This SOP is a harmonized version combining SOPs EAP023 and EAP035, which were both dissolved oxygen SOPs.
Please note that the Washington State Department of Ecology’s Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical and administrative experts. Their primary purpose is for internal Ecology use, although sampling and administrative SOPs may have a wider utility. Our SOPs do not supplant official published methods. Distribution of these SOPs does not constitute an endorsement of a particular procedure or method.

Any reference to specific equipment, manufacturer, or supplies is for descriptive purposes only and does not constitute an endorsement of a particular product or service by the author or by the Department of Ecology.

Although Ecology follows the SOP in most instances, there may be instances in which Ecology uses an alternative methodology, procedure, or process.
## SOP Revision History

<table>
<thead>
<tr>
<th>Revision Date</th>
<th>Rev</th>
<th>Summary of changes</th>
<th>Sections</th>
<th>Reviser(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/21/2006</td>
<td>1.1</td>
<td>Editorial; formatting</td>
<td>all</td>
<td>Bill Kammin</td>
</tr>
<tr>
<td>11/2006</td>
<td></td>
<td>Editorial, formatting</td>
<td>all</td>
<td>Bill Ward</td>
</tr>
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<td>11/2006</td>
<td></td>
<td>Editorial Review</td>
<td>all</td>
<td>Dave Hallock</td>
</tr>
<tr>
<td>12/13/2006</td>
<td></td>
<td>Editorial Review</td>
<td>all</td>
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</tr>
<tr>
<td>1/18/2007</td>
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<td>Incorporate Comments/More Edits</td>
<td>all</td>
<td>Bill Ward</td>
</tr>
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<td></td>
<td>Second Editorial Review</td>
<td>6, 8</td>
<td>Bill Kammin</td>
</tr>
<tr>
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<td>6, 8</td>
<td>Bill Ward</td>
</tr>
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<td></td>
<td>Editorial</td>
<td>all</td>
<td>Bob Cusimano</td>
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<tr>
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<td>Harmonized SOPs 023 and 035</td>
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<td>2/2/2011</td>
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<td>6</td>
<td>Bill Ward</td>
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<td>4/11/2013</td>
<td>2.3</td>
<td>Revised and moved language to safety section. Also referenced it from the lab procedures.</td>
<td>6, 9</td>
<td>Bill Ward</td>
</tr>
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</table>
Environmental Assessment Program

Standard Operating Procedure for the Collection and Analysis of Dissolved Oxygen (Winkler Method)

1.0 Purpose and Scope

1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for field collection and laboratory procedures used to determine the concentration of dissolved oxygen (DO) in water samples. The samples are analyzed using the Winkler Method (Azide-Modification), SM 21st Edition, 2005 (See attachment A for chemical reaction details). The volume, in mL, of sodium thiosulfate used to analyze a 200mL sample with this method is equal to the DO concentration in mg/L.

1.2 In general, the concentration of DO in water varies in response to changes in atmospheric pressure and water temperature. The higher the atmospheric pressure the higher the oxygen solubility in water and the higher the potential DO concentration. The opposite is true with temperature, the higher the temperature the lower the solubility and saturation concentration of oxygen in water. DO is one of the major factors that determine the types of biological communities that inhabit an aquatic system. The addition of organic or inorganic material that exerts an oxygen demand through respiration and biodegradation lowers the DO concentration and can facilitate the growth of nuisance organisms.

2.0 Applicability

2.1 This SOP is intended for freshwater monitoring.

3.0 Definitions

3.2 EAP – Environmental Assessment Program.
3.3 EIM – Environmental Information Management System. A searchable database developed and maintained by the Washington State Department of Ecology.
3.4 Dissolved Oxygen – The concentration of dissolved oxygen (mg/L) in a water sample.
3.5 Field Logbook – A weather resistant logbook containing “Rite in the Rain” ® writing paper used to document any and all field activities, sample data, methods and observations for each and all collection sites.
3.6 MQO’s – Measurement Quality Objectives
3.7 MSDS – Material Safety Data Sheets provides both workers and emergency personnel with the proper procedures for handling or working with a particular substance. MSDS’s include information such as physical data (melting point, boiling point, flash point, etc.), toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment and spill/leak procedures.

3.8 QA – Quality Assurance

4.0 Personnel Qualifications/Responsibilities

4.1 Field operations require training specified in EAP’s Field Safety Manual such as First Aid, CPR, and Defensive Driving.

4.2 Boat operations require that staff meet specific training requirements as described in EAP’s Field Safety Manual, such as an EAP Boating Course and an approved Boating Safety Course.

4.3 Because the procedure requires the use of hazardous materials, training is required as per the Ecology Chemical Hygiene Plan and Hazardous Material Handling Plan (Section 1) (Ecology, 2006), which includes Laboratory Safety Orientation, Job-Specific Orientation and Chemical Safety Procedures. The Standard Operating Procedures in Section 16 of the Chemical Hygiene Plan and Hazardous Material Handling Plan for handling chemicals must also be followed.

5.0 Equipment, Reagents, and Supplies

5.1 For Sampling

5.1.1 DO Sampler (based on design presented in Figure 4500-0:1 of the 20th Edition of Standard Methods), 1 L Funnel-Tube Sampler, or Kemmerer/Van Dorn Samplers

5.1.2 Sampling rope

5.1.3 DO box

5.1.4 Plastic gloves

5.1.5 300 mL BOD bottles

5.1.6 Glass BOD stoppers

5.1.7 Plastic BOD bottle caps

5.1.8 250 mL plastic wash bottle

5.1.9 Deionized water (DI water)

5.1.10 3 mL graduated disposable transfer pipettes

5.1.11 Manganese sulfate monohydrate reagent (see Attachment B for MSDS) *Caution* this chemical is a skin and eye irritant and may be harmful if inhaled or swallowed.

5.1.12 Alkali-iodine-azide reagent (see Attachment C for MSDS) *Danger* this chemical is corrosive and may cause eye or skin burns or internal damage if inhaled or swallowed.

5.1.13 Field Logbook or Field Data Report Form (see Attachment D.)

Figure 1. 300mL BOD bottle with glass stopper.
5.2 For Analysis

5.2.1 Nitrile gloves
5.2.2 Plastic apron
5.2.3 Face shield
5.2.4 25 mL graduated burette, w/3-way stopcock
5.2.5 10 mL volumetric burette, w/3-way stopcock or glass volumetric pipette
5.2.6 500 mL Erlenmeyer flask
5.2.7 Magnetic stirrer
5.2.8 Magnetic stir bar
5.2.9 203 mL volumetric flask
5.2.10 Concentrated sulfuric acid (95-98%), (see Attachment E for MSDS) *Danger* this chemical is a strong acid and may cause eye or skin burns or internal damage if inhaled or swallowed.
5.2.11 Aqueous starch solution preserved with salicylic acid (must be kept in refrigerator and discarded if older than nine months)
5.2.12 Sodium thiosulfate (0.025 M), purchased at this concentration, (see Attachment F for MSDS)
5.2.13 Potassium bi-iodate (0.025 M), purchased at this concentration, (see Attachment G for MSDS)

5.3 Sample Containers

5.3.1 The normal container for dissolved oxygen samples is a 300 mL glass biological oxygen demand (BOD) bottle, narrow and flared mouth, tapered and pointed ground glass stopper.

5.3.2 The bottles, stoppers, and bottle caps should be cleaned and rinsed with tap water after every use and stored in a manner to prevent dust and other materials from contaminating them.

5.3.3 Check bottle numbers before sampling to ensure that all numbers are unique (no duplications) to avoid confusion in data processing.

6.0 Summary of Procedure

6.1 EAP Wet Lab Preparation

6.1.1 The wet labs located at the EAP Western Operations Center (OC), the Eastern Regional Office Operations Center (EROC), and the Central Regional Office (CRO) are maintained by all lab users. Please do your part to keep it clean, tidy and safe. Titration chemicals and equipment are maintained by the current lab room coordinator/s at each facility. Bottles and preservatives for each vehicle, or for each project, are maintained by the vehicle custodian and/or project officer.
6.1.2 The appropriate EAP lab room coordinator should be contacted immediately if lab supplies or chemicals are running low or might be contaminated or expired so that fresh supplies/chemicals can be ordered. The project officer should check all equipment and reagents before sampling and notify others involved in the project of the status of the DO lab and other equipment. The project officer is also responsible to coordinate with lab room coordinator for the replacement/repair of DO equipment and/or chemicals.

6.2 Field Preparation

6.2.1 Prepare DO Box:

6.2.1.1 Use clear 125 mL or 250mL capped bottles (Figure 2) for field reagent storage (Manganous sulfate monohydrate and alkali-iodide-azide) in the DO Box to reduce the contamination potential and to be able to see if they have gone bad. These volumes also ensure that the reagents are essentially fresh when used and refilled on a regular basis. Discard reagents that have been stored in the DO Box longer than a year.

6.2.1.2 Store the 3 mL graduated disposable transfer pipettes, used to dispense these reagents, in a manner to prevent reagent contamination or cross-contamination. One easy and simple method is to drill a hole in the center of the bottle, just barely larger than the diameter of the pipette, that allows the designated pipette to be inserted for filling and storage purposes (Figure 2).

![Figure 2. Reagent containers with holes for pipette filling and storage.](image)

6.2.1.3 The supersaturated alkali-iodide-azide solution is chemically unstable and, when contaminated with dirt or other impurities, can form a colored (not white) precipitate that makes it difficult to pipette. Standard Methods indicates that the white turbidity in the azide solution is acceptable (APHA, 2005). Always stir any turbid solution with the pipette before reagent extraction.
6.2.1.4  Label reagents and pipettes to avoid cross contamination. The manganous sulfate solution is typically labeled with the number “1” and the azide solution is typically labeled with the number “2” (Figure 2).

6.2.2  Record the BOD bottle number, date, time, and sampling location in a Field Logbook or Field Data Report Form.

6.2.3  Selecting an Appropriate Sampling Device.

6.2.3.1  The American Public Health Association (APHA) type ‘DO sampler’ (Figure 3a) is used to collect samples from a bridge or from the stream bank through the use of a rope.

6.2.3.2  The Kemmerer (Figure 3b) and Van Dorn (Figure 3d) samplers are often used to collect samples at depth in lakes or deeper rivers.

6.2.3.3  The ‘Funnel-Tube Sampler’ (Figure 3c) is typically used to collect samples in shallow, wadeable streams.

Figure 3a. APHA type DO sampler

Figure 3b. Kemmerer Sampler

Figure 3c. Funnel-Tube surface sampler

Figure 3d. Van Dorn sampler
6.3 Sample Collection

6.3.1 **DO sampler method.** This method is typically used to collect samples from a bridge or from the stream bank through the use of a rope.

6.3.1.1 Rinse the sampler, top, and filler tubes with stream, tap water, or DI water.

6.3.1.2 Place the BOD bottle into the sampler. Orient the lid of the sampler to insure the filler tube is inserted into the BOD bottle and the lid is secure¹.

