May cause irritiation
Skin Contact: May cause irritiation
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: May cause: gastrointestinal disturbances blood pressure changes cardiac depression gastroenteritis
Target Organs: None reported
Inhalation: May cause: irritation of nose and throat
Target Organs: None reported
Medical Conditions Aggravated: Pre-existing: Kidney conditions
Chronic Effects: None reported
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.
This product does NOT contain any IARC listed chemicals.
This product does NOT contain any NTP listed chemicals.
Additional Cancer / Reproductive Toxicity Information: None reported

Toxicologically Synergistic Products: None reported

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4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with plenty of water. Call physician if irritation develops.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: Remove to fresh air.

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5. FIRE FIGHTING MEASURES

Flammable Properties: Does not burn, but may melt in a fire, releasing toxic fumes.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not determined
Hazardous Combustion Products: None reported
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

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6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:

Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.
Containment Technique: Stop spilled material from being released to the environment.

Clean-up Technique: Sweep up material. Dilute with a large excess of water. Flush the spilled material to the drain with a large excess of water.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin Do not breathe dust. Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves In the EU, the selected gloves must satisfy the specifications of EU Directive 89/686/EEC and standard EN 374 derived from it. lab coat
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes skin Do not breathe: dust Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Red-brown to green powder
Physical State: Solid
Molecular Weight: Not applicable
Odor: None
pH: of 5% solution = 9.0
Vapor Pressure: Not applicable
Vapor Density (air = 1): Not applicable
Boiling Point: Not applicable
Melting Point: 181°C (358°F)
Specific Gravity/ Relative Density (water = 1; air =1): 1.91
Evaporation Rate (water = 1): Not applicable
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not determined
Solubility:
Water: Soluble
Acid: Soluble
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Extreme temperatures Excess moisture
Reactivity / Incompatibility: None reported
Hazardous Decomposition: Toxic fumes of: chlorides
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: Potassium Chloride: Oral rat LD_{50} = 2600 mg/kg, Oral man LD_{Lo} = 20 mg/kg

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product. Mobility in soil: No data available
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Dilute material with excess water making a weaker than 5% solution. Open cold water tap completely, slowly pour the material to the drain. Flush system with plenty of water.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard

S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.

--

302 (EHS) TPQ (40 CFR 355): Not applicable

304 CERCLA RQ (40 CFR 302.4): Not applicable

304 EHS RQ (40 CFR 355): Not applicable

Clean Water Act (40 CFR 116.4): Not applicable

RCRA: Contains no RCRA regulated substances.

C.P.S.C.: Not applicable

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.

Identification of Prop. 65 Ingredient(s): None

California Perchlorate Rule CCR Title 22 Chap 33: Not applicable

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).

TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Laboratory Reagent Indicator for pH

References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Technical Judgment. In-house information. Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991.

Revision Summary: Substantial revision to comply with EU Reg 1272/2008, Reg 1907/2006 and UN GHS (ST/SG/AC.10/36/Add.3).

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00368

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Buffer Solution pH 4.01 ± 0.02
Catalog Number: 2283449

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00368
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: Practically non-toxic.
Date of MSDS Preparation:
Day: 26
Month: July
Year: 2012

2. COMPOSITION / INFORMATION ON INGREDIENTS

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: >95.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Other components, each
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: < 0.1
Percent Range Units: weight / volume
LD50: Not applicable
LC50: Not applicable
TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Potassium Acid Phthalate
CAS No.: 877-24-7
TSCA CAS Number: 877-24-7
Percent Range: 1.0 - 5.0
Percent Range Units: weight / volume
LD50: Oral rat LDLo = 3200 mg/kg

LC50: None reported
TLV: Not established
PEL: Not established
Hazard: Experimental mutagen. May cause reproductive and fetal effects

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, red liquid
Odor: None
HMIS:
Health: 0
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 0
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: No effects are anticipated
Skin Contact: No effects are anticipated
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: No Effects Anticipated
Target Organs: Not applicable
Inhalation: No effects anticipated
Target Organs: Not applicable
Medical Conditions Aggravated: None reported
Chronic Effects: No effects anticipated
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.
This product does NOT contain any IARC listed chemicals.
This product does NOT contain any NTP listed chemicals.
Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Flush eyes with water. Call physician if irritation develops.
Skin Contact (First Aid): Wash skin with soap and plenty of water.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: None required.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: Not applicable
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions

Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Cover spilled material with an alkali, such as soda ash or sodium bicarbonate. Scoop up slurry into a large beaker. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Flush reacted material to the drain with a large excess of water. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Wash thoroughly after handling.
Storage: Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves In the EU, the selected gloves must satisfy the specifications of EU Directive 89/686/EEC and standard EN 374 derived from it.
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, red liquid
Physical State: Liquid
Molecular Weight: Not applicable
Odor: None
pH: 4.01
Vapor Pressure: Not determined
Vapor Density (air = 1): Not determined
Boiling Point: > 100°C (> 212°F)
Melting Point: < 0°C (< 32°F)
Specific Gravity/ Relative Density (water = 1; air =1): 1.002
Evaporation Rate (water = 1): Not determined
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not determined
Solubility:
Water: Soluble
Acid: Soluble
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Extreme temperatures
Reactivity / Incompatibility: None reported
Hazardous Decomposition: None reported
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: Potassium Acid Phthalate: Oral rat LD_{Lo} = 3200 mg/kg

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product. Mobility in soil: No data available
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Open cold water tap completely, slowly pour the reacted material to the drain.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA

Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:

O.S.H.A.: This product does not meet the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)

E.P.A.:

S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): This product is not hazardous under 29 CFR.1910.1200 and therefore is not covered by Title III under SARA.

S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.

--

302 (EHS) TPQ (40 CFR 355): Not applicable

304 CERCLA RQ (40 CFR 302.4): Not applicable

304 EHS RQ (40 CFR 355): Not applicable

Clean Water Act (40 CFR 116.4): Not applicable

RCRA: Contains no RCRA regulated substances.

C.P.S.C.: Not applicable

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.

Identification of Prop. 65 Ingredient(s): --

California Perchlorate Rule CCR Title 22 Chap 33: Not applicable

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).

TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Laboratory Reagent Buffer

References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Technical Judgment. In-house information. Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991.

Revision Summary: Substantial revision to comply with EU Reg 1272/2008, Reg 1907/2006 and UN GHS (ST/SG/AC.10/36/Add.3).

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00369

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Buffer Solution pH 7.00 ± 0.02
Catalog Number: 2283549

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00369
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: Practically non-toxic.
Date of MSDS Preparation:
Day: 01
Month: December
Year: 2011

2. COMPOSITION / INFORMATION ON INGREDIENTS

Potassium Phosphate, Monobasic
CAS No.: 7778-77-0
TSCA CAS Number: 7778-77-0
Percent Range: < 1.0
Percent Range Units: weight / volume
LD50: Oral rat LD50 = 7100 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: >95.0
Percent Range Units: volume / volume
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Other components, each
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: < 1.0
Percent Range Units: volume / volume
LD50: Not applicable
LC50: Not applicable

TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Sodium Phosphate, Dibasic
CAS No.: 7558-79-4
TSCA CAS Number: 7558-79-4
Percent Range: < 1.0
Percent Range Units: weight / volume
LD50: Oral rat LD50 = 17 g/kg.
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, yellow liquid
Odor: None
HMIS:
Health: 0
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 0
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: No effects are anticipated
Skin Contact: No effects are anticipated
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: No Effects Anticipated
Target Organs: Not applicable
Inhalation: No effects anticipated
Target Organs: Not applicable
Medical Conditions Aggravated: None reported
Chronic Effects: No effects anticipated
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.
This product does NOT contain any IARC listed chemicals.
This product does NOT contain any NTP listed chemicals.
Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Flush eyes with water. Call physician if irritation develops.
Skin Contact (First Aid): Wash skin with plenty of water.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: None required.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn. Not applicable
Flash Point: Not applicable

Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: None reported
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Absorb spilled liquid with non-reactive sorbent material. Place material in a plastic bag. Mark bag 'Non-hazardous trash', and dispose of as normal refuse.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Wash thoroughly after handling.
Storage: Protect from: heat Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: Not applicable
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, yellow liquid
Physical State: Liquid
Molecular Weight: Not applicable
Odor: None
pH: 7.0 at 20°C
Vapor Pressure: Not determined
Vapor Density (air = 1): Not determined
Boiling Point: ~100°C (~212°F)
Melting Point: ~0°C (~32°F)
Specific Gravity/ Relative Density (water = 1; air =1): ~1.0
Evaporation Rate (water = 1): Not determined
Volatile Organic Compounds Content: Not applicable

Partition Coefficient (n-octanol / water): Not determined
Solubility:
Water: Soluble
Acid: Soluble
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Heat Evaporation
Reactivity / Incompatibility: None reported
Hazardous Decomposition: None reported
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: --
No toxicological data available for the ingredients of this product.

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product. Mobility in soil: No data available
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Open cold water tap completely, slowly pour the material to the drain.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA

I.M.O.:

I.M.O. Proper Shipping Name: Not Currently Regulated

--

I.M.O. Hazard Class: NA

I.M.O. Subsidiary Risk: NA

I.M.O. ID Number: NA

I.M.O. Packing Group: NA

Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:

O.S.H.A.: This product does not meet the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)

E.P.A.:

S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): This product is not hazardous under 29 CFR.1910.1200 and therefore is not covered by Title III under SARA.

S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.

302 (EHS) TPQ (40 CFR 355): Not applicable

304 CERCLA RQ (40 CFR 302.4): Not applicable

304 EHS RQ (40 CFR 355): Not applicable

Clean Water Act (40 CFR 116.4): Not applicable

RCRA: Contains no RCRA regulated substances.

C.P.S.C.: Not applicable

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.

Identification of Prop. 65 Ingredient(s): None

California Perchlorate Rule CCR Title 22 Chap 33: Not applicable

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).

TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Laboratory Reagent Buffer

References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Technical Judgment. In-house information.

Revision Summary: Substantial revision to comply with EU Reg 1272/2008, Reg 1907/2006 and UN GHS (ST/SG/AC.10/36/Add.3).

