

**Document Type:** Administrative Record  
**Index Field:** Final Environmental  
Document  
**Project Name:** SCR Catalyst Management –  
Multiple Plants  
**Project Number:** 2004-115

## FINAL ENVIRONMENTAL ASSESSMENT

# REPLACEMENT OR REJUVENATION OF CATALYST FOR SELECTIVE CATALYTIC REDUCTION (SCR) OF NITROGEN OXIDES (NO<sub>x</sub>) AT SEVEN TVA FOSSIL PLANTS IN THE TENNESSEE VALLEY

TENNESSEE VALLEY AUTHORITY

JANUARY 2005

Page intentionally blank

# TABLE OF CONTENTS

## The Proposed Decision and Need

Background

Other Pertinent Environmental Reviews and Documentation

Permits or Permit Modifications Required

## Alternatives

Alternative A - No Action

Alternative B – Replacement of SCR Catalyst

Alternative C – Rejuvenation of SCR Catalyst - On-site, *In situ*

Alternative D – Rejuvenation of SCR Catalyst - On-site, *Ex-situ*

## Affected Environment and Evaluation of Impacts

Air Quality

Handling and Disposal of Solid and Hazardous Waste

Wastewater

## Commitments and Mitigation Measures

### Preferred Alternative(s)

### TVA Contributors

## Appendices

Appendix A – Material Safety Data Sheets for SCR NO<sub>x</sub> Catalyst, Detergent; and Regeneration Compound

Appendix B – Photos of an SCR Catalyst Log, SCR Catalyst Module, Spray Headers, Catch Basins and Collection Tanks (Frac tank)

Appendix C - Amount and Type of Waste Generated by Replacement or Rejuvenation Alternatives

## LIST OF FIGURES

Figure 1. On-site, *in-situ* Rejuvenation Process for SCR Catalyst Management  
Figure 2. On-site, *ex-situ* Rejuvenation Process for SCR Catalyst Management

## LIST OF TABLES

- Table 1. Ash Pond Effluent Limits For NPDES Permits at Each Plant With SCR Catalyst
- Table 2. Laboratory Results from Rejuvenation of SCR Catalyst -- On-Site, *In-Situ*
- Table 3. Concentrations in Inflows to Ash Ponds for Selected Wastewater Parameters -- On-Site, *In-Situ*
- Table 4. Laboratory Results from Rejuvenation of SCR Catalyst -- On-Site, *Ex-Situ*
- Table 5. Concentrations in Inflows to Ash Ponds for Selected Wastewater Parameters -- On-Site, *Ex-Situ*

## FINAL ENVIRONMENTAL ASSESSMENT

### REPLACEMENT OR REJUVENATION OF CATALYST FOR SELECTIVE CATALYTIC REDUCTION OF NO<sub>x</sub> AT TVA FOSSIL PLANTS IN THE TENNESSEE VALLEY

TENNESSEE VALLEY AUTHORITY

JANUARY 2005

## The Proposed Decision and Need

To maintain the continuity of TVA Fossil power facilities as generating assets and ensure that air emissions reductions from these plants continue to contribute to TVA system-wide targets for reduction in emissions of nitrogen oxides (NO<sub>x</sub>), TVA must decide 1) whether or not to rejuvenate or replace catalyst used in the Selective Catalytic Reduction (SCR) systems at seven TVA plants over the next few years; and 2) to select a method or methods for doing so, if rejuvenation or replacement is the chosen route.

## Background

In order to meet Title 1 Clean Air Act requirements for ozone for which Nitrogen Oxides (NO<sub>x</sub>) are a precursor, TVA has installed and operates Selective Catalytic Reduction (SCR) systems at seven of TVA's fossil plants for the purpose of reducing emissions of NO<sub>x</sub> by as much as 90 percent. Nineteen SCRs have been installed or are under construction at the following seven plants: Allen (ALF) Units 1-3; Bull Run (BRF) Unit 1; Colbert (COF) Unit 5; Cumberland (CUF) Units 1-2; Kingston (KIF) Units 1-8; Paradise (PAF) Units 1-3; and Widows Creek (WCF) Units 7-8. All of the SCR systems installed at the identified plants to date have been what are termed "high dust" SCRs, i.e., the SCR is installed upstream of the electrostatic precipitators in the flue gas flow. Operation of these SCR systems allows TVA to meet its system-wide NO<sub>x</sub>-reduction goals and to continue operation of the fossil plants as TVA generating assets.

SCRs at the various fossil power facilities were installed or have been under construction between 1999 and 2004. Over time the catalyst used in the SCR systems declines in effectiveness for removing NO<sub>x</sub>. The vanadium pentoxide catalyst currently has an operational life expectancy of approximately 18-20,000 hours of effective operational use. In order to maintain the NO<sub>x</sub>-removal effectiveness of the SCR systems, catalyst must be either replaced, or the existing catalyst cleaned, rejuvenated and possibly regenerated at intervals. It is anticipated that over time, the selected method or methods among the proposed action alternatives would become intermittent, routine maintenance on the SCR systems.

