Lake Oswego · Tigard Water Partnership
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MWH

Water Treatment Plant Land Use Application

Submittal Section 18B

Safe Operations Plan for the Water Treatment Plant

CONTENTS

Appendix

1.0 Introduction

The purpose of this Safe Operations Plan is to document how the Lake Oswego-Tigard Water Partnership (Partnership) will assure the long-term integrity of its proposed expanded Water Treatment Plant (WTP).

The cities of Lake Oswego and Tigard are committed to the safe operation of all elements of the proposed Partnership facilities. In fact, the basic mission of the Partnership is to design, build, and maintain a safe, reliable, long-term water supply system that is resilient to multiple potential hazards, consistent with the critical importance of the system to public health and safety.

The citizens of Lake Oswego and Tigard will depend on the new water supply system at all times, but perhaps no more so than during and following an emergency or natural disaster. And the citizens of West Linn, in the event of damage to or malfunction of any key element of its water system or the South Fork Water Board supply facilities, will also rely on the Partnership's water treatment facilities, for its backup source of supply. The Partnership's facilities will create the opportunity to access all four major sources of water in the region.

The proposed WTP is a key piece of infrastructure for Lake Oswego and Tigard. Designed to meet both Lake Oswego and Tigard's water needs, it represents a substantial investment to be made by Lake Oswego and Tigard water customers. Therefore, a strong commitment to maintenance through proactive and sustained asset management is warranted. This commitment is reflected in the Intergovernmental Agreement (IGA) that formed the Partnership. The IGA commits Lake Oswego and Tigard to an asset management program intended to maximize the service life of the entire water system by performing timely monitoring, assessment, maintenance, and upgrades.

Safety during ongoing operations is focused on ensuring the continuous mechanical, structural, and electrical integrity of all the equipment and structures within the WTP. As with any water facility, the critical objectives to be addressed through detailed design, construction, inspection, and maintenance include the following:

- Site Security
- Structural Integrity
- Process Redundancy
- Operational Control
- Hazardous Material Management
- Maintenance

Strategies to achieve these critical performance objectives are summarized below:

- **Compact and secure site** to enhance public safety.
- **Selection of durable building materials** and an advanced seismic support system designed to meet the industry's highest seismic standard, during its 75- to 100-year design service life.
- **Mechanical and electrical redundancy** including multiple backup power supplies to mitigate risk of a power failure while minimizing on-site fuel storage.
- **State of the art operational controls and instrumentation systems** running a robust treatment process.
- **Fully contained hazardous materials handling systems** which mitigate the risk of an uncontained spill and provide early detection in the event of a chemical leak.

- **Thorough construction inspection and testing program.** Careful construction inspection and a wide range of performance testing will validate that the facilities are constructed as intended by the design engineers.
- **Proactive asset management** and routine ongoing monitoring, assessment, and maintenance of every aspect of the facility documented and checked by a comprehensive Asset Management Plan will ensure this facility remains in good working order.

Each of these items is described in more detail in the sections that follow.

2.0 Safety and Security

A secure treatment facility including secure fencing, a remotely monitored security system, separate visitor and operations areas, and an efficient, effective lighting plan will combine to safeguard the site, plant staff, visitors and the neighborhood.

Some of the key considerations incorporated into the WTP design are presented below.

2.1 Site Security

After the events of September 11, 2001, a Presidential Directive created the Department of Homeland Security. Because of the critical importance of drinking water facilities to the security of communities nationwide, public law (PL 107-188), the Bioterrorism and Public Health Security Act, required all community water systems to assess the vulnerabilities of their critical water infrastructure to intentional malevolent acts. Lake Oswego submitted the findings and recommendations of its Vulnerability Assessment to EPA in 2004. The modernization of Lake Oswego's WTP, creates the opportunity to also modernize its site security systems which include the following elements:

Secure Fencing & Controlled Access Gates. Good neighbor fencing around the WTP will use decorative wood paneling on the neighborhood facing side and chain link fencing on the plant facing side. This will give the site an architecturally pleasant look while maintaining a secure perimeter around the site. Automatically locking gates and signage will direct public traffic to publically accessible areas of the site while restricting access to critical systems within the treatment plant only to authorized personnel.

Site Monitoring. Monitoring for detection of unauthorized access or activity within on the site is a key component of a robust security system. The plant will employ a variety of sophisticated devices to continually monitor the site and specific operations (e.g. chemical truck unloading). The security features will greatly enhance the safety and security of the staff and WTP facilities.

2.2 Practical Site Layout and Efficient Facility Design

The approach taken on site layout as well as the efficient design of each treatment processes provides general operational safety and improves the safety of the surrounding neighborhood.

Separation of Work and Visitor Areas. The WTP is purposefully laid out to keep plant process areas and publicly accessible areas separate. Chemical and other delivery trucks are kept away from personal vehicles by creating a separate loop road, interior to the WTP, which avoids the public parking areas. Tour routes allow visitors to see the inner workings of the facility without being accessible to operating equipment, chemical storage, electrical equipment, or plant control systems.

Line-of-sight. A simple but important concept incorporated into the WTP layout is creating line-of-sight. This applies to roadways, sidewalks, pedestrian paths, hallways, and all areas with vehicle crossings. Safety is greatly enhanced when people can see where they are going and what is coming their way.

A variety of lighting systems will assure appropriate illumination for the many needs of an operating water treatment facility including area lighting, task lighting, and security lighting. Lighting system design is key to worker productivity, safety, energy efficiency, and minimizing undesirable uplighting and glare to offsite properties.

Access for Emergency Responders. The proposed walking path on the southeast side of the property doubles as an alternative access point for emergency responders to access the interior of the WTP site and travel between Kenthorpe Way and Mapleton Drive. In case of an emergency in which access to the WTP is blocked via Kenthorpe Way emergency responders can access the WTP site via Mapleton Drive. This access-way also serves the surrounding neighborhood by giving emergency responders access through the WTP site should regular traffic routes to either Mapleton or Kenthorpe be blocked.

Clearance. Providing sufficient clearance around equipment, along walkways, and under overhead piping is important in creating a comfortable and safe work space suitable to every day access by plant operations staff as well as emergency response personnel.

3.0 Durable Design

WTP infrastructure is designed to last 75+ years. The Partnership has adopted the approach recommended by the American Society of Civil Engineers and the International Building Code for very important structures. This approach effectively mitigates the hazards of an earthquake to the highest level accepted worldwide. This is the standard applicable to life sustaining structures such as hospitals and emergency response facilities. The robust structural design and construction includes consideration of the magnitude 9.0 Cascadia Subduction Zone (CSZ) megathrust event, and will allow the WTP facility to remain operational and occupiable even after a CSZ event.

3.1 Pile Foundations

To mitigate site specific seismic hazards pile foundations are used beneath both new and existing structures. Detailed analysis of the existing Lake Oswego WTP site determined that seismic liquefaction under the CSZ event may cause settlements throughout the site of about 5 to 9 inches and differential settlements ranging from 1 to 5 inches. To prevent damage to both new and existing structures due to seismic liquefaction and settlement, auger-cast piles, embedded sufficiently into the non-liquefiable dense gravel underlying the liquefiable silty sand, will be used. The use of piles coupled with robust concrete design described in section 3.2, provides additional safeguards, so the WTP structures will not suffer a catastrophic failure even during the 9.0 CSZ event. For additional details, see the *Lake Oswego & Tigard Water Treatment Plant – Seismic Geologic Hazards and Mitigations Technical Memorandum* (Shannon & Wilson, July 2012), submitted as part of this supplemental application, as well as the *Lake Oswego & Tigard Water Treatment Plant – Draft Geotechnical Engineering Report* (Shannon & Wilson, March 2012), submitted as part of the original Land Use Application, submitted to West Linn dated March 29, 2012.

3.2 Concrete Design

Robust reinforced concrete design maximizes the durability and performance of concrete structures. The conservative concrete design of every treatment plant structure provides added strength and durability to each structure. Some of the elements of advanced concrete design utilized on WTP structures includes enhanced concrete mix requirements which eliminates the use of fly-ash for improved strength and durability, tighter spacing of reinforcing rebar to minimize concrete cracking, and the application of concrete damp proofing and waterproofing to protect foundations and walls.

3.3 Corrosion Control

Corrosion potential is mitigated by using multiple barriers. To improve the design life of treatment facilities, corrosion prevention measures are included on both the concrete structures and buried pipelines.

Corrosion of below ground concrete structures is mitigated by reducing external moisture penetration using waterproof concrete coatings as well as drain boards to shed stormwater away from structures. Above ground concrete structures also receive waterproofing or damp proofing treatments utilizing breathable membrane materials.

Corrosion protection of pipelines within the WTP will be accomplished by several barriers including coatings and linings, as well as dielectric isolation and, in some cases cathodic protection. The application of the various corrosion protection measures varies by pipeline size and material. However, the following standard corrosion prevention methodologies apply:

- Cement mortar lining and coating
- High-performance urethane or epoxy lining and coating
- Tape coating
- Poly-ethylene encasement
- Dielectric isolation
- Cathodic protection systems

Careful selection of the specific corrosion prevention measures for each pipe type ensures long pipeline service life and effectively mitigates the risk of pipeline failure.

4.0 Process Redundancy

The WTP includes a number of redundant systems which allow flexible operations in a variety of modes under varying conditions. Redundant systems are valuable from both a maintenance perspective, when systems or processes are taken offline for scheduled routine maintenance as well as during emergency conditions when a system or process unexpectedly fails. Redundant systems at the WTP account for occurrences in both categories without negatively impacting plant performance or risking public safety. This provides a significant benefit to West Linn residents, who rely on the Partnership facilities, including the WTP, for their emergency water supply in the event of damage to or failure of any key element of the South Fork Water Board's or West Linn's supply system.

4.1 Process and Equipment Redundancy

Redundant treatment units and mechanical equipment allows plant staff the flexibility to by-pass most areas enhancing the WTP's ability to provide emergency water supply. Some of the redundant processes include:

- Two parallel Ballasted Flocculation basins allowing for treatment of up to 30 million gallons per day (mgd) while one basin is out of service.
- Ozone contactor can be bypassed while other WTP processes still provide essential treatment to meet public health requirements.
- Six individual filters can treat up to 8 mgd each; providing up to 32 mgd of water even if two are out of service.

In addition to the redundant main treatment processes, equipment within each process also provides internal redundancy – such as redundant pumps, instrumentation, and electrical equipment.

4.2 Power Supply Redundancy

Redundant electrical supply from the local utility Portland General Electric (PGE) is a key feature of the Partnerships approach to sustaining treatment operations except in the most extreme circumstances. In addition to the primary power supply which enters the site via overhead power lines, a second buried power feed provides a robust and reliable supply of electrical energy capable of operating the WTP in the event that the primary supply is interrupted. The two power feeds are fed from two separate power substations and follow two physically separate routes along Highway 43 and to the plant site. On-site switchgear allows the plant to automatically switch from one power source to the other without adversely interrupting plant production. In this way, the risk of a localized event causing a loss of power, such as wind damage or minor seismic event, is mitigated.

In the unlikely event that both electrical feeds fail simultaneously, a diesel backup generator will power critical emergency monitoring and communications equipment (including key instrumentation and alarms) within the WTP's control room. This redundant power strategy minimizes the generator size requirement which, in turn, limits the total volume requirement for on-site fuel storage. Furthermore, because PGE lists the WTP as a critical facility, the PGE response protocol in the event of an outage gives restoration of power to the WTP a priority.

4.3 Overflow Strategy

A series of on-site containment basins provide water storage in the event of an emergency plant overflow. In the unlikely event that these storage structures are overwhelmed before plant operators can safely shutdown pumps and control valves water is conveyed through an overflow pipeline to the Willamette River. This overflow strategy mitigates the risk of flooding to the WTP site or surrounding neighborhood during an overflow event.

Overflow events, though unlikely, could conceivably occur in an emergency situation when flow cannot be passed to downstream water treatment structures due to valve malfunction, pipeline obstruction, or catastrophic pump failure. However, even under these circumstances, the WTP is designed to contain and convey overflows to safe storage locations, preventing damage to the site or surrounding properties.

In the unlikely event of an emergency overflow water levels in the core process areas (Ballasted Flocculation, Ozone Contactor, and Filters) would rise above normal operating levels and begin to flow over an overflow weir. Water passing over this weir is conveyed to the Washwater Equalization Basin. Alarms indicating an overflow is occurring will alert plant staff to this condition and allow them to immediately initiate a plant shutdown to prevent further overflows. If the plant shutdown cannot be completed before the Washwater Basin is completely full, this basin will overflow to the existing Lagoons. Finally, if the Lagoons become full they will overflow via the existing overflow pipeline to the Willamette River. This overflow process is similar for the Clearwell.

All overflows, up to the plant treatment capacity can be contained in the on-site containment basins or discharged to the Willamette River without causing flooding of the site or surrounding neighborhood.

5.0 Operational Control System

While the WTP will feature a state of the art supervisory control and data acquisition system (SCADA) for monitoring, controlling, and automating intake, pipeline, WTP and reservoir operations, the plant will only operate when WTP staff are on-site. WTP operators are highly trained to safely operate water supply and treatment systems and can efficiently diagnose, troubleshoot, and repair plant systems in the event of an emergency. Combined with an array of process monitoring equipment and instrumentation located throughout the WTP and relayed through the SCADA system, staff is able to quickly detect operational issues and solve problems before emergencies occur.

Plant operations staff are certified as Drinking Water Operators by the state of Oregon. Water treatment plant operators must pass certification exams as well as periodically renew their certification with continuing education courses and seminars.

Operation of the WTP is flexible and can allow both remote, local, and automatic control. Programming of the SCADA system will automate many of the key processes during normal operation. However, under non-routine circumstances staff can manually operate equipment either remotely, through the SCADA system screens, or on local control panels directly adjacent to the process equipment. This flexibility ensures that even during unique situations staff can maintain full control of treatment processes.

