

**SIGMA CAT 2195 (DMEA)  
AMINE SCRUBBER SOLUTION  
SAFE HANDLING GUIDE &  
AMINE RECOVERY PROGRAM**

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# CHEMTECH SERVICES, INC.

## AMINE SCRUBBER SOLUTION SAFE HANDLING GUIDE & AMINE RECOVERY PROGRAM

### Introduction

The use of amines in the foundry industry dates back to the introduction of the Phenolic Urethane Cold Box Process in (PUCB) 1967. Low boiling point amines provided the chemical means to introduce catalysts into closed box tooling, containing sand mixtures, and achieve a near instantaneous cure of the sand core. The commercial development of this cold curing chemical process required vapor generation and containment systems related to the handling of the amine catalyst, and disposal methods associated with the unconsumed catalyst which was invariably a part of the process.

Chemical scrubber technology was widely used in the chemical industry when the PUCB was introduced, and this technology was quickly applied to capturing the amine effluent as it exited the core making machines. The use of chemical scrubbers operating with phosphoric and sulfuric acid became the preferred amine vapor capture method which effectively removed the amine VOC's from the carrier gas prior to discharge into the atmosphere. However, the disposal of the saturated scrubber solution (amine sulfate) presented an issue which became more significant as municipal treatment facilities and regulatory agencies imposed more restrictions on liquid waste disposal.

An alternative to liquid waste disposal is available, which involves the recovery of amine from the amine sulfate solution scrubber solution. The chemistry of the recovery requires a chemical reaction with the amine sulfate solution and results in the formation of an alternative salt and the release of an amine/water solution which can be subsequently distilled to yield a pure amine solution. Chemtech Services, Inc., has developed the process technology required to conduct the required reaction and distillation procedures, and offers this service to foundries qualified to participate in the program.

### Qualifying for the scrubber solution program

Chemtech Services, Inc., accepts for recovery, amine saturated scrubber solution (acid based –  $H_2SO_4$ ) shipped from those foundries which it has pre-qualified for participation in the program. Qualification requires a number of prerequisites which include:

1. Corporate sponsor, typically the supplier of amine to the foundry.
2. Approved SOP related to the correct charging of acid solution into the scrubber.
3. Scrubber monitoring program where pH and SG are measured and controlled.
4. Approved SOP related to the discharge, packaging and labeling of scrubber solution being shipped to Chemtech.
5. Shipment of saturated scrubber solution (by participating foundry) to Chemtech's facility in Joliet, Illinois, freight prepaid.

Chemtech will assist foundries in the preparation of monitoring programs and procedures related to points 2 – 4 above. The purpose of the SOP's is: (A) to assure a safe operating procedure is used when handling the acidic solution; and (B) to assure that the amine sulfate concentration is sufficiently high (but below a pH of 4.0) which allows the economic recovery of high quality amine. The following sections will provide more detail in relation to operating procedures and monitoring methods to assure safety in your operation and that the amine concentration in your acid scrubber is adequate to insure economic recovery.

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### A. ACID CHARGING OF THE SCRUBBER

Acid scrubbers for the PUCB Process are available from a number of equipment manufacturers and all models should come with an "Operating Manual" which describes the manufacturers recommendations for the safe charging and operation of the equipment. Suggestions in this guide are not intended to replace the manufacturers operating manual, but serve as additional guidelines to insure the suitability of the discharged saturated solution for economic recovery.