The environmental reviews for the original installation of SCR systems (see next section) assumed that catalyst disposal would be managed by a catalyst contractor in compliance with applicable regulations. In those EAs TVA envisioned that services for replacement of catalyst would include acceptance and ownership of the used catalyst by the vendor. The current vendor will not accept such ownership. Additionally, it was identified in those EAs that the waste materials (used catalyst) might be hazardous in nature. If hazardous, TVA

would have responsibility for proper disposal, and if TVA became the custodian of any hazardous waste associated with the catalyst, a qualified hazardous waste disposal facility would be used for ultimate disposal. The EAs did not explicitly state what would be done should the used catalyst be characterized as non-hazardous. The Material Safety Data Sheets (MSDSs) for the SCR system catalyst, as well as those for the detergent cleaner and rejuvenation chemicals, are included as Appendix A to this EA.

## **Other Pertinent Environmental Reviews and Documentation**

Environmental reviews pertinent to the installation and operation of the SCR systems at TVA fossil plants were documented in:

Paradise Fossil Plant Units 1, 2, and 3 Selective Catalytic Reduction Systems for Nitrogen Oxide Control – Environmental Assessment (EA) and Finding of No Significant Impact (FONSI), January 1999. Tennessee Valley Authority

Cumberland Fossil Plant Units 1 and 2 Selective Catalytic Reduction Systems for Nitrogen Oxide Control – EA and FONSI, December 2000. Tennessee Valley Authority

Allen Fossil Plant Units 1, 2 and 3 Selective Catalytic Reduction Systems for Nitrogen Oxide Control – EA and FONSI, March 2001. Tennessee Valley Authority

Widows Creek Fossil Plant Units 7 and 8 Selective Catalytic Reduction Systems for Control of Nitrogen Oxide – EA and FONSI, July 2001. Tennessee Valley Authority.

Bull Run Fossil Plant Unit 1 Selective Catalytic Reduction System for Nitrogen Oxide Control – Final EA and FONSI, April 2002. Tennessee Valley Authority

Kingston Fossil Plant Units 1 through 9 Reduction Systems for Nitrogen Oxide Control - Final EA and FONSI, May 2002. Tennessee Valley Authority

ALF Reroute Proposal, (Yeager to T. E. Jamison and S. E. Barnes, 10/11/2002), Letter to files.

Colbert Fossil Plant Units 1 Through 5 Reduction Systems for Control of Nitrogen Oxides – Final EA and FONSI, February 2003. Tennessee Valley Authority

Kingston Fossil Plant Units 1 through 9 Reduction Systems for Nitrogen Oxide Control – Final Supplemental EA and FONSI, March 2003. Tennessee Valley Authority

Replacement of Catalyst for Selective Catalytic Reduction of NO<sub>x</sub> at Allen Fossil Plant Unit 2, Final EA and FONS, August 2004. Tennessee Valley Authority

## **Permits, Permit Modifications and Notifications Required**

Under RCRA, a one-time notification to the appropriate agencies would be necessary for the elementary neutralization process described in the wastewater section. The use of TRI chemicals would be reported under requirements of the Emergency Planning and

Community Right to Know Act. If off-site solid waste disposal is used for the replacement of catalyst logs or the loose ash vacuumed from the catalyst logs, a solid waste application to the appropriate landfill would be necessary.

For the no action alternative and the *in-situ* catalyst replacement option there are no specific water related permitting requirements. It is recommended to provide the water regulatory agency a courtesy notification to document the activity as a minor additional source of wastewater. For the *in-situ* catalyst regeneration option using sulfuric acid/vanadyl oxalate and the *ex-situ* process option, which utilizes an oxalic acid solution, the existing NPDES water discharge permit would require modification to ensure that the additional chemical contaminants and the associated activities are covered by the permit.

## Alternatives

TVA is considering the No Action and four Proposed Action alternatives for rejuvenating or replacing portions of the SCR system catalysts for the seven identified fossil power generating facilities. These alternatives were developed from vendor responses to a TVA Request for Proposals (RFP) issued in June 2004 for catalyst cleaning, rejuvenation and regeneration services at TVA facilities.

The specific nature of deactivation of the SCR catalyst may vary between fossil plants, thus favoring one method of replacement or rejuvenation over another at different plants. Among the rejuvenation alternatives, determination of the appropriate cleaning, rejuvenation and/or regeneration process would be based upon the particular catalyst deactivation mechanisms at the specific plant. As only the SCR for ALF Unit 2 has undergone its first cycling through maintenance of the catalyst, the site-specific nature of deactivation cannot be determined for the other facilities until just prior to the time the catalyst would need replaced or rejuvenated. The analyses in this EA bounds the potential for impacts from selection of any of the three action alternatives considered herein. At the time a specific catalyst management action is to be taken at a particular facility, any site-specific issues would be addressed and documented via the appropriate level of environmental review (most likely a categorical exclusion checklist {CEC}) tiered from this EA.