5.1 Warning and Alarm Systems

The process monitoring equipment and instrumentation communicates with the SCADA system and provides warnings and alarms to staff when issues occur within the WTP, at the intake, pipelines, or remote storage reservoirs. These warnings can be initiated automatically based on feedback from online analyzers and instrument sensors. For example, several online analyzers at the plant continuously report on the effectiveness of treatment systems and can provide warnings or alarms in the event of any inconsistency in the treatment stream. Another example is instruments which monitor the physical state of processes and equipment such as high temperature or high water level indicators, indicating issues with equipment or process flows. Again these instruments are integrated with the SCADA system, providing an early warning system which allows operations staff to react to the problem, diagnose the cause, and correct the issue.

5.2 Uninterruptable Power Supplies

In addition to the power redundancy strategies discussed in Section 4.2, Uninterruptable Power Supplies (UPS) allow the SCADA system, local control panels, the communication systems, and critical instrumentation/alarms to remain in continuous operation even during complete power failures. These UPS systems are engaged instantly after a power failure and provide power for a minimum of 15 minutes. This allows adequate time for non-critical systems to properly shut-down and also allows time for the backup generator to start-up, providing long-term power to critical systems, even during catastrophic emergencies.

5.3 Fire Detection & Suppression System

Fire suppression systems serve to protect and mitigate fire hazards throughout the WTP site. These systems consist of external fire hydrants, fire suppression sprinklers in several buildings, and smoke detection systems. The smoke detection systems will be tied into the WTP communication system to alert staff and visitors as well as fire and rescue professionals in the event of a fire. Buildings at the WTP with advanced fire suppression systems proposed include:

- Chemical Building including the Chemical Storage Room and Ozone Generation Room
- Administration and Operations Building
- Filter Gallery and Ballasted Floc/Ozone Gallery

6.0 Hazardous Material Management Plan

The primary purpose of the Hazardous Material Management Plan (HMMP) is to provide information to interested regulatory agencies concerning the storage, handling and spill response procedure for chemicals used in the treatment and disinfection of water at the WTP.

The current HMMP was developed during the last major capital improvements project at the WTP in 1997. A completely revised and updated HMMP will be developed as part of the proposed plant expansion. An overview of the hazardous materials at the expanded WTP as well as basic details regarding the separation, containment, monitoring and emergency response for these materials and material handling systems is provided in the sections below.

6.1 Chemical Deliveries

The Chemical Building is located near the center of the plant site, within the secure area and a contained perimeter. Chemicals are delivered via tank trucks to permanent chemical storage tanks within the Chemical Building. The chemical fill station is located directly adjacent to the Chemical Building in a covered area enclosed on two sides. This allows easy drive-thru access for delivery trucks, providing protection from environmental elements such as wind and rain and facilitates containment in the unlikely event of a spill. Chemical delivery truck drivers are well trained and follow strict industry standards to ensure safe and effective transfer of chemicals. The fill station will receive bulk deliveries for the following chemicals: caustic soda, sodium hypochlorite, liquid alum, and a secondary coagulant such as aluminum chlorohydrate or polyaluminum chloride. Tank level indicators, located at the fill station, monitor the tank filling operations.

The tank filling area is divided into two sub-areas: one with filling connections for acids, including the alum and secondary coagulant; and one with filling connections for bases, including the caustic soda and sodium hypochlorite. In the event of a spill, drains located in each tank filling sub-area will convey spilled chemical into the appropriate containment sump within the chemical building. This methodology for containment exceeds common safety practices for chemical fill stations and further mitigates the risk of a spill causing harm on or around the plant site.

6.2 Chemical Storage Areas

Inside the Chemical Building, chemical storage tanks, separated into acid and base categories depending on their relative pH and reactivity, are placed in large containment areas which further mitigate the risk of a potential spill. These containment areas are designed to hold the contents of one full tank and 20 minutes of flow from the fire suppression sprinklers, while maintaining a minimum of 6 inches of freeboard. Within each containment area a sump with a chemical resistant pump allows chemical spills to be pumped out of the containment sump and into a tanker truck for safe transport to the appropriate disposal facility. Chemical feed pumping facilities as well as ancillary equipment related to chemical feed are also located in this same containment area mitigating the risk of minor leaks associated with the pumps or pump piping connections.

6.3 Chemical Piping

Chemical piping outside the containment areas is double contained within both the primary chemical feed pipe and an additional pipe sleeve. Double contained chemical pipes are sloped appropriately to ensure any leaks in the pipe are ultimately contained in sumps at either end of the piping. In the event that the primary chemical feed pipe develops a leak, the leaked chemical would flow by gravity into a containment sump where sensors would trigger an alarm to plant staff indicating the issue. From there, plant staff can shut down the feed pump and isolate the section of leaking pipe to further diagnose and resolve the problem.

Redundant chemical piping for key chemical systems and their associated dosing points ensures the WTP can remain online in the event of a chemical pipe failure.

6.4 Specific Considerations for LOX and Ozone

The ozone treatment process at the WTP consists of several highly specialized, sophisticated pieces of equipment. Each piece of equipment features a myriad of highly specialized control and monitoring equipment, designed specifically to provide a safe and secure operating environment. The system can automatically detect issues and initiate immediate shut down, isolating each element of the process as needed. The key elements of the ozone system are:

- Liquid oxygen (LOX) Tank
- LOX vaporizers
- Ozone generators
- Ozone dissolution and injection equipment
- Ozone contactor
- Ozone destruct units

LOX. At the WTP, LOX will be present on the site as the primary constituent for making ozone. The LOX tank features double wall construction utilizing specially formulated high-nickel stainless

steel. The annular space between double walls is insulated and under vacuum to isolate the outside of the tank from the cold temperatures inside the tank. This allows the outside of the tank to be safe to touch without the risk of frostbite.

The LOX tank features redundant safety valves to prevent over-pressurization during filling and redundant shut-off valves, including an emergency shut-off valve separate from any control interlocks, to isolate the tank.

The LOX tank is located centrally on the site, safe within the secure perimeter. The location of the tank includes adequate distance from other structures and sufficient ventilation to prevent accumulation of oxygen in the unlikely event of a leak. Warning signs around the tank indicate the risk of combustion in the immediate area. Because liquid oxygen quickly vaporizes, dilutes and dissipates in the atmosphere, the increased risk of combustion rapidly decreases at short distances away from the tank itself and is minimal beyond the secure perimeter.

LOX is conveyed via foam-glass insulated seamless stainless steel piping to the LOX vaporizers where it is converted to gaseous oxygen. The careful design of the LOX conveyance system and use of specific pipe materials and fittings mitigates the risk of a LOX or gaseous oxygen leak. However, in the unlikely event of a leak additional safety systems are provided to safely isolate and shutdown the LOX system. Small leaks in the LOX tank or LOX piping is easily detectible since escaping LOX will cause moisture in the area to freeze causing noticeable frost in the area of concern. More significant leaks are immediately detected via the increased speed of pressure loss from the tank. In this case the system can quickly be shut down while a more thorough inspection, diagnoses the problem and remediation can be undertaken.

The gaseous oxygen conveyance piping is similar to the LOX piping, heavy wall seamless stainless steel with thoroughly tested, corrosion resistant (passivated) welded joints. No connections are provided between the vaporizers and the ozone generation room to mitigate the risk of leaks in this piping.

Ozone Generators. Using fully contained specialized reactors gaseous oxygen is converted to ozone in the ozone generators. These generators are located in the ozone generation room, part of the chemical building. The ozone generation process is monitored by numerous sensors including pressure, temperature, flow rate, and ozone concentration. Any deviation from standard operating parameters will trigger an immediate shutdown of the ozone generator. Temperatures in the ozone generators are kept cool by a continuous cooling water stream which maintains a temperature approximately between 60°F and 120°F.

Inside the Ozone Generation room redundant ambient sensors detect elevated levels of oxygen or ozone and trigger alarms, shutting down the systems in the event of an abnormal detection. The ozone is conveyed via stainless steel piping to the ozone dissolution and injection equipment in the Ballasted Floc/Ozone gallery. Similar oxygen and ozone sensors in this gallery can trigger alarms and shutdown ozone systems as needed. Both areas feature additional ventilation systems that can rapidly bring outside air in, diluting and venting ozone or oxygen gas harmlessly to the atmosphere. These ventilation systems are triggered automatically by the sensors but can also be manually initiated via emergency stop buttons located near the building exits at each location.

Ozone is readily identifiable by smell and can be detected by people at levels well below the human health and safety standard. Operations staff are trained to be alert and aware of increased levels of

ozone in the gallery or generator areas and can manually initiate the emergency stop procedures if needed.

Ozone Contactor. The ozone is dissolved in the water stream and allowed time to react inside the Ozone Contactor. The ozone contactor is sealed to prevent gas escaping. It is also kept under constant vacuum pressure to actively draw out any ozone gas present in the headspace between the water surface and the sealed lid of the contactor. The vacuum pressure is provided by the Ozone Destruct Unit blowers which employ a thermal catalytic reaction using magnesium dioxide to ensure the complete conversion of ozone back to oxygen before it is vented harmlessly to the atmosphere through vents in the chemical building roof. Monitoring equipment on the Ozone Destruct Unit exhaust ensures all ozone is destroyed before leaving the building. Any reading above acceptable set points immediately shuts down the ozone system.

7.0 Construction Inspection and Testing

Engineering designs are an important start in the process to achieve a reliable, long-lived water treatment facility. The next step is careful construction inspection and a battery of performance tests that will be used to assure the finished product meets the design intent. Thorough inspection and testing helps ensure the WTP expansion will be constructed as designed

The process begins during submittal review, with verification that all proposed materials and equipment provided by the contractor meet or exceed the project specifications for a variety of requirements including features, dimensions, uniformity, strength, composition, source, and other measures of quality prior to shipping. This process continues during installation where an experienced construction engineers/inspectors monitor construction for compliance with contract requirements. For complex equipment, manufacturers' representatives, experts on their own systems, ensure that the equipment is installed correctly.

Start-up and performance testing is the final step and includes many different checks to assure the quality and performance of constructed facilities meet or exceed design requirements.

8.0 Asset Management Program

An asset management program is being developed by the Partnership to maximize longevity and reliability of the expanded WTP, intake, pipelines, reservoir, and pumping station that comprise the new supply system. The objective of asset management is to care for valued assets properly so they can reliably meet the required level of service at the least cost over their useful lives. Definition of several of these terms helps put this objective in perspective:

- **Level of service.** Treatment facilities are vital to public health and safety; therefore, they must remain in service at virtually all times, even during emergencies and natural disasters. As noted above, the selected design seismic event at the WTP is designed to withstand the Cascadia Subduction Zone megathrust event. Even after a magnitude 9.0 seismic event the plant will continue to be operational and occupiable.

- **Least cost.** The substantial initial capital investment required to build a WTP warrants the utmost vigilance in operations and maintenance (O&M) to maximize the return on the ratepayers' capital investment. Nothing is more costly for ratepayers than premature

replacement of valuable facilities. Least cost for the treatment facilities can be realized only through longevity.

- **Useful life.** While the useful life of WTP equipment varies, the asset management program maximizes the useful life of each piece of equipment. Structures at the WTP are designed for a useful life of at least 75 years.

Proactive maintenance and regular condition assessment are two practices that will help meet the Partners' asset management objective for WTP and are discussed further below.

8.1 Proactive Maintenance

A comprehensive, proactive maintenance program will continue to keep the WTP in good working order. All O&M procedures will be documented in an O&M manual to ensure best practices are standardized and available to future generations of plant staff.

8.2 Routine Condition Assessment

Routine condition assessments inform WTP managers and operation staff of the true condition of equipment and facilities. These assessments can be used to identify the timing of future equipment upgrades and required repairs. Condition assessments on all critical WTP facilities will be conducted at regular intervals. As these assessments are tracked over time they will help inform decisions about timing for maintenance, rehabilitation, or replacement.

Additional details about the scope and frequency of these condition assessments are documented in the *Chemical and Materials Management Protocols Memorandum* (City of Lake Oswego, July 2012) (see ***Appendix A***), developed specifically for the Lake Oswego Water Treatment Plant. The memo discusses the required daily, weekly, monthly, quarterly and yearly inspections of chemical and materials handling systems currently conducted by plant staff. The memo outlines the extensive list of protocols used for the inspections as well as the established safety plans and procedures at the Lake Oswego Water Treatment Plant. The WTP has a well-established culture of excellent health and safety practices related to daily operations and these strict assessment practices will continue to be an important part of facility operations.

Appendix A

Chemical and Materials Management Protocols

CITY OF LAKE OSWEGO

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MEMORANDUM

TO: Joel Komarek, P.E., Project Director – Lake Oswego – Tigard Water Partnership

FROM: Kari Duncan, Water Treatment Plant Manager

SUBJECT: Chemical and Materials Management Protocols

DATE: July, 9 2012

Introduction

At your request, I have prepared this memorandum which summarizes the protocols and practices currently in place at our Water Treatment Plant (WTP) relating to the delivery, storage, and handling of water treatment chemicals. These protocols and practices were developed jointly between management and staff and reflect knowledge of the potential exposure hazards from these chemicals, knowledge of practices currently in place at other WTP's in the region and knowledge of best practices within the larger water treatment industry gleaned from literature review of professional publications on this subject.

Background

The Lake Oswego Water Treatment Plant (WTP) has an exemplary safety record of no safety or health violations relating to the delivery, storage, and handling of chemicals typically found at water treatment plants globally. We are proud of our 40-plus year record of no accidents attributable to storage and use of water treatment chemicals. But our record didn't just happen. It depends on adequate and continuing professional education for management and operations staff and constant vigilance.