6.3.1.3 Attach the sampling rope to sampler.

6.3.1.4 Put on a high-visibility safety vest and move to a well mixed location such as the main part of the channel where a representative sample may be collected.

6.3.1.5 Carefully lower the sampler to the water surface, taking care to not dislodge any bridge debris onto it. Allow the bottom of the sampler to touch the water surface, and then raise the sampler off the water for a few moments to allow any debris from the bottom of the sampler to drop off and float away, and rapidly lower the sampler about 0.5 meters to submerged it. **Note: This minimizes the sampling of surface film and any debris from the bottom of the sampler.**

6.3.1.6 Retrieve the sampler when the bubbles from the vent tube stop (bottle is full). If a swift current carries the sampler downstream (before it can completely fill) then pull the sampler from the water, allow it to swing upstream, and then drop it back into the water. This action may need to be repeated a few times until the BOD bottle fills.

6.3.1.7 Retrieve the sampler, taking care not to dislodge bridge debris into it.

6.3.1.8 Set the sampler down and carefully remove the top.

6.3.1.9 Insert stopper and remove the BOD bottle.

6.3.2 **1L Funnel-Tube Sampler Method.** This method is typically used to collect a sample from a small or shallow stream.

6.3.2.1 Rinse the funnel in the stream.

6.3.2.2 Invert the funnel or orient the open end of the funnel upstream and slowly submerge it until it and the funnel tubing completely fills avoiding any entrainment of air bubbles.

6.3.2.3 Pinch the funnel tubing about six inches from the end and remove the funnel (top end first) from the water.

6.3.2.4 Insert the end of the funnel tubing to the bottom of the BOD bottle. Let go of the tubing to allow the water to overfill the bottle (Figure 3c). Withdraw the tubing from the bottle just before the funnel has emptied. This step avoids any aeration of the sample with bubbles from the final discharge of the funnel.

¹ The lid should be secured with bailing wire or string when sampling a stream with high velocity.
6.3.2.5 Insert stopper into BOD bottle.

6.3.3 **Kemmerer or Van Dorn Method.** This method is typically used to collect samples from lake depths.

6.3.3.1 Rinse the sampler with water, attach the sampling rope, and set the sampler trigger mechanism.

6.3.3.2 Lower the sampler to the desired depth and trip the trigger.

6.3.3.3 Insert the end of the sampler tubing into the bottom of a BOD bottle, open the top of the sampler or the air inlet valve, and over fill the bottle with more than two times its volume prior to quickly removing the tubing (do not use any samples that were aerated by the final discharge from the sampler).

6.3.3.4 Insert stopper into BOD bottle.

6.4 **Field Processing**

6.4.1 Wear chemical resistant gloves and eye protection to prevent reagents from getting on hands and in eyes. Hold sample away from body and mix carefully to avoid getting reagents on shoes or clothing.

6.4.2 If necessary, tap the side of the BOD bottle to dislodge air bubbles clinging to the inside

6.4.3 Insert a glass stopper in the BOD bottle and tip it to discard the displaced water.

6.4.4 Remove the stopper and fix the sample by adding two milliliters of manganous sulfate reagent followed by two milliliters of alkaline-azide reagent using the disposable pipettes reserved for each reagent. Gently add these reagents while holding tip of the pipette just above the water (avoids splashing and entraining air bubbles in the reagent stream).

6.4.5 Replace the stopper and mix the contents by inverting the bottle a few times.

6.4.6 Add a few milliliters of deionized water around the stopper to form a water seal and cover the bottle top with a plastic BOD bottle cap. Then rinse the exterior of bottle with deionized water to prevent DO contamination box with reagent.

6.4.7 Place the fixed sample into the DO box. Samples need to be analyzed with in four days.

6.5 **Laboratory Analysis** Note: Always dilute the chemicals going into the sink with a continuous stream of tap water to prevent damage to the plumbing or impacts to wastewater treatment facilities (See 9.4 Waste Disposal).
6.5.1  Initial Cleaning Procedure:

6.5.1.1  Put on a plastic apron and Nitrile gloves.

6.5.1.2  Thoroughly rinse the flask and stir bar with deionized water.

6.5.1.3  Check and if necessary fill the Potassium bi-iodate dispenser and starch squirt bottle.

6.5.1.4  Fill the Sodium thiosulfate reservoir and leave the cap loose.

6.5.1.5  Open the volumetric burette stopcock to a fill position.

6.5.1.6  Raise and lower the sodium thiosulfate storage bottle reservoir above and below the volumetric burette a few times to flush the burette and mix the sodium thiosulfate in the reservoir.

6.5.1.7  Clamp the reservoir onto the workstation lab-frame above the volumetric burette.

6.5.1.8  Use the volumetric burette stopcock to fill the burette and get rid of any air in the burette around the stopcock.

6.5.2  Titration Procedure:

6.5.2.1  Remove the plastic cap from the BOD bottle.

6.5.2.2  Pour off the water seal and invert the bottle several times to mix the floc.

6.5.2.3  Allow the floc to settle to the lower half of the bottle.

6.5.2.4  Put on the face shield.

6.5.2.5  Remove the bottle-top sulfuric acid dispenser from the acid storage cabinet. The dispenser should already be pre-set to dispense 2 mL of acid.

6.5.2.6  Remove the glass stopper of the BOD bottle. Dispense 2 mL of the acid into the DO sample and put the acid bottle back into the cabinet. Note: Concentrated sulfuric acid is a very dangerous chemical and should be handled very carefully. Never add water to it and always immediately dispose of gloves that get any acid on them.

6.5.2.7  Re-stopper the BOD bottle and invert it several times over the sink until the precipitate has completely dissolved. The sample should typically have a clear orange or yellow color. If some floc remains in BOD bottle, then invert the bottle several times to mix the floc and allow 5-6 minutes for the precipitate to dissolve. If the floc still has not dissolved then add a few drops of sulfuric acid from the sulfuric acid dispenser until floc completely dissolves.

6.5.2.8  Slide a magnetic stir bar into an empty 500 mL Erlenmeyer flask.
6.5.2.9  Fill a 203 mL volumetric flask\(^2\) with the DO sample, transfer the sample to the Erlenmeyer flask, and set the flask in the sink.

6.5.2.10  Refill the volumetric burette with sodium thiosulfate (make sure the sodium thiosulfate escapes from the top nipple).

6.5.2.11  Place the Erlenmeyer flask containing the sample on the magnetic stirrer and turn on the stirrer to the lowest setting.

6.5.2.12  Titrate the sample with the Sodium thiosulfate from the volumetric burette until it turns to a pale yellow color.

6.5.2.13  Squirt 1 to 2 mL of the starch solution into the sample. *Note: the addition of the starch solution earlier than this can cause a less distinct titration endpoint.*

6.5.2.14  Continue the titration process by adding the sodium thiosulfate by quickly twisting the burette stopcock past the discharge point or by slowly adding individual drops until the purple color of the sample just disappears. This is the titration end point\(^3\) and it should be sharp and distinct\(^4\). Care should be taken to avoid an end point overrun.

6.5.2.15  Check the titration end point of any sample that was possibly overrun by adding a drop of bi-iodate from a 3 mL graduated disposable transfer pipette to the titrated sample. If the end point is correct, a faint purple color should reappear. If more than one drop of bi-iodate is required to get a faint purple color, then the end point was overrun. Do a Back-Titration (see 6.4.3 – Back-Titration) to correct the titration volume of the sample.

6.5.2.16  Record the titration result or corrected titration result in the proper column on the Field Data Report Form or in the field notes as mg/L of DO\(^5\). If the value is between the 0.1 mL marks on the burette, round the even numbers down and the odd numbers up (e.g., 10.25 to 10.2 and 10.35 to 10.4).

6.5.3  Back-Titration Procedure

\(^2\) This is a slight modification of azide modification method presented in SM 20\(^\text{th}\) Edition, 1998, which calls for the addition of 1 mL of manganous sulfate and alkali-iodine azide instead of 2 mL. The excess reagents are accounted for by using 203mL volumetric flasks rather than 201mL flasks.

\(^3\) The volume of sodium thiosulfate used to titrate 203 mL of a sample equals the DO of the sample in mg/L.

\(^4\) If the end point was not sharp and distinct or the sample contains purple flakes, then replace the starch solution (it may have gone bad – this is rare). Record the result with a "J" qualification to indicate the result is an estimate and note that the starch was bad and was replaced on the Field Logbook or Field Data Report Form.

\(^5\) The mL of Sodium thiosulfate used to analyze a 200mL sample with this method is equal to the DO concentration in mg/L.
6.5.3.1 Back-titrate an overrun end point sample using bi-iodate drops from a 3 mL graduated disposable transfer pipette (1 drop = 0.05 mg/L). Correct the final value\(^6\) if the back-titration requires fewer than or equal to 8 drops and record the result without qualification\(^7\). If the back-titration requires more than 8 drops but less than or equal to 20, correct the final value and record the result with a "J" qualification (twenty drops are equivalent to 1 mg/L). If the back-titration requires more than 20 drops, do not record a result, but make a comment on the Field Data Report Form indicating the titration error\(^8\).

6.5.3.2 If a graduated burette or pipette is available, then carefully back-titrate to the overrun end point sample using a measured quantity of bi-iodate and subtract the amount used to correct the final result.

6.5.4 Sodium Thiosulfate Normality Check. The test is done to verify the strength of the Sodium Thiosulfate solution and get a data correction factor. The normality check result should almost always be 10.0 mL if the Sodium Thiosulfate has been stored properly (a 9.95 or 10.05 result is considered a 10.0 result). The result should also be very similar to those that others have recently recorded in the Titration Log.

6.5.4.1 After the first sample has been titrated to its end point, add exactly 10 mL of the bi-iodate standard using a 10 mL volumetric burette, w/3-way stopcock, or glass volumetric pipette, rinse the inside wall of flask with starch solution, and re-titrate.

6.5.4.2 Repeat this procedure mid-way through the batch of samples to be titrated.

6.5.4.3 Record the volume of the sodium thiosulfate needed for each normality check on the field note book or worksheet and on the titration log located next to the titration station (The average of the two normality checks is used as a correction factor for the field data). Note: These normality checks should be very close, within 0.2 mL. If they are not, then do at least two more until you have three consecutive results (within 0.2 mL of each other) to use to calculate a correction factor.

6.5.4.4 If you get less than a 9.95 mL result, then repeat the normality check but do the following first:

6.5.4.4.1 Eliminate air from the tip of the Potassium Biiodate bottle-top dispenser to ensure it gives you 10.0 mL,

6.5.4.4.2 Gently dispense the Potassium Biiodate into the titrated solution in the bottom of the Erlenmeyer flask and avoid getting any on the inside flask wall,

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\(^6\) The corrected final value is the final value - (number of drops used x 0.05 mg/L). For example, if 8 drops were used and the final value was 10.3 mg/L, then the corrected final value is 9.9 mg/L (10.3 mg/L - (8 x 0.05 mg/L or 0.4 mg/L)).

\(^7\) Justification: Our MQOs specify 0.2 mg/L; 8 drops is equivalent to 0.4 mg/L which leaves a generous allowed error of 50% for miscounting, imprecise drop size, etc. to still be within MQOs.