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00370

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Buffer Solution pH 10.01 ± 0.02
Catalog Number: 2283649

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00370
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: May cause irritation.
Date of MSDS Preparation:
Day: 01
Month: December
Year: 2011

2. COMPOSITION / INFORMATION ON INGREDIENTS

Sodium Carbonate
CAS No.: 497-19-8
TSCA CAS Number: 497-19-8
Percent Range: < 1.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 4090 mg/kg
LC50: Inhalation rat LC50 = 2300 mg/m^3/2hr
TLV: Not established
PEL: Not established
Hazard: Causes moderate eye irritation.

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: > 99.0
Percent Range Units: volume / volume
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Other components, each
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: < 1.0
Percent Range Units: volume / volume
LD50: Not applicable
LC50: Not applicable

TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Sodium Bicarbonate
CAS No.: 144-55-8
TSCA CAS Number: 144-55-8
Percent Range: < 0.1
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 4220 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, blue
Odor: None
HMIS:
Health: 1
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 0
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: May cause irritiation
Skin Contact: May cause irritiation
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: None reported
Target Organs: None reported
Inhalation: No effects anticipated
Target Organs: Not applicable
Medical Conditions Aggravated: None reported
Chronic Effects: None reported
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.
This product does NOT contain any IARC listed chemicals.
This product does NOT contain any NTP listed chemicals.
Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with plenty of water. Call physician if irritation develops.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: None required.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable

Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: None
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Cover spilled material with a dry acid, such as citric or boric. Scoop up slurry into a large beaker. Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Flush reacted material to the drain with a large excess of water.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Protect from: heat Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves lab coat
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, blue
Physical State: Liquid
Molecular Weight: Not applicable
Odor: None
pH: 10.0
Vapor Pressure: Not determined
Vapor Density (air = 1): Not determined
Boiling Point: ~100°C (~212°F)
Melting Point: ~0°C (~32°F)
Specific Gravity/ Relative Density (water = 1; air =1): 0.990
Evaporation Rate (water = 1): 0.76

Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not determined
Solubility:
Water: Soluble
Acid: Soluble
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Heat Evaporation
Reactivity / Incompatibility: None reported
Hazardous Decomposition: None reported
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: None reported

12. ECOLOGICAL INFORMATION

Product Ecological Information: No information available for this product.
Ingredient Ecological Information: None reported

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Open cold water tap completely, slowly pour the reacted material to the drain.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:

I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.
--
302 (EHS) TPQ (40 CFR 355): Not applicable
304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable
RCRA: Contains no RCRA regulated substances.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): None
California Perchlorate Rule CCR Title 22 Chap 33: Not applicable
Trade Secret Registry: Not applicable
National Inventories:
U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).
TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Buffer
References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Technical Judgment. In-house information.
Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

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P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00005

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: CalVer ® 2 Calcium Indicator
Catalog Number: 85299

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00005
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: Causes moderate eye irritation.
Date of MSDS Preparation:
Day: 15
Month: October
Year: 2009

2. COMPOSITION / INFORMATION ON INGREDIENTS

Sodium Chloride
CAS No.: 7647-14-5
TSCA CAS Number: 7647-14-5
Percent Range: > 99.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 3000 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: Causes moderate eye irritation.

Hydroxynaphthol Blue
CAS No.: 63451-35-4
TSCA CAS Number: 63451-35-4
Percent Range: 0.1 - 1.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 > 5000 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Dark blue powder
Odor: Amine
MAY CAUSE EYE IRRITATION

HMIS:
Health: 1
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 1
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: Causes moderate irritation
Skin Contact: Causes mild irritation
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: May cause: vomiting dehydration diarrhea blood pressure changes muscular twitching rigidity collapse death
Target Organs: None reported
Inhalation: No effects anticipated
Target Organs: Not applicable
Medical Conditions Aggravated: Pre-existing: Eye conditions
Chronic Effects: None reported
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.

This product does NOT contain any IARC listed chemicals.

This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: Azo dye compounds have produced tumors in laboratory animals. Azo dye exposure has produced no known cases of cancer in humans. Casarett and Doull's Toxicology, 2nd ed. page 96-97.
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with plenty of water.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: Remove to fresh air.

5. FIRE FIGHTING MEASURES

Flammable Properties: During a fire, corrosive and toxic gases may be generated by thermal decomposition.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: Toxic fumes of: chlorides sodium monoxide
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Sweep up material. Flush the spilled material to the drain with a large excess of water. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: Not applicable

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Keep container tightly closed when not in use. Store at 10 - 30°C.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Have an eyewash station nearby. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: lab coat disposable latex gloves
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Dark blue powder
Physical State: Solid
Molecular Weight: Not applicable
Odor: Amine
pH: 5% solution = 7.9
Vapor Pressure: Not applicable
Vapor Density (air = 1): Not applicable
Boiling Point: Not applicable
Melting Point: decomposes @ 274°C; 525°F
Specific Gravity (water = 1): 2.13
Evaporation Rate (water = 1): Not applicable
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not applicable
Solubility:
Water: Soluble
Acid: Not determined
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Extreme temperatures Excess exposure to air (carbon dioxide) may make powder turn purple

Reactivity / Incompatibility: None reported
Hazardous Decomposition: None reported
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: Sodium chloride eye rabbit 100 mg/24 hr MODERATE; Sodium chloride skin rabbit 500 mg/24 hr MILD
Mutation Data: None reported
Reproductive Effects Data: In a laboratory test, single subcutaneous injection of sodium chloride into pregnant mice at the level of 2500 mg/kg caused fetal deaths and malformations.
Ingredient Toxicological Data: Sodium chloride oral rat LD50 = 3000 mg/kg

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product.
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Dilute to 3 to 5 times the volume with cold water. Open cold water tap completely, slowly pour the material to the drain. Allow cold water to run for 5 minutes to completely flush the system.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS

part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:

O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)

E.P.A.:

S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard

S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.

--

302 (EHS) TPQ (40 CFR 355): Not applicable

304 CERCLA RQ (40 CFR 302.4): Not applicable

304 EHS RQ (40 CFR 355): Not applicable

Clean Water Act (40 CFR 116.4): Not applicable

RCRA: Contains no RCRA regulated substances.

C.P.S.C.: Not applicable

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.

Identification of Prop. 65 Ingredient(s): None

California Perchlorate Rule CCR Title 22 Chap 33:

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).

TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Calcium determination

References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Cassaret and Doull's Toxicology, 3rd Ed. New York: Macmillan Publishing Co., Inc., 1986. CCINFO RTECS. Canadian Centre for Occupational Health and Safety. Hamilton, Ontario Canada: 30 June 1993. In-house information. Technical Judgment. Acta Anat. 74: 121-124 (1969). Journal of Clinical Investigations 41: 710-714 (1962).

Revision Summary: Canadian MSDS Only Updates in Section(s) 3,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

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Loveland, CO USA 80539
(970) 669-3050

MSDS No: M01135

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: EDTA Tetrasodium Salt 0.1428 ± 0.0007 M
Catalog Number: 1496001

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M01135
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: May cause irritation.
Date of MSDS Preparation:
Day: 14
Month: December
Year: 2007

2. COMPOSITION / INFORMATION ON INGREDIENTS

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: 90.0 - 100.0
Percent Range Units: volume / volume
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Other component
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: < 0.1
Percent Range Units: volume / volume
LD50: Not applicable
LC50: Not applicable
TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

EDTA Tetrasodium Salt
CAS No.: 64-02-8

TSCA CAS Number: 64-02-8
Percent Range: < 10.0
Percent Range Units: weight / volume
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, colorless to light yellow liquid
Odor: Not determined
MAY CAUSE EYE AND SKIN IRRITATION

HMIS:
Health: 1
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 1
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: May cause irritiation
Skin Contact: May cause irritiation
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: Very large doses may cause: calcium deficiency in the blood gastrointestinal irritation fever kidney damage bone marrow changes
Target Organs: Kidneys Bone marrow
Inhalation: No data reported.
Target Organs: None reported
Medical Conditions Aggravated: Pre-existing: Eye conditions
Chronic Effects: Chronic overexposure may cause kidney damage
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.

This product does NOT contain any IARC listed chemicals.

This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with plenty of water. Call physician if irritation develops.

Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: None required.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: This material will not burn.
Fire / Explosion Hazards: This product will not burn or explode.
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Cover spilled material with a dry acid, such as citric or boric. Scoop up slurry into a large beaker. Dilute with a large excess of water. Adjust to a pH between 6 and 9. Use sulfuric or citric acid to lower pH. Use soda ash or sodium bicarbonate to increase pH. Flush reacted material to the drain with a large excess of water. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: Not applicable

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Have an eyewash station nearby. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes skin Wash thoroughly after handling.
TLV: Not established

PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, colorless to light yellow liquid
Physical State: Liquid
Molecular Weight: Not applicable
Odor: Not determined
pH: 11.1
Vapor Pressure: Not determined
Vapor Density (air = 1): Not determined
Boiling Point: ~100°C
Melting Point: Not applicable
Specific Gravity (water = 1): 1.030
Evaporation Rate (water = 1): 0.99
Volatile Organic Compounds Content: Not determined
Partition Coefficient (n-octanol / water): Not applicable
Solubility:
Water: Miscible
Acid: Not determined
Other: Not determined
Metal Corrosivity:
Steel: 0.0002 in/yr
Aluminum: 0.000 in/yr

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Extreme temperatures
Reactivity / Incompatibility: Incompatible with: oxidizers
Hazardous Decomposition: Heating to decomposition releases: carbon dioxide carbon monoxide nitrogen oxides
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: Tetrasodium EDTA: Skin rabbit 500 mg/24H - MODERATE; Eye rabbit 100 mg/24H - MODERATE
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: --
No toxicological data available for the ingredients of this product.

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product.
Ingredient Ecological Information: Tetrasodium EDTA: BOD = 0.02 g/g, COD = 0.54 g/g, Fish toxicity Bluegill LC50 = 410 mg/l/96H

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: Not applicable
Special Instructions (Disposal): Dilute to 3 to 5 times the volume with hot water. Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Open cold water tap completely, slowly pour the reacted material to the drain.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.
--
302 (EHS) TPQ (40 CFR 355): Not applicable
304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable

RCRA: Contains no RCRA regulated substances.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): Not applicable
California Perchlorate Rule CCR Title 22 Chap 33:
Trade Secret Registry: Not applicable
National Inventories:
U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).
TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Hardness determination Calcium determination Determination of Magnesium
References: Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Technical Judgment. In-house information.
Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

The following list contains the Material Safety Data Sheets you requested. Please scoll down to view the requested MSDS(s).