All of the Lake Oswego WTP Operators have met extensive training, education requirements and passed written examinations to be certified by the State of Oregon for the treatment and distribution of drinking water. Included in the education, training and testing to become a certified water operator is comprehensive understanding of safety and health requirements for working around water treatment chemicals such as chlorine, alum and CO2.

WTP Safe Operating Practices

Below is a list of the frequent inspections that are performed on chemical storage and feed areas at the WTP as well as the safety procedures and manuals associated with these practices. The Operations Staff

works every day in close proximity to the treatment chemicals stored at the plant and it is essential that the City maintain a safe environment for both the employees at the plant and the surrounding neighborhood.

Inspections Performed:

Daily:

- Continuous monitoring by Operations Staff of all chemicals stored at the plant occurs via "SCADA" Supervisory Control and Data Acquisition" system. The SCADA system digitally connects the Operator on duty to the plants chemical systems allowing real time observation and control. If a chemical spill occurs, or if a tank is too full or a feed system is not working properly, the SCADA system will immediately alarm and notify the Operator on duty of such conditions, and the Operator can then take appropriate action, such as terminating filling procedures, stopping feed pumps or initiating spill clean-up. The SCADA system operates 24/7 365 days a year and in the event of a loss of utility power is still operational through an on-site emergency backup generators.
- In addition to SCADA monitoring and control, visual inspection of all chemical storage and feed systems is performed daily by on-duty Operators. This redundant task provides Operators confidence in the digital SCADA information received in the control room and the opportunity to physically touch and inspect these systems. These inspections are documented twice per day.

Weekly:

- Safety shower inspection

Monthly:

- Fire extinguisher inspection
- WTP Operations Staff have hand held gas detectors that are calibrated monthly. These multi-gas detectors inform Operators if a confined space such as a vault or clearwell is safe to enter.
- CO2 booster pump- exercise and check operation

Quarterly:

- Lake Oswego Safety Committee Quarterly Inspection - This inspection covers all areas of safety at the WTP including hazardous material safety.

Yearly:

- Annual Inspection by TVF&R: This inspection consists of a walkthrough of the entire WTP and outbuildings to check for fire-life safety issues, improper chemical storage or problems, and anything else that could result in an emergency response. The inspections are documented and the findings are on file at the WTP. All inspections have found that chemicals are properly and safely stored.
- An Annual Hazardous Substance Survey is submitted to the Oregon State Fire Marshall with detailed information about all chemicals stored in reportable quantities. This record is public information and is available on the Community Right to Know information site: http://www.oregon.gov/OSP/SFM/CR2K_InfoAvailable.shtml
- Contracted maintenance and inspection on mechanical systems associated with CO2, records are on file at the WTP.

- Fire sprinkler and alarm system inspection and maintenance by an outside contractor. Records are on file at the WTP and are reviewed by TVF&R annually.

Additional Inspections:

- Voluntary OSHA Inspection in 2008 of all plant systems including chemical storage.
- Pressurized storage vessel inspection by State every 3-5 years. The last inspection was in 2011 and the external inspections revealed no evidence of leakage or corrosion and found that the proper safety pressure relief valves were installed.
- Before each chemical delivery, the Operator on duty inspects the valves and the receiving tank to ensure that it is sound and ready to receive a delivery. In addition to the Operator check, the vendor representative also performs their own inspection of the City Owned equipment before each delivery to verify that the system is ready to receive a delivery and in good working condition.

Safety Plans, Procedures and Training:

- Material Safety Data Sheets (MSDS) sheets for all chemicals are located at the entrance to plant and in Laboratory. MSDS sheets provide Operators detailed information on the name and type of chemical, its uses, handling procedures, first aid response procedures and contact information for public health agencies and emergency responders.
- Hazardous Materials Management Plan (HMMP). This document was developed in 1997 as a condition of approval for a prior plant upgrade. It was reviewed and approved by TVF&R. It is updated as needed to reflect changes in types and quantities of chemicals used at the WTP.
- Standard Operating Procedures (SOP). These documents are developed by Operations Staff and plant management and establish best practices for Operators to follow when operating or performing maintenance on plant systems. SOP's also establish reporting and record keeping procedures for all activities that occur at the WTP as they relate to plant operations.
- Emergency Response Plan for the Lake Oswego Water System – Prepared for compliance with the *Public Health Security and Bioterrorism Response Act of 2002*.
- City of Lake Oswego Safety Manual prepared by the City Safety Committee in 2011. This manual covers the whole City but has chapters relevant to the WTP such as laboratory safety and health plan, lead compliance plan, and hazard communication plan.
- Water Treatment Plant Lockout Tag out and Confined Space Entry Plans.
- Operator safety training on various topics monthly in addition to special safety training and safety schools attended by individual staff. This training is to meet a variety of state and federal requirements including OSHA requirements, Oregon State Drinking Water Program requirements and City and WTP safety and health goals.

As you can see by the extensive list of safety protocols and documentation, the Lake Oswego Water Treatment Plant has a well established culture of excellent health and safety practices related to daily operations. The City of Lake Oswego is committed to sustaining a safe work environment for its employees, visitors and surrounding neighborhood and community of West Linn. The descriptions of the many safety and health practices in use at the plant demonstrate this commitment and our record of over 40-years of operations with no safety or health violations manifests that commitment.

Appendix B

Material Safety Data Sheets (MSDS) for all Anticipated Chemicals at the LO-T WTP

Alum

BSP Captor®

Caustic Soda Liquid

Clarifloc® WE-137 Polymer

Magnafloc E30

Oxygen, Refrigerated Liquid

Pass C

Sunny Sol® 150

NOTE: HMIS Health reduced from 2 to 1
Jan 1/30/08

kemira

MATERIAL SAFETY DATA SHEET
Alum

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

	USA	CANADA
Supplier:	Kemira Water Solutions, Inc. 316 Bartow Municipal Airport Bartow, Florida 33830	Kemira Water Solutions Canada Inc. 3405 Blvd. Marie Victorin Varennes, Québec J3X 1T6
Customer Service Telephones:	(800) 879-6353 (785) 842-7424	(800) 465-6171 (450) 652-0665

(800) 450-7352 - Polymers

Emergency Contacts (24 hr.)

FOR EMERGENCIES INVOLVING CHEMICAL SPILL OR RELEASE, CALL

CHEMTREC	**(800) 424-9300**	**USA (TOLL FREE)**
CANUTEC	**(613) 996-6666**	**CANADA (CALL COLLECT)**

Product Name: Aluminum Sulfate
Chemical Family: Inorganic Salts
Formula: $Al_2(SO4)_3$
Synonym: Aluminum Sulfate
Acceptable Product Uses: Paper production, Water and wastewater treatment

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS Number #	Concentration
Aluminum sulfate	10043-01-3	48-50% (as $Al_2(SO4)_3 * 14\ H_2O$)

WHMIS Classification: Class E

3. HAZARDS IDENTIFICATION

Emergency Overview: Irritating to skin, eyes, and mucous membranes.

Potential Effects on Health: Acute and chronic.

Carcinogenicity: Does not contain any known carcinogens or potential carcinogens.

4. FIRST AID MEASURES

General: If you feel unwell, seek medical attention (show the label or this MSDS if possible). Ensure that medical personnel are aware of the material(s) involved.

Skin Contact: Remove all contaminated clothing, jewelry, and shoes. Wash affected area with soap or mild detergent and running water for at least 15 minutes. Remove contaminated clothing and wash before reuse. If irritation develops, seek medical attention.

Eye Contact: Flush immediately with water for at least 15 minutes, occasionally lifting upper and lower lids. Obtain medical attention.

Inhalation: Move to fresh air. Give artificial respiration ONLY if breathing has stopped. Do not use mouth-to-mouth method if victim has ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Obtain medical attention if cough or other symptoms develop,

Ingestion: **DO NOT INDUCE VOMITING**. If conscious, give two (2) glasses of water. Do not give anything by mouth to an unconscious person. Get medical attention.

5. FIRE FIGHTING MEASURES

Flash point	Not applicable. Will not burn
Flammable Limits (Lower)	Not applicable
Flammable Limits (Upper)	Not applicable
Auto Ignition Temperature	Not applicable
Combustion and Thermal Decomposition Products	Oxides of sulfur. Aluminum oxides. .
Rate of Burning	Does not burn
Explosive Power	Not applicable
Sensitivity to Static Discharge	Not available

Fire and Explosion Hazards: During a fire, irritating/toxic and corrosive fumes may evolve.
Extinguishing Media: The substance is not combustible. Use extinguishing media appropriate to the surrounding fire.

6. ACCIDENTAL RELEASE MEASURES

Spills, Leaks, or Release:

→ **Restrict access** until clean-up operations are complete. Wear appropriate Personal Protective Equipment per Section 8. Ensure trained personnel conduct clean up and wear Personal Protective Equipment per Section 8.

→ **Stop leak if possible**. Avoid personal risk.

→ **Notify Authorities** if release exceeds reportable quantity per Section 15
→ **Small Spills** – Absorb spill with clay or dry material or neutralize with lime, limestone or soda ash and collect in appropriate container for disposal. Neutralization with soda ash can generate carbon dioxide so additional ventilation may be necessary.
→ **Large Spills** – Prevent entry into sewers and confined areas. Dike, if possible. Keep unnecessary people away, isolate area and deny entry. Pump liquid material into appropriate vessels as possible or absorb spill with clay absorbents or non-reactive dry materials and collect in appropriate container for disposal.
→ **Neutralize spill residuals** carefully with lime, limestone, or soda ash and collect in a suitable container for disposal. Flush area with water. This could generate carbon dioxide so additional ventilation may be necessary. Notify the appropriate environmental authorities.

7. HANDLING AND STORAGE

Handling: Handle all chemicals with respect. Review the label, this MSDS and any other applicable information before use. Keep separated from incompatible substances. Use appropriate Personal Protective Equipment per Section 8. Handle only with equipment, materials and supplies specified by their manufacturer as being compatible and appropriate for use with this product.

Storage Requirements:
Bulk storage containers and ancillary fill and feed systems should be constructed out of appropriate materials. Store in 316 stainless steel or rubber lined steel. For temperatures below 40° C (104° F), fiberglass or 304 stainless steel are also acceptable materials of construction.

Material may be stored in tightly closed shipping containers, preferably the supplier's containers. Containers of this material may be hazardous when empty, since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Preventive Measures:

Engineering Controls: A ventilation system of local/general exhaust is recommended to keep employee exposure below the Airborne Exposure Limits. Ensure that eyewash station and safety showers are proximal to the workstation location.

Personal Protection Equipment:

Eye Protection: Wear splash resistant chemical goggles and, where splashing is possible, a full face shield. Maintain eye wash fountain and quick-drench facilities in work area.

Skin Protection: Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to avoid skin contact.

Recommended Protective Material: Neoprene, Never use leather.

Respiratory Protection: Under conditions of misting or contact with head gases, respiratory protection may be needed. Consider respirator warning properties before use.

- With limited contact use an appropriate chemical cartridge respirator with acid gas cartridge(s)

- When cleaning, decontaminating or performing maintenance on tanks, containers, piping systems and accessories, and in any other situations where airborne contaminants and/or dust could be generated, use protective equipment to protect against ingestion or inhalation. HEPA or air supplied respirator, full protective coveralls with head cover, gloves and boots or chemical suits, and boots are suggested.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Clear
Odor:	Slight acidic
Form:	Liquid
pH as is:	< 2.5
Vapor Pressure (mm Hg):	40 mm Hg @ 35° C
Boiling Point:	106° C (220° F)
Specific Gravity (20°C):	1.2-1.35
Solubility (water):	soluble
Vapor Density (Air=1):	N/A
Percent Volatile by Vol.:	N/A
Freezing Point:	Concentration dependent (Consult your Kemira representative)

10. STABILITY AND REACTIVITY

Hazardous Decomposition Products: Thermal decomposition: after completely dry and heated to decomposition will produce sulfur oxides and aluminum oxides.
Chemical Stability: Stable at normal temperatures and pressure.
Conditions to Avoid: Avoid contact with mineral acids, excessive heat and bases/alkalis
Incompatibility with other Substances: Carbon steel, aluminum, carbon, brasses, and nylon.
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Not available.

12. ECOLOGICAL INFORMATION

Not available.

13. DISPOSAL CONSIDERATIONS

Review Federal, State, Provincial, and Local government regulations prior to disposal. This material exhibits the characteristic of corrosivity to metals and other building materials and any disposal must comply with hazardous waste disposal requirements. Any residues

and/or rinse waters from cleaning of tanks, containers, piping systems and accessories may be a hazardous characteristic waste and must be properly disposed of in accordance with federal, state, provincial and local laws.
RCRA: Test waste material for corrosivity, D002, prior to disposal

14. TRANSPORT INFORMATION

	Canada (TDG)	U.S. (DOT)
Shipping Name	Corrosive liquid.	Corrosive liquid,
Hazard Class/Division	8: Corrosive Liquid, Acidic, Inorganic, N.O.S.	8: Corrosive Liquid, Acidic, Inorganic, N.O.S.
Identification No. Packing Group:	UN 3264 III	UN 3264 III

Transportation Emergency Telephone Numbers:
1-800-424-9300 CHEMTREC (USA)
1-613-996-6666 CANUTEC (CANADA) (CALL COLLECT)

IATA/ICAO Class: 8

15. REGULATORY INFORMATION

USA CLASSIFICATION:

OSHA Classification: Hazardous by definition of Hazard Communication Standard (29 CFR 1920.1200)

CERCLA: Hazardous substance/reportable quantity (RQ): final RQ = 5,000 lb. (2273 kg) Based on anhydrous aluminum sulfate (divide by solution concentration to obtain solution weight)

SARA Regulations sections 313 and 40 CFR 372: No

SARA Hazard Categories, SARA SECTIONS 311/312 (40CRF370.21):

Acute	Yes
Chronic	No
Fire	No
Reactive	No
Sudden Release	No
OSHA Process Safety (29CFR1910.119)	No

Clean Water Act Requirements: Designated as a hazardous substance under section 311(b)(2)(A) of the Federal Water Pollution Control Act and further regulated by the Clean Water Act Amendments of 1977 and 1978. These regulations apply to discharges of this substance.
TSCA: This substance or all ingredients of this product are listed on the Chemical Substances Inventory of the TSCA. Does not require reporting.