\(^8\) Justification: Results with a potential error of 50% of 1 mg/L, or 0.5 mg/L, should not be recorded at all.
6.5.4.4.3 Rinse the inside flask wall with starch solution to ensure that all of the Potassium Biiodate is in the titrated solution, and

6.5.4.4.4 Eliminate Sodium Thiosulfate drops/residue from the outside of the refillable burette tip and tube connection.

6.5.5 Correcting Titration End Point Results with Normality Check (NC) Results

6.5.5.1 Divide the average of the two or more normality check results into 10 to get the correction factor \((10/\text{NC}_{\text{avg.}})\) and then multiply the final result by the correction factor \((\text{CF})\) to get the corrected final result \((\text{DO}_{\text{final}} \times \text{CF})\).

6.5.5.2 For example, if the average of the normality checks was 9.9 mL and the sample titration result was 11.5 mL, then:

6.5.5.3 Correction Factor Multiplier = \((10/\text{NC}_{\text{avg.}}) = (10/9.9 \text{ mL}) = 1.01\text{CF}\)

6.5.5.4 Corrected Final Result = \((\text{DO}_{\text{final}} \times \text{CF}) = (11.5 \text{ mL} \times 1.01\text{CF}) = 11.6 \text{ mL}\)

6.5.5.5 Note: The corrected final result is the volume, in mL, of sodium thiosulfate used to titrate a 200mL sample. This volume is equivalent to the concentration of DO in mg/L.

6.5.6 Clean Up Procedure

6.5.6.1 Move the sodium thiosulfate reservoir back to its storage area on the counter.

6.5.6.2 Open the volumetric burette stopcock to a fill position (this allows the thiosulfate in the volumetric burette to return to the reservoir).

6.5.6.3 Tighten the reservoir cap and turn the volumetric burette stopcock to a closed position.

6.5.6.4 Thoroughly rinse the used flasks and stir bar(s), and give them a final rinse with deionized water.

6.5.6.5 Return all lab equipment to designated storage locations.

6.5.6.6 Clean counter and give sinks a final rinse.
7.0 **Records Management**

7.1 All hardcopy documentation of the data, such as completed Field Logbook and Field Data Report Forms are kept and maintained by the project lead. These documents are organized in binders or in expanding files. After about six years, hardcopies are boxed and moved to EAP archives.

7.2 Data collected for Ecology’s Ambient River and Stream Monitoring Program will be entered into an Access-based database, reviewed and verified following the Quality Control and Quality Assurance procedures (see 8.1 below), uploaded into EIM, and posted on our web page [http://www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html](http://www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html).

7.3 Data collected for special projects or Total Maximum Daily Load (TMDL) studies will be reviewed, verified, and stored based on the Quality Assurance Project Plan (QAPP) for the project.

8.0 **Quality Control and Quality Assurance**

8.1 Freshwater Ambient Monitoring Program

8.1.1 The data QA program for field sampling consists of four parts: (1) adherence to the SOP procedures for sample collection, processing, and periodic evaluation of sampling personnel, (2) consistent instrument calibration methods and schedules, (3) titration endpoint verification, and (4) collection and processing of field quality control (QC) samples. Our QA program is described in detail in [https://fortress.wa.gov/ecy/publications/summarypages/0303200.html](https://fortress.wa.gov/ecy/publications/summarypages/0303200.html). (Hallock and Ehinger 2003).

8.1.2 The field QC sample is collected as a duplicate (Sequential) Field Sample. This consists of the collection of an additional sample approximately 15-20 minutes after the initial collection at a station. This sample represents the total variability due to short-term, in-stream dynamics, sample collection and processing, and laboratory analysis.

8.1.3 A two-tiered system is used to evaluate data quality of individual results based on field QC. The first tier consists of an evaluation of the variability in field duplicates and the reasonableness of the result. Results exceeding pre-set limits are flagged. The second tier QC evaluation is a manual review of the data flagged in the first tier. Data are then coded from 1 through 9 (1 = data meets all QA requirements, 9 = data are unusable). Criteria for assigning codes are discussed in more detail in Hallock and Ehinger (2003). We do not routinely use or distribute data with quality codes greater than 4. *Note: results from highly turbid samples are estimated.*

8.2 Total Maximum Daily Load (TMDL) Studies

8.2.1 The TMDL data QA program for field sampling consists of two parts: (1) adherence to the SOP procedures for sample/data collection and periodic evaluation of sampling
personnel and (2) the collection of a field quality control (QC) sample for ten percent of the samples collected for a given study.

8.2.2 The field QC sample is collected as a duplicate field sample. This consists of the collection of an additional sample in either a side by side manner or immediately following the initial sample. This sample represents the total variability due to sample collection and laboratory analysis.

8.2.3 QA/QC procedures will be addressed more thoroughly on a project-by-project basis in the QAPP for the project.

9.0 Safety

9.1 Safety is the primary concern when collecting samples. Since most sample sites are located on highway bridges, road and pass conditions should always be checked before departure (especially in winter). If roadside hazards, weather, accidents, construction, etc. make sample collection dangerous, then skip that station. Note the reason on the Field Data Report Form and notify your supervisor of the hazard when you return to the office. If the hazard is a permanent condition, relocation of the station may be necessary. Review Ecology’s Safety Program Manual (Ecology, 2010) periodically to assist with these safety determinations.

9.2 The proper safety gear (gloves, apron, face shield, etc.) should be worn, as described in the field processing and lab analysis sections above, to avoid exposure to potentially dangerous chemicals.

9.3 Refer to attached MSDS sheets for proper first aid and cleanup procedures should a chemical spill or exposure occur.

9.4 Waste Disposal. Rinse the titrated sample, as well as the excess sample in the D.O. bottle, down the drain with copious amounts of tap water. The solution is acidic so it must be diluted as much as possible to reduce any impact on the wastewater treatment system.

10.0 References


https://fortress.wa.gov/ecy/publications/summarypages/0303200.html
ATTACHMENT A

The Chemistry of the Winkler Method:

1. \( \text{MnSO}_4 \) (manganous sulfate) + 2 KOH + KI (alkali-iodide) \( \rightarrow \) Mn(OH)\(_2\) + K\(_2\)SO\(_4\)

2. Mn(OH)\(_2\) (white precipitate) + O\(_2\) \( \rightarrow \) MnO(OH)\(_2\) (brown precipitate)

3. MnO(OH)\(_2\) + H\(_2\)SO\(_4\) \( \rightarrow \) Mn\(^{+4}\)(SO\(_4\))\(_2\) + 3H\(_2\)O
   \[\text{Mn}^{+2}\text{SO}_4 + K_2\text{SO}_4 + I_2 \text{ (dark brown/red, free iodine)}\]

4. 2 Na\(_2\)S\(_2\)O\(_3\) (thiosulfate) + I\(_2\) \( \rightarrow \) Na\(_2\)S\(_4\)O\(_6\) + 2NaI

Steps one and two occur simultaneously and result in a brown precipitate. The addition of acid (step 3) produces the iodine that is equivalent to the DO concentration, i.e., the iodine reduced in step 4 is equivalent to the concentration of DO in the sample.

The Winkler method is sensitive to interference from a number of substances. Two of the most common substances that cause interference are nitrite ions (NO\(_2^-\)) and ferrous ions (Fe\(^{+2}\)). Since nitrite is common in environmental samples, an azide modification that eliminates environmental levels of nitrite is used.

Azide Modification:

5. 2NaN\(_3\) + H\(_2\)SO\(_4\) \( \rightarrow \) 2HN\(_3\) +Na\(_2\)SO\(_4\)
   
   \[\text{HNO}_2 + \text{HN}_3 \rightarrow \text{N}_2\text{O} + \text{N}_2 + \text{H}_2\]
Material Safety Data Sheet

Section 1. Product and Company Identification

Product Name: Manganous Sulfate Solution, 38%
Product Code: VW3329
Manufacturer: EMD Chemicals Inc.
P.O. Box 70 480 Democrat Road
Gibbstown, NJ 08027
Effective Date: 8/1/2005
Print Date: 10/5/2005
Prior to January 1, 2003 EMD Chemicals Inc. was EM Industries, Inc. or EM Science, Division of EM Industries, Inc.

For More Information Call
856-423-6300 Technical Service
800-424-9300 CHEMTREC (USA)
Monday-Friday: 8:00 AM - 5:00 PM
613-996-6666 CANUTEC (Canada)
24 Hours/Day: 7 Days/Week

In Case of Emergency Call
Synonym: None.

Material Uses: Laboratory Reagent

Section 2. Composition and Information on Ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manganese Sulfate</td>
<td>10034-96-5</td>
<td>36.4</td>
</tr>
<tr>
<td>Water</td>
<td>7732-18-5</td>
<td>63.6</td>
</tr>
</tbody>
</table>

Section 3. Hazards Identification

Physical State and Liquid. Appearance

Emergency Overview: CAUTION ! HARMFUL IF SWALLOWED. CAUSES EYE AND SKIN IRRITATION. MAY BE HARMFUL IF INHALED.

Routes of Entry: Eye contact. Inhalation.

Potential Acute Health Effects

**Eyes** Hazardous in case of eye contact (irritant). Inflammation of the eye is characterized by redness, watering, and itching.

**Skin** Hazardous in case of skin contact (irritant). Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering. Non-permeator by skin.

**Inhalation** May be hazardous in case of inhalation.

**Ingestion** Hazardous in case of ingestion. Do not take internally.
Potential Chronic Health Effects

Carcinogenic Effects This material is not known to cause cancer in animals or humans.
Additional information See Toxicological Information (section 11)

Medical Conditions Repeated exposure to a highly toxic material may produce general deterioration of health by an
Aggravated by accumulation in one or many human organs.

Section 4. First Aid Measures

Eye Contact Check for and remove any contact lenses. In case of contact, immediately flush eyes
with plenty of water for at least 15 minutes. Cold water may be used. Get medical
attention immediately.

Skin Contact In case of contact, immediately flush skin with plenty of water for at least 15 minutes
while removing contaminated clothing and shoes. Cover the irritated skin with an
emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean
shoes before reuse. Get medical attention immediately.

Inhalation If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give
oxygen. Get medical attention.

Ingestion If swallowed, do not induce vomiting unless directed to do so by medical personnel.
Never give anything by mouth to an unconscious person. Loosen tight clothing such as
a collar, tie, belt or waistband. Get medical attention immediately.

Section 5. Fire Fighting Measures

Flammability of the Non-flammable. Product
Auto-ignition Not applicable. Temperature

Flash Points Not applicable.
Flammable Limits Not applicable.

Products of Combustion Not applicable.

Fire Hazards in Presence Not applicable. of Various Substances

Explosion Hazards in Risks of explosion of the product in presence of static discharge: No. Presence of Various
Risks of explosion of the product in presence of mechanical impact: No.

Substances

Fire Fighting Media Not applicable. and Instructions
Protective Clothing (Fire) Not applicable.