Product	MSDS	Distributor	Format	Language	Quantity
246142	N/A	Hach Company	OSHA	English	1

Total Enclosures: 1

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00482

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Formazin Turbidity Standard 4000 NTU
Catalog Number: 246142

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00482
Chemical Name: Not applicable.
CAS No.: Not applicable
Chemical Formula: Not applicable.
Chemical Family: Not applicable
Hazard: May cause irritation. May cause allergic reaction.
Date of MSDS Preparation:
Day: 11
Month: November
Year: 2010

2. COMPOSITION / INFORMATION ON INGREDIENTS

Hexamethylenetetramine
CAS No.: 100-97-0
TSCA CAS Number: 100-97-0
Percent Range: 1.0 - 10.0
Percent Range Units: weight / weight
LD50: Orl mouse LDLo - 512 mg/Kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: Flammable solid. May cause allergic reaction.

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: 90.0 - 100.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Other components, each
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: < 1.0
Percent Range Units: weight / weight
LD50: Not applicable
LC50: Not applicable
TLV: Not established

PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Formazin Polymer
CAS No.: Not available
TSCA CAS Number: Not applicable
Percent Range: < 1.0
Percent Range Units: weight / weight
LD50: None reported.
LC50: None reported.
TLV: Not established.
PEL: Not established.
Hazard: Toxic properties unknown.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Turbid, milky suspension
Odor: None
MAY CAUSE EYE AND SKIN IRRITATION
MAY CAUSE ALLERGIC SKIN REACTION
HMIS:
Health: 2
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 2
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: May cause irritiation
Skin Contact: May cause irritiation May cause allergic reaction
Skin Absorption: None reported
Target Organs: Not applicable
Ingestion: May cause: gastrointestinal irritation
Target Organs: Not applicable
Inhalation: No effects anticipated
Target Organs: Not applicable
Medical Conditions Aggravated: Allergies or sensitivity to hexamethylenetetramine.
Chronic Effects: Chronic overexposure may cause symptoms similar to acute exposure.
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.
This product does NOT contain any IARC listed chemicals.
This product does NOT contain any NTP listed chemicals.
Additional Cancer / Reproductive Toxicity Information: Contains: an experimental mutagen.
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with plenty of water. Remove contaminated clothing. Call physician if irritation develops.
Ingestion (First Aid): Induce vomiting using syrup of ipecac or by sticking finger down throat. Never give anything by mouth to an unconscious person. Call physician immediately.
Inhalation: Remove to fresh air.

5. FIRE FIGHTING MEASURES

Flammable Properties: During a fire, this product decomposes to form toxic gases.
Flash Point: Not applicable.
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable.
Upper Explosion Limits: Not applicable.
Autoignition Temperature: Not determined.
Hazardous Combustion Products: Toxic fumes of: ammonia formaldehyde nitrogen oxides. carbon monoxide, carbon dioxide.
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.
Containment Technique: Absorb spilled liquid with non-reactive sorbent material. Dike large spills to keep spilled material from entering sewage and drainage systems or bodies of water.
Clean-up Technique: Absorb spilled liquid with non-reactive sorbent material. Sweep up material. Place material in a plastic bag. Mark bag 'Non-hazardous trash', and dispose of as normal refuse. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Formaldehyde - RQ 100 lbs
D.O.T. Emergency Response Guide Number: Not applicable.

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin Do not breathe mist or vapors. Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Store between 5 - 25 °C. Keep away from: direct sunlight Protect from: heat
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Have an eyewash station nearby. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves In the EU, the selected gloves must satisfy the specifications of EU Directive 89/686/EEC and standard EN 374 derived from it.
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes skin Do not breathe: mist/vapor Wash thoroughly after handling.
TLV: Not established.
PEL: Not established.

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Turbid, milky suspension
Physical State: Liquid
Molecular Weight: Not applicable.

Odor: None
pH: 6.4
Vapor Pressure: Not determined.
Vapor Density (air = 1): Not determined.
Boiling Point: ~ 100°C (~ 212°F)
Melting Point: Not applicable.
Specific Gravity/ Relative Density (water = 1; air =1): 1.002
Evaporation Rate (water = 1): 0.63
Volatile Organic Compounds Content: Not determined.
Partition Coefficient (n-octanol / water): Not applicable.
Solubility:
Water: Miscible.
Acid: Miscible.
Other: Not determined.
Metal Corrosivity:
Steel: Not determined.
Aluminum: Not determined.

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Extreme temperatures
Reactivity / Incompatibility: Incompatible with: oxidizers
Hazardous Decomposition: Heating to decomposition releases: ammonia carbon monoxide formaldehyde nitrogen oxides
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: Oral rat LD50 > 5000 mg/kg
LC50: None reported.
Dermal Toxicity Data: None reported.
Skin and Eye Irritation Data: None reported.
Mutation Data: Hexamethylenetetramine: Cytogenetic analysis in human Hela cells @ 1 mmol/l; Oncogenic Transformation - hamster kidney - 10 mg/L .
Reproductive Effects Data: None reported.
Ingredient Toxicological Data: Hexamethylenetetramine: Oral mouse LDLo = 512 mg/kg.

12. ECOLOGICAL INFORMATION

Product Ecological Information: No specific ecological information available for this product.
Ingredient Ecological Information: Hexamethylenetetramine: Water Pollution Factors: BOD_5: 0.015; 0.026 std. dil. sew.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: Not applicable.
Special Instructions (Disposal): Dilute material with excess water making a weaker than 5% solution. Open cold water tap completely, slowly pour the material to the drain. Flush system with plenty of water.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA

DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard Delayed (Chronic) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product contains a chemical(s) subject to the reporting requirements of Section 313 of Title III of SARA.
Formaldehyde
302 (EHS) TPQ (40 CFR 355): Formaldehyde 500 lbs.
304 CERCLA RQ (40 CFR 302.4): Formaldehyde 1000 lbs.
304 EHS RQ (40 CFR 355): Formaldehyde - RQ 100 lbs
Clean Water Act (40 CFR 116.4): Formaldehyde - RQ 100 lbs.
RCRA: Contains no RCRA regulated substances.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): None
California Perchlorate Rule CCR Title 22 Chap 33: Not applicable
Trade Secret Registry: Not applicable
National Inventories:
U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).
TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Laboratory Use Standard solution
References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. CCINFO RTECS. Canadian Centre for Occupational Health and Safety. Hamilton, Ontario Canada: 30 June 1993. Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991. IARC Monographs on the Evaluation of the Carcinogenic Risks to Humans. World Health Organization (Volumes 1-42) Supplement 7. France: 1987. Lefevre, Marc J. First Aid Manual for Chemical Accidents, 2nd Ed. New York: Van Nostrand Reinhold Company, 1989. List of Dangerous Substances Classified in Annex I of the EEC Directive (67/548) - Classification, Packaging and Labeling of Dangerous Substances, Amended July 1992. Sixth Annual Report on Carcinogens, 1991. U.S. Department of Health and Human Services. Rockville, MD: Technical Resources, Inc. 1991. Technical Judgment. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-

1993. American Conference of Governmental Industrial Hygienists, 1992. Verschueren, Karel. Handbook of Environmental Data on Organic Chemicals. New York: Van Nostrand Reinhold Co., 1977.
Revision Summary: Substantially Revised MSDS

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00055

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: NitriVer ® 3 Nitrite Reagent
Catalog Number: 2107169

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00055
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: Causes eye burns.
Date of MSDS Preparation:
Day: 09
Month: February
Year: 2012

2. COMPOSITION / INFORMATION ON INGREDIENTS

Chromatropic Acid, Disodium salt
CAS No.: 129-96-4
TSCA CAS Number: 129-96-4
Percent Range: 1.0 - 5.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 > 5000 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

Sodium Sulfanilate
CAS No.: 515-74-2
TSCA CAS Number: 515-74-2
Percent Range: 5.0 - 15.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: Toxic properties unknown. May cause irritation.

Potassium Pyrosulfate
CAS No.: 7790-62-7
TSCA CAS Number: 7790-62-7
Percent Range: 1.0 - 10.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 2340 mg/kg
LC50: None reported

TLV: Not established
PEL: Not established
Hazard: Causes eye burns.

Potassium Phosphate, Monobasic
CAS No.: 7778-77-0
TSCA CAS Number: 7778-77-0
Percent Range: 75.0 - 85.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 7100 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

1,2-Cyclohexanediaminetetraacetic Acid Trisodium Salt
CAS No.: 36679-96-6
TSCA CAS Number: 36679-96-6
Percent Range: 1.0 - 5.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: Toxic properties unknown. May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: White powder
Odor: Not determined
CAUSES EYE BURNS MAY CAUSE SKIN AND RESPIRATORY TRACT IRRITATION
HMIS:
Health: 3
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 2
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: Causes eye burns.
Skin Contact: May cause irritiation
Skin Absorption: None reported
Target Organs: None reported
Ingestion: May cause: irritation of the mouth and esophagus Very large doses may cause: gastrointestinal disturbances cardiac depression kidney damage
Target Organs: Heart Kidneys
Inhalation: May cause: irritation of nose and throat
Target Organs: None reported
Medical Conditions Aggravated: Pre-existing: Eye conditions Kidney conditions Central nervous system diseases
Chronic Effects: None reported
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.
This product does NOT contain any IARC listed chemicals.
This product does NOT contain any NTP listed chemicals.
Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with soap and plenty of water. Call physician if irritation develops.
Ingestion (First Aid): Do not induce vomiting. Give 1-2 glasses of water. Call physician immediately. Never give anything by mouth to an unconscious person.
Inhalation: Remove to fresh air. Give artificial respiration if necessary. Call physician.