- **General design and operating principals.** Most acid scrubbers are manufactured with similar design parameters and the subsequent operation follows the same principals. The basic components of the scrubber are: (1) the treatment tower or column; (2) the acid solution reservoir; (3) solution circulating pump; (4) pH meter; (5) level control and operating system; and (6) exhaust blower to atmosphere. The basic operating principal of the scrubber is that an acid solution is pumped from the reservoir and introduced into the top of the treatment tower where it reacts with amine vapor (flowing up the tower in a counter flow direction) as it falls back to the reservoir. The most popular scrubber design is a "packed tower" design which uses inert material in the treatment tower to increase the surface area coated by the acid solution and enhance the contact and reaction between the amine vapor and acid. The pH meter, level control and (if applicable) overall control system operate in a programmed fashion to assure makeup water enters the system as required (makeup water to replace losses through evaporation) and the pH of the system is constantly monitored to assure efficient scrubbing of the amine vapor.
- **Acid charging procedures.** Extreme caution needs to be exercised when initially charging or recharging the scrubber. Sulfuric acid is very corrosive and is harmful to employees coming into contact with the solution. Sulfuric acid rapidly penetrates clothing and will severely burn the skin and body tissue upon contact, so all precautions should be exercised to avoid worker exposure. A few operating suggestions are offered below:
  - ▶ Proper saturation of the scrubber solution for economic recovery of the amine requires a sulfuric acid concentration of approximately 30—40%  $H_2SO_4$  in a water solution. Many foundries elect to purchase "battery acid" for charging their scrubber which has a concentration of approximately 37%. Alternatively, higher concentrations of  $H_2SO_4$  may be used and diluted with water during the charging procedure.
  - ▶ If concentrated  $H_2SO_4$  is used, extreme caution should be exercised during the dilution process to avoid contact with workers. For example, always charge the acid into the water to avoid splashes of concentrated solution.
  - ▶ Make sure all components coming into contact with the acid solution (e.g., pumps, containers, plumbing lines and valves, packing materials, etc.) are acid resistant. Materials such as: PVC, Teflon and Kynar are suitable for use with acid scrubbers. Do not use copper based alloys.
  - ▶ The water used in the scrubber should be relatively soft and free of calcium, sodium or magnesium salts which will react with the acid and form a resilient on the surface of scrubber components including packing materials.

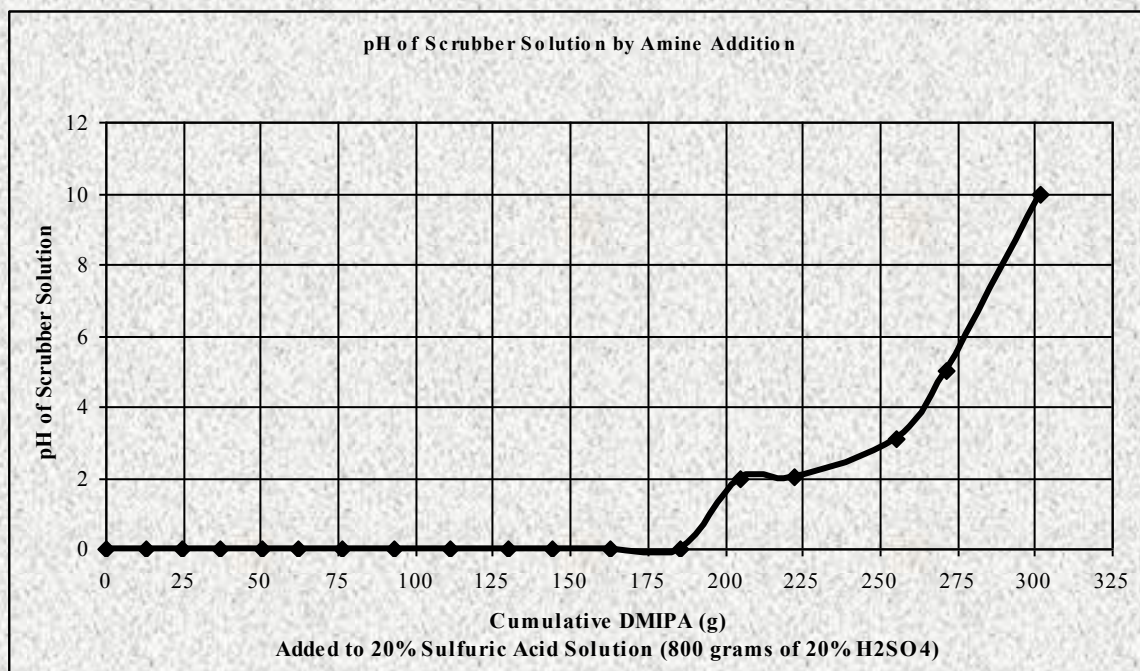
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### B. MONITORING THE SCRUBBER SOLUTION