Other Regulations/Legislation which apply to this product:
California Proposition 65: No

Right-To-Know Lists: Massachusetts, New Jersey, Pennsylvania, California

This product does not contain, nor is it manufactured with, ozone-depleting substances.

CANADIAN CLASSIFICATION

This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS (Material Safety Data Sheet) contains all information required by the CPR.

Controlled Products Regulation (WHMIS) Classification: E: Corrosive

CEPA / Canadian Domestic Substances List (DSL): The substance in this product is on the Canadian Domestic Substances List (CEPA DSL).

16. OTHER INFORMATION

National Fire Protection Association (NFPA) and Hazardous Materials Identification System (HMIS) Ratings:

	NFPA	HMIS
HEALTH	1	1
FIRE	0	0
REACTIVITY	0	0

4 = Extreme/Severe
3 = High/Serious
2 = Moderate
1 = Slight
0 = Minimum

Kemira Water Solutions, Inc., and Kemira Water Solutions Canada, Inc. provide the foregoing information in good faith and make no representations as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using the product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose.

Kemira Water Solutions, Inc., and Kemira Water Solutions Canada, Inc. make no representations or warranties, either expressed or implied, including without limitation any warranties of merchantability or fitness for a particular purpose with respect to the information set forth herein or the product to which the information refers. Accordingly, Kemira Water Solutions, Inc., and Kemira Water Solutions of Canada, Inc. disclaim responsibility for damages resulting from use or reliance upon this information.

MSDS Revised on February 16, 2007 by Kemira Water Solutions HSE group

For more information on the use or the performance of our products, or for sample requests please contact your Kemira Water Solutions Representative or Customer Service at the numbers in Section 1 of this MSDS

Best Sulfur Products
Division of Ag Formulators, Inc.
5427 E. Central Avenue
Fresno, CA 93725

Date of revision: April 4, 2000
Date of issue: August 19, 1996
Product Information: 1 (559) 485-0114
Emergency: Chemtrec 1 (800) 424-9300

MATERIAL SAFETY DATA SHEET

I. PRODUCT: BSP CAPTOR®

II. COMPOSITION:

Chemical	CAS#	Concentration	Regulated
Calcium Thiosulfate	10124-41-1	30%	No
A solution of CaS_2O_3 in water			

SYNONYMS: Thiosulfuric Acid ($H_2S_2O_3$ calcium salt [1:1], Thiosulfuric Acid calcium salt [1:1])
CHEMICAL FAMILY: Inorganic salt

III. HAZARDOUS IDENTIFICATION:

CERCLA Ratings (0-3): **Health = 0** **Fire = 0** **Reactivity = 0** **Persistence = 0**
NFPA Ratings (0-4): **Health = 0** **Fire = 0** **Reactivity = 0**
NSF International Standard 60 listed for use in drinking water

POTENTIAL SHORT-TERM HEALTH EFFECTS:
Skin contact: May Cause Irritation **Eye Contact:** May Cause Irritation
Ingestion: No information available on significant adverse effects.
LONG-TERM HEALTH EFFECTS: No information on long-term effects is available.

CARCINOGEN STATUS: OSHA – N NTP – N LARC – N
NO HAZARDOUS INGREDIENTS ARE CONTAINED IN THIS PRODUCT

IV. PHYSICAL AND CHEMICAL CHARACTERISTICS

DESCRIPTION: Clear colorless solution
Molecular Weight: 152.20
Molecular formula for active ingredient: CaS_2O_3
Melting Point: N/A
Specific Gravity: 1.245
Percent Volatile: 70%
Vapor pressure: (mm Hg) N/A

Water Solubility: Completely soluble in water
Solvent Solubility: Nearly insoluble in alcohol
Viscosity: #2 Zhan cup – 15 seconds.
Water: 17 seconds
pH: 6.5 – 7.5

V. FIRE AND EXPLOSION HAZARD:

Negligible hazard when exposed to heat or flame
EXTINGUISHING MEDIA: Extinguish using agent suitable for type of surrounding fire.
FIRE FIGHTING: No acute hazard. Move container from fire area if possible. Avoid breathing vapors. Keep upwind. Use agents suitable for type of surrounding fire. Avoid breathing hazardous vapors. Keep upwind.
HAZARDOUS COMBUSTION PRODUCTS: Thermal decomposition products may include toxic oxides of sulfur.

IX. EMPLOYEE PROTECTION:

RESPIRATORY: None generally required. If conditions exist where excessive mist might be generated, a mist respirator is recommended.
CLOTHING: Rubber gloves and apron should be used for prolonged or repeated contact. Safety glasses or chemical goggles are recommended to avoid eye contact. Do not wear contact lenses.
ADDITIONAL PROTECTIVE MEASURES: NIOSH approved self-contained breathing apparatus should be available to fire-fighters working in an area where this product is stored.
(See section **VI: REACTIVITY**).

X. FIRST AID MEASURES:

SKIN CONTACT: Remove contaminated clothing and shoes and wash product from skin.
EYE CONTACT: Immediately flush eyes with clean water, lifting upper and lower lids, for at least 15 – 20 minutes. Obtain medical attention if irritation occurs or persist.
INGESTION: If vomiting occurs, keep head lower than hips to help prevent aspiration. Treat symptomatically and supportively. Get medical attention if needed.
NOTE TO PHYSICIAN – ANTIDOTE: No specific antidote. Treat symptomatically and supportively.

XI. ENVIRONMENTAL PROTECTION:

Absorb small spills on sand, earth, sweeping compound or other inert absorbent. Dispose of in accordance with all government regulations. Large spills should be diked to prevent entry of large quantities of product into sewers or drains. Recover as much of solution as possible. Flush residue to soil with large quantities of water if permitted by applicable disposal regulation. Dispose of in accordance with applicable local, county, state, and federal regulations.

XII. TRANSPORTATION REQUIREMENTS:

Classification: Not Hazardous by D.O.T. Regulations
D.O.T. Proper Shipping Name Not D.O.T. Regulated
Other Requirements: N/A

XIII. OTHER REGULATORY CONTROLS: None

XIV: DISCLOSURE:

While the information and recommendations contained herein are based on data which is believed to be correct, Best Sulfur Products makes no guarantee or warranty of any kind, expressed or implied, with respect to the information contained herein.

Prepared by: Roy L. Hardison

VI. REACTIVITY:

Stable under normal temperatures and pressures.

CONDITIONS TO AVOID: No reports found.
INCOMPATIBILITIES: No data available.
HAZARDOUS DECOMPOSITION: Thermal decomposition products may include toxic oxides of sulfur.
POLYMERIZATION: Hazardous polymerization has not been reported.
INCOMPATIBILITIES: Reacts with acid to form sulfur dioxide. Corrosive to brass and copper.

VII. OCCUPATION EXPOSURE LIMITS:

No occupational exposure limits established by OSHA, ACGIH, or NIOSH.
FOR FIRE-FIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:
Use any self-contained breathing apparatus that has a full face-piece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

VIII. HEALTH INFORMATION:

TOXICITY DATA:
Anhydrous $CaS_2O_3 \cdot 6H_2O$: 374 mg/kg intravenous – rat LD 50: 573 mg/kg intraperitoneal – mouse LD 50: 115 mg/kg intraperitoneal.
CARCINOGEN STATUS: None
ACUTE TOXICITY LEVEL: Insufficient data.
TARGET EFFECTSs: No data available.
SKIN CONTACT – Acute Exposure: No data available.
EYE CONTACT – Acute Exposure: No data available. May be irritating.
INGESTION – Acute Exposure: Thiosulfate salts are poorly absorbed from the alimentary tract. Ingestion may result in a cathartic effect.
CHRONIC EXPOSURE: No data available for any type of exposure.

TSCA STATUS: N
CERCLA SECTION 103 (40CFR 302.40): N **SARA SECTION 302 (40CFR 355.30): N**
SARA SECTION 304 (40CFR 355.30): N **SARA SECTION 313 (40CFR 372.55): N**
OSHA PROCESS SAFETY (29CFR 1910.119): N **CALIFORNIA PROPOSITION 65: N**

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR 370.21)

Acute Hazard: N **Chronic Hazard: N** **Fire Hazard: N**
Reactivity Hazard: N **Sudden Release Hazard: N**

005 08/14/01 CAUSTIC SODA LIQUID (ALL GRADES)

****
PRODUCT IDENTIFICATION
****

PRODUCT NAME: CAUSTIC SODA LIQUID (ALL GRADES)

MSDS#: OZ32415

DATE ISSUED: 07/30/01

SUPERSEDES: 12/31/98

ISSUED BY: 008730

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: CAUSTIC SODA LIQUID (ALL GRADES)

PRODUCT USE : Metal finishing, industrial cleaners, chemical processing, petroleum industry

CHEMICAL NAME : Sodium hydroxide

CHEMICAL FORMULA : NaOH

SYNONYMS/COMMON NAMES
Sodium hydroxide solution

2. COMPOSITION/ INFORMATION ON INGREDIENTS

CAS NUMBER / NAME
7732-18-5 Water

EXPOSURE LIMITS		PERCENTAGE	
PEL:	Not Established	VOL	ND
TLV:	Not Established	WT	48.5-94.5
PELZ2:	Not Established		

COMMON NAMES:
(MW 18.02)

Listed On (List Legend Below):
00 19 22 23 51

1310-73-2 Sodium hydroxide (Na(OH))

EXPOSURE LIMITS		PERCENTAGE	
PEL:	2 MG/M3 CEIL	VOL	ND
TLV:	2 MG/M3 CEIL	WT	5.5-51.5
PELZ2:	Not Established		

COMMON NAMES:
CAUSTIC SODA (MW 40.00)

Listed On(List Legend Below):
00 12 13 21 22 51 56 57

7647-14-5 Sodium chloride (NaCl)

EXPOSURE LIMITS		PERCENTAGE	
PEL:	Not Established	VOL	ND
TLV:	Not Established	WT	0-1.3

PELZ2: Not Established

COMMON NAMES:
Salt (MW 58.4)

Listed On(List Legend Below):
00 22 23 51

LIST LEGEND

00	TSCA INVENTORY	12	PA HAZARDOUS SUBSTANCE
13	PA ENVIRONMENTAL HAZ SUBSTANCE	19	PA REQUIREMENT- 3% OR GREATER
21	NJ SPECIAL HEALTH HAZ SUB	22	CANADIAN DOMESTIC SUB LIST
23	NJ REQUIREMENT- 1% OR GREATER	51	EINECS
56	OSHA PERMISSIBLE EXPOSURE LIM.	57	ACGIH THRESHOLD LIMIT VALUES

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

MAY CAUSE BURNS TO THE EYES, SKIN, RESPIRATORY AND GASTROINTESTINAL TRACT. MAY CAUSE PERMANENT EYE DAMAGE.

* Clear liquid with no distinct odor

POTENTIAL HEALTH EFFECTS

ROUTES OF ENTRY:
Inhalation, Ingestion.

TARGET ORGANS:
Eyes, Skin, Respiratory Tract, Gastrointestinal Tract.

IRRITANCY:
All routes of exposure, Corrosive.

SENSITIZING CAPABILITY:
None known.

REPRODUCTIVE EFFECTS:
None known.

CANCER INFORMATION:
Not classified as carcinogenic by NTP, IARC, OSHA, ACGIH, or NIOSH.

SHORT-TERM EXPOSURE (ACUTE)

INHALATION:
Exposure can produce burns.

EYES:
Corrosive.

Contact may cause burns and tissue destruction.

The severity of the effects depend on concentration and how soon after exposure the area is washed.

MAY CAUSE PERMANENT EYE DAMAGE.

SKIN:
Corrosive.

Contact may cause burns and tissue destruction.

May cause burns that are not immediately noticed or painful.

INGESTION:
Corrosive.

Contact may cause burns and tissue destruction.

REPEATED EXPOSURE (CHRONIC)
None known.

SYNERGISTIC MATERIALS:
None known.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:
None known.

4. FIRST AID MEASURES

EYES:
Immediately flush eyes with a directed stream of water for at least 15 minutes, forcibly: Molding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN:
Immediately flush contaminated areas with water. Remove contaminated clothing and footwear. Wash contaminated areas with plenty of soap and water. Wash clothing before reuse. Discard footwear which cannot be decontaminated. GET MEDICAL ATTENTION IMMEDIATELY.

INHALATION:
Remove to fresh air if safe to transport. Otherwise attempt to provide fresh air by ventilation. If breathing is difficult, have a trained person administer oxygen. If respiration or pulse has stopped, have a trained person administer Basic Life Support (Cardio-Pulmonary Resuscitation/Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY (911 or emergency transport services).

INGESTION:
Never give anything by mouth to an unconscious person. If swallowed, do not induce vomiting. Give large quantities of water. (If available, give several glasses of milk.) If vomiting occurs spontaneously, keep airway clear and give more water. GET MEDICAL ATTENTION IMMEDIATELY.

NOTES TO PHYSICIAN:
No specialized procedures. Treat for clinical symptoms.

5. FIRE FIGHTING MEASURES

Flash Point: Not applicable

Method: Not applicable

Autoignition Temperature: Not applicable

FLAMMABLE LIMITS IN AIR, BY % VOLUME

Upper: Not applicable
Lower: Not applicable

EXTINGUISHING MEDIA:

Non-flammable / Non-combustible.