5. FIRE FIGHTING MEASURES

Flammable Properties: During a fire, this product decomposes to form toxic gases.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: Toxic fumes of: phosphorus oxides carbon monoxide, carbon dioxide.
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Scoop up spilled material into a large beaker and dissolve with water. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Flush the spilled material to the drain with a large excess of water.
Evacuation Procedure: Evacuate local area (15 foot radius or as directed by your facility's emergency response plan) when: any quantity is spilled.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin Do not breathe dust. Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Protect from: light heat moisture
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Have an eyewash station nearby. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves lab coat
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes skin Do not breathe: dust Wash thoroughly after handling. Protect from: light heat moisture

TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: White powder
Physical State: Solid
Molecular Weight: Not applicable
Odor: Not determined
pH: of 5% solution = 3.2
Vapor Pressure: Not applicable
Vapor Density (air = 1): Not applicable
Boiling Point: Not applicable
Melting Point: 224°C (435°F)
Specific Gravity/ Relative Density (water = 1; air =1): 3.12
Evaporation Rate (water = 1): Not applicable
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not applicable
Solubility:
Water: Soluble
Acid: Not determined
Other: Not determined
Metal Corrosivity:
Steel: 0.057 in/yr
Aluminum: 0.00 in/yr

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Excess moisture Extreme temperatures
Reactivity / Incompatibility: None reported
Hazardous Decomposition: Toxic fumes of: phosphorus oxides carbon dioxide carbon monoxide
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: Chromatropic Acid: Oral rat LD50: >5000 mg/kg, Potassium Phosphate Monobasic: Oral rat LD50 = 7100 mg/kg, Potassium Pyrosulfate: Oral rat LD50 = 2340 mg/kg

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product. Mobility in soil: No data available
Ingredient Ecological Information: Sodium Sulfanilate: pimephales promelas 96hr LC50 = 100.4 mg/l; Daphnia magna 48hr EC50 = 85.66 mg/l; Scenedesmus subspicatus 72hr EC50 = 91mg/l. Potassium Pyrosulfate: Oncorhynchus mykiss 96 hr LC50 = 420 mg/L; Daphnia magna 48 hr EC50 = 140 mg/L

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Dilute material with excess water making a weaker than 5% solution. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Open cold water tap completely, slowly pour the reacted material to the drain.

Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.
--
302 (EHS) TPQ (40 CFR 355): Not applicable
304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable
RCRA: Contains no RCRA regulated substances.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): None
California Perchlorate Rule CCR Title 22 Chap 33: No
Trade Secret Registry: Not applicable
National Inventories:
U.S. Inventory Status: This product contains a chemical(s) exempt from the TSCA 8(b) Inventory due to a Low Volume Exemption held by Hach Company.
TSCA CAS Number: Not applicable
1,2-Cyclohexanediaminetetraacetic Acid Trisodium Salt. This chemical may only be used as a chelating reagent for chemical reactions.

16. OTHER INFORMATION

Intended Use: Laboratory Reagent Determination of nitrite

References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991. In-house information. Technical Judgment. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992.

Revision Summary: Substantial revision to comply with EU Reg 1272/2008, Reg 1907/2006 and UN GHS (ST/SG/AC.10/36/Add.3).

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00008

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Phenolphthalein Indicator Powder
Catalog Number: 94299

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00008
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: May cause eye irritation. Experimental carcinogen.
Date of MSDS Preparation:
Day: 29
Month: October
Year: 2012

2. COMPOSITION / INFORMATION ON INGREDIENTS

Phenolphthalein
CAS No.: 77-09-8
TSCA CAS Number: 77-09-8
Percent Range: < 1.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause allergic reaction. May cause irritation. Suspected carcinogen.

Other component
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: < 1.0
Percent Range Units: weight / weight
LD50: Not applicable
LC50: Not applicable
TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Sodium Chloride
CAS No.: 7647-14-5
TSCA CAS Number: 7647-14-5
Percent Range: >95.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 3000 mg/kg
LC50: None reported

TLV: Not established
PEL: Not established
Hazard: Causes moderate eye irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: White or light pink powder
Odor: None
MAY CAUSE EYE IRRITATION
CONTAINS MATERIAL WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA
HMIS:
Health: 2*
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 2
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: Causes moderate irritation
Skin Contact: Causes mild irritation
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: May cause: dehydration vomiting blood pressure changes muscular twitching rigidity
Target Organs: None reported
Inhalation: No effects anticipated
Target Organs: Not applicable
Medical Conditions Aggravated: Pre-existing: Eye conditions
Chronic Effects: None reported
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.
An ingredient of this mixture is: IARC Group 2B: Experimental Carcinogen
Phenolphthalein
An ingredient of this mixture is: NTP Listed Group 2B: Experimental Carcinogen
Phenolphthalein
Additional Cancer / Reproductive Toxicity Information: Contains: a suspected mutagen.
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Flush eyes with water. Call physician if irritation develops.
Skin Contact (First Aid): Wash skin with plenty of water.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: Remove to fresh air.

5. FIRE FIGHTING MEASURES

Flammable Properties: During a fire, this product decomposes to form toxic gases.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: Toxic fumes of: chlorides sodium oxides
Fire / Explosion Hazards: May react violently with: bromine trifluoride
Static Discharge: None reported.

Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Scoop up spilled material into a large beaker and dissolve with water. Dilute with a large excess of water. Flush the spilled material to the drain with a large excess of water. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves In the EU, the selected gloves must satisfy the specifications of EU Directive 89/686/EEC and standard EN 374 derived from it. lab coat
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes skin Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: White or light pink powder
Physical State: Solid
Molecular Weight: Not applicable
Odor: None
pH: of 5% solution = 6.2
Vapor Pressure: Not applicable
Vapor Density (air = 1): Not applicable
Boiling Point: Not applicable
Melting Point: 258°-262°C (496°-504°F)
Specific Gravity/ Relative Density (water = 1; air =1): 2.10
Evaporation Rate (water = 1): Not applicable
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not determined
Solubility:
Water: Soluble
Acid: Soluble
Other: Not determined

Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Heating to decomposition. Excess moisture
Reactivity / Incompatibility: Incompatible with: bromine trifluoride lithium
Hazardous Decomposition: Toxic fumes of: chlorides sodium oxides
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: In a laboratory test, single subcutaneous injection of sodium chloride into pregnant mice at the level of 2500 mg/kg caused fetal deaths and malformations.
Ingredient Toxicological Data: Sodium Chloride: Oral rat LD50 = 3000 mg/kg

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product. Mobility in soil: No data available
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Dilute material with excess water making a weaker than 5% solution. Open cold water tap completely, slowly pour the material to the drain. Flush system with plenty of water.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA

I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard Delayed (Chronic) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.
--
302 (EHS) TPQ (40 CFR 355): Not applicable
304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable
RCRA: Contains no RCRA regulated substances.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: WARNING - This product contains a chemical known to the State of California to cause cancer.
Identification of Prop. 65 Ingredient(s): Phenolphthalein
California Perchlorate Rule CCR Title 22 Chap 33: Not applicable
Trade Secret Registry: Not applicable
National Inventories:
U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).
TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Laboratory Reagent Indicator for pH
References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Technical Judgment. Journal of Clinical Investigations 41: 710-714 (1962). Acta Anat. 74: 121-124 (1969). Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991. In-house information.
Revision Summary: Substantial revision to comply with EU Reg 1272/2008, Reg 1907/2006 and UN GHS (ST/SG/AC.10/36/Add.3).

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

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Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00216

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Potassium Hydroxide Solution 8 N
Catalog Number: 28232H

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00216
Chemical Name: Not Applicable
CAS No.: Not Applicable
Chemical Formula: Not Applicable
Chemical Family: Not applicable
Hazard: Causes severe burns.
Date of MSDS Preparation:
Day: 02
Month: August
Year: 2012

2. COMPOSITION / INFORMATION ON INGREDIENTS

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: 50.0 - 60.0
Percent Range Units: volume / volume
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Potassium Hydroxide
CAS No.: 1310-58-3
TSCA CAS Number: 1310-58-3
Percent Range: 40.0 - 50.0
Percent Range Units: weight / volume
LD50: Oral rat LD50 = 273 mg/kg
LC50: None reported
TLV: 2 mg/m^3 Ceiling
PEL: 2 mg/m^3 Ceiling
Hazard: Toxic. Causes severe burns.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, colorless liquid
Odor: Irritating

CAUSES SEVERE BURNS

HMIS:

Health: 3
Flammability: 0
Reactivity: 1
Protective Equipment: X - See protective equipment, Section 8.

NFPA:

Health: 3
Flammability: 0
Reactivity: 1
Symbol: Not applicable

Potential Health Effects:

Eye Contact: Causes severe burns
Skin Contact: Causes severe burns
Skin Absorption: None reported
Target Organs: None reported
Ingestion: Causes: severe burns abdominal pain vomiting Can cause: death
Target Organs: None reported
Inhalation: Causes: severe burns sneezing coughing discomfort bronchospasms Can cause: death
Target Organs: None reported
Medical Conditions Aggravated: Pre-existing: Eye conditions Skin conditions Respiratory conditions
Chronic Effects: None reported
Cancer / Reproductive Toxicity Information:

This product does NOT contain any OSHA listed carcinogens.
This product does NOT contain any IARC listed chemicals.
This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: None reported

Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with plenty of water for 15 minutes. Remove contaminated clothing. Call physician immediately.
Ingestion (First Aid): Do not induce vomiting. Give 1-2 glasses of water. Call physician immediately. Never give anything by mouth to an unconscious person.
Inhalation: Remove to fresh air. Give artificial respiration if necessary. Call physician.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: This material will not burn.
Fire / Explosion Hazards: Contact with metals gives off hydrogen gas which is flammable
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Water.
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:

Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and

guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.
Containment Technique: Absorb spilled liquid with non-reactive sorbent material. Stop spilled material from being released to the environment.
Clean-up Technique: Cover spilled material with a dry acid, such as citric or boric. Scoop up slurry into a large beaker. Dilute with a large excess of water. Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Flush reacted material to the drain with a large excess of water. Decontaminate the area of the spill with a weak acid solution.
Evacuation Procedure: Evacuate local area (15 foot radius or as directed by your facility's emergency response plan) when: any quantity is spilled. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Product is regulated as RCRA hazardous waste in the U.S. Mixture contains a component which is regulated as a water pollutant in the U. S. .
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: 154