To insure the economic and efficient operation of the acid scrubber, the concentration of the solution should be regularly monitored and recorded. There are two common measuring parameters for monitoring the scrubber solution: pH and Specific Gravity (SG). An acid scrubber charged with fresh acid (37%  $H_2SO_4$ ) will typically have a pH of 0, and a density of 10.5 lbs/gallon. As amine vapor is passed through the scrubber it reacts with the acid to form an amine sulfate salt. This reaction is actually a two step reaction progressing from the initially formed mono-ammonium sulfate salt to the final di-ammonium sulfate salt. As the pH of the solution progresses to 4.5, the maximum solubility of the amine salt is achieved and the scrubber solution is ready to be refreshed or exchanged. A number of operating parameters should be considered in relation to monitoring the scrubber solution:

- **pH is a prime indicator.** The pH of the acid solution will remain relatively unchanged (pH = 0) through the first stage of the reaction and until the second stage of the reaction is almost complete. The curve below indicates that approximately 70% of the saturation expected will be achieved before the pH rises above pH=0.00. Once the pH begins to increase, its rate of rise will be significant and must be closely monitored to preclude an increase above pH=4.0. When the pH reaches a value of pH=2.5, it is time to prepare for exchanging the solution. Under no circumstances should the pH be allowed to rise above pH=4.0. At levels above pH=5.0 the solution is less stable and the free amine content is likely to result in a noticeable amine odor and free amine content in the vicinity of the solution above 1ppm (1.0 part per million).

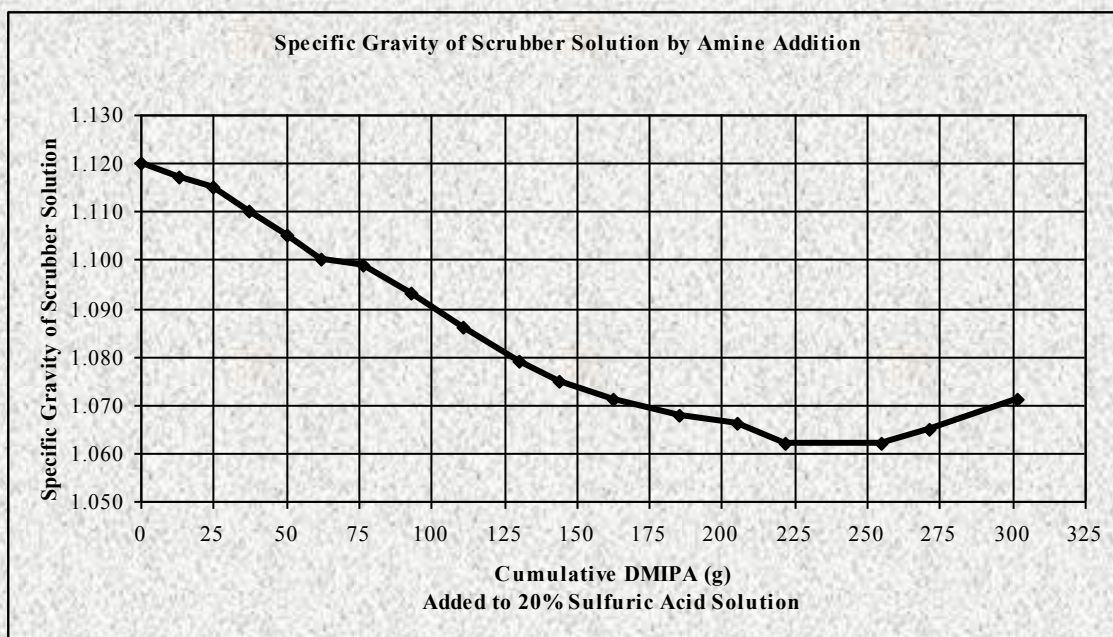


- **Specific Gravity is a useful tool.** SG can also be used in conjunction with the pH measurement to monitor the saturation (with amine) of the acid scrubber solution. Recognizing the amine molecule is relatively light compared to the sulfuric acid solution (e.g., 37% concentration), as amine saturates the acid solution, the SG will decrease and this trend will indicate the level of saturation.