Special Remarks on Fire Not available. Hazards

Special Remarks on Not available. Explosion Hazards

Section 6. Accidental Release Measures

Small Spill and Leak Dilute with water and mop up, or absorb with an inert dry material and place in an
ATTACHMENT B

appropriate waste disposal container. If necessary: **Neutralize the residue with a dilute solution of sodium carbonate.**

**Large Spill and Leak**

Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. **Neutralize the residue with a dilute solution of sodium carbonate.** Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

**Spill Kit Information** No specific spill kit required for this product.

<table>
<thead>
<tr>
<th>Section 7. Handling and Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Handling</strong></td>
</tr>
<tr>
<td><strong>Storage</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section 8. Exposure Controls/Personal Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engineering Controls</strong></td>
</tr>
<tr>
<td><strong>Personal Protection</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Protective Clothing (Pictograms)**

**Personal Protection in Case of a Large Spill**

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Product Name**

Manganese Sulfate

**Exposure Limits**

**Belgium Minister of Labour (Belgium, 1998).**

**VL:** 0.2 mg/m$^3$ 8 hour(s).

**BAUA (Germany, 1997).**

Blarinlagen: 2 mg/m$

TWA: 0.5 mg/m 8 hour(s). **DK-Arbejdstyssinet (Denmark, 1996).**
ATTACHMENT B

GV: 2.5 mg/m³ 8 hour(s).
Tytterveyslaitos (Finland, 1998).
TWA: 0.5 mg/m³ 8 hour(s).
INRS (France, 1996).
VME: 1 mg/m³ 8 hour(s).
National Authority for Occupational Safety/Health (Ireland, 1999).
OEL: 5 mg/m³ 8 hour(s).

Arbeidsinspectie (Netherlands, 1999).

TGG 15 min: 3 mg/m³ 15 minute(s).
TGG 8 uur: 1 mg/m³ 8 hour(s).
N-Arbeidstysinet (Norway, 1996).
AN: 2.5 mg/m³ 8 hour(s).
AFS (Sweden, 1996).
NGV: 1 mg/m³ 8 hour(s).
EH40-OES (United Kingdom (UK), 1997).
TWA: 5 mg/m³ 8 hour(s). Water Not available.

Section 9. Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odor</td>
<td>Odorless.</td>
</tr>
<tr>
<td>Color</td>
<td>Clear.</td>
</tr>
<tr>
<td>Physical State and Appearance</td>
<td>Liquid.</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Molecular Formula</td>
<td>MnSO₄.H₂O, H₂O</td>
</tr>
<tr>
<td>pH</td>
<td>3.8 [Acidic.]</td>
</tr>
<tr>
<td>Boiling/Condensation Point</td>
<td>The lowest known value is 99.9°C (211.8°F) (Water).</td>
</tr>
<tr>
<td>Melting/Freezing Point</td>
<td>May start to solidify at -0.1°C (31.8°F) based on data for: Water.</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>Not available.</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>Not available.</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>Not available.</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>Not available.</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>0.36 (Water) compared to (n-Butyl Acetate =1)</td>
</tr>
<tr>
<td>LogKow</td>
<td>Not available.</td>
</tr>
</tbody>
</table>

Solubility Soluble in water.

Section 10. Stability and Reactivity
**Stability and Reactivity** The product is stable.

**Conditions of Instability** Not available.

**Incompatibility with** Highly reactive with oxidizing agents, metals. **Various Substances** Reactive with reducing agents. Non-reactive with acids. **Rem/Incompatibility** Not available.

**Hazardous Decomposition** SOx Products

**Hazardous Polymerization** Will not occur.

### Section 11. Toxicological Information

**RTECS Number:** Manganous Sulphate Monohydrate OP0893500 Water ZC01100000  
Toxicity LD50: Not available. LC50: Not available.

**Chronic Effects on** Not available. Humans

**Acute Effects on Humans**  
Hazardous in case of eye contact (irritant). Inflammation of the eye is characterized by redness, watering, and itching. Hazardous in case of skin contact (irritant). Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering. Non-permeator by skin. May be hazardous in case of inhalation. Hazardous in case of ingestion.

**Special Remarks on Other** MAY BE IRRITATING ON CONTACT WITH MUCOUS MEMBRANES. (Manganese Sulfate) Toxic Effects on Humans

**Synergetic Products** Not available. (Toxicologically)

**Irritancy**  
Draize Test: Not available.

**Sensitization** Not available.

**Carcinogenic Effects** This material is not known to cause cancer in animals or humans.

**Toxicity to Reproductive** Not available. System

**Teratogenic Effects** Not available.

**Mutagenic Effects** Not available.

### Section 12. Ecological Information

**Ecotoxicity** Not available.

**BOD5 and COD** Not available.

**Toxicity of the Products of Biodegradation**  
The products of degradation are less toxic than the product itself.

### Section 13. Disposal Considerations

**EPA Waste Number** Not available.
ATTACHMENT B

Treatment
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished. Always contact permitted waste disposer (TSD) to assure compliance with all Current local, State and Federal Regulations.

Section 14. Transport Information

DOT Classification Not available

TDG Classification Not available.

IMO/IMDG Classification Not available.

ICAO/IATA Classification Not available.

Section 15. Regulatory Information

U.S. Federal Regulations
TSCA 8(b) inventory: Manganese Sulfate; Water SARA 302/304/311/312 extremely hazardous substances: No products were found. SARA 302/304 emergency planning and notification: No products were found. SARA 302/304/311/312 hazardous chemicals: Manganese Sulfate SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Manganese Sulfate: Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard SARA 313 toxic chemical notification and release reporting: No products were found. Clean Water Act (CWA) 307: No products were found. Clean Water Act (CWA) 311: No products were found. Clean air act (CAA) 112 accidental release prevention: No products were found. Clean air act (CAA) 112 regulated flammable substances: No products were found. Clean air act (CAA) 112 regulated toxic substances: No products were found.

WHMIS (Canada)
Class D-2B: Material causing other toxic effects (TOXIC).
CEPA DSL: Water
This product has been classified in accordance with the hazard criteria of the Controlled Product Regulations and the MSDS contains all required information.

International Regulations

EINECS Manganese Sulfate 232-089-9 Water 231-791-2

DSCL (EEC) R38- Irritating to skin. R41- Risk of serious damage to eyes.
International Lists  Australia (NICNAS): Manganese Sulfate; Water Japan (MITI): Water Korea (TCCL): Water Philippines (RA6969): Manganese Sulfate; Water

China: No products were found.

State Regulations  New Jersey: Manganese Sulfate Solution, 38% California prop. 65: No products were found.

Section 16. Other Information

National Fire Protection Association (U.S.A.)
Specific Hazard

Changed Since Last Revision

Notice to Reader
The statements contained herein are based upon technical data that EMD Chemicals Inc. believes to be reliable, are offered for information purposes only and as a guide to the appropriate precautionary and emergency handling of the material by a properly trained person having the necessary technical skills. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use, storage and disposal of these materials and the safety and health of employees and customers and the protection of the environment. EMD CHEMICALS INC. MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE, WITH RESPECT TO THE INFORMATION HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS.
Material Safety Data Sheet

Section 1. Product and Company Identification

Product Name: Alkaline-Iodide-Azide Solution
Product Code: VW3301

Manufacturer: EMD Chemicals Inc.
P.O. Box 70
480 Democrat Road Gibbstown, NJ 08027
Prior to January 1, 2003 EMD Chemicals Inc. was EM Industries, Inc. or EM Science, Division of EM Industries, Inc.

Effective Date: 9/9/2004
Print Date: 9/9/2004

For More Information Call: 856-423-6300
In Case of Emergency Call: 800-424-9300 CHEMTREC (USA) Monday-Friday: 8:00 AM - 5:00 PM
613-996-6666 CANUTEC (Canada) 24 Hours/Day: 7 Days/Week

None.

Synonym

Material Uses: Analytical reagent.

Chemical Family: Solution.

Section 2. Composition and Information on Ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>7732-18-5</td>
<td>20-50</td>
</tr>
<tr>
<td>Sodium Azide</td>
<td>26628-22-8</td>
<td>0-1</td>
</tr>
<tr>
<td>Sodium Iodide</td>
<td>7681-82-5</td>
<td>15-40</td>
</tr>
<tr>
<td>Sodium Hydroxide</td>
<td>1310-73-2</td>
<td>15-40</td>
</tr>
</tbody>
</table>

Section 3. Hazards Identification

Physical State and Liquid: Liquid. Appearance

Emergency Overview: DANGER! CAUSES EYE AND SKIN BURNS. HARMFUL IF INHALED OR SWALLOWED. MAY BE HARMFUL IF ABSORBED THROUGH SKIN. CAUSES RESPIRATORY TRACT IRRITATION. CONTAINS MATERIAL WHICH CAUSES DAMAGE TO THE FOLLOWING ORGANS: KIDNEYS, LUNGS, RESPIRATORY TRACT, SKIN, CENTRAL NERVOUS SYSTEM, EYE, LENS OR CORNEA.

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Potential Acute Health Effects

Eyes: Hazardous in case of eye contact (corrosive). Causes eye burns.

Skin: Hazardous in case of skin contact (corrosive). Skin contact produces burns. May be hazardous in case of skin contact (permeator).

Inhalation: Hazardous in case of inhalation (lung irritant).

Ingestion: Hazardous in case of ingestion.

Potential Chronic Health Effects
Carcinogenic Effects  This material is not known to cause cancer in animals or humans. Additional information See Toxicological Information (section 11)

Medical Conditions  Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe Aggravated by skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract Overexposure: irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

### Section 4. First Aid Measures

**Eye Contact**  Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

**Skin Contact**  In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

**Inhalation**  If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

**Ingestion**  If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

### Section 5. Fire Fighting Measures

**Flammability of the**  Non-flammable. **Product**

**Auto-ignition**  Not applicable. **Temperature**

**Flash Points**  Not applicable.

**Flammable Limits**  Not applicable.

**Products of Combustion**  Not available.

**Fire Hazards in Presence of Various Substances**  Not applicable.

**Explosion Hazards in Presence of Various Substances**

- Risks of explosion of the product in presence of static discharge: No.
- Risks of explosion of the product in presence of mechanical impact: No.

**Fire Fighting Media and Instructions**  Not applicable.

**Protective Clothing (Fire)**  Not applicable.

**Special Remarks on Fire Hazards**  Not available.

**Special Remarks on Explosion Hazards**  Forms explosion sensitive compounds with some metals such as lead, silver, mercury and copper. (Sodium Azide)

### Accidental Release Measures

**Small Spill and Leak**  Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

**Large Spill and Leak**  Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get
ATTACHMENT C

water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

**Spill Kit Information** The following EMD Chemicals Inc. SpillSolv ® absorbent is recommended for this product: SX1320 Caustic Treatment Kit

### Section 7. Handling and Storage

**Handling** Do not ingest. Do not breathe vapor or mist. Keep container closed. Do not get in eyes, on skin, or on clothing.

**Storage** Keep container in a cool, well-ventilated area.

### Section 8. Exposure Controls/Personal Protection

**Engineering Controls** Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective occupational exposure limits. Ensure that eyewash stations and safety showers are proximal to the work-station location.