Use agents appropriate for surrounding fire.

FIRE FIGHTING PROCEDURES:

Wear NIOSH/MSHA approved positive pressure self-contained breathing apparatus and full protective clothing.

FIRE AND EXPLOSION HAZARD:

None known.

SENSITIVITY TO MECHANICAL IMPACT:

Not sensitive.

SENSITIVITY TO STATIC DISCHARGE:

Not sensitive.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS:
Follow protective measures provided under Personal Protection in Section 8.

Evacuate unnecessary personnel and eliminate all sources of ignition.

ENVIRONMENTAL PRECAUTIONS:
Do not allow entry into sewers and waterways.

METHODS FOR CLEANING UP:
For small spills, soak up with absorbent material and place in properly labeled containers for disposal.

For large spills, dike and pump into properly labeled containers for reclamation or disposal.

7. HANDLING AND STORAGE

HANDLING:
Use with adequate ventilation.

Avoid breathing vapors.

Wear personal protective equipment as described in Exposure Controls/Personal Protection (Section 8) of the MSDS.

SPECIAL MIXING AND HANDLING INSTRUCTIONS:

Do not allow contact with materials as noted in Section 10.

STORAGE:
Keep container tightly closed and properly labeled.
Do not store in aluminum container or use aluminum fittings or transfer lines, as flammable hydrogen gas can be generated.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS:

Handle product in a well ventilated area.

If product. is handled in an open system, the use of process enclosures, local exhaust ventilation, and/or other engineering controls should be considered to control airborne levels to below recommended exposure limits, or below acceptable levels where there are no limits

PERSONAL PROTECTION

RESPIRATORY:

A NIOSH approved respirator with a dust, fume and mist filter may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits, or when symptoms have been observed that are indicative of overexposure.

A respiratory protection program that meets 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant use of a respirator.

EYE/FACE:

Wear chemical safety goggles plus full face shield to protect against contact when appropriate (ANSI Z87.1).

SKIN:

Wear protective clothing to minimize skin contact.

Wear chemical resistant gloves such as rubber, neoprene or vinyl.

OTHER:

Discard leather items that cannot be decontaminated.

Emergency shower and eyewash facility should be in close proximity (ANSI 2358.1) .

25%, S.G = 1.275

9. PHYSICAL- AND CHEMICAL PROPERTIES

	Concentration, weight %				
Physical State: Liquid:	10	20	30	40	50
Boiling Pt @ 760 mm Hg, C:	110	113	119	129	144
Freezing Pt C:	-10	-32	0	15	12
Vapor Press., mm Hg @ 60 C:	135	110	76	46	13
Spec. Grav. @ 15.6 C:	1.11	1.22	1.33	1.43	1.53
Density, lb/gal @ 15.6 C :	9.27	10.20	11.11	11.97	12.76
Sol. in H2O, % by Wt	100				
Vapor Density:	Not applicable				
Odor Threshold (ppm):	Not determined				
Evaporation Rate:	Not determined				
Coefficient Water/Oil Distribution:	Not applicable				
pH:	7.5% solution has pH 14.0				

1.275 x .25
0.31 gram
1 gram / 0.31 gram
= 3.22 mils
x 10
= 32 mils

Appearance and Odor: Clear liquid with no distinct odor

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY:

X STABLE UNSTABLE

REACTS WITH:

X	AIR	_	OXIDIZERS	X	METALS
_	WATER	X	ACIDS	X	OTHER
_	HEAT	_	ALKALIS	_	NONE

HAZARDOUS POLYMERIZATION:

_ OCCURS X WILL NOT OCCUR

COMMENTS:

Product is corrosive to tin, aluminum, zinc and alloys containing these metals and will react with these metals in powder form. Avoid contact with leather, wool, acids, organic halogen compounds, or organic nitro compounds. Hazardous carbon monoxide gas can form upon contact with reducing sugars, food and beverage products in enclosed spaces and can cause death. Follow appropriate tank entry procedures.

Prolonged contact with aluminum may produce flammable hydrogen gas.

HAZARDOUS DECOMPOSITION PRODUCTS:

None.

11. TOXICOLOGICAL INFORMATION

1310-73-2 Sodium hydroxide (Na(OH))
This substance is alkaline and corrosive. Minimize contact. The irritating and corrosive properties of this substance depend on its concentration. It is toxic by the oral route. It may cause burns and other effects to the mucous membranes, mouth and digestive tract. Its dermal toxicity has not been determined. It may cause burns that are not immediately noticed or painful. Inhalation of dust or vapors can cause airway effects including burns. This substance is irritating and corrosive to the eyes and skin.

The irritating and corrosive properties of this substance depend on its concentration. In general, serious injury is associated with products with a pH of 11.5 or higher.

For further information call or write the address shown on page 1 of the MSDS.

12. ECOLOGICAL INFORMATION

1310-73-2 Sodium hydroxide (Na(OH))

TOXICITY: This material is believed to be slightly toxic to aquatic life.

PERSISTENCE: This material is believed to be unlikely to persist in the environment.

BIOACCUMULATION: This material is believed to be unlikely to bioaccumulate.

For further information call or write the address shown on page 1 of the MSDS.

13. DISPOSAL CONSIDERATIONS

Dispose of all waste and contaminated equipment in accordance with all applicable federal, state and local health and environmental regulations.

14. TRANSPORT INFORMATION

DOT PROPER SHIPPING NAME:	Sodium Hydroxide, Solution
DOT HAZARD CLASS:	8
DOT IDENTIFICATION NO:	UN1824
DOT PACKING GROUP:	II
DOT HAZARDOUS SUBSTANCE:	RQ 1,000 Lbs. (Sodium Hydroxide)
DOT MARINE POLLUTANT(S):	Not Applicable

ADDITIONAL DESCRIPTION REQUIREMENT: Not Applicable

15. REGULATORY INFORMATION

U.S. 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:

All components of this product that are required to be on the TSCA inventory are listed on the inventory.

SARA/TITLE III HAZARD CATEGORIES:

If the word "YES" appears next to any category, this product may be reportable by you under the requirements of 40 CFR 370. Please consult those regulations for details.

Immediate(Acute)	Health:	YES	Reactive Hazard	YES
Delayed(Chronic)	Health:	NO	Sudden Release of Pressure	NO
Fire Hazard:		NO		

HMIS HAZARD RATINGS:

HEALTH HAZARD:	3	FIRE HAZARD:	0	REACTIVITY:	2

STATE REGULATIONS:

See Section 2. COMPOSITION/INFORMATION ON INGREDIENTS list legend for applicable state regulation.

Consult local laws for applicability.

INTERNATIONAL REGULATIONS:

Consult the regulations of the importing country.

CANADA:

WHMIS Hazard Class: D1B, D2B, E

16. OTHER INFORMATION

For additional non-emergency health, safety or environmental information telephone (972) 404-2076 or write to:

Occidental Chemical Corporation
Product Stewardship Department
5005 LBJ Freeway
P.O. Box 809050
Dallas, Texas 75380

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)

* = See Section 3 Hazards Identification - Repeated Exposure(Chronic) Information

This Material Safety Data Sheet (MSDS) covers the following materials:

- CAUSTIC SODA LIQUID (ALL GRADES)
- 50% CAUSTIC SODA DIAPHRAGM GRADE
- 18% CAUSTIC SODA RAYON GRADE
- 20% CAUSTIC SODA RAYON GRADE
- 25% CAUSTIC SODA RAYON GRADE
- 30% CAUSTIC SODA RAYON GRADE
- 50$ CAUSTIC SODA RAYON GRADE
- 50% CAUSTIC SODA RAYON GRADE OS
- 50% CAUSTIC SODA MEMBRANE GRADE
- 18% CAUSTIC SODA - DIAPHRAGM
- 15% CAUSTIC SODA - DIAPHRAGM
- 30% CAUSTIC SODA - DIAPHRAGM
- 25% CAUSTIC SODA - DIAPHRAGM
- 20% CAUSTIC SODA - DIAPHRAGM
- 35% CAUSTIC SODA - DIAPHRAGM
- 50$ CAUSTIC SODA DIAPHRAGM
- 50$ CAUSTIC SODA- DIAPHRAGM OS
- 50$ CAUSTIC SODA - PURIFIED
- 50$ CAUSTIC SODA - PURIFIED OS
- 18% CAUSTIC SODA - MEMBRANE
- CAUSTIC SODA LIQUID 70/30
- 50% CAUSTIC SODA - MEMBRANE
- 50% CAUSTIC SODA - MEMBRANE OS
- 25% CAUSTIC SODA - MEMBRANE
- 20% CAUSTIC SODA - MEMBRANE
- 40% CAUSTIC SODA - DIAPHRAGM
- 25% CAUSTIC SODA-MEMBRANE
- 6% CAUSTIC SODA-MEMBRANE
- 10% CAUSTIC SODA-DIAPHRAGM
- 25% CAUSTIC SODA-DIAPHRAGM
- MEMBRANE BLENDED
- 48% CAUSTIC SODA-MEMBRANE

17. WARNING LABEL INFORMATION

SIGNAL WORD:

DANGER

HAZARD WARNINGS:

MAY CAUSE BURNS TO THE EYES, SKIN, RESPIRATORY AND GASTROINTESTINAL TRACT.

MAY CAUSE PERMANENT EYE DAMAGE.

Section 10).

DISPOSAL:

Dispose of all waste and contaminated equipment in accordance with all applicable federal, state and local health and environmental regulations.

INFORMATION REQUIRED BY FEDERAL, STATE OR LOCAL REGULATIONS:
This Product Contains:

CAS#	NAME
7732-18-5	Water
1310-73-2	Sodium hydroxide (Na(OH))
7647-14-5	Sodium chloride (NaCl)

HMIS RATING: HEALTH 3 FLAMMABILITY 0 REACTIVITY 2

LABEL NUMBER: 0701M32415

For Industrial Use Only

---------- FOR ADDITIONAL INFORMATION ----------
CONTACT: MSDS COORDINATOR VOPAK USA INC.
DURING BUSINESS HOURS, PACIFIC TIME (425)889-3400
---------- NOTICE ----------

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* * * E N D O F M S D S * * *

May 7, 2012 (BC)

MATERIAL SAFETY DATA SHEET

1. IDENTIFICATION OF THE PRODUCT AND THE COMPANY

CLARIFLOC® WE-137 POLYMER

Supplier :

POLYDYNE INC.

PO Box 279
Riceboro, GA 31323
Tel : 800-848-7659 Fax : 912-884-8770

2. COMPOSITION/INFORMATION ON INGREDIENTS

Identification of the preparation : Anionic water-soluble polymer in emulsion

3. HAZARDS IDENTIFICATION

Spills produce extremely slippery surfaces.

4. FIRST AID MEASURES

Inhalation : Move to fresh air.

Skin contact : Wash off immediately with soap and plenty of water. In case of persistent skin irritation, consult a physician.

Eye contact : Rinse thoroughly with plenty of water, also under the eyelids. In case of persistent eye irritation, consult a physician.

Ingestion : The product is not considered toxic based on studies on laboratory animals.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media : Water, water spray, foam, dry powder, carbon dioxide (CO2)

Special fire-fighting precautions : Spills produce extremely slippery surfaces.

Protective equipment for firefighters : No special protective equipment required.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions : No special precautions required.

Environmental precautions : Do not contaminate water.

Methods for cleaning up : Do not flush with water. Dam up. Soak up with inert absorbent material. If liquid has been spilled in large quantities clean up promptly by scoop or vacuum. Keep in suitable and closed containers for disposal. After cleaning, flush away traces with water.

7. HANDLING AND STORAGE

Handling : Avoid contact with skin and eyes. When preparing the working solution ensure there is adequate ventilation. When using do not smoke.

Storage : Keep in a dry, cool place (0 - 30°C). When preparing the working solution ensure there is adequate ventilation. Freezing will affect the physical condition and may damage the material.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls : Use local exhaust if misting occurs. Natural ventilation is adequate in absence of mists.

Personal protection equipment

- ***Respiratory protection :*** In case of insufficient ventilation wear suitable respiratory equipment.
- ***Hand protection :*** Rubber gloves.
- ***Eye protection :*** Safety glasses with side-shields. Do not wear contact lenses
- ***Skin protection :*** Chemical resistant apron or protective suit if splashing or contact with solution is likely.

Hygiene measures : Wash hands before breaks and immediately after handling the product. Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form :	viscous liquid
Color :	milky
Odor :	aliphatic
pH :	6-8@ 5 g/l for product series. See Technical Bulletin for specific value.
Melting point (°C) :	Not applicable.
Flash point (°C) :	Does not flash
Autoignition temperature (°C) :	Does not ignite
Vapour pressure (mm Hg) :	0.002 @ 20°C
Bulk density :	See Technical Bulletin
Water solubility :	See Technical Bulletin

Viscosity (mPa s) : See Technical Bulletin

10. STABILITY AND REACTIVITY

Stability : Product is stable, No hazardous polymerization will occur..

Oxidizing agents may cause exothermic reactions.

Hazardous decomposition products : Thermal decomposition may produce : carbon oxides, nitrogen oxides (NOx).

11. TOXICOLOGICAL INFORMATION

Acute toxicity

- Oral : LD50/oral/rat > 5000 mg/kg

- Dermal : The product is not expected to be toxic in contact with the skin.

- Inhalation : The product is not expected to be toxic by inhalation.

Irritation

- Skin : May cause skin irritation with susceptible persons.

- Eyes : May cause eye irritation with susceptible persons.

Sensitization : The product is not expected to be sensitizing.

Chronic toxicity : Prolonged skin contact may defat the skin and produce dermatitis.

12. ECOLOGICAL INFORMATION

- Fish LC50/Danio rerio/96 hr > 100 mg/L (OECD 203) (Based on the toxicity of the components using the Conventional Method.)