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin clothing Do not breathe mist or vapors. Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Store away from: acids metals organic peroxides combustible materials Protect from: heat freezing
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Use a fume hood to avoid exposure to dust, mist or vapor. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves In the EU, the selected gloves must satisfy the specifications of EU Directive 89/686/EEC and standard EN 374 derived from it. lab coat
Inhalation Protection: laboratory fume hood
Precautionary Measures: Avoid contact with: eyes skin clothing Do not breathe: mist/vapor Wash thoroughly after handling. Protect from: heat freezing
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, colorless liquid
Physical State: Liquid
Molecular Weight: Not applicable
Odor: Irritating
pH: 14
Vapor Pressure: 450.5 mm Hg @ 100 °C
Vapor Density (air = 1): Not determined
Boiling Point: > 100 °C >212 °F
Melting Point: Not determined
Specific Gravity/ Relative Density (water = 1; air =1): 1.3
Evaporation Rate (water = 1): 0.18
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not applicable
Solubility:
Water: Soluble
Acid: Soluble
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: 21.311 in/yr

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Extreme temperatures
Reactivity / Incompatibility: May react violently in contact with: acids metals organic peroxides combustible materials
Hazardous Decomposition: Contact with metals may release flammable hydrogen gas.
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: Potassium Hydroxide Oral Rat LD50 = 365mg/kg

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product. Mobility in soil: No data available
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: D002
Special Instructions (Disposal): Dilute material with excess water making a weaker than 5% solution. Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Open cold water tap completely, slowly pour the reacted material to the drain. Flush system with plenty of water.
Empty Containers: Dispose of empty container as normal trash. Rinse three times with an appropriate solvent.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Potassium Hydroxide, Solution
--
DOT Hazard Class: 8
DOT Subsidiary Risk: NA
DOT ID Number: UN1814
DOT Packing Group: II
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Potassium Hydroxide Solution
--
ICAO Hazard Class: 8
ICAO Subsidiary Risk: NA
ICAO ID Number: UN1814
ICAO Packing Group: II
I.M.O.:
I.M.O. Proper Shipping Name: Potassium Hydroxide Solution
--
I.M.O. Hazard Class: 8
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: UN1814
I.M.O. Packing Group: II
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS

part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:

O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)

E.P.A.:

S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard

S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.

--

302 (EHS) TPQ (40 CFR 355): Not applicable

304 CERCLA RQ (40 CFR 302.4): Potassium hydroxide 1000 lbs.

304 EHS RQ (40 CFR 355): Not applicable

Clean Water Act (40 CFR 116.4): Potassium hydroxide - RQ 1000 lbs.

RCRA: Contains RCRA regulated substances. See Section 13, EPA Waste ID Number.

C.P.S.C.: The label for this product bears the signal word "POISON" because the concentration of Potassium Hydroxide in the product is greater than/equal to 10%.

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.

Identification of Prop. 65 Ingredient(s): Not applicable

California Perchlorate Rule CCR Title 22 Chap 33: Not applicable

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).

TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Calcium determination Hardness determination Buffer Laboratory Reagent

References: Sax, N. Irving. Dangerous Properties of Industrial Materials, 7th Ed. New York: Van Nostrand Reinhold Co., 1989. Gosselin, R. E. et al. Clinical Toxicology of Commercial Products, 5th Ed. Baltimore: The Williams and Wilkins Co., 1984. Technical Judgment. In-house information. Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992.

Revision Summary: Substantial revision to comply with EU Reg 1272/2008, Reg 1907/2006 and UN GHS (ST/SG/AC.10/36/Add.3).

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

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Loveland, CO USA 80539
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MSDS No: M00438

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Sodium Hydroxide Solution 5.0 N
Catalog Number: 245053

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00438
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: Causes severe burns.
Date of MSDS Preparation:
Day: 23
Month: August
Year: 2012

2. COMPOSITION / INFORMATION ON INGREDIENTS

Sodium Hydroxide
CAS No.: 1310-73-2
TSCA CAS Number: 1310-73-2
Percent Range: 15.0 - 25.0
Percent Range Units: weight / weight
LD50: Oral rat LDLo = 500 mg/kg.
LC50: None reported
TLV: 2 mg/m³ Ceiling/STEL
PEL: 2 mg/m³
Hazard: Causes severe burns. Toxic.

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: 75.0 - 85.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, colorless
Odor: None
CAUSES SEVERE BURNS

HMIS:
Health: 3
Flammability: 0
Reactivity: 1
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 3
Flammability: 0
Reactivity: 1
Symbol: Not applicable
Potential Health Effects:
Eye Contact: Causes severe burns
Skin Contact: Causes severe burns May cause: scarring
Skin Absorption: None reported
Target Organs: None reported
Ingestion: Causes: severe burns
Target Organs: None reported
Inhalation: Causes: severe burns May cause: pneumonitis
Target Organs: None reported
Medical Conditions Aggravated: Pre-existing: Eye conditions Respiratory conditions Skin conditions
Chronic Effects: Chronic overexposure may cause destruction of any tissue contacted
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.
This product does NOT contain any IARC listed chemicals.
This product does NOT contain any NTP listed chemicals.
Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with plenty of water for 15 minutes. Remove contaminated clothing. Call physician immediately.
Ingestion (First Aid): Do not induce vomiting. Give 1-2 glasses of water. Never give anything by mouth to an unconscious person. Call physician immediately.
Inhalation: Remove to fresh air. Remove to fresh air.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: This material will not burn.
Fire / Explosion Hazards: This product will not burn or explode.
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear. Evacuate area and fight fire from a safe distance.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.

Containment Technique: Releases of this material may contaminate the environment. Absorb spilled liquid with non-reactive sorbent material. Stop spilled material from being released to the environment. Dike the spill to contain material for later disposal.
Clean-up Technique: Cover spilled material with a dry acid, such as citric or boric. Scoop up slurry into a large beaker. Dilute with a large excess of water. Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Flush reacted material to the drain with a large excess of water. Decontaminate the area of the spill with a weak acid solution.
Evacuation Procedure: Evacuate local area (15 foot radius or as directed by your facility's emergency response plan) when: any quantity is spilled. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Mixture contains a component which is regulated as hazardous waste in the U. S. . Mixture contains a component which is regulated as a water pollutant in the U. S. .
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: 154

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin clothing Do not breathe mist or vapors. Wash thoroughly after handling. Use with adequate ventilation. Maintain general industrial hygiene practices when using this product.
Storage: Keep container tightly closed when not in use. Store in a cool, dry place. Keep away from: acids / acid fumes. heat
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Have an eyewash station nearby. Have a safety shower nearby. Use general ventilation to minimize exposure to mist, vapor or dust.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields safety glasses with top and side shields
Skin Protection: disposable latex gloves lab coat
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes skin clothing Do not breathe: mist/vapor Wash thoroughly after handling. Use with adequate ventilation. Keep away from: acids/acid fumes heat
TLV: 2 mg/m³
PEL: 2 mg/m³

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, colorless
Physical State: Liquid
Molecular Weight: Not applicable
Odor: None
pH: 14
Vapor Pressure: Not determined.
Vapor Density (air = 1): Not determined.
Boiling Point: 100°C (212°F)
Melting Point: Not applicable
Specific Gravity/ Relative Density (water = 1; air =1): 1.181
Evaporation Rate (water = 1): 0.59
Volatile Organic Compounds Content: None.
Partition Coefficient (n-octanol / water): Not applicable
Solubility:
Water: Miscible.
Acid: Miscible.
Other: Not determined.
Metal Corrosivity:
Steel: 0.00 in/yr (0.00 mm/yr)
Aluminum: > 20 in/yr (> 508 mm/yr)

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.

Conditions to Avoid: Extreme temperatures
Reactivity / Incompatibility: Incompatible with: acids
Hazardous Decomposition: No hazardous decomposition products known.
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported.
LC50: None reported.
Dermal Toxicity Data: None reported.
Skin and Eye Irritation Data: None reported.
Mutation Data: None reported.
Reproductive Effects Data: None reported.
Ingredient Toxicological Data: Sodium Hydroxide: Oral rat LDLo = 500 mg/kg; Several skin and eye irritation test results reported in RTECS.

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product. Mobility in soil: No data available
Ingredient Ecological Information: Sodium hydroxide: Oncorhynchus mykiss 96 h LC50 = 45.4 mg/L; Daphnia sp. 48 h EC50 = 100 mg/L.
CEPA categorization for each and every ingredient: Not Persistent or Bioaccumulative. Not inherently toxic to aquatic organisms.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: D002
Special Instructions (Disposal): Work in an approved fume hood. Dilute to 3 to 5 times the volume with cold water. Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Open cold water tap completely, slowly pour the reacted material to the drain. Allow cold water to run for 5 minutes to completely flush the system.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Sodium Hydroxide Solution
--
DOT Hazard Class: 8
DOT Subsidiary Risk: NA
DOT ID Number: UN1824
DOT Packing Group: II
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Sodium Hydroxide Solution
--
ICAO Hazard Class: 8
ICAO Subsidiary Risk: NA
ICAO ID Number: UN1824
ICAO Packing Group: II
I.M.O.:
I.M.O. Proper Shipping Name: Sodium Hydroxide Solution
--
I.M.O. Hazard Class: 8
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: UN1824
I.M.O. Packing Group: II

Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:

O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)

E.P.A.:

S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard

S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.

--

302 (EHS) TPQ (40 CFR 355): Not applicable

304 CERCLA RQ (40 CFR 302.4): Sodium Hydroxide 1000 lbs.

304 EHS RQ (40 CFR 355): Not applicable

Clean Water Act (40 CFR 116.4): Sodium Hydroxide - RQ = 1000 lbs. (454 kgs.)

RCRA: Contains RCRA regulated substances. See Section 13, EPA Waste ID Number.

C.P.S.C.: The label for this product bears the signal word "POISON" because the concentration of Sodium Hydroxide in the product is greater than/equal to 10%.

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.

Identification of Prop. 65 Ingredient(s): --

California Perchlorate Rule CCR Title 22 Chap 33: Not applicable

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).

TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Laboratory Use Standard solution

References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. CCINFO RTECS. Canadian Centre for Occupational Health and Safety. Hamilton, Ontario Canada: 30 June 1993. IARC Monographs on the Evaluation of the Carcinogenic Risks to Humans. World Health Organization (Volumes 1-42) Supplement 7. France: 1987. List of Dangerous Substances Classified in Annex I of the EEC Directive (67/548) - Classification, Packaging and Labeling of Dangerous Substances, Amended July 1992. Sixth Annual Report on Carcinogens, 1991. U.S. Department of Health and Human Services. Rockville, MD: Technical Resources, Inc. 1991. Technical Judgment. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992.