**Personal Protection**

- **Eyes** Face shield.
- **Body** Full suit.
- **Respiratory** Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
- **Hands** Gloves.
- **Feet** Boots.

**Protective Clothing (Pictograms)**

[Images of protective clothing]

**Personal Protection in Case of a Large Spill**

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Sodium Azide</strong></td>
<td></td>
</tr>
<tr>
<td>Sodium Iodide Sodium Hydroxide</td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>ACGIH (United States, 1996).</strong></td>
<td>CEIL: 0.29 mg/m$^3$ Form: Vapor</td>
</tr>
<tr>
<td></td>
<td>CEIL: 0.11 ppm Form: Vapor</td>
</tr>
<tr>
<td><strong>NIOSH REL (United States, 1994). Skin</strong></td>
<td>CEIL: 0.3 mg/m$^3$ Form: As NaN3</td>
</tr>
<tr>
<td></td>
<td>CEIL: 0.1 ppm Form: As HN3</td>
</tr>
<tr>
<td><strong>OSHA Final Rule (United States, 1989). Skin</strong></td>
<td>CEIL: 0.3 mg/m$^3$ CEIL: 0.1 ppm Not available.</td>
</tr>
<tr>
<td><strong>ACGIH (United States).</strong></td>
<td>CEIL: 2 mg/m$^3$</td>
</tr>
<tr>
<td><strong>OSHA (United States).</strong></td>
<td>CEIL: 2 mg/m$^3$</td>
</tr>
<tr>
<td><strong>AUVA (Austria, 1995).</strong></td>
<td>Spitzenbegrenzung: 4 mg/m$^3$ 8 times per shift, 5 minute(s).</td>
</tr>
</tbody>
</table>
TWA: 2 mg/m³ 8 hour(s).

Belgium Minister of Labour (Belgium, 1998).
   CEIL: 2 mg/m³
   VL: 2 mg/m³ 8 hour(s).

BAUA (Germany, 1997).
   Spitzenbegrenzung: 2 mg/m³
   TWA: 2 mg/m³ 8 hour(s).

DK-Arbejdstyssinet (Denmark, 1996).
   Loftværdi: 2 mg/m³
   GV: 2 mg/m³ 8 hour(s).

Tyterveylaitos (Finland, 1998).
   TWA: 2 mg/m³ 8 hour(s).

INRS (France, 1996).
   VME: 2 mg/m³ 8 hour(s).

National Authority for Occupational Safety/Health (Ireland, 1999).
   STEL: 2 mg/m³ 15 minute(s).

Arbeidsinspectie (Netherlands, 1999).
   MAC-C: 2 mg/m³
   TGG 8 uur: 2 mg/m³ 8 hour(s).

N-Arbeidstysselinet (Norway, 1996).
   AN: 2 mg/m³ 8 hour(s).

AFS (Sweden, 1996).
   KTV: 2 mg/m³ 15 minute(s).

EH40-OES (United Kingdom (UK), 1997).
   STEL: 2 mg/m³ 15 minute(s).

NIOSH REL (United States, 1994).
   CEIL: 2 mg/m³

OSHA Final Rule (United States, 1989).
   CEIL: 2 mg/m³
Section 9. Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odor</td>
<td>Not available.</td>
</tr>
<tr>
<td>Color</td>
<td>Not available.</td>
</tr>
<tr>
<td>Physical State and Appearance</td>
<td>Liquid.</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Molecular Formula</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>pH</td>
<td>Not available.</td>
</tr>
<tr>
<td>Boiling/Condensation Point</td>
<td>The lowest known value is 99.9°C (211.8°F) (Water).</td>
</tr>
<tr>
<td>Melting/Freezing Point</td>
<td>May start to solidify at -0.1°C (31.8°F) based on data for: Water.</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>The only known value is 2.13 (Water = 1) (Sodium Hydroxide).</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>Not available.</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>Not available.</td>
</tr>
<tr>
<td>Odor Threshold</td>
<td>Not available.</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>0.36 (Water) compared to (n-BUTYL ACETATE=1)</td>
</tr>
<tr>
<td>LogKow</td>
<td>Not available.</td>
</tr>
<tr>
<td>Solubility</td>
<td>Soluble in water.</td>
</tr>
</tbody>
</table>

Section 10. Stability and Reactivity

Stability and Reactivity: The product is stable.
Conditions of Instability: Not available.

Incompatibility with: Reactive with acids.
Various Substances: Slightly reactive to reactive with oxidizing agents, organic materials, metals.
Rem/Incompatibility: Contact with acids liberates toxic gas. (Sodium Azide)

Hazardous Decomposition: Nitrogen oxides (NO, NO2...) Products
Hazardous Polymerization: Will not occur.
### Section 11. Toxicological Information

<table>
<thead>
<tr>
<th>RTECS Number:</th>
<th>Water ZC0110000</th>
<th>Sodium Azide VY8050000</th>
<th>Sodium Iodide WB6475000</th>
<th>Sodium Hydroxide WB4900000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxicity</td>
<td>Acute oral toxicity (LD₅₀): 4340 mg/kg [Rat]. (SODIUM IODIDE).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Chronic Effects on Humans
- Not available.

#### Acute Effects on Humans
- Hazardous in case of eye contact (corrosive). Causes eye burns.
-接触 (腐蚀性). Skin contact produces burns. May be hazardous in case of skin contact (permeator).
- Hazardous in case of inhalation (lung irritant).
- Hazardous in case of ingestion.

#### Synergetic Products (Toxicologically)
- Not available.

#### Irritancy
- Draize Test: Not available.

#### Sensitization
- Not available.

#### Carcinogenic Effects
- This material is not known to cause cancer in animals or humans.

#### Toxicity to Reproductive System
- Not available.

#### Teratogenic Effects
- Not available.

### Mutagenic Effects
- Not available.

#### Information
- Ecotoxicity: Not available.
- BOD₅ and COD: Not available.

#### Toxicity of the Products of
- The products of degradation are less toxic than the product itself.

### Section 13. Disposal Considerations

| EPA Waste Number | D002 P105 |

#### Treatment
- Specified Technology - Neutralize to pH 6-9. Contact your local permitted waste disposal site (TSD) for permissible treatment sites. Always contact a permitted waste disposal (TSD) to assure compliance with all current local, state, and Federal Regulations.
Section 14. Transport Information

DOT Classification Not available.

TDG Classification Not available.

IMO/IMDG Not available. Classification

ICAO/IATA Not available. Classification

Section 15. Regulatory Information

U.S. Federal Regulations TSCA 8(b) inventory: Water; Sodium Azide; SODIUM IODIDE; Sodium Hydroxide SARA 302/304/311/312 extremely hazardous substances: Sodium Azide SARA 302/304 emergency planning and notification: Sodium Azide SARA 302/304/311/312 hazardous chemicals: Sodium Azide; SODIUM IODIDE; Sodium Hydroxide SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Sodium Azide: Immediate (Acute) Health Hazard; SODIUM IODIDE: Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard; Sodium Hydroxide: Immediate (Acute) Health Hazard

Clean Water Act (CWA) 307: No products were found.
Clean Water Act (CWA) 311: Sodium Hydroxide
Clean air act (CAA) 112 accidental release prevention: No products were found.

Clean air act (CAA) 112 regulated flammable substances: No products were found.
Clean air act (CAA) 112 regulated toxic substances: No products were found.

WHMIS (Canada) Class D-1B: Material causing immediate and serious toxic effects (TOXIC). Class D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

CEPA DSL: Water; Sodium Azide; SODIUM IODIDE; Sodium Hydroxide
This product has been classified in accordance with the hazard criteria of the Controlled Product Regulations and the MSDS contains all required information.

International Regulations

EINECS Water 231-791-2 Sodium Azide 247-852-1 SODIUM IODIDE 231-679-3 Sodium Hydroxide 215-185-5


International Lists  Australia (NICNAS): Water; Sodium Azide; SODIUM IODIDE; Sodium Hydroxide Japan (MITI): Water; Sodium Azide; SODIUM IODIDE; Sodium Hydroxide Korea (TCCL): Water; Sodium Azide; SODIUM IODIDE; Sodium Hydroxide Philippines (RA6969): Water; Sodium Azide; SODIUM IODIDE; Sodium Hydroxide

China: No products were found.

State Regulations Pennsylvania RTK: Sodium Azide: (environmental hazard, generic environmental hazard); Sodium Hydroxide: (environmental hazard, generic environmental hazard) Massachusetts RTK: Sodium Azide; Sodium Hydroxide New Jersey: Water; Sodium Azide; Sodium Hydroxide

California prop. 65: No products were found.
Section 16. Other Information

National Fire Protection Association (U.S.A.)

Changed Since Last Revision

Notice to Reader

The statements contained herein are based upon technical data that EMD Chemicals Inc. believes to be reliable, are offered for information purposes only and as a guide to the appropriate precautionary and emergency handling of the material by a properly trained person having the necessary technical skills. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use, storage and disposal of these materials and the safety and health of employees and customers and the protection of the environment.

EMD CHEMICALS INC. MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE, WITH RESPECT TO THE INFORMATION HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS.
ATTACHMENT D

FIELD DATA REPORT FORM
**FIELD DATA REPORT FORM**

<table>
<thead>
<tr>
<th>STATION NO.</th>
<th>STATION NAME</th>
<th>TIME</th>
<th>TEMP °C</th>
<th>DO mg/L</th>
<th>DO #</th>
<th>TEMP pH METER</th>
<th>TRUE pH</th>
<th>COND μMHOS/CM</th>
<th>BARO. PRESS. in. Hg</th>
<th>STAGE HEIGHT</th>
<th>CHK BAR/ WT LENGTH ADDTN</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

WEATHER, etc.:

<table>
<thead>
<tr>
<th>Relinquished By:</th>
<th>Received By:</th>
<th>Da</th>
<th>Hr</th>
<th>Mn</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

ECY 040-2-41 (Rev. 8/04)

* 1 = WWG 2 = Staff 3 = GH 4 = Tape Down 5 = Other (Specify above)
Material Safety Data Sheet

Sulfuric Acid, GR

Section 1. Product and Company Identification

P.O. Box 70480 Democrat Road Gibbstown, NJ 08027 856-423-6300 Technical Service Monday - Friday: 8:00 - 5:00 PM


613-996-6666 CANUTEC (Canada) 24 Hours/Day: 7 Days/Week

Section 2. Hazards Identification

Physical state: Liquid. (Clear viscous liquid.)  Odor: Odorless.  OSHA/HCS status: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview: DANGER! POISON! MAY BE FATAL IF INHALED, ABSORBED THROUGH SKIN OR SWALLOWED. CAUSES SEVERE EYE AND SKIN BURNS. CAUSES RESPIRATORY TRACT BURNS. OXIDIZER. CAUSES DAMAGE TO THE FOLLOWING ORGANS: LUNGS, MUCOUS MEMBRANES, RESPIRATORY TRACT, SKIN, EYE, LENS OR CORNEA, TEETH. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE.