For the plants having SCRs with bypass capabilities (i.e., BRF, CUF 1-2, PAF 1-3 and WC 7-8), the units would presently not necessarily need to be in outage or shut down while work was conducted. The SCRs at ALF 1-3, CO5, KIF 1-8 (Appendix Table C-1) do not have systems that allow flue gas to bypass when the SCR is out of service (i.e., to manage the SCR catalyst under all action alternatives the unit must be in outage or shut down). For both plants with bypass and those without bypass capability, catalyst management would occur during non-ozone season.

The SCRs are presently operated only during the ozone season (May to September). After about 2010, it is likely that TVA would consider operating the SCRs year around in order to meet targets for further reduced NO<sub>x</sub> levels. At that time, even the units with bypass capability may need to be in outage for the SCR catalyst management. The activities required for alternatives including replacement or rejuvenation of catalyst would be integrated and coordinated with other scheduled outages to the extent possible under all these operating scenarios in order to avoid outages specially designated for catalyst management.

## **Alternative A - No Action**

Under the No Action Alternative TVA would not replace or rejuvenate the SCR catalyst. Over time the catalyst would no longer be effective at reducing NO<sub>x</sub> to the target levels needed to maintain compliance with Clean Air Act requirements. TVA would need to address NO<sub>x</sub> reduction targets through installation of such systems at other facilities, or purchase of NO<sub>x</sub> emission credits. The No Action alternative is inconsistent with TVA's stated purpose and need of maintaining the continuity of its fleet of fossil power plants as generating assets, maintaining compliance with air regulatory compliance requirements for those facilities, and continuing their contribution to attainment of TVA's system-wide NO<sub>x</sub>-reduction targets.

## **Proposed Action Alternatives**

### **Alternative B - Replacement of SCR Catalyst**

Under this alternative, during an outage catalyst elements (logs – Appendix Figure B-1) in the catalyst modules (Appendix Figure B-2) would be replaced in one (1) layer of the SCR systems without removing the modules from the reactor. The catalyst would be vacuumed to remove ash prior to removal of the catalyst elements. A contractor would be responsible for removal, handling and reinstallation of catalyst modules, equipment set-up, take down and removal; and executing the work within the stipulated time frames. The vendor predicts that the life expectancy for effective catalyst activity would be extended to 24,000 service hours. The replacement of spent catalyst would be carried out during scheduled outages (see previous discussion under Alternatives). Based upon the number of modules per plant and scaling from the recent experience at ALF Unit 2, it is estimated the process execution time would range from 5 to 36 days for the various plants. The contractor would have from ten to twenty people on-site at any one time for set up and to conduct the work. Truck deliveries for materials, set up and conducting the process would be fewer than twenty. The number of modules involved by plant each time the catalyst is replaced is shown in Appendix Tables C-1 and C-2. Depending upon fossil plant, trips of a standard dump truck required for disposal of spent catalyst would be between 10 (ALF) and 90 (CUF) per layer (one outage).

### **Alternative C - Rejuvenation of SCR Catalyst - On-site, *In-situ***

For the on-site, *in-situ* alternative, at any one outage one layer of the system (90-360 modules) would be rejuvenated with the catalyst modules (Appendix Figure B-1 and B-2) remaining in the reactor. The rejuvenation of catalyst would be carried out during scheduled outages (see previous discussion under Alternatives). The process execution time would vary from plant to plant and, to the extent possible, be coordinated within outages scheduled for other purposes. Based upon the number of modules per plant and scaling from contractor performance estimates for conducting similar work at ALF that were provided in response to a TVA Request for Proposals (RFP), it is estimated the process execution time would range from 5 to 36 days for the various plants. The contractor would have ten to twenty people on-site at any one time to set up for and conduct the work. Truck deliveries for materials, set up and conducting the process would be fewer than twenty.

Catalyst would be restored to 85-90 percent of original catalyst activity. The *in-situ* rejuvenation process would be as follows:

- Ash would be vacuumed from the catalyst
- Each module would be washed with once-through de-ionized (DI) water for 5-10 minutes at a rate of 190 gallon/minute (950-1900 gallons/module)
- Each module would then be washed with recirculated 3 percent by weight H<sub>2</sub>SO<sub>4</sub> and DI water solution for 25 minutes (total of 530 gallons of solution/module)
- An alternative to the previous step is that DI water-only may be used if it is determined that the acid solution is not needed to attain adequate treatment
- A second recirculation treatment with vanadyl oxalate (V<sub>2</sub>C<sub>2</sub>O<sub>4</sub>) solution (MSDS in Appendix A) may be conducted to regenerate the catalyst. It is believed that this step would not be required to attain the desired restoration of 85-90 percent catalyst activity, but is included in the event that additional catalyst analysis at the time of rejuvenation indicates that it is needed to finalize the process.