Revision Summary: Substantial revision to comply with EU Reg 1272/2008, Reg 1907/2006 and UN GHS (ST/SG/AC.10/36/Add.3).

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

Horizon Chemical Co., Inc

2125 Energy Park Drive, St. Paul, MN 55108

651.917.3075 • FAX 651.917.3087

MATERIAL SAFETY DATA SHEET

PRODUCT NAME:	SODIUM HYPOCHLORITE 6-16%	DATE:	1/21/2004

MANUFATURER'S NAME: Vertex Chemical Corporation
9909 Clayton Road
Suite 219
St. Louis, MO 63124
314.991.4005

DISTRIBUTED BY: Horizon Chemical Co., Inc.
2125 Energy Park Drive
St. Paul, MN 55108
651.917.3075

NATIONAL EMERGENCY RESPONSE CENTER: 1-800-424-8802
FOR EMERGENCY DURING TRANSPORTATION ONLY: 1-800-535-5053

SECTION I - PRODUCT IDENTIFICATION

TRADE NAME: Horizon Liquified Chlorinator

PRODUCT USE: Sanitation

CHEMICAL NAME: Sodium Hypochlorite

CHEMICAL FORMULA: NaOCl

CHEMICAL FAMILY: Oxidizing Agent (Hypochlorite)

CAS NO.: 7681-52-9

SYNONYMS/ COMMON NAMES:
Liquid Bleach, Soda Bleach, VERTEX CSS-6, VERTEX CONCENTRATE, VERTEX CSS-10, VERTEX CSS-12, VERTEX Germicidal Ultra Bleach, Chlorine, Horizon Liquified Chlorinator.

SHIPPING NAME & HAZARD CLASS- (DOT):
Hypochlorite Solution 8
Corrosive Material, UN1791
PG III, RQ (Sodium Hypochlorite)

SECTION II - EMERGENCY RESPONSE INFORMATION

HEALTH HAZARDS: See Section VI

FIRE OR EXPLOSION: See Section IX

IMMEDIATE PRECAUTIONS: WASH FROM EYES: Section V, First Aid
Section X, Reactivity
Section XI, Spill, Leak & Disposal Procedures

SPILLS OR LEAKS: See Section XI

FIRST AID: See Section V

SECTION III - COMPOSITION

COMPONENT	CAS NO.	% by weight	PEL	TLV	OTHER	HAZARD
Sodium Hypochlorite	7681-52-9	6-16	None	None	None	Corrosive/Oxidizer
Sodium Chloride	7647-14-5	5-13	None	None	None	None
Sodium Hydroxide	1310-73-2	0.2-4.0	2MG/M3	2MG/M3	None	Corrosive
Water	7732-18-5	Balance	None	None	None	None

SECTION IV - PHYSICAL PROPERTIES

Concentration	6% NaOCl	11%NaOCl	13%NaOCl
Appearance	Banana-Colored Clear Liq.	Banana-Colored Clear Liq.	Banana-Colored Clear Liq.
Boiling Point, F	219°F	222°F	225°F
Color	Clear Yellow	Clear Yellow	Clear Yellow
Density	NA	NA	NA
Evaporation Rate	NA	NA	NA
Freeze Point, F	20°F	-1°F	-12°F
Melting Point	NA	NA	NA
Molecular Weight	74.45	74.45	74.45
Odor	Pungent Chlorine Odor	Pungent Chlorine Odor	Pungent Chlorine Odor
pH	12.31	12.95	13.05
Solubility	Soluble in Water	Soluble in Water	Soluble in Water
Specific Gravity	1.115	1.173	1.211
Vapor Density	NA	NA	NA
Vapor Pressure @ 55°C (Kpa)	7.63	7.63	9.34
Viscosity	NA	NA	NA
Vapor Pressure @ 50°C (Kpa)	6	6.2	7.5

SECTION V - FIRST AID MEASURES

EYES: Immediately flush eyes thoroughly and continue to repeatedly flush eyes with constantly running water for 15 minutes, lifting the upper and lower eyelids occasionally. Get immediate medical attention.

SKIN: Immediately flush skin thoroughly and continue to repeatedly flush eyes with constantly running water for 15 minutes. Remove contaminated clothing and shoes; wash before reuse. Get immediate medical attention.

INHALATION: Remove to fresh air. Give artificial respiration if not breathing. Administer Oxygen if breathing is difficult. Get immediate medical attention.

INGESTION: Do not induce vomiting. If conscious, give water or milk, or milk of magnesia. Do not give baking soda or acid antidotes. Do not give anything by mouth to an unconscious or convulsing person. Get immediate medical attention.

NOTES TO PHYSICIAN:

None.

SECTION VI - HEALTH HAZARDS IDENTIFICATION / INFORMATION

OVERVIEW: Primary Routes of Exposure: Skin or eye contact, inhalation Avoid eye or skin contact, inhalation.

SHORT-TERM EXPOSURE (ACUTE)

INHALATION: Inhalation of fumes or mists causes respiratory tract irritation and irritation of mucous membranes. If sodium hypochlorite is mixed with ammonia or other chemicals, evolution of chlorine or chlorine based compounds results. These gases can produce pulmonary edema. **Never mix with any other chemicals.**

EYES: Liquid and mists may severely irritate or damage eyes.

SKIN: The liquid will irritate the skin, causing redness and possibly inflammation, or chemical burns to broken skin.

INGESTION: Mists and liquid are extremely corrosive to the mouth and throat, mucous membranes and stomach. Swallowing the liquid burns the tissues, causes severe abdominal pain, nausea, vomiting, circulatory collapse, confusion, delirium, coma and collapse. Swallowing large quantities can cause death.

OTHER HEALTH EFFECTS OR NOTES:

Chronic Effects of Exposure: Irritation effects increase with strength of solution and time of exposure. Prolonged or repeated exposure can lead to constant irritation of eyes and throat. Prolonged or repeated contact may cause dermatitis and sensitization.

Medical Conditions Generally Aggravated By Exposure: Asthma or other pre-existing ling/respiratory illness.

SECTION VII - TOXICOLOGICAL INFORMATION

ACUTE ORAL: For 5% Solution Rat LD50 = 13 G/KG
For 12.5% Solution Rat LD50 = 5G/KG

DERMAL: Rat LD50 > 3.0 G/KG

ACUTE INHALATION: No Data Available

CARCINOGENICITY: This material is not considered to be a carcinogen by the National Toxicology Program, the International Agency for Research of Cancer, or the Occupational Safety and Health Administration.

OTHER DATA: None.

SECTION VIII - PERSONAL PROTECTION / EXPOSURE CONTROLS

VENTILATION: Local mechanical exhaust ventilation to minimize exposure to vapors or mist at the point of use.

RESPIRATORY: Wear a NIOSH-approved respirator appropriate for the vapor of mist concentration at the point of use. Appropriate respirators may be a full face-piece or a half mask air-purifying cartridge respirator equipped for acid gases/mists, a self-contained breathing apparatus in the pressure demand mode, or a supplied-air respirator.

EYE/FACE: Chemical goggles and full face-shield unless a full face-piece respirator is also worn. It is generally recognized that contact lenses should not be worn when working with chemicals because contact lenses may contribute to the severity of an eye injury. In laboratory situation, where running water is immediately available and an eyewash nearby, for handling of sixteen (16) ounces or less of product, safety glasses are acceptable eye protection.

SKIN: Long-sleeved shirt, trousers, rubber boots, rubber gloves, and rubber apron. In a laboratory situation, where running water is immediately available and an eyewash nearby, for handling sixteen (16) ounces or less of product, rubber gloves can be omitted. Hands should be rinsed immediately until slick feeling is gone from skin is exposure occurs.

OTHER: An eyewash and safety shower should be nearby and ready for use.

SECTION IX - FIRE FIGHTING MEASURES

FLASH POINT: Not Flammable
METHOD: N/A
AUTOIGNITION TEMPERATURE: N/A

FLAMMABLE LIMITS IN AIR, BY % VOLUME
LOWER: N/A UPPER: N/A

FLAMMABLE LIMITS (% BY VOLUME)
LOWER: N/A UPPER: N/A

EXTINGUISHING MEDIA: This material is not combustible. Use extinguishing media appropriate for surrounding fire.

FIRE FIGHTING PROCEDURES:

Fire fighters should wear self-contained breathing apparatus and full protective clothing. Use water spray to cool nearby containers and structures exposed to fire.

FIRE & EXPLOSION HAZARD:

Containers of this material can explode as oxygen is liberated under high heat or fire conditions. Toxic fumes similar to chorine gas are liberated by contact with acids, ammonia, some detergent cleaners, organic materials, oxidizing agents and some reducing agents. See Special Precautions Section for TLV of elemental chlorine. Highly exothermic reactions with organic materials and oxidizable materials may cause fires in adjacent, heat sensitive materials: Do not store where contact may result with organic or oxidizable materials, e.g., sawdust, paper waste, or others.

SENSITIVITY TO MECHANICAL IMPACT: N/A

SENSITIVITY TO STATIC DISCHARGE: N/A

NFPA RATING:	HEALTH:	2	REACTIVITY:	1
	FIRE:	0	SPECIFIC HAZARD:	Corrosive

SECTION X - STABILITY AND REACTIVITY

STABILITY: STABLE X UNSTABLE _____

HAZARDOUS POLYMERIZATION: OCCURS _____ WILL NOT OCCUR X

REACTS WITH:						
	AIR	_____	OXIDIZERS	X	METALS	X
	WATER	_____	ACIDS	X	OTHER	X
	HEAT	_____	ALKALIS	_____	NONE	_____

HAZARDOUS DECOMPOSITION PRODUCTS:

HOCL, Chlorine, HCL, NACL, Sodium Chlorate, and oxygen which depend on pH, temperature and time.

COMMENTS: Stability decreases with increased concentration, heat, light exposure, decrease in pH and contamination with heavy metals such as nickel, cobalt, copper and iron. DECREASES IN PH AND/OR CONTAMINATION CAN RESULT IS EVOLUTION OF CHLORINE (TOXIC) GAS.