- Algae : IC50/Scenedesmus subspicatus/72 hr > 100 mg/L (OECD 201)(Based on the toxicity of the components using the Conventional Method.)

- Daphnia : EC50/Daphnia magna/48 hr > 100 mg/L (OECD 202) (Based on the toxicity of the components using the Conventional Method.)

Persistence / degradability : Not readily biodegradable

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products : In accordance with federal, state and local regulations.

Contaminated packaging : Rinse empty containers with water and use the rinse water to prepare the working solution. Can be landfilled or incinerated, when in compliance with local regulations

14. TRANSPORT INFORMATION

Not regulated by DOT.

15. REGULATORY INFORMATION

All components of this product are on the TSCA and DSL inventories.

RCRA status : Not a hazardous waste.

Hazardous waste number : Not applicable

Reportable quantity (40 CFR 302) : Not applicable

Threshold planning quantity (40 CFR 355) : Not applicable

California Proposition 65 information : *The following statement is made in order to comply with the California Safe Drinking Water and Toxic Enforcement Act of 1986:* This product contains a chemical(s) known to the State of California to cause cancer : residual acrylamide.

HMIS & NFPA Ratings		**NFPA**
Health :	1	1
Flammability :	1	1
Reactivity :	0	0

16. OTHER INFORMATION

Person to contact : Regulatory Affairs Manager

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release, and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process unless specified in the text.

FILTER AID POLYMER

Ciba Specialty Chemicals Corporation
USA

2301 Wilroy Road
P. O. Box 820
Suffolk, VA 23434

8am to 5pm Phone: (757)536-3700
24-Hour Health/Environmental Emergency Phone: (800)873-1138

Ciba

Value beyond chemistry

Effective Date: 12/19/01 **Material Safety Data Sheet** MSDS No: 16684

SECTION 1. PRODUCT IDENTIFICATION

Trade Name: MAGNAFLOC E30

Chemical Family: Polyacrylamide

Health	**2**
Flammability	**1**
Reactivity	**0**
Protective Equipment	**B**

HMIS RATING

SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

OSHA	CAS No.	CHEMICAL IDENTITY	EXPOSURE LIMITS					CARCINOGEN STATUS		
			ACGIH		OSHA		MFR.	IARC	NTP	OSHA
			TWA	STEL	PEL	STEL				
*	64742-47-8 Common Name:	Distillates, petroleum, hydrotreated light PETROLEUM DISTILLATES	500 ppm	NE	NE	NE	NE	NR	NR	NR
	9003-05-8	POLYACRYLAMIDE	NE	NE	NE	NE	NE	NR	NR	NR

NE = Not Established NR = Not Reviewed * = OSHA Hazardous Ingredient

SECTION 3. HAZARDS IDENTIFICATION

Emergency Overview:

Description: White viscous emulsion with a slight hydrocarbon odor.

Statement of Hazards: Eye and skin irritant. May be harmful by inhalation. Possible aspiration hazard. Slip hazard when wet.

Precautionary Measures: Do not get in eyes, on skin, on clothing. Wash thoroughly after handling.

Primary Route(s) of Entry: Eye or Skin contact. Inhalation.

Signs and Symptoms of Exposure: Contact with the eye or skin may produce irritation and/or redness.

Chronic: Contains petroleum distillates. Prolonged repeated exposure to petroleum distillate vapor may cause central nervous system damage as well as heart and blood disorders.

Target Organ(s): Eyes, skin. Lungs. Central Nervous System, Heart, Blood.

SECTION 4. FIRST AID MEASURES

Ingestion: Not expected to be toxic by ingestion.

Skin: Immediately wash skin thoroughly with soap and water. Remove and wash clothing before re-use. Contact a physician if irritation persists.

Inhalation: Remove to fresh air. If symptoms develop, consult a physician.

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes. Call a physician if irritation continues.

SECTION 5. FIRE FIGHTING MEASURES

Flash Point:	> 200 F
Flash Point Method Used:	ASTM D93 (Pensky-Martens Closed Cup)
Autoignition:	Not Evaluated

Sensitivity to Mechanical Impact: None

Sensitivity to Static Discharge: Not Evaluated.

Fire Fighting Instructions: Cool containers with water if exposed to fire.

Fire Fighting Extinguishing Media: Carbon dioxide, dry chemical, foam or water spray.

Fire Fighting Equipment: Firefighters should wear normal protective equipment. SCBA is recommended for confined areas. Cool exposed drums or tanks with water.

Emergency Response Guidebook Information: No ERG # indicated.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Accidental Release Measures: Product creates an extreme slip hazard. Remove all ignition sources. Dike area to control runoff, and collect spill in appropriate container(s). Use an inert absorbant such as vermiculite to collect residual liquid. Then water wash area to waste treatment to eliminate slip hazard.

Water Spill: Note: The petroleum distillates in this product are classified as an oil under Section 311 of the Clean Water Act. Spills, entering (A) surface waters or (B) any water courses or sewers entering or leading to surface water, that cause a sheen must be reported to the National Response Center at 800-424-8802.

SECTION 7. HANDLING AND STORAGE

Precautions: Keep away from heat, sparks and flames. Use with adequate ventilation. Avoid contact with eyes, skin, and clothing. Wear impervious gloves when handling. Do not take internally.

Storage Information: Do not use iron, copper, or aluminum containers or equipment with product. Store at ambient temperature. Store between 10-40 °C.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Skin Protection: Chemical resistant gloves.

Respiratory Protection: Not expected to be required in normal use. Use NIOSH approved respirator protection if exposure level is unknown or exceeds limits.

Eye Protection: Chemical goggles. Wear a face shield over goggles for added protection.

Engineering Controls: Provide local mechanical ventilation to reduce potential exposure.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Physical Form:	Emulsion
Color:	White
Odor:	Slight hydrocarbon oil like odor
Odor Threshold:	Not evaluated
Physical State:	Liquid
Solubility in Water:	Appreciable
Vapor Pressure:	Not Evaluated
Specific Gravity:	1
Boiling Point:	Not evaluated
Melting Point:	Not Applicable
Freezing Point:	0° F (-18 ° C)
Decomposition Temperature:	Not Evaluated
pH:	4 - 6

Percent Volatile:
~ 70%

Additional Information:
7783-20-2 AMMONIUM SULFATE
May be harmful by inhalation, ingestion, or skin absorption. Causes Eye and Skin irritation. Irritating to mucous membranes and upper respiratory tract.

SECTION 10. STABILITY AND REACTIVITY

Conditions to Avoid: Avoid wet and humid conditions. Avoid temperature extremes or ignition sources.

Stability: Stable.

Hazardous Polymerization: Will not occur.

Hazardous Decomposition Products: Thermal decomposition or combustion may produce oxides of carbon and nitrogen, various hydrocarbons, and/or ammonia which may be irritating or harmful.

Incompatibility: Strong oxidants.

SECTION 11. TOXICOLOGICAL INFORMATION

Acute Oral Toxicity:
Low oral toxicity.

Carcinogenicity:
Not listed as a carcinogen by IARC, NTP, OSHA, or ACGIH.

Reproductive Toxicity:
No data for product.

Teratoginicity:
No data for product.

Mutagenicity:
No data for product.

Effects of Chronic Exposure:
Prolonged repeated exposure to petroleum distillate vapors may cause central nervous system damage as well as heart and blood disorders.

Skin Irritation:
Prolonged or repeated contact can remove skin oils, possibly leading to dry skin, irritation, or dermatitis.

Eye Irritation:
May cause eye irritation.

Acute Ingestion Exposure Effects:
Aspiration of petroleum distillates may cause chemical pneumonitis.

Sub-Chronic:
9003-05-8 POLYACRYLAMIDE
Rats were given diets containing up to 10,000 ppm for 28 days. No significant adverse findings were evident.

Chronic Toxicity:
9003-05-8 POLYACRYLAMIDE
Rats and dogs were fed diets containing up to 10% for 2 years without signs of adverse efects.

Toxicologically Synergistic Products:
None known.

SECTION 12. ECOLOGICAL INFORMATION

Fish Toxicity:
Trout 96 Hr. LC50 > 100 mg/L.
Bluegill 96 Hr. LC50 > 100 mg/L.

Invertebrate Toxicity:
7783-20-2 AMMONIUM SULFATE
24 hr TLm (Daphnia magna): 423 mg/L.

Additional Information:
7783-20-2 AMMONIUM SULFATE
24 hr LC50 (Juvenile H.Trivolvis snails): 393 mg/L.
24 hr LC50 (Adult H.Trivolvis snails): 657 mg/L.

SECTION 13. DISPOSAL CONSIDERATIONS

RCRA Hazard Class: This product, when unadulterated, is not a RCRA regulated hazardous waste.

Waste Disposal Method: Disposal must be arranged in accordance with local, state and federal regulations. Care must be taken to prevent environmental contamination from the disposal of material, residues and containers.

SECTION 14. TRANSPORT INFORMATION

DOT:
Proper Shipping Name: NOT A DOT/IMO HAZARDOUS MATERIAL
IATA:
Proper Shipping Name: NOT HAZARDOUS FOR TRANSPORT BY AIR
IMO:
Proper Shipping Name: NOT A DOT/IMO HAZARDOUS MATERIAL

Department of Transportation: This product is considered to be an oil per the definitions in 49 CFR 130.2. If packed in a container with a capacity of 3,500 gallons or more, the Communication Requirements at 49 CFR 130.11 and the Response Plan Requirements at 49 CFR 130.31 and 130.33 apply to Domestic transportation by motor vehicles and rolling stock.

Notification of releases to the National Response Center (NRC), 800-424-8802, may be necessary. In the Washington, DC metropolitan area, call 202-426-2675.

SECTION 15. REGULATORY INFORMATION

US Federal Regulations:

Chemical Weapons Convention (CWC): This product does not contain any chemicals listed under the Chemical Weapons Convention Schedules of Chemicals.

Clean Air Act -Hazardous Air Pollutants (HAP): The following chemical(s) are listed as hazardous air pollutants (HAP) under the U.S. Clean Air Act Section 12 (40 CFR 61):

Chemical Name: ACRYLAMIDE (Impurity)
CASRN: 79-06-1
Percent in Composition: < 0.1 % by wt

Clean Air Act - Ozone Depleting Substances (ODS): This product neither contains, nor was manufactured with, a Class I or Class II ozone depleting substance (ODS), as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App. A+B).

Clean Water Act - Priority Pollutants (PP): This product does not contain any priority pollutants listed under the U.S. Clean Water Act Section 307 (2)(1) Priority Pollutant List (40 CFR 401.15).

Occupational Safety and Health Act (OSHA): This product is considered to be a hazardous chemical under the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Resource Conservation and Recovery Act (RCRA): This product is not considered to be a P or U listed hazardous waste under RCRA (40 CFR 261).

SARA Title III: Section 302 - Extremely Hazardous Substances (EHS): This product contains the following chemicals regulated under Section 302 (40 CFR 355) as extremely hazardous substances:

Chemical Name: ACRYLAMIDE (Impurity)
CASRN: 79-06-1
Percent in Composition: < 0.1 % by wt

SARA Title III: Section 304 - CERCLA: This product contains the following chemicals regulated under Section 304 (40 CFR 302) as hazardous substance(s) for emergency release notification ("CERCLA" List):

Chemical Name: ACRYLAMIDE (Impurity)
CASRN: 79-06-1
Percent in Composition: < 0.1 % by wt
Component RQ: 5000

SARA Title III: Section 311/312 - Hazard Communication Standard (HCS): This product is regulated under Section 311-312 (40 CFR 370). Acute health hazard.

SARA Title III: Section 313 Toxic Chemical List (TCL): This product does not contain any chemicals for routine annual toxic chemical release reporting under Section 313 (40 CFR 372).

TSCA Section 5(e) - Consent Order / SNUR: This product is not subject to a Section 5(e) Consent Order or Significant New Use Rule (SNUR).

TSCA Section 8(b) - Inventory Status: All chemical(s) comprising this product are either exempt or listed on the TSCA inventory.

TSCA Section 12(b) - Export Notification: This product does not contain any chemical(s) that are subject to a Section 12(b) export notification.

International Regulations:

Canadian Inventory Status: This product contains only chemicals that are currently listed on the Canadian Domestic Substance List.

State Regulations:

California Proposition 65: The following is required composition information. This product contains the following chemical(s) which are currently listed on the California list of Known Carcinogens and Reproductive Toxins:

Chemical Name: ACRYLAMIDE (Impurity)
CASRN: 79-06-1
Percent in Composition: < 0.1 % by wt

Massachusetts Right-to-Know: The following is required composition information:

Chemical Name: AMMONIUM SULFATE
CASRN: 7783-20-2
Percent in Composition: 1 % by wt

Chemical Name: ACRYLAMIDE (Impurity)
CASRN: 79-06-1
Percent in Composition: < 0.1 % by wt

New Jersey Right-to-Know: The following is required composition information:

Chemical Name: PETROLEUM DISTILLATES
CASRN: 64742-47-8

Chemical Name: AMMONIUM SULFATE
CASRN: 7783-20-2

Chemical Name: WATER
CASRN: 7732-18-5

Chemical Name: POLYACRYLAMIDE
CASRN: 9003-05-8

Chemical Name: VENDOR PROPRIETARY
CASRN: T179

Pennsylvania Right-to-Know: The following is required composition information:

Chemical Name: WATER
CASRN: 7732-18-5
Comment: Not on Pennsylvania Hazardous Substance List

Chemical Name: POLYACRYLAMIDE
CASRN: 9003-05-8
Comment: Not on Pennsylvania Hazardous Substance List

Chemical Name: PETROLEUM DISTILLATES
CASRN: 64742-47-8
Comment: Not on Pennsylvania Hazardous Substance List

Chemical Name: VENDOR PROPRIETARY
CASRN: T179
Comment: Not on Pennsylvania Hazardous Substance List

Chemical Name: AMMONIUM SULFATE
CASRN: 7783-20-2
Comment: Environmental Hazardous Substance

SECTION 16. OTHER INFORMATION

MSDS No: 16684
Prepared By: Leon Knight
Approved By:
Title:

Sections Modified: Section 14. Section 6.