The overall process for *in-situ* rejuvenation would be as appears in Figure 1. Examples of spray headers (Appendix Figure B-3), catch basins and collection tanks appear in Appendix B. Where applicable (more than one layer) the process would be repeated for an additional layer of catalyst at subsequent outages.

### **Alternative D - Rejuvenation of SCR Catalyst - On-site, *Ex-situ***

For the on-site, *ex-situ* alternative, one layer of the system (90-306 modules, Appendix Figures B-1 and B-2) would be rejuvenated with the catalyst modules removed from the reactor. The rejuvenation of catalyst would, to the extent possible, be coordinated within scheduled outages (see previous discussion under Alternatives). The process execution time would vary from plant to plant. Based upon the number of modules per plant and scaling from contractor performance estimates for conducting similar work at ALF that were provided in response to a TVA Request for Proposals (RFP), it is estimated the process execution time would range from 8 to 48 days for the various plants. The contractor would have ten to twenty people on-site at any one time to set up for and conduct the work. Truck deliveries for materials, set up and conducting the process would be fewer than twenty.

Catalyst would be restored to 90-95 percent original catalyst activity. A temporary mobile washing plant would be established at the plant in close proximity to the SCR components and within the existing area of the plant infrastructure previously disturbed for construction of the power plant. This set up would include tanks to conduct the acid and rinse washes, those tanks necessary to capture the wash wastes and ancillary support equipment such as a small lift crane to move the catalyst modules into and out of the wash and rinse tanks. Selection of the site for the temporary set up would be coordinated with the appropriate Program Administrator (Environment) for the specific plant and the appropriate Best Management Practices (BMPs) identified in the Categorical Exclusion Checklist tiering off this Environmental Assessment. The *ex-situ* rejuvenation process would be as follows:

- Loose ash would be vacuumed from the modules
- Each module would be prewashed with a solution of city water and detergent (see MSDS in Appendix A)
- Each module would then be washed in 2 percent by weight oxalic acid solution
- Rinsed with city water