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- **Specific Gravity is a useful tool (cont.).** Specific Gravity represents the ratio of the density of the material being tested vs. the density of water. As indicated previously, the density of a 37% concentration of sulfuric acid is approximately 10.5 lbs/gallon which represents a SG of approximately 1.27. The graph below was generated in conjunction with the pH graph presented in the previous section, and indicates the reduction in SG as the saturation of the acid solution with amine increases. As indicated, the SG gradually falls until saturation conditions are reached and free amine begins to move the slope of the curve to a positive value.



Chemtech recommends that both the pH of the solution and the Specific Gravity should be monitored to: (1) assure that the concentration of the scrubber is correct when it is recharged (e.g., start at SG > 1.25) and discharged (e.g., terminate after SG begins to increase); and (2) that pH level below pH < 4.0 is maintained to assure proper removal of the amine from the vapor stream and preclude discharge into the atmosphere.

### C. DISCHARGING SATURATED SCRUBBER SOLUTION

The scrubber solution will ultimately become saturated with the amine removed from the vapor discharged from the core box. The SG and the pH of the solution, as indicated in the above section, will serve as measurements of the saturation level and indicate when the solution needs to be discharged and replaced with fresh acid. Chemtech's qualification requirements (see below) may require the submission of scrubber solution samples to Chemtech (prior to discharge and shipment of the scrubber solution) before authorization is issued to the foundry to ship material to Chemtech for recycling. Provide Chemtech has: (1) tested a representative sample and issued a written authorization to ship the solution; or (2) Chemtech, based on previous test records, has authorized the foundry to ship scrubber solution without prior approval, IBC shipments of scrubber solution from qualified customers will be accepted at Chemtech's facility in Joliet, Illinois. A few important points need to be considered in relation to submitting samples or shipping scrubber solution to Chemtech:

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### C. DISCHARGING AND PACKAGING SATURATED SCRUBBER SOLUTION (Cont.)

- Scrubber solution will only be accepted when shipped in a IBC (intermediate bulk container) approved by Chemtech. The only three containers currently approved by Chemtech are: (i) 275 gallon Schutz Totes; (ii) 275 gallon Hoover Totes; and (iii) 275 gallon Mamour Totes. All of the above indicated containers are manufactured to the same dimensional characteristics and easily handled at Chemtech's site in Joliet. All other containers will be rejected upon receipt of shipment.
- The containers should be supplied from Chemtech and be free of any contaminant which may be detrimental to the recycling process. Do not use totes which previously contained resin or other petroleum products. Contaminated totes will be rejected upon receipt of shipment.
- Totes must be properly labeled. Chemtech will supply the appropriate product labels and corrosive placards with each empty tote shipment to customers. The customer is the shipper of record and is responsible to complete the label (see below, all areas shaded in yellow need to be completed) and apply it to the tote prior to shipment to Chemtech. The tote may not contain any other label or placard other than the label and placard supplied by Chemtech. Incorrect labeling and/or placarding may represent a violation of DOT regulations and the customers bears the responsibility for citations which may result from such violations.
- Do not ship any tote which has noticeable damage or leakage.
- All totes must be shipped freight prepaid. Chemtech will not accept scrubber solution totes which are shipped to the Joliet location freight collect.