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

Do not ingest. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Store in tightly-closed container. Avoid contact with combustible materials. Use only with adequate ventilation. Wash thoroughly after handling. Risk of cancer depends on duration and level of exposure.
Routes of entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects

<table>
<thead>
<tr>
<th>Eyes</th>
<th>Skin</th>
<th>Inhalation</th>
<th>Ingestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcinogenic effects</td>
<td>Severely corrosive to the eyes.</td>
<td>Very toxic in contact with skin. Severely corrosive to the skin.</td>
<td>Very toxic by inhalation. Corrosive to the respiratory system.</td>
</tr>
<tr>
<td>Mutagenic effects</td>
<td>Very toxic if swallowed. May cause burns to mouth, throat and stomach.</td>
<td>May cause cancer. Risk of cancer depends on duration and level of exposure.</td>
<td></td>
</tr>
<tr>
<td>Teratogenicity/Reproductive toxicity</td>
<td>No known significant effects or critical hazards.</td>
<td>No known significant effects or critical hazards.</td>
<td></td>
</tr>
</tbody>
</table>

Section 2. Hazards Identification

Medical conditions: Repeated skin exposure can produce local skin destruction or dermatitis. Repeated or aggravated by prolonged exposure to the substance can produce lung damage. Repeated or exposure prolonged contact with spray or mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to the substance can produce target organs damage.

See toxicological information (section 11)

Section 3. Composition/Information on Ingredients

<table>
<thead>
<tr>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfuric Acid</td>
</tr>
</tbody>
</table>

Section 4. First Aid Measures

Eye contact: Get medical attention immediately. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician.

Skin contact: Get medical attention immediately. Flush contaminated skin with plenty of water. Continue to rinse for at least 10 minutes. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing or wear gloves. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Inhalation: Get medical attention immediately. Move exposed person to fresh air. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. Keep person warm and at rest. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
Section 5. Fire Fighting Measures

Flammability of the product: This material increases the risk of fire and may aid combustion. Contact with combustible material may cause fire.

Extinguishing media

Suitable: Use an extinguishing agent suitable for the surrounding fire.

Not suitable: None known.

Special exposure hazards: Not available.

Special protective: Fire-fighters should wear appropriate protective equipment and self-contained breathing equipment for fire-fighters apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Special remarks on fire: Flammable hydrogen gas may be produced on prolonged contact with metals such as aluminum, tin, lead and zinc.

Section 6. Accidental Release Measures

Personal precautions: Immediately contact emergency personnel. Eliminate all ignition sources. Keep unnecessary personnel away. Use suitable protective equipment. Do not touch or walk through spilled material.

Environmental precautions: Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up: If emergency personnel are unavailable, contain spilled material. For small spills, add absorbent (soil may be used in the absence of other suitable materials) and use a non-sparking or explosion-proof means to
transfer material to a sealable, appropriate container for disposal. For large spills, dike spilled material or otherwise contain material to ensure runoff does not reach a waterway. Place spilled material in an appropriate container for disposal.

Section 7. Handling and Storage

Handling:
Do not ingest. Do not get in eyes or on skin or clothing. Keep container closed. Use only with adequate ventilation. Do not breathe vapor or mist. Store in tightly-closed container. Avoid contact with combustible materials. Wash thoroughly after handling.

Storage:
Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalis, reducing agents and combustibles.

Section 8. Exposure Controls/Personal Protection

<table>
<thead>
<tr>
<th>Product name</th>
<th>Exposure limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>ACGIH TLV (United States, 1/2006). Notes: Refers to Appendix A -Carcinogens. Thoracic fraction. See Appendix C, paragraph B. Thoracic Particulate Mass TLVs (TPM–TLVs) for those materials that are hazardous when deposited anywhere within the lung airways and the gas-exchange region. Sulfuric acid contained in strong inorganic acid mists ACGIH 2004 Adoption TWA: 0.2 mg/m³ 8 hour/hours. Form: All forms NIOSH REL (United States, 12/2001). TWA: 1 mg/m³ 10 hour/hours. Form: All forms OSHA PEL (United States, 8/1997). TWA: 1 mg/m³ 8 hour/hours. Form: All forms OSHA PEL 1989 (United States, 3/1989). TWA: 1 mg/m³ 8 hour/hours. Form: All forms</td>
</tr>
</tbody>
</table>

Consult local authorities for acceptable exposure limits.

Engineering measures:
Use only with adequate ventilation. If user operations generate dust, fumes, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Personal protection:

Eyes:
Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts.
Recommended: splash goggles, face shield

Skin:
Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Body: Recommended: chemical-resistant protective suit

**Respiratory :**
Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

**Hands :**
Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: neoprene

**Hygiene measures :**
Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

### Section 9. Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Physical state</th>
<th>Color</th>
<th>Odor</th>
<th>Molecular weight</th>
<th>Molecular formula</th>
<th>Boiling/condensation point</th>
<th>Melting/freezing point</th>
<th>Relative density</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Liquid.</td>
<td>(Clear viscous liquid.)</td>
<td></td>
<td>H2-04-S</td>
<td>290°C (554°F)</td>
<td>10.56°C (51°F)</td>
<td>1.84 (Water = 1)</td>
</tr>
<tr>
<td></td>
<td>Colorless.</td>
<td></td>
<td>98.08 g/mole</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Odorless.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>0.1 kPa (1 mm Hg) (at 20°C)</td>
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<td>&gt;1 ppm</td>
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<td>&lt;1</td>
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</tr>
</tbody>
</table>
**Section 10. Stability and Reactivity**

**Stability and reactivity**: The product is stable.

**Incompatibility with various**: Extremely reactive or incompatible with reducing agents, combustible materials, organic substances, metals, acids, alkalis, moisture.

**Hazardous polymerization**: Will not occur.

**Conditions of reactivity**: Flammable in the presence of combustible materials

**Section 11. Toxicological Information**

**Toxicity data United States**

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>Sulfuric Acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD50 Oral</td>
<td>2140 mg/kg</td>
</tr>
<tr>
<td>LD50 Oral</td>
<td>2140 mg/kg</td>
</tr>
<tr>
<td>LC50 Inhalation</td>
<td>2140 mg/kg</td>
</tr>
<tr>
<td>320 mg/m3 (2 hour) Oral Inhalation</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Test Result</td>
</tr>
<tr>
<td>Rat</td>
<td>Route</td>
</tr>
<tr>
<td>Mouse</td>
<td>Species</td>
</tr>
</tbody>
</table>

**Chronic effects on humans**: CARCINOGENIC EFFECTS: Classified 1 (Proven for humans.) by IARC, 1 (Known to be human carcinogens.) by NTP. Classified A2 (Suspected for humans.) by ACGIH. Causes damage to the following organs: lungs, mucous membranes, upper respiratory tract, skin, eye, lens or cornea, teeth.

**Other toxic effects on humans**: Extremely hazardous in case of skin contact (corrosive, permeator), of eye contact (corrosive), of ingestion. Very hazardous in case of inhalation (lung corrosive).

**Specific effects**

**Carcinogenic effects**: May cause cancer. Risk of cancer depends on duration and level of exposure.

**Section 11. Toxicological Information**

- Mutagenic effects
- Teratogenicity /
  - Reproductive toxicity Sensitization
  - Ingestion
  - Inhalation
  - Eyes
  - Skin

: No known significant effects or critical hazards.
May cause burns to mouth, throat and stomach.
Corrosive to the respiratory system.
Severely corrosive to the eyes.
Severely corrosive to the skin.

Section 12. Ecological Information

Environmental precautions: No known significant effects or critical hazards.
Products of degradation: These products are sulfur oxides (SO₂, SO₃ etc.).
Toxicity of the products of: The products of degradation are less toxic than the product itself.

Section 13. Disposal Considerations

Waste disposal: The generation of waste should be avoided or minimized wherever possible. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements.

Disposal should be in accordance with applicable regional, national and local laws and regulations. Local regulations may be more stringent than regional or national requirements.

The information presented below only applies to the material as supplied. The identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSOAL PROTECTION for additional handling information and protection of employees.

Section 14. Transport Information

<table>
<thead>
<tr>
<th>Regulatory information</th>
<th>UN number</th>
<th>Proper shipping name</th>
<th>Class</th>
<th>PG*</th>
<th>Label</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT Classification</td>
<td>UN1830</td>
<td>SULFURIC ACID</td>
<td>8</td>
<td>II</td>
<td></td>
<td>Reportable quantity 1000 lbs. (453.6 kg)</td>
</tr>
</tbody>
</table>

PG*: Packing group
Section 15. Regulatory Information

United States HCS Classification: Oxidizing material Highly toxic material Corrosive material Carcinogen Target organ effects

U.S. Federal regulations: TSCA 8(b) inventory: Listed
- SARA 302/304/311/312 extremely hazardous substances: Sulfuric Acid
- SARA 302/304 emergency planning and notification: Sulfuric Acid
- SARA 302/304/311/312 hazardous chemicals: Sulfuric Acid

SARA 311/312 MSDS distribution - chemical inventory - hazard identification:
- Sulfuric Acid: reactive, Immediate (acute) health hazard, Delayed (chronic) health hazard
- Clean Water Act (CWA) 307: No products were found.
- Clean Water Act (CWA) 311: SULFURIC ACID
- Clean Air Act (CAA) 112 accidental release prevention: No products were found.
- Clean Air Act (CAA) 112 regulated flammable substances: No products were found.
- Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

SARA 313

Product name CAS number Concentration

Form R - Reporting: Sulfuric Acid 7664-93-9 100

Supplier notification: Sulfuric Acid 7664-93-9 100

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

State regulations:
- Pennsylvania RTK: SULFURIC ACID: (environmental hazard, generic environmental hazard) Massachusetts RTK: SULFURIC ACID New Jersey: SULFURIC ACID

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

Ingredient name Cancer Reproductive No significant risk level Maximum acceptable dosage level

Sulfuric Acid Yes. No. No. No.

Canada

WHMIS (Canada): Class C: Oxidizing material. Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
- Class E: Corrosive material

CEPA DSL/CEPA NDSL: CEPA DSL: SULFURIC ACID

This product has been classified according to the hazard criteria of the CPR and the MSDS contains all the
ATTACHMENT E

information required by the CPR.

**EU regulations Risk phrases**: This product is not classified according to EU legislation. **International regulations International lists**: Australia (NICNAS):

Sulfuric Acid China: Sulfuric Acid Germany water class:

Sulfuric Acid Japan (METI): Sulfuric Acid Korea (TCCL):

Sulfuric Acid Philippines (RA6969): Sulfuric Acid

Section 16. Other Information

**Label requirements**: DANGER!

POISON!
MAY BE FATAL IF INHALED, ABSORBED THROUGH SKIN OR SWALLOWED.
CAUSES SEVERE EYE AND SKIN BURNS.
CAUSES RESPIRATORY TRACT BURNS.
OXIDIZER.
CAUSES DAMAGE TO THE FOLLOWING ORGANS: LUNGS, MUCOUS MEMBRANES, RESPIRATORY TRACT, SKIN, EYE, LENS OR CORNEA, TEETH.
SUSPECT CANCER HAZARD.
MAY CAUSE CANCER.
CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE.