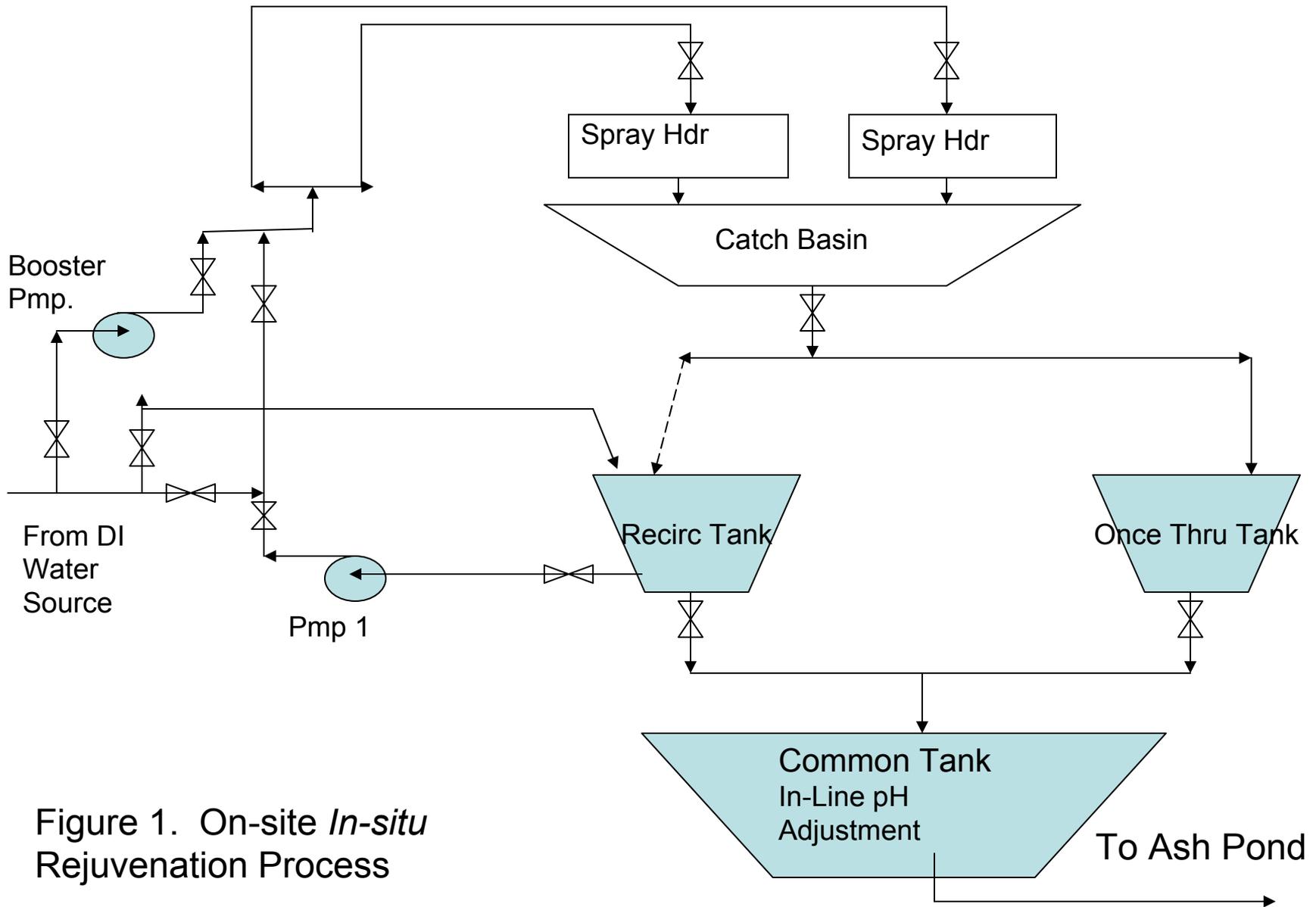


Figure 1. On-site *In-situ* Rejuvenation Process

- Dried, and
- Re-installed

Detergent concentration will be approximately 250ml per basin (based on a basin volume of 10m<sup>3</sup>) so the concentration will be in the range of 0.0025-0.003 percent volume. The overall process for on-site, *ex-situ* rejuvenation would be as appears in Figure 2. At the time of rejuvenation, additional catalyst analysis may be needed to finalize the process. Where applicable (more than one layer) the process would be repeated for an additional layer of catalyst at subsequent outages.

### **Alternative E – Delayed Rejuvenation of SCR Catalyst On-site, *Ex Situ* and Interim Replacement with New Catalyst**

Alternative E involves elements of Alternatives B and D. For Alternative E, 1) the catalyst modules from one layer would be removed, temporarily held for a period of time (potentially until the next replacement/rejuvenation cycle for that particular or another catalyst layer, i.e., perhaps as long as two years), rejuvenated for re-use using the on-site, *ex-situ* process, and then re-installed in an SCR at the next replacement cycle; and 2) new catalyst modules would be installed to replace the layer of catalyst removed for delayed rejuvenation. During the holding period, it is anticipated that the removed catalyst would undergo additional testing to improve techniques for rejuvenation. The removed catalyst would be held for re-use in a stable environment (e.g., at ambient temperatures, but protected from the elements), such as in temporary or permanent on-site storage structures. Adequate storage facilities are either pre-existing or would be constructed on pre-disturbed areas (such as those heavily re-contoured for original construction of the plant). In the event that such is not the case, prior to TVA taking action, at that time environmental review under NEPA will be conducted for identifying and evaluating any such proposed structures.

### **Activities Common to all Proposed Action Alternatives**

Although two of the proposed action alternatives do not require major replacement of catalyst logs, damaged logs may be replaced if necessary. In this event, due care will be taken during removal of the logs to not break or otherwise crumble the used catalyst logs and modules, and therefore, minimize the potential for fugitive dust. While handling used catalyst, workers will wear respiratory protection to prevent inhalation of the minor, insignificant amount of dust or fines that could be generated during removal and handling. The contractor shall address specific Industrial Hygiene issues in the site Work Safety Plan.

Ash entrained on or in the catalyst is exempt from hazardous waste determination under the Bevill exemption at 40 CFR 261.4(b)(4) when co-managed and co-disposed through an ash handling system. A sample catalyst log from ALF (with 15,000 hours of service) was tested at TVA's Environmental Chemistry Laboratory (EC) to determine waste status. A representative sample of the spent catalyst log with entrained ash was taken. The results of this testing showed that this waste was not RCRA hazardous waste. Although the individual characteristics (coal type burned; number of hours of operation) may vary from plant to plant, this analysis indicates that we do not anticipate the logs being hazardous.