<h2 style="margin: 0;">DMEA Sulfate Solution</h2>							
<small>Scrubber Sludge Destined for Recovery</small>							
<small>FOR INDUSTRIAL USE ONLY</small>							
<small>EMERGENCY TELEPHONE</small>							
<p style="text-align: center;"><b>WARNING!</b></p> <p><small>Causes chemical burns to eyes - Harmful if inhaled - Can cause burns to nose, throat and lungs - May be harmful if swallowed - Causes chemical burns to skin</small></p> <p><small>Wash thoroughly after handling. Always use appropriate Personal Protective Equipment (PPE). Do not breathe vapor. Use with adequate ventilation. Do not get on skin. Do not get in eyes.</small></p> <p style="text-align: center;"><b>FIRST AID</b></p> <p><small><b>INGESTION:</b> If accidentally swallowed, dilute by drinking large quantities of water. If the individual is drowsy or unconscious, do not give anything by mouth. Immediately contact poison control center or hospital emergency room for advice on whether to induce vomiting or for any other additional treatment directions.</small></p> <p><small><b>INHALATION:</b> If inhaled, remove to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician.</small></p> <p><small><b>SKIN:</b> Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing. Call a physician. Wash clothing before reuse.</small></p> <p><small><b>EYES:</b> Immediately flush eyes with plenty of water for at least 15 minutes. Eyelids should be held apart during irrigation to ensure water contact with entire surface of eyes and lids. Call a physician.</small></p>	<p style="text-align: center;"><b>FIRE AND EXPLOSION HAZARDS</b></p> <p><small>In case of fire, use dry chemical or CO<sub>2</sub>. Use water to keep fire-exposed containers cool. Wear full emergency protective equipment including NIOSH approved pressure demand self-contained breathing apparatus.</small></p> <p style="text-align: center;"><b>SPILL OR LEAK PROCEDURES</b></p> <p><small>Contain and/or absorb spill with inert material (e.g. sand, vermiculite), then place in a suitable container. For large spills, use water spray to disperse vapors and flush spill area. Prevent runoff from entering waterways or sewers. Use appropriate Personal Protective Equipment (PPE).</small></p> <p><small>Do not neutralize. Increasing pH above approximately 6.0 (standard units) may liberate flammable vapors.</small></p> <p style="text-align: center;"><b>WASTE DISPOSAL</b></p> <p><small>Recover free liquid. Absorb residue and dispose of according to local, state/provincial, and federal requirements. NOTE: This material may be reclassified as waste if diverted to disposal.</small></p> <p style="text-align: center;"><b>STORAGE PRECAUTIONS</b></p> <p><small>Keep container closed. Store in cool, dry area away from sun, heat, oxidizing materials and alkaline materials. Empty container may contain product residues. DO NOT cut, torch or reuse without commercial cleanser. Do not use air to unload bulk trucks. Unload using pumps or an inert gas, such as nitrogen. Store at room temperature. Do not store with strong alkalis or strong bases.</small></p> <p style="text-align: center;"><b>HAZARDOUS INGREDIENTS</b></p> <p><small>The ingredients listed below have been associated with one or more immediate and/or delayed(*) health hazards. Risk of damage and effects depends upon duration and level of exposure. BEFORE USING, HANDLING, OR EXPOSURE TO THESE INGREDIENTS, READ AND UNDERSTAND THE MSDS.</small></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;"><small>26292-53-5</small></td> <td style="width: 50%;"><small>Ethanediamine, N-ethyl-, sulfate</small></td> </tr> <tr> <td><small>7664-03-9</small></td> <td><small>Sulfuric Acid</small></td> </tr> <tr> <td><small>7732-18-5</small></td> <td><small>Water</small></td> </tr> </table>	<small>26292-53-5</small>	<small>Ethanediamine, N-ethyl-, sulfate</small>	<small>7664-03-9</small>	<small>Sulfuric Acid</small>	<small>7732-18-5</small>	<small>Water</small>
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<small>7732-18-5</small>	<small>Water</small>						
<p><b>LOT NO.:</b> _____</p> <p><b>GROSS WEIGHT:</b> _____</p> <p><b>TARE WEIGHT:</b> _____</p> <p><b>NET WEIGHT:</b> _____</p> <p style="text-align: center;"><small>Read MSDS Before Using Product</small></p> <p><small>DMEA Sulfate Solution 07/01/2005</small></p>	<p><b>FILL DATE:</b> _____</p> <p><b>Health</b> 3</p> <p><b>Flammability</b> 0</p> <p><b>Reactivity</b> 0</p> <p><small>Non-Emergency Telephone</small> _____</p> <p><small>Manufacturers Address Here</small> _____</p>						