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

National Fire Protection Association (U.S.A.):

<table>
<thead>
<tr>
<th>Health</th>
<th>Instability Flammability</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>W</td>
</tr>
</tbody>
</table>

Special

Notice to reader

The statements contained herein are based upon technical data that EMD Chemicals Inc. believes to be reliable, are offered for information purposes only and as a guide to the appropriate precautionary and emergency handling of the material by a properly trained person having the necessary technical skills. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use, storage and disposal of these materials and the safety and health of employees and customers and the protection of the environment. EMD CHEMICALS INC. MAKES NO REPRESENTATION...
OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING
MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE, WITH
RESPECT TO THE INFORMATION HEREIN OR THE PRODUCT TO WHICH
THE INFORMATION REFERS.
Product Name: Sodium Thiosulfate 0.0250N

Manufacturer: EMD Chemicals Inc. P.O. Box 70 480 Democrat Road Gibbstown, NJ 08027
Prior to January 1, 2003 EMD Chemicals Inc. was EM Industries, Inc. or EM Science, Division of EM Industries, Inc.

Effective Date: 8/25/2005
Print Date: 10/5/2005

For More Information Call 856-423-6300 Technical Service Monday-Friday: 8:00 AM - 5:00 PM

800-424-9300 CHEMTREC (USA)
613-996-6666 CANUTEC (Canada)
24 Hours/Day: 7 Days/Week

In Case of Emergency Call

Synonym: None.

Material Uses: Laboratory Reagent

Chemical Family: Mixture.

Section 2. Composition and Information on Ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Thiosulfate</td>
<td>10102-17-7</td>
<td></td>
</tr>
<tr>
<td>Sodium Hydroxide</td>
<td>1310-73-2</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>7732-18-5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;0.8</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td></td>
<td>&gt;99</td>
<td></td>
</tr>
</tbody>
</table>

Section 3. Hazards Identification

Physical State and Appearance: Liquid.

Emergency Overview

CAUTION ! MAY CAUSE EYE AND SKIN IRRITATION. CONTAINS MATERIAL WHICH MAY CAUSE DAMAGE TO THE FOLLOWING ORGANS: LUNGS, RESPIRATORY TRACT, SKIN, EYE, LENS OR CORNEA.

Routes of Entry: Dermal contact. Eye contact. Inhalation.

Potential Acute Health Effects

Eyes: May be hazardous in case of eye contact (irritant).

Skin: May be hazardous in case of skin contact (irritant). Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Inhalation: No known acute effects of this product resulting from inhalation.
ATTACHMENT F

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Sodium Thiosulfate 0.0250N</th>
<th>Product Code</th>
<th>VW3227</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>EMD Chemicals Inc. P.O. Box 70 480 Democrat Road Gibbstown, NJ 08027 Prior to January 1, 2003 EMD Chemicals Inc. was EM Industries, Inc. or EM Science, Division of EM Industries, Inc.</td>
<td>Effective Date</td>
<td>8/25/2005</td>
</tr>
<tr>
<td>Print Date</td>
<td>10/5/2005</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For More Information Call</td>
<td>856-423-6300 Technical Service Monday-Friday: 8:00 AM - 5:00 PM</td>
<td>800-424-9300 CHEMTREC (USA) 613-996-6666 CANUTEC (Canada) 24 Hours/Day: 7 Days/Week In Case of Emergency Call</td>
<td></td>
</tr>
</tbody>
</table>

| Synonym | None. |
| Material Uses | Laboratory Reagent |
| Chemical Family | Mixture. |

Section 2. Composition and Information on Ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Thiosulfate Sodium Hydroxide Water</td>
<td>10102-17-7 1310-73-2 7732-18-5</td>
<td>&lt;0.8 &lt;0.2 &gt;99</td>
</tr>
</tbody>
</table>

Section 3. Hazards Identification

Physical State and Appearance | Liquid. |

Emergency Overview

CAUTION ! MAY CAUSE EYE AND SKIN IRRITATION. CONTAINS MATERIAL WHICH MAY CAUSE DAMAGE TO THE FOLLOWING ORGANS: LUNGS, RESPIRATORY TRACT, SKIN, EYE, LENS OR CORNEA.

Routes of Entry Dermal contact. Eye contact. Inhalation.

Potential Acute Health Effects

*Eyes* May be hazardous in case of eye contact (irritant).

*Skin* May be hazardous in case of skin contact (irritant). Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

*Inhalation* No known acute effects of this product resulting from inhalation.

*Ingestion* No known acute effects of this product resulting from ingestion.
Potential Chronic Health Effects

*Carcinogenic Effects* This material is not known to cause cancer in animals or humans.

Additional information See Toxicological Information (section 11)

Medical Conditions

Aggravated by

Overexposure:

Section 4. First Aid Measures

**Eye Contact** Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

**Skin Contact** In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

**Inhalation** If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

**Ingestion** Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Section 5. Fire Fighting Measures

**Flammability of the** Non-flammable. Product

**Auto-ignition** Not applicable. Temperature

**Flash Points** Not applicable.

**Flammable Limits** Not applicable.

**Products of Combustion** Not applicable.

**Fire Hazards in Presence** Not applicable. of Various Substances

**Explosion Hazards in** Risks of explosion of the product in presence of static discharge: No. Presence of Various Substances

Risks of explosion of the product in presence of mechanical impact: No.

**Fire Fighting Media** Not applicable. and Instructions

Not applicable.

**Special Remarks on Fire** Development of hazardous combustion gases or vapors possible in the event of fire. Hazards
**ATTACHMENT F**

**Special Remarks on Not available. Explosion Hazards**

### Section 6. Accidental Release Measures

**Small Spill and Leak** Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

**Large Spill and Leak** Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

**Spill Kit Information** No specific spill kit required for this product.

### Section 7. Handling and Storage

**Handling** Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

**Storage** Keep container tightly closed. Keep container in a cool, well-ventilated area.

### Section 8. Exposure Controls/Personal Protection

**Engineering Controls** Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective occupational exposure limits.

**Personal Protection**

- **Eyes** Face shield.

- **Body** Full suit.

- **Respiratory** Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

- **Hands** Gloves.

- **Feet** Boots.

**Protective Clothing (Pictograms)**

**Personal Protection in Case of a Large Spill** Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Product Name**

- Sodium Thiosulfate Not available.
- Sodium Hydroxide ACGIH (United States). CEIL: 2 mg/m³
- OSHA (United States). CEIL: 2 mg/m³
- AUVA (Austria, 1995). Spitzenbegrenzung: 4 mg/m³ 8 times per shift, 5 minute(s). TWA: 2 mg/m³ 8 hour(s).

---

X:\EA PROGRAM\ECYEAPSOP\Approved SOPs\ECY_EAP_SOP_CollectionandAnalysisofDOWinklerMethod_v2_3EAP023.docx_6/18/2007_Page 50
Belgium Minister of Labour (Belgium, 1998).
   CEIL: 2 mg/m
   VL: 2 mg/m 8 hour(s).

BAUA (Germany, 1997).
   Spitzenbegrenzung: 2 mg/m³ TWA: 2 mg/m³ 8 hour(s).

DK-Årsbejdstyssinet (Denmark, 1996).
   Loftværdi: 2 mg/m³ GV: 2 mg/m³ 8 hour(s).

Tyterveetslaitos (Finland, 1998).
   TWA: 2 mg/m³ 8 hour(s).

INRS (France, 1996).
   VME: 2 mg/m³ 8 hour(s).

National Authority for Occupational Safety/Health (Ireland, 1999).
   STEL: 2 mg/m 15 minute(s).

Arbeidsinspectie (Netherlands, 1999).
   MAC-C: 2 mg/m³
   TGG 8 uur: 2 mg/m³ 8 hour(s).

N-Arbeidstyssinet (Norway, 1996).
   AN: 2 mg/m³ 8 hour(s).

AFS (Sweden, 1996).
   KTV: 2 mg/m³ 15 minute(s).

EH40-OES (United Kingdom (UK), 1997).
   STEL: 2 mg/m 15 minute(s).

NIOSH REL (United States, 1994).
   CEIL: 2 mg/m³

OSHA Final Rule (United States, 1989).
   CEIL: 2 mg/m³ Water Not available.

### Section 9. Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odor</td>
<td>Odorless.</td>
</tr>
<tr>
<td>Color</td>
<td>Clear. Colorless.</td>
</tr>
<tr>
<td>Physical State and Appearance</td>
<td>Liquid.</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Molecular Formula</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>pH</td>
<td>Not available.</td>
</tr>
<tr>
<td>Boiling/Condensation Point</td>
<td>The lowest known value is 99.9°C (211.8°F) (Water).</td>
</tr>
<tr>
<td>Melting/Freezing Point</td>
<td>May start to solidify at -0.1°C (31.8°F) based on data for: Water.</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>Not available.</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>Not available.</td>
</tr>
</tbody>
</table>
Vapor Density          Not available.
Odor Threshold         Not available.
Evaporation Rate       0.36 (Water) compared to (n-Butyl Acetate =1)
LogK_{ow}              Not available.
Solubility             Soluble in water.

**Section 10. Stability and Reactivity**

Incompatibility with Not available.
Various Substances
Rem/Incompatibility Not available.

**Hazardous Decomposition** Not available. **Products**

**Hazardous Polymerization** Will not occur.

**Section 11. Toxicological Information**

<table>
<thead>
<tr>
<th>RTECS Number</th>
<th>Sodium Thiosulfate</th>
<th>WE6660000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sodium Hydroxide</td>
<td>WB4900000</td>
</tr>
<tr>
<td></td>
<td>Water</td>
<td>ZC0110000</td>
</tr>
</tbody>
</table>

**Toxicity**

<table>
<thead>
<tr>
<th>LD_{50}</th>
<th>Not available.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC_{50}</td>
<td>Not available.</td>
</tr>
</tbody>
</table>

**Chronic Effects on**
Humans                Not available.

**Acute Effects on**
Humans                May be hazardous in case of eye contact (irritant). May be hazardous in case of skin contact (irritant). Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

**Synergetic Products**
(Toxicologically)     Not available.

**Irritancy**
Draize Test: Not available.

**Sensitization**
Not available.

**Carcinogenic Effects**
This material is not known to cause cancer in animals or humans.

**Toxicity to**
Reproductive System
Not available.

**Teratogenic Effects**
Not available.

**Mutagenic Effects**
Not available.
Section 12. Ecological Information

Ecotoxicity
Not available.

BOD5 and COD
Not available.

Toxicity of the Products of Biodegradation
The product itself and its products of degradation are not toxic.

Section 13. Disposal Considerations

EPA Waste Number
Not available.

Treatment
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished.

Section 14. Transport Information

DOT Classification
Not available.

TDG Classification
Not available.

IMO/IMDG Classification
Not available.

ICAO/IATA Classification
Not available.