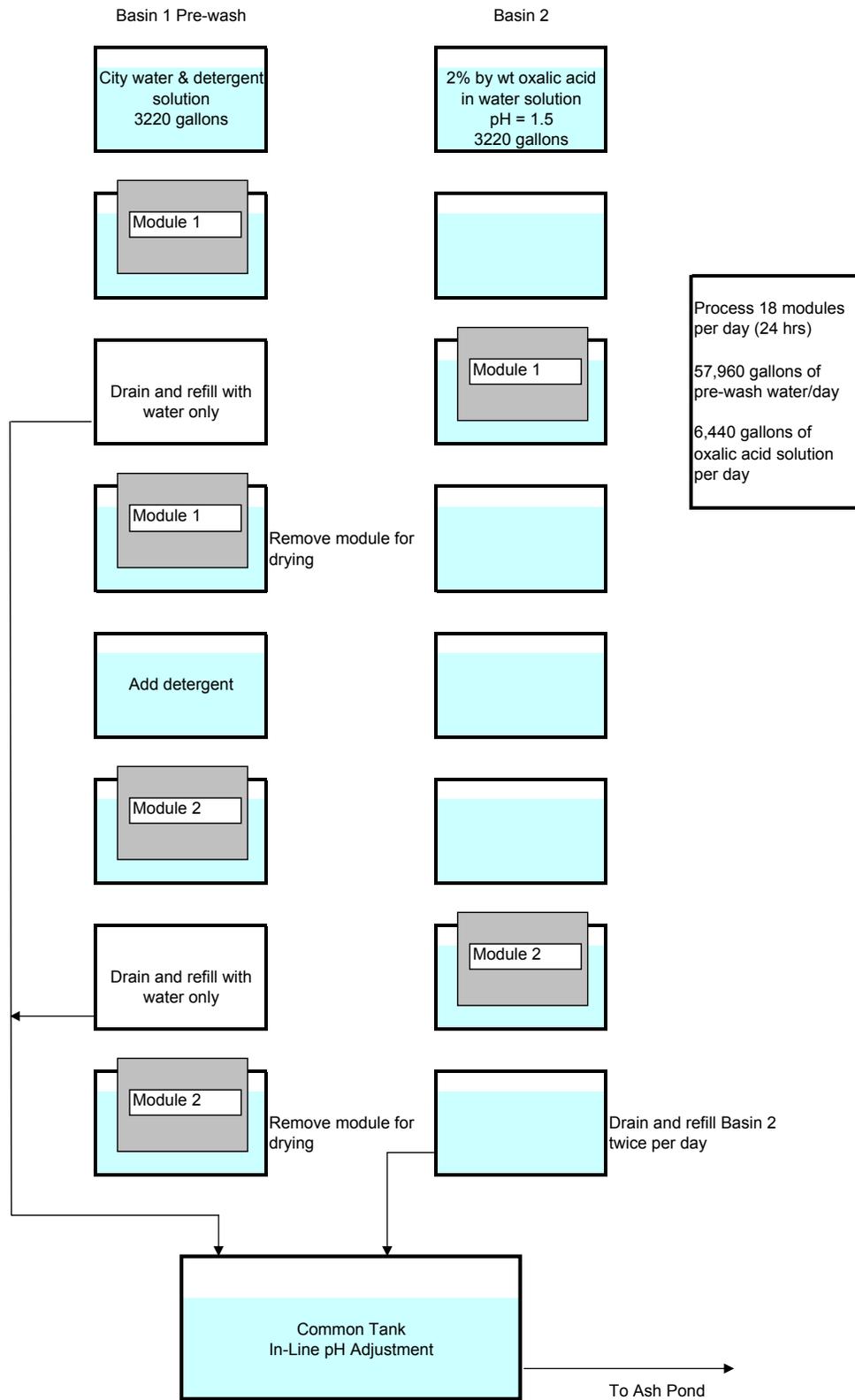


Figure 2. On-site, *Ex-situ* Rejuvenation Process

However, as a precaution should the logs be removed for disposal a representative sample will be taken in order to make a determination of waste characteristic (i.e., non-hazardous or hazardous). The analysis will be conducted by TVA's EC Lab in Chattanooga or TVA-designated equivalent laboratory (analyzing for TCLP Metals with the Inorganic Underlying Hazardous Constituents at non-wastewater detection levels). The results of these analyses shall be sent to FPG-Environmental Affairs for future determinations utilizing process knowledge.

Should TVA be a co-generator or generator of hazardous waste associated with the replacement of catalyst, a qualified hazardous waste disposal facility that is on TVA's Environmental Restricted Awards List (ERAL) at the time of the project would be used for the ultimate disposal.

### **Other Alternatives Not Considered in Detail**

The option of *ex-situ*, off-site rejuvenation of catalyst is currently substantively more expensive than other comparably-effective methods available, did not take advantage of existing facilities or capabilities, and had greater potential for environmental impacts than the proposals currently under evaluation, so was eliminated from further detailed consideration in this review. However, TVA may re-evaluate the applicability of this option at some future date. In that event, the appropriate environmental review will be completed at that time.

## **Affected Environment and Evaluation of Impacts**

An interdisciplinary team of TVA project, resource and technical specialists reviewed the potential direct, indirect and cumulative effects of the proposed options for rejuvenation or replacement of catalyst in the SCR systems from the seven identified fossil plants.