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### D. SAMPLING SCRUBBER SOLUTION FOR QUALIFICATION

Chemtech requires all generators of scrubber solution to undergo a qualification procedure to assure the foundry is familiar with scrubber charging and monitoring procedures. During the qualification period the foundry will be required to submit representative samples of every batch of scrubber solution they intend to return to Chemtech for recycling.

Chemtech requires an 8 ounce sample of the scrubber solution to be submitted in a Hazmat qualified package to avoid leakage or breakage during transit. If the customer does not have proper packaging available they may request Hazmat packaging from Chemtech for the submittal of scrubber solution samples.

Scrubber solution samples should be directed to the following address:

Attention: Dave Casper  
Amine Recycling Program  
Chemtech Services, Inc.  
1225 Channahon Road  
Joliet, Illinois 60434  
Tel: 815-744-4696 (ext. 234)

Any questions related to the sampling procedure can be directed to Dave Casper at the telephone number indicated above.

After successfully completing a testing program of between 5-10 samples from different lots of returned scrubber solution, Chemtech may elect to defer subsequent scrubber solution testing on the basis of the foundry exercising good manufacturing practices. In such case Chemtech will issue written notification to the foundry that they are exempt from future sampling requirements.

### E. Shipment to Chemtech

Qualified scrubber solution lot numbers may be shipped to:

Chemtech  
374 East Joe Orr Road  
Chicago Heights, IL 60411

- ▶ **All totes must be properly labeled per the instructions in point C, page 6.**
- ▶ **All shipment must be accompanied by a MSDS which is available through Chemtech Services, Inc. The customer is required to complete the section titled: "Manufacturer/Supplier Information" of the MSDS, which requires the customers address and emergency telephone number to be printed in the space provided.**

Questions related to this program may be directed to the following individuals:

Dave Casper                      Tel: 815-744-2090  
John Hart                              Tel: 815-744-2090

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### STANDARD OPERATING PROCEDURE SUBMISSION OF SATURATED SCRUBBER SOLUTION FOR RECYCLING

#### I. PURPOSE

The following Standard Operating Procedure shall be utilized to recycle amine scrubber solution.

#### II. SCOPE

Triethylamine (TEA), Dimethylethylamine (DMEA) and Dimethylisopropylamine (DMIPA) are utilized in foundries to cure phenolic urethane cold box binders (PUCB). Residual amine is captured in an air pollution control device (scrubber) containing a strong acid. The acid, typically sulfuric acid, neutralizes the amine and a non-hazardous salt is formed. When the acid is consumed, the resulting scrubber solution is either sent for recycling or to a qualified waste facility for disposal.

#### III. RESPONSIBILITY & AUTHORITY

A designated representative of the foundry has the responsibility to understand and use this procedure. The designated representative has the authority to execute all parts of this procedure. The designated representative has the responsibility to initiate steps that stop the reaction when abnormal process conditions develop.

#### IV. DEFINITIONS

**Phenolic Urethane Cold Box Binder:** Two liquid components; one, a phenolic resin dissolved in solvent, the second, a polymeric polyisocyanate dissolved in solvent.

**Amine:** Triethylamine (TEA), Dimethylethylamine (DMEA) and Dimethylisopropylamine (DMIPA). The amine is vaporized and is blown through the PUCB coated sand core. The residual amine is captured in the scrubber.