CONDITIONS TO AVOID: EXCESSIVE HEAT, EXPOSURE TO LIGHT, REDUCED ALKALINITY, AND CONTAMINATION OF ANY KIND. REDUCED ALKALINITY OR CONTAMINATION CAN RESULT IN EVOLUTION OF CHLORINE (TOXIC) GAS.

STRONG OXIDIZING AGENT: in contact with the following incompatible, oxidizable materials, chemical reaction will occur allowing hazardous gases to evolve: Ether, ammonia, acids, oxidizing agents, reducing agents, oxidizable or combustible materials such as wood, cloth or organic materials, heavy metals such as iron, copper, magnesium, aluminum, tin, manganese, zinc, chromium, nickel, and their alloys. DO NOT MIX THIS PRODUCT WITH ANY OF THE FOREGOING OR HAZARDOUS GASES CAN RESULT.

SECTION XI - SPILL, LEAK AND DISPOSAL PROCEDURES

PERSONAL PRECAUTIONS:

Wear alkali-resistant slicker suit and complete protective equipment including goggles, rubber gloves, rubber boots, and a self-contained breathing apparatus in the pressure demand mode or a supplied-air respirator. If the spill or leak is small, a full face-piece air-purifying cartridge respirator equipped with acid gases/mists filters may be satisfactory. In any event, always wear eye protection.

- Follow protective measures provided under Personal Protection in Section 8.

ENVIRONMENTAL PRECAUTIONS:

Keep non-neutralized material out of sewers, storm drains, surface waters, and soil. This product is very toxic to aquatic life.

According to 40 CFR 302 Table 302.4 (CERCLA), environmental releases that exceed the RQ must be reported to the National Response Center by calling 800-424-8802 (202-426-2675) and the state emergency response commission and the local emergency planning committee (40 CFR 355.49) as appropriate.

METHODS FOR CLEANING UP:

For small spills or drips, mop or wipe up and dispose of in DOT-approved waste containers. For large spills, contain by diking with soil or other non-combustible absorbent material and dispose according to federal or local regulations.

Comply with all applicable governmental regulations on spill reporting, and handling of disposal waste.

DISPOSAL METHODS:

Dispose of contaminated product and materials used in cleaning up spills or leaks in a manner approved for this material.

Consult appropriate federal, state and local regulatory agencies to ascertain proper disposal procedures.

OTHER NOTES: Empty containers can have residues, gases and mists and are subject to proper waste disposal, as above.

SECTION XII - HANDLING AND STORAGE

HANDLING: Do not use pressure to empty container. Wash thoroughly after handling. Do no get in eyes, on skin, or on clothing. Store in original containers only at temperatures below 85°F. Do not store near acids, oxidizable materials, or organics. Do not store on wooden floors.
ATTENTION: When empty, the container may still be hazardous. Because container, even after they have been emptied, still retain product residues(vapor, liquid or solid), all labeled hazard precautions MUST BE OBSERVED. If "emptied" product containers of 110 gallons or greater volume are to be shipped, DOT requires the containers to be triple rinsed (or equivalent) to remove any residue and DOT placards be removed or covered with plain placards before they can be shipped as empty containers.

SPECIAL MIXING AND HANDLING INSTRUCTIONS:

Containers, even those that have been emptied, will retain product residue and vapors. Always obey hazard warnings and handle empty containers as if they were full. Do not mix or contaminate this product with ammonia, acids, hydro-carbons, alcohols, ethers, reducing agents, oxidizers, cleaning agents or other products which may liberate chlorine or other toxic vapors. For elemental chlorine, the OSHA PEL is .5 PPM TWA and 1 PPM STEL; the ACGIH TLV is 1 PPM TWA, with a STEL of 3 PPM. This product degrades with age. Use it within one month of receipt. It is a violation of federal law to use this product in a manner inconsistent with its labeling. EPA pesticides regulations apply, and EPA registration is required when using for disinfecting or sanitation purposes. THIS PRODUCT IS LISTED ON THE TOXIC SUBSTANCES CONTROL ACT (TSCA) INVENTORY OF CHEMICAL SUBSTANCES.

STORAGE: Store in a cool, dry, well-ventilated place away from incompatible materials. Keep container tightly closed and vented when no in use.

SECTION XIII - ECOLOGICAL INFORMATION

AQUATIC ECOTOX DATA

FISH: This product is very toxic to aquatic life.

INVERTEBRATES:

This product is very toxic to aquatic life.

AMPHIBIANS: This product is very toxic to aquatic life.

PLANTS: This product is very toxic to aquatic life.

TERRESTRIAL ECOTOX DATA

WILDLIFE: No Data.

PLANTS: No Data.

ENVIRONMENTAL FATE DATA

BIOTIC: No Data.

ABIOTIC: No Data.

ADDITIONAL INFORMATION

None.

SECTION XIV - DISPOSAL CONSIDERATIONS

See Section VII, Handling and Storage.

SECTION XV - TRANSPORT INFORMATION

DOT PROPER SHIPPING NAME:	Hypochlorite Solution
DOT HAZARD CLASS:	8
DOT IDENTIFICATION NUMBER:	UN1791
DOT PACKING GROUP:	PG III
DOT HAZARDOUS SUBSTANCE(S):	RQ 100 LBS.
DOT MARINE POLLUTANT(S):	MARINE POLLUTANT
ADDITIONAL DESCRIPTION RQMT:	

SECTION XVI - REGULATORY INFORMATION

US FEDERAL REGULATIONS:

OSHA Standard 29 CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, material safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this material safety data sheet available to your employees.

TSCA Inventory Status: Listed on inventory.
SARA - 313 Listed Chemicals - No
RCRA Hazardous Waste No.: N/A
CERCLA: Yes

Vertex sodium hypochlorite is regulated under many federal and local laws, including OSHA, TSCA, RCRA, FIFRA, CERCLA and EPCRA. It is NOT on the list of Extremely Hazardous Substances, 40 CFR Part 355 Appendix A, nor on the "337 Toxic Chemicals" list, 40 CFR 372.

SARA/TITLE III HAZARD CATEGORIES:

IMMEDIATE (ACUTE) HEALTH:	N/A	REACTIVE HAZARD:	N/A
DELAYED (CHRONIC) HEALTH:	N/A	SUDDEN RELEASE OF PRESSURE:	N/A
FIRE HAZARD:	N/A		

HMIS HAZARD RATINGS:

HEALTH HAZARD: 2 FIRE HAZARD: 0 REACTIVITY: 1

SPECIFIC HAZARD: Corrosive

STATE REGULATIONS:

No Data.

INTERNATIONAL REGULATIONS:

No Data.

SECTION XVII - OTHER INFORMATION

MSDS LEGEND:

ACGIH	AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS
CAS	CHEMICAL ABSTRACTS SERVICE REGISTRY NUMBER
CEILING	CEILING LIMIT (15 MINUTES)
CEL	CORPORATE EXPOSURE LIMIT
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
PEL	PERMISSIBLE EXPOSURE LIMIT (OSHA)
STEL	SHORT TERM EXPOSURE LIMIT (15 MINUTES)
TDG	TRANSPORTATION OF DANGEROUS GOODS (CANADA)
TLV	THRESHOLD LIMIT VALUE (ACGIH)
TWA	TIME WEIGHTED AVERAGE (8 HOURS)
WHMIS	WORKER HAZARDOUS MATERIALS INFORMATION SYSTEM (CANADA)

FOR ADDITIONAL INFORMATION

CONTACT: MSDS Coordinator Horizon Chemical Co., Inc. During Business Hours, Central Time
651.917.3075
Manufacturer MSDS's can also be obtained by contacting the number above. See notice below.

NOTICE

Horizon Chemical Co., Inc. ("Horizon") expressly disclaims all express or implied warranties of merchantability and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a product specification sheet and/or a certificate of analysis. These can be obtained from the Horizon sales office.

All information appearing herein is based upon data obtained from the manufacturer and/or recognized technical sources. While the information is believed to be accurate, Horizon makes no representations as to its accuracy or sufficiency. Conditions of use are beyond Horizons control and therefore users are responsible to verify this data under their own operating conditions to determine whether the product is suitable for their particular purposes and they assume all risks of their use, handling, and disposal of the product, or from the publication or use of, or reliance upon, information obtained herein. This information relates only to the product designated herein, and does not relate to its use in combination with any other material or in any other process.

END OF MSDS

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00337

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Sulfuric Acid 0.1600 ± 0.0008 N
Catalog Number: 1438801

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00337
Chemical Name: Not applicable.
CAS No.: Not applicable.
Chemical Formula: Not applicable.
Chemical Family: Not applicable
Hazard: May cause eye irritation.
Date of MSDS Preparation:
Day: 15
Month: October
Year: 2009

2. COMPOSITION / INFORMATION ON INGREDIENTS

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: >98
Percent Range Units: weight / volume
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Other components, each
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: 0.01 - 0.1
Percent Range Units: weight / weight
LD50: Not applicable
LC50: Not applicable
TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Sulfuric acid
CAS No.: 7664-93-9
TSCA CAS Number: 7664-93-9
Percent Range: 0.1 - 1.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 2140 mg/kg.
LC50: Inhalation rat LC50 = 87 ppm/4 hr

TLV: 1 mg/m³ (TWA); 3 mg/m³ (STEL)
PEL: 1 mg/m³
Hazard: Causes severe burns. Harmful if inhaled. Recognized carcinogen.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, colorless liquid
Odor: None
MAY CAUSE EYE IRRITATION

HMIS:
Health: 1
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 1
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: May cause irritiation
Skin Contact: No effects are anticipated
Skin Absorption: None reported
Target Organs: Not applicable
Ingestion: Practically non-toxic
Target Organs: None reported
Inhalation: No data reported.
Target Organs: None reported
Medical Conditions Aggravated: None reported
Chronic Effects: None reported
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.

An ingredient of this mixture is: IARC Group 1: Recognized Carcinogen
Sulfuric Acid - The IARC evaluation was based on exposure to the mist or vapor of concentrated sulfuric acid generated during chemical processes.
This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with plenty of water. Call physician if irritation develops.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: None required.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable.
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable.
Upper Explosion Limits: Not applicable.