Disclaimer: The following supercedes Buyer's documents. SELLER MAKES NO REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, INCLUDING OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No statements herein are to be construed as inducements to infringe any relevant patent. Under no circumstances shall Seller be liable for incidental, consequential or indirect damages for alleged negligence, breach of warranty, strict liability, tort or contract arising in connection with the product(s). Buyer's sole remedy and Seller's sole liability for any claims shall be Buyer's purchase price. Data and results are based on controlled or lab work and must be confirmed by Buyer by testing for its intended conditions of use. The product(s) has not been tested for, and is therefore not recommended for, uses for which prolonged contact with mucous membranes, abraded skin, or blood is intended; or for uses for which implantation within the human body is intended.

BOC GASES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: OXYGEN, REFRIGERATED LIQUID

1. Chemical Product and Company Identification

BOC Gases,
Division of,
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE NUMBER: CHEMTREC (800) 424-9300

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE NUMBER: (905) 501-0802
EMERGENCY RESPONSE PLAN NO: 2-0101

PRODUCT NAME: OXYGEN, REFRIGERATED LIQUID
CHEMICAL NAME: Oxygen
COMMON NAMES/SYNONYMS: Liquid Oxygen, LOX
TDG (Canada) CLASSIFICATION: 2.2 (5.1)
WHMIS CLASSIFICATION: A, C

PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 3/22/00

2. Composition, Information on Ingredients

EXPOSURE LIMITS[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Oxygen FORMULA: O_2 CAS: 7782-44-7 RTECS #: RS2060000	99.6 to 99.997	None Established	Not Available	Not Available

[1] Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 1998-1999 Threshold Limit Values for Chemical Substances and Physical Agents.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

3. Hazards Identification

EMERGENCY OVERVIEW

Clear odorless pale blue liquid and colorless gas. Nonflammable, oxidizer. Will accelerate combustion and increase the risk of fire and explosion in combustible or flammable materials. Elevated oxygen levels may result in cough and other pulmonary changes. Non-toxic. Prolonged inhalation of high concentrations may cause coughing and lung effects. Contact with liquid form may cause frostbite or freeze burns in exposed tissues. Contents under pressure. Use and store below 125 °F.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	No	Yes	Yes	Yes

HEALTH EFFECTS:

Exposure Limits	Irritant	Sensitization
No	No	No
Teratogen	Reproductive Hazard	Mutagen
No	No	No
Synergistic Effects None known		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:
Contact with evaporating liquid may cause tissue freezing.

SKIN EFFECTS:
Contact with evaporating liquid product can cause cryogenic "burns" or frostbite. Frostbite effects are a change in color of the skin to gray or white, possibly followed by blistering.

INGESTION EFFECTS:
Contact with liquid product may cause tissue freezing.

INHALATION EFFECTS:
Oxygen is non-toxic. Prolonged inhalation of high oxygen concentrations (> 75%) may affect coordination, attention, and cause tiredness or respiratory irritation.

Oxygen is more toxic when inhaled at elevated pressures. Depending upon pressure and duration of exposure, pure oxygen at elevated pressures (i.e.: divers) may cause cramps, dizziness, difficulty breathing, convulsions, edema, and death.

Elevated oxygen concentrations in incubators has caused visual impairment and blindness in premature infants. High oxygen concentrations primarily affect eyes which are not fully developed (see Section 11).

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: None known.

NFPA HAZARD CODES	HMIS HAZARD CODES	RATINGS SYSTEM
Health: 3	Health: 3	0 = No Hazard
Flammability: 0	Flammability: 0	1 = Slight Hazard
Instability: 0	Reactivity: 0	2 = Moderate Hazard
		3 = Serious Hazard
OXIDIZER		4 = Severe Hazard

4. First Aid Measures

EYE:
Never introduce ointment or oil into the eyes without medical advice! In case of freezing or cryogenic "burns" caused by rapidly evaporating liquid, DO NOT WASH THE EYES WITH HOT OR EVEN TEPID WATER! Remove victim from the source of contamination. Open eyelids wide to allow liquid to evaporate. If pain is present, refer the victim to an ophthalmologist for treatment and follow up. If the victim cannot tolerate light, protect the eyes with a light bandage.

SKIN:
For dermal contact or frostbite: Remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physician should see the patient promptly if the cryogenic "burn" has resulted in blistering of the dermal surface or deep tissue freezing.

INGESTION:
A physician should see the patient promptly if the cryogenic "burn" has resulted in blistering of the dermal surface or deep tissue freezing.

INHALATION:
Overexposure to oxygen is not anticipated under normal working conditions. High oxygen concentrations in the air may present a fire and explosion hazard. PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE WHEN OXYGEN IS INHALED UNDER PRESSURE (i.e.: as in scuba diving). Conscious persons should be removed from exposure and inhale fresh air. Quick removal from the source of exposure or contaminated area is most important. Further treatment should be symptomatic and supportive. Inform the treating physician that the patient could be experiencing hyperoxia.

5. Fire Fighting Measures

Conditions of Flammability: Not flammable, Oxidizer		
Flash point: None	Method: Not Applicable	Autoignition Temperature: None
LEL(%): None	UEL(%): None	
Hazardous combustion products: None		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: None		

FIRE AND EXPLOSION HAZARDS:
High oxygen concentrations vigorously accelerate combustion. Will support or initiate combustion/ explosion of organic matter and other oxidizable material. Cylinder may rupture violently from pressure when involved in a fire situation.

EXTINGUISHING MEDIA:
Water spray to keep cylinders cool. Extinguishing agent appropriate for the combustible material.

FIRE FIGHTING INSTRUCTIONS:
If possible, stop the flow of oxygen which is supporting the fire. Firefighters should wear respiratory protection (SCBA) and full turnout or Bunker gear. Continue to cool fire-exposed cylinders until well after flames are extinguished.

6. Accidental Release Measures

Evacuate all personnel from affected area. A leak near combustible or flammable materials may represent a severe fire or explosion hazard. Eliminate all ignition sources. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Electrical classification:
Nonhazardous.

Liquid oxygen cannot be handled in carbon or low alloy steel. 18-8 and 18-10 stainless steel are acceptable as are copper and its alloys, nickel and its alloys, brass bronze, silicon alloys, Monel®, Inconel® and beryllium. Teflon®, Teflon® composites, or Kel-F® are preferred non-metallic gasket materials.

Equipment to contain oxygen must be "cleaned for oxygen service". Check with supplier to verify oxygen compatibility for the service conditions. Stationary customer site vessels should operate in accordance with the manufacturer's and BOC's instruction. Do not attempt to repair, adjust or in any other way modify the operation of these vessels. If there is a malfunction or other type of operations problem with the vessel, contact the closest BOC location immediately.

Oxygen, refrigerated liquid is delivered to a customer into stationary, vacuum-jacketed vessels at the customer's location or in portable vacuum-jacketed "liquid" cylinders.

Post "NO SMOKING OR OPEN FLAMES" signs in storage and use areas. There should be no sources of ignition in storage and use areas.

Liquid oxygen vessels should be used only in well ventilated areas in accordance with manufacture and BOC's instructions. Cylinders must always be kept upright. Specialized trucks are needed for their movement. Full and empty cylinders should be stored away from flammable and combustible products.

For additional recommendations, consult Compressed Gas Association Pamphlets G-4, P-12, P-2.6, PS-4, AV-10, G-4.1, G-4.3, G-4.9, O2-DIR, P-8.1, and SB-9.

Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

8. Exposure Controls, Personal Protection

ENGINEERING CONTROLS:
Use local exhaust to prevent accumulation of high concentrations that increase the oxygen level in air to more than 25%.

EYE/FACE PROTECTION:
Safety goggles with faceshield where contact with liquid is possible.

SKIN PROTECTION:
Protective gloves made of any suitable material appropriate for the job. Insulated gloves recommended for cryogenic liquids.

OTHER/GENERAL PROTECTION:
Safety shoes, safety shower

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Cryogenic liquid	
Vapor pressure	: Above critical temp.	
Vapor density (Air = 1)	: 1.11	
Evaporation point	: Not Available	
Boiling point	: -297.3	°F
	: -182.9	°C
Freezing point	: -361.8	°F
	: -218.8	°C
PH	: Not Applicable	
Specific gravity	: 1.105	
Oil/water partition coefficient	: Not Available	
Solubility (H20)	: Slightly soluble	
Odor threshold	: Not Applicable	
Odor and appearance	: Clear, odorless, pale blue liquid.	

10. Stability and Reactivity

STABILITY:
Stable

INCOMPATIBLE MATERIALS:
All flammable, organic, and combustible materials.

HAZARDOUS DECOMPOSITION PRODUCTS:
None

HAZARDOUS POLYMERIZATION:
Will not occur.

11. Toxicological Information

SKIN AND EYE:
The incompletely developed retinal circulation is more susceptible to toxic levels of oxygen. In premature infants, arterial oxygen tension above 150 mm Hg may cause retrolental fibroplasia. Permanent blindness may occur several months later. One case of severe retinal damage in an adult was reported. An individual suffering from myasthenia gravis developed irreversible retinal atrophy after breathing 80% oxygen for 150 days. Contact with cryogenic liquid can cause tissue freezing.

INHALATION:
Human volunteers which inhaled 90-95% oxygen through a face mask for 6 hours showed signs of tracheal irritation and fatigue. Other symptoms (which might have been caused by placing a tube into the trachea during the experiment) included: sinusitis, conjunctivitis, fever, and symptoms of acute bronchitis.

Poisoning began in dogs 36 hours after inhalation of pure oxygen at atmospheric pressure. Distress was seen within 48 hours and death within 60 hours.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Oxygen, refrigerated liquid	Oxygen, refrigerated liquid
HAZARD CLASS:	2.2	2.2, 5.1
IDENTIFICATION NUMBER:	UN 1073	UN 1073
SHIPPING LABEL:	NONFLAMMABLE GAS, OXIDIZER	NONFLAMMABLE GAS, OXIDIZER

15. Regulatory Information

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III - HAZARD CLASSES:
Acute Health Hazard
Fire Hazard
Sudden Release of Pressure Hazard

16. Other Information

ACGIH	American Conference of Governmental Industrial Hygienists
DOT	Department of Transportation
IARC	International Agency for Research on Cancer
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
SARA	Superfund Amendments and Reauthorization Act
STEL	Short Term Exposure Limit
TDG	Transportation of Dangerous Goods
TLV	Threshold Limit Value
WHMIS	Workplace Hazardous Materials Information System

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

HYDOR-TECH LIMITED
MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Identification
Product Name: PASS C
Chemical Name: polyhydroxy aluminium chloride
CAS Number: 1327-41-9

Company Identification
Hydor-Tech Limited
7164-120th Street Scottsdale Square Business Centre
Surrey, B.C.
V3W 3M8
Business: (604) 592-8327 (For product information)
24 H - CANUTEC (CAN) (613) 996-6666 (For emergencies)

SPECIAL NOTES:
Product Use: Flocculant
Prepared and/or updated on March 5, 2010 by Technical, (780) 452-9888.

2. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Ingredients	Amount	CAS Number
POLYYDROXYL ALUMINUM CHLORIDE	25-40 %	1327-41-9

(See Section 8 for exposure guidelines)
(See Section 15 for regulatory information)

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:
Corrosive, clear yellow liquid with pH of < 1. Irritant. Avoid contact with eyes, skin and clothing.

HMIS Rating:
Health - 3
Flammability - 0
Reactivity - 0

POTENTIAL HEALTH EFFECTS

EYE:
Severely irritating to the eyes.

SKIN:
May cause skin irritation.

INHALATION:
May be irritating to the nose, throat, and respiratory tract.

INGESTION:
Under normal industrial use, ingestion is not considered a probable route of exposure. Corrosive to mouth, throat, and stomach.

SIGNS AND SYMPTOMS OF EXPOSURE:
Skin: Symptoms may include redness, watering, itching, or a burning sensation.

CHRONIC EFFECTS:
No known chronic health effects.

REPRODUCTIVE HAZARDS:
No known reproductive hazards.

CARCINOGENICITY INFORMATION:
No known cancer hazards.

TARGET ORGAN:
Routes of entry: Eye contact. Skin contact. Ingestion

MISCELLANEOUS:
(See Section 11 for toxicological information.)

4. FIRST AID MEASURES

EYE CONTACT FIRST AID:
Immediately flush with lukewarm, gently flowing water. After initial flushing, remove any contact lenses and continue flushing for 15 minutes while holding eyelids open. Get immediate medical attention.

SKIN CONTACT FIRST AID:
Immediately and thoroughly wash affected area with water. Remove contaminated clothing and launder before reuse. Get medical attention if irritation persists or in cases of substantial or prolonged contact.

INHALATION FIRST AID:
Remove to fresh air. Rest victim in half-upright position. If breathing is difficult, give oxygen by trained personnel and get immediate medical attention. Apply artificial respiration if indicated.

INGESTION FIRST AID:
Do not induce vomiting. Give conscious patients fluids. Call a physician and/or transport to medical facility. If victim is unconscious, never induce vomiting or give fluids. Place victim in a stable side position and keep warm.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES
COC Flash Point: N/A
Autoignition Temperature: N/A

FLAMMABLE LIMITS IN AIR

LEL: N/A
UEL: N/A

FLAMMABLE PROPERTIES:
This product is not classified as flammable or combustible according to WHMIS.

EXTINGUISHING MEDIA:
As required for surrounding fire.