Section 15. Regulatory Information

U.S. Federal Regulations

TSCA 8(b) inventory: Sodium Thiosulfate; Sodium Hydroxide; Water
SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: Sodium Thiosulfate; Sodium Hydroxide
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Sodium Thiosulfate: Immediate (Acute) Health Hazard; Sodium Hydroxide: Immediate (Acute) Health Hazard

SARA 313 toxic chemical notification and release reporting: No products were found.
Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: Sodium Hydroxide
Clean air act (CAA) 112 accidental release prevention: No products were found.
Clean air act (CAA) 112 regulated flammable substances: No products were found.

Clean air act (CAA) 112 regulated toxic substances: No products were found.
ATTACHMENT F

WHMIS (Canada)  
Class D-2A: Material causing other toxic effects (VERY TOXIC).

CEPA DSL: SODIUM HYDROXIDE; Water This product has been classified in accordance with the hazard criteria of the Controlled Product Regulations and the MSDS contains all required information. Sodium Thiosulfate 231-867-5 Sodium Hydroxide 215-185-5 Water 231-791-2

International Regulations EINECS

International Lists  
Australia (NICNAS): Sodium Thiosulfate; Sodium Hydroxide; Water Japan (MITI): Sodium Thiosulfate; Sodium Hydroxide; Water Korea (TCCL): Sodium Hydroxide; Water Philippines (RA6969): Sodium Thiosulfate; Sodium Hydroxide; Water

China: No products were found.

State Regulations  
Pennsylvania RTK: Sodium Hydroxide: (environmental hazard, generic environmental hazard) Massachusetts RTK: Sodium Hydroxide New Jersey: Sodium Thiosulphate 0.0250N

California prop. 65: No products were found.

Section 16. Other Information

Notice to Reader
The statements contained herein are based upon technical data that EMD Chemicals Inc. believes to be reliable, are offered for information purposes only and as a guide to the appropriate precautionary and emergency handling of the material by a properly trained person having the necessary technical skills. Users should consider these data only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use, storage and disposal of these materials and the safety and health of employees and customers and the protection of the environment. EMD CHEMICALS INC. MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE, WITH RESPECT TO THE INFORMATION HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS.
Material Safety Data Sheet

Section 1. Product and Company Identification

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Potassium Biiodate 0.0250N</th>
<th>Product Code</th>
<th>VW3452</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>EMD Chemicals Inc. P.O. Box 70 480 Democrat Road Gibbstown, NJ 08027 Prior to January 1, 2003 EMD Chemicals Inc. was EM Industries, Inc. or EM Science, Division of EM Industries, Inc.</td>
<td>Effective Date</td>
<td>3/4/2003 5/3/2004</td>
</tr>
</tbody>
</table>

For More Information Call 856-423-6300 Technical Service Monday-Friday: 8:00 AM - 5:00 PM

800-424-9300 CHEMTREC (USA)
613-996-6666 CANUTEC (Canada)
24 Hours/Day; 7 Days/Week In Case of Emergency Call

Synonym None.

Material Uses Laboratory Reagent

Chemical Family Solution.

Section 2. Composition and Information on Ingredients

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS #</th>
<th>% by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>POTASSIUM BIIODATE Water</td>
<td>13455-24-8 7732-18-5</td>
<td>&lt;1 &gt;99</td>
</tr>
</tbody>
</table>

Section 3. Hazards Identification

Physical State and Liquid. Appearance
Emergency Overview CAUTION!
Handle care generally in keeping with safe laboratory practices is recommended.

Routes of Entry Inhalation. Ingestion.

Potential Acute Health Effects

Eyes No known effect on eye contact, rinse with water for a few minutes.

Skin No known effect on skin contact; rinse with water for a few minutes.

Inhalation No known acute effects of this product resulting from inhalation.

Ingestion No known acute effects of this product resulting from ingestion.

Potential Chronic Health Effects
Carcinogenic Effects  This material is not known to cause cancer in animals or humans. Additional information See Toxicological Information (section 11)

Medical Conditions Repeated or prolonged exposure is not known to aggravate medical condition.

Aggravated by Overexposure:

Eye Contact Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention if irritation occurs.

Skin Contact Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.

Inhalation If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Ingestion Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

### Section 5. Fire Fighting Measures

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammability of the Product</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Auto-ignition Temperature</td>
<td>Non-flammable.</td>
</tr>
<tr>
<td>Flash Points</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Flammable Limits</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Products of Combustion</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Fire Hazards in Presence of</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Various Substances</td>
<td></td>
</tr>
<tr>
<td>Explosion Hazards in Presence of Various Substances</td>
<td>Risks of explosion of the product in presence of static discharge: No.</td>
</tr>
<tr>
<td></td>
<td>Risks of explosion of the product in presence of mechanical impact: No.</td>
</tr>
<tr>
<td>Fire Fighting Media and</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Instructions</td>
<td></td>
</tr>
<tr>
<td>Protective Clothing (Fire)</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Special Remarks on Fire</td>
<td>Not available.</td>
</tr>
<tr>
<td>Hazards</td>
<td></td>
</tr>
<tr>
<td>Special Remarks on Explosion</td>
<td>Not available.</td>
</tr>
<tr>
<td>Hazards</td>
<td></td>
</tr>
</tbody>
</table>
### Section 6. Accidental Release Measures

**Small Spill and Leak** Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

**Large Spill and Leak** Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

**Spill Kit Information** No specific spill kit required for this product. **Storage** Keep container tightly closed. Keep container in a cool, well-ventilated area.

### Section 8. Exposure Controls/Personal Protection

**Engineering Controls** Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

**Personal Protection**

- **Eyes** Safety glasses.
- **Body** Lab coat.
- **Respiratory** Vapor respirator. Be sure to use an approved/certified respirator or equivalent.
- **Hands** Gloves.
- **Feet** Not applicable.

**Protective Clothing (Pictograms)**

**Personal Protection in Case of a Large Spill** Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>POTASSIUM BIODATE</td>
<td>Not available.</td>
</tr>
<tr>
<td>Water</td>
<td>Not available.</td>
</tr>
</tbody>
</table>

### Section 9. Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odor</td>
<td>Odorless.</td>
</tr>
<tr>
<td>Color</td>
<td>Clear. Colorless.</td>
</tr>
<tr>
<td>Physical State and Appearance</td>
<td>Liquid.</td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>Not applicable.</td>
</tr>
<tr>
<td>Molecular Formula</td>
<td>Not applicable.</td>
</tr>
</tbody>
</table>
### Section 10. Stability and Reactivity

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>pH</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Boiling/Condensation Point</strong></td>
<td>The lowest known value is 99.9°C (211.8°F) (Water).</td>
</tr>
<tr>
<td><strong>Melting/Freezing Point</strong></td>
<td>May start to solidify at -0.1°C (31.8°F) based on data for: Water.</td>
</tr>
<tr>
<td><strong>Specific Gravity</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Vapor Pressure</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Vapor Density</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Odor Threshold</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Evaporation Rate</strong></td>
<td>0.36 (Water) compared to (n-BUTYL ACETATE=1)</td>
</tr>
<tr>
<td><strong>LogK&lt;sub&gt;ow&lt;/sub&gt;</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Solubility</strong></td>
<td>Soluble in water.</td>
</tr>
</tbody>
</table>

**Stability and Reactivity** The product is stable.

**Conditions of Instability** Not available.

**Incompatibility with** Highly reactive with reducing agents.

**Various Substances Rem/Incompatibility** Not available.

**Hazardous Decomposition** Not available. **Products**

**Hazardous Polymerization** Will not occur.

### Section 11. Toxicological Information

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RTECS Number:</strong></td>
<td>Potassium Biiodate</td>
</tr>
<tr>
<td></td>
<td>Water</td>
</tr>
<tr>
<td><strong>Toxicity</strong></td>
<td>LD&lt;sub&gt;50&lt;/sub&gt;: Not available.</td>
</tr>
<tr>
<td></td>
<td>LC&lt;sub&gt;50&lt;/sub&gt;: Not available.</td>
</tr>
<tr>
<td><strong>Chronic Effects on Humans</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Acute Effects on Humans</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Synergetic Products (Toxicologically)</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Irritancy</strong></td>
<td>Draize Test: Not available.</td>
</tr>
<tr>
<td><strong>Sensitization</strong></td>
<td>Not available.</td>
</tr>
<tr>
<td><strong>Carcinogenic Effects</strong></td>
<td>This material is not known to cause cancer in animals or humans.</td>
</tr>
</tbody>
</table>

**Toxicity**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LD&lt;sub&gt;50&lt;/sub&gt;</td>
<td>Not available.</td>
</tr>
<tr>
<td>LC&lt;sub&gt;50&lt;/sub&gt;</td>
<td>Not available.</td>
</tr>
</tbody>
</table>

**ZC0110000**
Toxicity to Reproductive System Not available.

Teratogenic Effects Not available.

Mutagenic Effects Not available.

**Section 12. Ecological Information**

Ecotoxicity Not available.

**BOD5 and COD** Not available.

Toxicity of the Products of The product itself and its products of degradation are not toxic.

Biodegradation

**Section 13. Disposal Considerations**

**EPA Waste Number** Not available.

Treatment Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished. ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

**Section 14. Transport Information**

**DOT Classification** Not available.

**TDG Classification** Not available.

**IMO/IMDG Classification** Not available.

**ICAO/IATA Classification** Not available.

**Section 15. Regulatory Information**

**U.S. Federal Regulations**

TSCA 8(b) inventory: POTASSIUM BIIODATE; Water
SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: No products were found.
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: No products were found.
SARA 313 toxic chemical notification and release reporting: No products were found.

Clean Water Act (CWA) 307: No products were found.
Clean Water Act (CWA) 311: No products were found.

Clean air act (CAA) 112 accidental release prevention: No products were found.

Clean air act (CAA) 112 regulated flammable substances: No products were found.

Clean air act (CAA) 112 regulated toxic substances: No products were found.

<table>
<thead>
<tr>
<th>WHMIS (Canada)</th>
<th>Not controlled under WHMIS (Canada).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CEPA DSL; POTASSIUM BIIODATE; Water This product has been classified in accordance with the hazard criteria of the Controlled Product Regulations and the MSDS contains all required information. POTASSIUM BIIODATE 236-650-9 Water 231-791-2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>International Regulations EINECS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSCL (EEC)</td>
</tr>
<tr>
<td>This product is not classified according to the EU regulations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>International Lists</th>
<th>Australia (NICNAS): POTASSIUM BIIODATE; Water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Japan (MITI): POTASSIUM BIIODATE; Water</td>
</tr>
<tr>
<td></td>
<td>Korea (TCCL): POTASSIUM BIIODATE; Water</td>
</tr>
<tr>
<td></td>
<td>Philippines (RA6969): POTASSIUM BIIODATE; Water</td>
</tr>
</tbody>
</table>

| China: No products were found. |

<table>
<thead>
<tr>
<th>State Regulations</th>
<th>New Jersey: Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>California prop. 65: No products were found.</td>
<td></td>
</tr>
</tbody>
</table>

**Section 16. Other Information**

**National Fire**

<table>
<thead>
<tr>
<th>Protection Association (U.S.A.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Hazard</td>
</tr>
<tr>
<td>Reactivity</td>
</tr>
<tr>
<td>Specific Hazard</td>
</tr>
</tbody>
</table>

Changed Since Last Revision
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