Autoignition Temperature: Not applicable.
Hazardous Combustion Products: This material will not burn.
Fire / Explosion Hazards: This product will not burn or explode.
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Absorb spilled liquid with non-reactive sorbent material. Stop spilled material from being released to the environment.
Clean-up Technique: Cover spilled material with an alkali, such as soda ash or sodium bicarbonate. Scoop up slurry into a large beaker. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Dispose of material in government approved hazardous waste facility. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Mixture contains a component which is regulated as a water pollutant in the U. S. . Mixture contains a component which is regulated as hazardous waste in the U. S. .
304 EHS RQ (40 CFR 355): Sulfuric Acid - RQ 1000 lbs.
D.O.T. Emergency Response Guide Number: Not applicable.

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Store between 10° and 25°C.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Have an eyewash station nearby. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves lab coat
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes Wash thoroughly after handling. Use with adequate ventilation. Protect from: heat
TLV: Not established.
PEL: Not established.

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, colorless liquid
Physical State: Liquid
Molecular Weight: Not applicable.
Odor: None
pH: 1.1
Vapor Pressure: Not determined.
Vapor Density (air = 1): Not determined.
Boiling Point: ~ 100° C (~ 212° F)
Melting Point: Not determined.
Specific Gravity (water = 1): 0.990
Evaporation Rate (water = 1): 0.56

Volatile Organic Compounds Content: Not applicable.
Partition Coefficient (n-octanol / water): Not applicable.
Solubility:
Water: Miscible.
Acid: Miscible.
Other: Not determined.
Metal Corrosivity:
Steel: 0.027 in/yr (0.689 mm/yr)
Aluminum: 0.124 in/yr (3.150 mm/yr)

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Extreme temperatures Evaporation
Reactivity / Incompatibility: Incompatible with: caustics
Hazardous Decomposition: None reported
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported.
LC50: None reported.
Dermal Toxicity Data: None reported.
Skin and Eye Irritation Data: None reported.
Mutation Data: None reported.
Reproductive Effects Data: None reported.
Ingredient Toxicological Data: Sulfuric Acid: Oral rat LD_{50} = 2140 mg/kg; Inhalation rat LC_{50} = 347 ppm/1 hr.

12. ECOLOGICAL INFORMATION

Product Ecological Information: No specific ecological information available for this product.

Ingredient Ecological Information: Sulfuric Acid: The 48-Hour TLm in flounder is 100-300 ppm.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: D002
Special Instructions (Disposal): Dilute to 3 to 5 times the volume with cold water. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Open cold water tap completely, slowly pour the reacted material to the drain. Flush system with plenty of water.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:

I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard Delayed (Chronic) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product contains a chemical(s) subject to the reporting requirements of Section 313 of Title III of SARA.
Sulfuric acid (acid aerosols including mists, vapors, gas, fog, and other airborne forms of any particle size.)
302 (EHS) TPQ (40 CFR 355): Sulfuric Acid 1000 lbs.
304 CERCLA RQ (40 CFR 302.4): Sulfuric Acid 1000 lbs.
304 EHS RQ (40 CFR 355): Sulfuric Acid - RQ 1000 lbs.
Clean Water Act (40 CFR 116.4): Sulfuric acid - RQ 1000 lbs.
RCRA: Contains RCRA regulated substances. See Section 13, EPA Waste ID Number.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): None
California Perchlorate Rule CCR Title 22 Chap 33:
Trade Secret Registry: Not applicable
National Inventories:
U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).
TSCA CAS Number: Not applicable.

16. OTHER INFORMATION

Intended Use: Alkalinity determination
References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). CCINFO RTECS. Canadian Centre for Occupational Health and Safety. Hamilton, Ontario Canada: 30 June 1993. Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991. IARC Monographs on the Evaluation of the Carcinogenic Risks to Humans. World Health Organization (Volumes 1-42) Supplement 7. France: 1987. List of Dangerous Substances Classified in Annex I of the EEC Directive (67/548) - Classification, Packaging and Labeling of Dangerous Substances, Amended July 1992. Sixth Annual Report on Carcinogens, 1991. U.S. Department of Health and Human Services. Rockville, MD: Technical Resources, Inc. 1991. Technical Judgment. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Verschueren, Karel. Handbook of Environmental Data on Organic Chemicals. New York: Van Nostrand Reinhold Co., 1977.

Revision Summary: Updates in Section(s) 15,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00299

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Sulfuric Acid 1.600 ± 0.008 N
Catalog Number: 1438901

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00299
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: Carcinogen. Causes eye burns.
Date of MSDS Preparation:
Day: 06
Month: November
Year: 2012

2. COMPOSITION / INFORMATION ON INGREDIENTS

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: 90.0 - 100.0
Percent Range Units: volume / volume
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Other component
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: 0.01 - 0.1
Percent Range Units: weight / weight
LD50: Not applicable
LC50: Not applicable
TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Sulfuric Acid
CAS No.: 7664-93-9
TSCA CAS Number: 7664-93-9
Percent Range: 1.0 - 10.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 2140 mg/kg

LC50: Inhalation rat LC50 = 87 ppm/4 hr
TLV: 1 mg/m³ (TWA); 3 mg/m³ (STEL)
PEL: 1 mg/m^3
Hazard: Causes severe burns. Harmful if inhaled. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, colorless
Odor: Acidic
CAUSES EYE BURNS MAY CAUSE RESPIRATORY TRACT IRRITATION
HMIS:
Health: 3
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 3
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: Causes eye burns.
Skin Contact: No effects are anticipated
Skin Absorption: None reported
Target Organs: None reported
Ingestion: Causes: irritation of the mouth and esophagus May cause: vomiting diarrhea
Target Organs: None reported
Inhalation: May cause: respiratory tract irritation teeth erosion mouth soreness difficult breathing
Target Organs: Lungs
Medical Conditions Aggravated: Pre-existing: Eye conditions Respiratory conditions
Chronic Effects: Chronic overexposure may cause erosion of the teeth chronic irritation or inflammation of the lungs cancer
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.
An ingredient of this mixture is: IARC Group 1: Recognized Carcinogen
Sulfuric Acid - The IARC evaluation was based on exposure to the mist or vapor of concentrated sulfuric acid generated during chemical processes.
NTP Listed Group 1: Recognized Carcinogen
Sulfuric Acid Mist or Vapor
Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with plenty of water.
Ingestion (First Aid): Do not induce vomiting. Call physician immediately. Give 1-2 glasses of water under medical supervision. Never give anything by mouth to an unconscious person.
Inhalation: Remove to fresh air.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn. During a fire, irritating and highly toxic gases may be generated by thermal decomposition.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable

Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: This material will not burn.
Fire / Explosion Hazards: This product will not burn or explode.
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance. Outside of the US, only persons properly qualified according to state or local regulations should respond to a spill involving chemicals.
Containment Technique: Absorb spilled liquid with non-reactive sorbent material. Stop spilled material from being released to the environment.
Clean-up Technique: Cover spilled material with an alkali, such as soda ash or sodium bicarbonate. Scoop up slurry into a large beaker. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Flush reacted material to the drain with a large excess of water. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate local area (15 foot radius or as directed by your facility's emergency response plan) when: any quantity is spilled. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Mixture contains a component which is regulated as a water pollutant in the U. S. . Product is regulated as RCRA hazardous waste in the U.S.
304 EHS RQ (40 CFR 355): Sulfuric Acid - RQ 1000 lbs.
D.O.T. Emergency Response Guide Number: Not applicable

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Do not breathe mist or vapors. Use with adequate ventilation. Maintain general industrial hygiene practices when using this product. Wash thoroughly after handling.
Storage: Store between 10° and 25°C.
Flammability Class: Class IIIB

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Use general ventilation to minimize exposure to mist, vapor or dust. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves lab coat
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes skin Do not breathe: mist/vapor Use with adequate ventilation. Protect from: heat
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, colorless
Physical State: Liquid
Molecular Weight: Not applicable
Odor: Acidic
pH: <0.5
Vapor Pressure: Not determined
Vapor Density (air = 1): Not determined
Boiling Point: ~ 100 °C (212 °F)
Melting Point: Not determined

Specific Gravity/ Relative Density (water = 1; air =1): 1.047
Evaporation Rate (water = 1): 0.53
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not applicable
Solubility:
Water: Soluble
Acid: Soluble
Other: Not determined
Metal Corrosivity:
Steel: 0.096 in/yr
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Extreme temperatures Exposure to air. Heating to decomposition.
Reactivity / Incompatibility: Incompatible with: alkalies oxidizers reducers
Hazardous Decomposition: Heating to decomposition releases toxic and/or corrosive fumes of: sulfur oxides
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: Skin testing with 10% solution shows no irritation.
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: Sulfuric Acid: Oral rat LD50 = 2140 mg/kg, Inhalation rat LC50 87 ppm/4Hours

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product. Mobility in soil: No data available
Ingredient Ecological Information: Sulfuric Acid: The 48-Hour TLm in flounder is 100-300 ppm.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: D002
Special Instructions (Disposal): Work in an approved fume hood. Dilute to 3 to 5 times the volume with cold water. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Open cold water tap completely, slowly pour the reacted material to the drain. Allow cold water to run for 5 minutes to completely flush the system.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA

ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard Delayed (Chronic) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product contains a chemical(s) subject to the reporting requirements of Section 313 of Title III of SARA.
Sulfuric acid (acid aerosols including mists, vapors, gas, fog, and other airborne forms of any particle size.)
302 (EHS) TPQ (40 CFR 355): Sulfuric Acid 1000 lbs.
304 CERCLA RQ (40 CFR 302.4): Sulfuric Acid 1000 lbs.
304 EHS RQ (40 CFR 355): Sulfuric Acid - RQ 1000 lbs.
Clean Water Act (40 CFR 116.4): Sulfuric acid - RQ 1000 lbs.
RCRA: Contains RCRA regulated substances. See Section 13, EPA Waste ID Number.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): None
California Perchlorate Rule CCR Title 22 Chap 33: Not applicable
Trade Secret Registry: Not applicable
National Inventories:
U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).
TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Laboratory Use Alkalinity determination
References: TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. In-house information. Technical Judgment. Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. Vendor Information. IARC Monographs on the Evaluation of the Carcinogenic Risks to Humans. World Health Organization (Volumes 1-42) Supplement 7. France: 1987.
Revision Summary: Substantial revision to comply with EU Reg 1272/2008, Reg 1907/2006 and UN GHS (ST/SG/AC.10/36/Add.3).

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.