Because of 1) nature of the proposed project work; 2) the location of the actions within the existing plant infrastructure, 3) small, on-site contractor staff required for completing the proposed work 4) features incorporated into the design of the proposed action alternatives, and 5) commitments and mitigation measures incorporated for disposal of solid and hazardous waste and on-site treatment of wastewater, there is only a minor potential for even insignificant impacts to the following resource areas: terrestrial ecology, wetlands, floodplains, land use, visual aesthetics, and noise, surface water, aquatic ecology, groundwater quality, and transportation. No potential for effects to protected or sensitive species or to archaeological and historic resources was identified. Under the No Action alternative, over time, emission of NO<sub>x</sub> from the identified fossil plants would increase until the affected units would need to derate or cease operation to maintain compliance with air regulatory requirements. No action is not a viable alternative to address TVA's stated purpose and need.

The only areas in which potential impacts were identified from the proposed actions were for air quality, handling and disposal of solid and hazardous waste and management of wastewater.

## ***Air Quality***

### **Resource Description**

The air quality in the vicinity of ALF, BRF, COF, CUF, KIF, PAF, and WCF is generally good, with most areas in which the plants are located currently in compliance with all National Ambient Air Quality Standards (NAAQS). Regionally, air quality is also generally good. However, for some areas, attainment of the 8-hour ozone standard of 80 parts per billion (ppb) has been more difficult to achieve. Anderson County, Tennessee, where BRF is located and Shelby County, Tennessee, where ALF is located have been designated in nonattainment of the 8-hour ozone standard; however, the latest 2004 ozone data shows that Anderson and Shelby counties will likely meet the 8-hour ozone standard. In addition, some areas could experience periods when fine particulate concentrations will be above the recently adopted annual PM<sub>2.5</sub> standard. EPA has designated Anderson County, Tennessee, where BRF is located, a portion of Roane County, Tennessee, where KIF is located and a portion of Jackson County, Alabama, where WCF is located as being in nonattainment of the PM<sub>2.5</sub> standard.

### **Alternative A – No Action Impacts**

Under the No Action Alternative, current air quality levels in the vicinity of ALF, BRF, COF, CUF, KIF, PAF, and WCF is expected to continue. States are required to develop State Implementation Plans that will assure that all areas will achieve and maintain attainment with the NAAQS by the required attainment date. The no action alternative will have no impact in Anderson and Shelby county ozone nonattainment areas since BRF and ALF have installed best available control technology for controlling emissions impacting ozone.

### **Alternative B – Replacement of SCR Catalyst Impacts**

Under this alternative catalyst elements (logs) would be removed from the catalyst modules, and new elements would be installed. The catalyst would be vacuumed to remove ash prior to removal of the catalyst elements. Air pollutant emissions resulting from this action are vehicle emissions associated with the delivery of catalyst and transport of used catalyst for disposal. Truck deliveries for materials, set up and conducting the process would be fewer than twenty. The number of modules involved by plant each time the catalyst is replaced is shown in Appendix Tables C-1 and C-2. Depending upon the fossil plant, trips of a standard dump truck required for disposal of spent catalyst would be between 10 (ALF) and 90 (CUF) per layer (one outage). These emissions are temporary and transient and would not have a significant impact on air quality.

### **Alternative C – Rejuvenation of SCR Catalyst – On-Site, *In-Situ* Impacts**

Under this alternative the catalyst remains in the SCR structure and is vacuumed to remove ash and then washed with de-ionized (DI) water and may be washed with 3 percent by weight H<sub>2</sub>SO<sub>4</sub> and DI water solution and/or vanadyl oxalate (V<sub>2</sub>C<sub>2</sub>O<sub>4</sub>) solution as needed. The vacuuming of dust from the catalyst will be done with equipment equipped with bagfilters to prevent the discharge of dust particles during this activity. Since the catalyst is in the SCR structure enclosure and the rinsing solutions are not heated, there should be no discharge of air contaminants to the atmosphere during this activity. Since all rejuvenating materials are in a liquid form and are not highly volatile, no

air contaminate emissions are anticipated during the handling, transfer and storage of the materials.

### **Alternative D – Rejuvenation of SCR Catalyst – On-Site, *Ex-Situ* Impacts**

Under this alternative the catalyst is vacuumed to remove ash and moved from the SCR structure to a mobile washing plant and then prewashed with a solution of city water and detergent, washed in 2 percent by weight oxalic acid solution and rinsed with city water, dried and reinstalled. The vacuuming of dust from the catalyst will be done with equipment equipped with bagfilters to prevent the discharge of dust particles during this activity. Since the wash area of the mobile washing plant is enclosed and the rinsing solutions are not heated, there should be no discharge of air contaminants to the atmosphere during this activity. Since all rejuvenating materials are in a liquid form and are not highly volatile, no air contaminate emissions are anticipated during the handling, transfer and storage of the materials.