FIRE & EXPLOSION HAZARDS:
SENSITIVITY TO STATIC DISCHARGE: Not sensitive.

SENSITIVITY TO MECHANICAL IMPACT: Not sensitive.

FIRE FIGHTING INSTRUCTIONS:
Evacuate non-emergency personnel to a safe area. Contact emergency personnel as necessary. Avoid breathing smoke, fumes, and decomposition products. As in any fire, wear self-contained breathing apparatus pressure-demand MSHA/NIOSH (approved or equivalent) and full protective gear.

COMBUSTION PRODUCTS:
Hydrogen chloride is evolved on boiling. Hazardous combustion products may include but are not limited to oxides of aluminium, carbon, nitrogen, ammonia, hydrogen chloride, and other products.

6. ACCIDENTAL RELEASE MEASURES

SAFEGUARDS (PERSONNEL):
Wear appropriate personal protective equipment. Evacuate non-emergency personnel to a safe area. Secure area.

INITIAL CONTAINMENT:
Shut off leak and/or contain spilled material if safe to do so.

LARGE SPILLS PROCEDURE:
Absorb spill with inert material (e g, dry sand or earth), then place in a chemical waste container.

SMALL SPILLS PROCEDURE:
Absorb spills with inert material.

MISCELLANEOUS:
Treat or dispose of waste material in accordance with all local, state/provincial, and federal requirements.

Spill can be neutralized with sodium carbonate — caution — carbon dioxide will be evolved.

7. HANDLING AND STORAGE

HANDLING (PERSONNEL):
Handle in accordance with good industrial hygiene practice. Wash thoroughly after handling. Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling. Avoid inhalation of vapour or mists.

STORAGE PRECAUTIONS:
Keep container closed when not in use. Keep from freezing. Keep from incompatible materials (refer to

Section 10).

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS:
Good general ventilation should be sufficient to control airborne levels. If operations generate dusts, fumes or mists, use ventilation as necessary to keep exposure to airborne contaminants below the exposure limits.

EYE / FACE PROTECTION REQUIREMENTS:
Chemical goggles or safety glasses essential. Face shield recommended.

SKIN PROTECTION REQUIREMENTS:
Wear protective clothing as required to prevent skin contact. Rubber boots recommended. Rubber gloves recommended.

RESPIRATORY PROTECTION REQUIREMENTS:
Generally not required. Wear an approved NIOSH/MSHA respirator with mist cartridge if necessary.

MISCELLANEOUS:
Facilities storing or utilizing chemicals, including this material, should be equipped with an eyewash facility and a safety shower.

EXPOSURE GUIDELINES:

POLYHYDROXY ALUMINIUM CHLORIDE
ACGIH TWA: (as Al) 2 mg/m^3

9. PHYSICAL AND CHEMICAL PROPERTIES

FORM:	Liquid
COLOUR:	Clear
ODOUR THRESHOLD:	Odourless
BOILING POINT:	105°C / 221°F
VAPOUR PRESSURE:	Not available mm Hg
VAPOR DENSITY:	Not available (Air = 1)
SOLUBILITY IN WATER:	Appreciable
SPECIFIC GRAVITY:	1.22 – 1.26 (Water = 1)
MELTING/FREEZING POINT:	Approximately -20° C / -4°F
pH:	< 2.2-2.8
% VOLATILES:	Not Available
EVAPORATION RATE:	Slow
ODOUR THRESHOLD:	Not available
COEFFICIENT OF WATER/OIL DISTRIBUTION:	> 1

10. STABILITY AND REACTIVITY

STABILITY:
Stable.

POLYMERIZATION:
Hazardous polymerization will not occur.

INCOMPATIBILITY WITH OTHER MATERIALS:
Avoid contact with strong acids, strong bases, aluminium and zinc.

CONDITIONS TO AVOID:
Avoid temperatures below 10°C / 50°F. Avoid temperatures above 35°C / 95°F.

11. TOXICOLOGICAL INFORMATION

MISCELLANEOUS:
No specific information is currently available. Contact Hydor-Tech Limited at (780) 452-9888 for further information.

12. ECOLOGICAL INFORMATION

MISCELLANEOUS:
No specific information is currently available. Contact Hydor-Tech Limited at (780) 452-9888 for further information.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL:
Treat or dispose of waste material in accordance with all local, state/provincial, and federal requirements.

14. TRANSPORTATION INFORMATION

PRODUCT LABEL: PASS C

TDG Status
SHIPPING NAME: CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
TECHNICAL SHIPPING NAME: (Polyhydroxy aluminium chloride)
HAZARD CLASS: 8
UN NUMBER: 3264
PACKING GROUP: II

15. REGULATORY INFORMATION

WHMIS HAZARD SYMBOLS:
Class D-2(B) - Materials Causing Other Toxic Effects, Class E - Corrosive Material

MISCELLANEOUS INFORMATION:
This material or all of its components are listed on the Inventory of Existing Chemical Substances under the Toxic Substance Control Act (TSCA). This material or all of its components are listed on the Canadian Domestic Substances List (DSL).

This product has been classified in accordance with the hazard criteria of the Controlled Product Regulations (CPR) and the MSDS contains information as required by the CPR.

Maximum use levels for potable water applications is 250 mg/L.

16. OTHER INFORMATION

PREPARED BY: Technical
APPROVED BY: Technical
TITLE: Technical
APPROVAL DATE: March 5, 2010
SUPERCEDES DATE: N/A

ADDITIONAL INFORMATION:
The data in this Material Safety Data Sheet relates only to the specific material designated herein.

****
Every effort is made to ensure that the data presented herein is current and factual; however, no warranty nor any other legal responsibility is to be construed from this document. Numerical values reported represent nominal and/or typical properties and do not constitute specifications. Any use of the information presented herein must be determined by the user to be in accordance with applicable Federal, Provincial, State and local laws and regulations.

****
END OF MSDS
****

MATERIAL SAFETY DATA SHEET

JCI Jones Chemicals, Inc. Sunny Sol® 150

SECTION I - IDENTIFICATION

TRADE NAME:	Sunny Sol® 150
CHEMICAL NAME:	Sodium Hypochlorite
FORMULA:	NaOCl
DOT SHIPPING NAME:	Hypochlorite Solution
DOT HAZARD CLASS:	8
UN/NA NUMBER:	UN 1791
DOT LABEL:	Corrosive
DOT PLACARD:	Corrosive
PACKING GROUP:	III
REPORTABLE QUANTITY:	Sodium Hypochlorite: 100 Pounds/45.4 Kilograms
CAS NUMBER:	7681-52-9
NFPA DESIGNATION:	The NFPA has not rated sodium hypochlorite.

SECTION II - HAZARDOUS INGREDIENTS

MATERIAL	% BY WEIGHT	CAS NO.	OSHA PEL	ACGIH TLV
Sodium Hypochlorite	12.5-15.6	7681-52-9	Not Applicable	Not Applicable
Sodium Hydroxide	0.1-2.0	1310-73-2	2mg/m^3 ceiling	STEL/CEIL(c) 2mg/m^3 ceiling
Inert Ingredients	Balance	Not Applicable	Not Applicable	Not Applicable

CARCINOGENICITY STATUS: NTP - No, IARC - No, OSHA - No.

SECTION III - PHYSICAL DATA

APPEARANCE:	Yellow-green liquid
BOILING POINT:	219°F (104°C) for 12.5% NaOCl by wt.
FREEZING POINT:	- 11°F (- 24°C) for 12.5% NaOCl by wt.
ODOR:	Chlorine
pH:	12.5 - 13.5 s.u. @ 25°C
VISCOSITY (Cs):	2.15 @ 23°C for 12.5% NaOCl by wt.
% VOLATILE BY VOLUME:	Variable water plus products of decomposition
SOLUBILITY IN WATER:	Complete
SPECIFIC GRAVITY (Water=1):	1.218 @ 20°C for 13.79 % NaOCl by wt.
VAPOR DENSITY (AIR=1):	Not available
VAPOR PRESSURE (mm Hg):	Variable water plus products of decomposition.

SECTION VI - REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY
Solutions are fairly stable in concentrations below 10%. Stability decreases with concentration, heat, light, exposure, decrease in pH, and contamination with heavy metals, such as nickel, cobalt, copper, and iron.

INCOMPATIBILITY
Acids, alcohols, amines, ammonia, chlorinated isocyanurates, combustibles, cyanides, detergents, ethers, hydrocarbons, oxidizable materials, reducing agents. Corrosive to most metals.

DECOMPOSITION PRODUCTS
Hypochlorous Acid (HOCl), chlorine, hydrochloric acid. Composition depends upon temperature and decrease in pH. Additional decomposition products, which depend upon pH, temperature and time, are sodium chloride, sodium chlorate and oxygen.

CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION
Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

IN THE EVENT OF A TRANSPORTATION EMERGENCY, CALL CHEMTREC: (800) 424-9300

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
Cleanup personnel must wear proper protective equipment (See Section VIII). Contain in diked area. Neutralize with sodium bisulfite or ferrous salt solutions. Place neutralized material in DOT specification approved container(s). Flush area with large amounts of water. Comply with all Federal, State and Local reporting requirements.

WASTE DISPOSAL
Contact Federal, State, County, and Local environmental regulators for guidance regarding proper disposal.

SECTION VIII - SPECIAL PROTECTION INFORMATION

VENTILATION REQUIREMENTS: Local exhaust is recommended.

SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

- **RESPIRATORY:** Use National Institute of Occupational Safety and Health (NIOSH) or Mine Safety and Health Administration (MSHA) approved respirator appropriate for this product when permissible exposure limits are exceeded.
- **EYES:** Use chemical goggles and face shield.
- **GLOVES:** Use chemical resistant rubber, plastic, or neoprene gloves.
- **OTHER:** Use chemical resistant splash apron and boots. Safety shower and eye wash fountain should be located nearby.

SECTION IV - FIRE AND EXPLOSION DATA

FLASH POINT (Test method): Not applicable
AUTO IGNITION TEMPERATURE: Not applicable
FLAMMABLE LIMITS IN AIR (Volume %): Not applicable
EXTINGUISHING MEDIA: Flood with water or carbon dioxide (CO2)
SPECIAL FIRE FIGHTING PROCEDURES: Use National Institute of Occupational Safety & Health (NIOSH) approved respirator with acid type canister or use self-contained breathing apparatus. Unusual fire and explosion hazards: material is a strong oxidizer. Contact with combustibles may initiate or promote combustion. Acid and heat accelerate decomposition. Decomposition products may include chlorine.

SECTION V - HEALTH HAZARD INFORMATION

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
No medical conditions are known to be aggravated by exposure.

ROUTES OF EXPOSURE

- **INHALATION**: Fumes from spills can cause severe irritation and chemical burns to the nose, throat, and lungs. Very little hazard from properly stored solution.
- **SKIN CONTACT**: Severe irritant, reddening of skin, can cause chemical burns to skin.
- **SKIN ABSORPTION**: Same as skin contact.
- **EYE CONTACT**: Severe irritant, corrosive, can severely burn eyes.
- **INGESTION**: Causes irritation of membranes of the mouth, throat, and stomach pain and possible ulceration. LD50 (oral, rat) for 12.5% NaOCl is approximately 5 g/kg body weight.

EFFECTS OF OVEREXPOSURE

ACUTE OVEREXPOSURE (see Routes of Exposure above)
- **SWALLOWING**: See "ingestion" under routes of exposure.
- **SKIN CONTACT**: severe Irritant, reddening of skin, skin damage, chemical burns.
- **INHALATION**: Fumes from spills are very irritating to mucous membranes.
- **EYE CONTACT**: Extreme irritant, corrosive.

CHRONIC OVEREXPOSURE (see Routes of Exposure above)
- **EYE**: Can cause damage.
- **SKIN**: Can cause damage, chemical burns.

EMERGENCY AND FIRST AID PROCEDURES

IF CONTACT WITH EYES OCCURS: flush with water for at least fifteen (15) minutes. Get medical attention. **IF CONTACT WITH SKIN OCCURS**: wash with plenty of soap and water. **INHALATION**: Remove to fresh air. Call a physician if exposure is severe. **IF SWALLOWED**: drink large amounts of water. Do NOT induce vomiting. Call a physician or poison control center immediately.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING

DANGER: This product is corrosive and may cause severe skin irritation or chemical burns to broken skin. Causes eye damage. Do not get in eyes, on skin or on clothing. Wear goggles and face shield and chemical resistant gloves when handling this product. Wash after handling. Avoid breathing vapors. Vacate poorly ventilated areas as soon as possible. Do not return until odors have dissipated.

PROPER STORAGE AND DISPOSAL REQUIREMENTS

Store this product in a cool, dry area away from direct sunlight and heat to avoid deterioration. In case of spill, flood areas with large quantities of water.

Disposal for domestic use: Do not reuse container. Rinse thoroughly before discarding in trash. Disposal for all other uses: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

Do not contaminate water, food, or feed by storage, disposal or cleaning of equipment.

STORE IN AN UPRIGHT POSITION

OTHER PRECAUTIONS

STRONG OXIDIZING AGENT: Mix only with water according to label directions. Mixing this product with gross filth such as feces, urine, etc., or with ammonia, acids, detergents or other chemicals may release hazardous gases irritating to eyes, lungs and mucous membranes.

ADDITIONAL REGULATORY CONCERNS

- **EPA:** May not be used for disinfection or sanitization without prior approval by EPA. Repackagers must obtain EPA registration and establishment numbers.
- **FIFRA:** This product is regulated under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) if used as a disinfectant or sanitizer.
- **TSCA:** Included in the Toxic Substances Control Act (TSCA) Inventory Of Chemical Substances.

MSDS PREPARED BY: JCI Jones Chemicals, Inc.
100 Sunny Sol Blvd.
Caledonia, NY 14423
Phone: 716-538-2314

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