**Air Pollution Control Device (Scrubber):** A mechanical device containing an aqueous solution of a strong acid, typically sulfuric acid.

**pH:** A method of determining the acidity of the scrubber solution. The initial pH of the scrubber solution will be 1.0 or less. When the pH is 4.0, the scrubber solution is spent and should be sent for disposal or recovery.

**SG:** Specific Gravity of the solution is a ratio of the scrubber solution density divided by the density of water. Hydrometers (or Baumé gauges) are the most common method of evaluating specific gravity of a solution.

**SOP:** Standard Operating Procedure, assures a safe and responsible guideline for conducting any repetitive task in a manufacturing operation.

#### V. SAFETY EQUIPMENT

Standard safety equipment required:

- Safety glasses with side shields.
- Full Plexiglas face shield
- Chemical resistant gloves

Additional safety equipment required when charging or emptying the scrubber.

- Clothing or apron, acid and chemically impervious
- Hard hat with clear Plexiglas face shield.

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### VI. SAFETY CONSIDERATIONS

- ▶ Check Personal Protective Equipment (PPE) for availability; PPE must be used at the work site.
- ▶ Review locations of safety devices in the area and exit routes.
- ▶ Put on protective equipment as required.
- ▶ Cautiously add acid to the scrubber. Never add water to acid. Only add acid to water in the scrubber
- ▶ When emptying the scrubber, use only approved drums or bulk containers.

### VII. ENVIRONMENTAL EQUIPMENT

Check that the containment system is in service prior to beginning the operation.

### VIII. ENVIRONMENTAL CONSIDERATIONS

The potential of undesirable emissions through the vent or other leaks that may develop as a result of incorrect operation may occur. These emissions have the odor of very strong ammonia. The emissions are toxic, corrosive and flammable. Use caution when eliminating the potential for any undesirable emissions.

Piping and valves in the system are a potential for leaks during any emergency. If any material leaks from the system, the material shall always be considered hazardous until proven otherwise. Put on appropriate PPE and collect small spills with absorbent. Properly dispose of all contaminated cleaning materials.

### IX. PROCESS EQUIPMENT

The operator must ensure that the following critical equipment and systems are in place, readily available and in good working condition prior to adding raw materials to the scrubber. Follow all operating procedures of the manufacturer of the scrubber.

1. pH meter, Range 0-14.
2. Hydrometer
3. Conductivity meter (Optional).
4. Industrial Scrubber with appropriate capacity (Typically 1,000 cfm/blower)
5. Acid recycling pump.
6. Vent line is clean and in good condition.
7. Valves are in good condition and operable.

The scrubber is typically charged with an acid solution that effectively absorbs the amine discharged from the core machine. Sulfuric acid is the preferred acid due to its ability to absorb relatively large quantities of amine based on the concentration of the acid. Sulfuric acid is often purchased in a higher concentration than the recommended concentration (30% - 40% H<sub>2</sub>SO<sub>4</sub> by weight) and dilution may be required. The correct concentration of the acid is a prerequisite to assure cost effective recovery of the amine in the recycling program. If there are any questions related to the desired amine concentration please consult with HA International's Technical or Marketing Departments.

### X. PROCEDURES

This section will be covered and complete upon the operator completing the pre-start checklist.

1. **Monitoring operation – Applicable when the scrubber is charged with the acid and all valves and pumps set per the scrubber manufacturer's instructions.**
  - A. Daily monitor the scrubber and check for and leaks or spills.
  - B. Observe and record the pH of the scrubber solution daily.

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C. In Case of Equipment failure or malfunction check:

- Pumping system and associated plumbing
- pH Meter – Check accuracy and calibration
- Check vent line for restrictions, plugs or leaks

D. Preparation for Recycling - As indicated above, the purpose of the scrubber is to capture amine vapors in the acid solution and avoid discharge of these vapors into the environment. The amine vapors are captured through a reaction with the sulfuric acid that results in the formation of an amine sulfate salt in the scrubber solution. As more amine vapors are cycled through the chemical scrubber, the acid solution gradually becomes saturated with amine sulfate and will ultimately reach a point (if preventative monitoring is not conducted) where the scrubber solution is no longer effective in capturing the vapors. The objective of the operator is to monitor the saturation level of the scrubber and determine when it is necessary to refresh the scrubber with a new acid solution.

E. Monitoring Activity – As suggested above, the pH of the acid solution in the scrubber should be monitored at least daily and more frequently if necessary. The saturation of the acid solution with amine takes place gradually and the operator should log and chart the pH of the solution to ensure that the solution is refreshed before saturation occurs. The table represents an example of a pH & SG log required to properly monitor the saturation level of the scrubber solution.

Date	Start								End
SG	>1.25								<1.080
pH	0.00								4.00

**Analysis of the scrubber solution sample will determine if the material can be economically recycled or if other disposal methods need to be considered. The scrubber solution must have a minimum pH value of 3.0 (4.0 is preferred) before it will be considered for the recycling process.**

## 2. Sample Submission, Shipment of Scrubber Solution for recovery & Contacts

### **DMEA (Dimethylethylamine) and DMIPA (Dimethylisopropyl amine)**

To participate in program and for detailed procedures contact:

Mr. Dave Casper  
Chemtech Services, Inc.  
1225 Channahon Road  
Joliet, Illinois 60434  
Phone: 815-744-4696  
Fax: 815-744-2640

Shipment of Scrubber Solution Samples: Ship to the following address:

Chemtech Services, Inc.  
1225 Channahon Road  
Joliet, Illinois 60434  
Phone: 815-744-4696  
Fax: 815-744-2640  
Attn: Mr. Dave Casper  
Amine Scrubber Solution Recovery Program

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### General Requirements of Scrubber Solution Physical Properties

pH: 3.0 - 4.0  
Sulfuric Acid: 5% Maximum  
DMEA or DMIPA recoverable: 35% Minimum

### Shipment of Bulk, Tote or Drum quantities of Scrubber Solution for recovery

Reminder – ALL Shipment are subject to sample approval.  
Bulk, Tote and/or Drums containing Scrubber Solution can be shipped to the above address subject to approval indicated in point (a) above.

#### **NOTE:**

Shipments that do not match the sample analysis will be returned to the submitting foundry with subsequent charges billed to the foundry.

Your HA International, LLC Sales Representative will provide any applicable pricing information after the sample has been analyzed.

Method of Shipment associated with bulk and packaged (Drum & Tote) scrubber solution for recovery must be made on the basis of shipping expenses prepaid. Material arriving freight collect will be rejected unless other arrangements have been made with HA International and a written authorization for freight collect shipments is issued.

Any billing associated with recovery services will be made through HA International, LLC, and they will notify the customer of their prerequisite terms and conditions associated with making the recovery services available.

**Chemtech Services, Inc.**  
**1225 Channahon Road**  
**Joliet, Illinois 60434**  
**Phone: 815-744-2090**  
**Fax: 815-744-2640**

CHEMTECH SERVICES, INC., MAKES NO WARRANTY, EXPRESSED OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANT ABILITY OR FITNESS THEREOF FOR ANY PURPOSE OR CONCERNING THE ACCURACY OF ANY INFORMATION HEREIN, except that the product shall conform to contracted specifications, and that the product does not , infringe any valid United States patent. The information provided herein was believed by Seller to be accurate at the time of preparation or prepared from sources believed to be reliable but it is the responsibility of the user to investigate and understand other pertinent sources of information to comply with all laws and procedures applicable to the safe handling and use of product and determine the suitability of the product for its intended use. Buyer's exclusive remedy shall be for damages and no claim of any kind, whether as to product delivered or for non-delivery of product and whether based on contract, breach of warranty, negligence or otherwise shall be greater in amount than the purchase price of the quantity of the product in respect of which damages are claimed. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is based on contract, breach or warranty , negligence or otherwise.