### **Alternative E – Delayed Rejuvenation of SCR Catalyst On-site, *Ex Situ* and Interim Replacement with New Catalyst**

Since the catalyst would be replaced and the removed catalyst held at the site instead of being sent for disposal, emissions from transportation for disposal of spent catalyst would not occur. Air emissions for the rejuvenation portion of actions proposed under this alternative would be as described for Alternative D. Emissions for this alternative would be temporary and transient; and would not have a significant impact on air quality.

## ***Handling and Disposal of Solid and Hazardous Waste***

### **Current Status and Conditions**

#### *Solid Waste*

Each plant generates solid waste which varies in amounts and specifics by plant. However, each plant routinely generates the following: municipal solid waste (garbage), scrap metal (recycled), wood wastes (pallets and brush and lumber), coal combustion by-products, and used oil/oily debris. Solid wastes are managed in accordance with applicable local, state, and federal laws and regulations.

#### *Hazardous Waste*

Each plant site is currently a hazardous waste generator with an EPA identification number. Hazardous wastes typically generated include paint and painting operation wastes, lead abatement wastes, and some solvent wastes. The rejuvenation alternatives (C and D) identified in this document have the potential to impact each site's generator status. As a site would select a particular rejuvenation method, the plant staff would analyze the impact to their generator status based on the current situation at that time. Hazardous wastes are handled in accordance with applicable local, state and federal laws and regulations.

## **Alternative A – No Action Impacts**

Under the No Action Alternative, none of the solid or potentially hazardous wastes identified in the Proposed Action Alternatives would be generated; therefore, none of the potential issues or impacts associated with these wastes would occur.

## **Alternative B – Replacement of SCR Catalyst Impacts**

Alternative B (Replacement of SCR Catalyst) would generate the approximate volumes of used catalyst indicated in Appendix C Tables C-1 and C-2. As mentioned in the section “Activities Common to all Proposed Action Alternatives,” the test conducted for the Environmental Assessment for the earlier replacement of catalyst at ALF Unit 3 (TVA, August 2004) indicates that the logs should not be RCRA hazardous wastes. However, because of the variables inherent by plant the following steps will be taken.

- Due care will be taken during the removal of the logs.
- Logs will be placed in a lined, covered dumpster compatible with the anticipated waste hazards.
- A representative sample of the logs shall be taken and sent to TVA’s Environmental Chemistry Laboratory. The constituents of concern are the RCRA metals and the Inorganic Underlying Hazardous Constituents. Waste determination will be made based upon the analytical results until sufficient data is obtained to utilize process knowledge.
- Preliminary testing of the spent catalyst logs show them to be non-hazardous despite the presence of minute amounts of vanadium pentoxide in the spent logs. Therefore, these logs could appropriately be disposed at a Subtitle D landfill for non-hazardous wastes. Due to the paucity of data, as described in the previous bullet, TVA would continue to test the spent logs, as SCRs are commissioned, to confirm the non-hazardous nature of the spent logs. Testing of the spent logs would be performed until sufficient data is obtained to use generator knowledge to determine the RCRA status of the spent catalyst logs. Alternatively, out of an abundance of caution, the logs could be disposed at a Subtitle C landfill for hazardous wastes. The impacts associated with the management of spent logs under either of the aforementioned options would be insignificant.

Any other solid waste generated during the outage shall be managed in accordance with plant procedures and contracts. These stipulations for Alternative B will insure that no significant impacts occur to any resources from activities associated with management of solid or hazardous wastes.

## **Alternative C – Rejuvenation of SCR Catalyst – On-Site, *In-Situ* Impacts**

The on-site *in-situ* alternative potentially generates solid or hazardous waste in three ways, i.e., 1) vacuuming of loose ash; 2) physical damage to catalyst logs discovered during the process; and 3) as a result of the acid rejuvenation washes. Generation of these wastes would be required on an intermittent, infrequent basis, depending upon the number or operating hours for the particular units and plant (i.e., every few years whenever the life expectancy of the SCR catalyst was being approached).

### *Vacuumed Ash*

The first step in this process is to vacuum loose ash. The resulting ash waste would be expected to be similar in nature to any other ash generated by the combustion process of the particular unit(s) served by the SCR. EPA has determined that the regulation of ash from the combustion of coal as a hazardous waste is not warranted, and that coal ash retains the hazardous waste exemption provided by the Bevill Amendment to RCRA. The ash would either be disposed of on-site through the existing ash handling system or offsite as a special waste going to an approved Subtitle D landfill.

#### *Damaged Catalyst Logs*

Since the catalyst logs will be left in the reactor modules during this process, a waste determination for the logs is not required. However, if the catalyst logs show sufficient physical damage, replacement of a limited number of logs may be required. In that case, the commitments identified in the section, "Commitments and Mitigation Measures," for handling and disposal of used catalyst would also apply for waste generated by physical damage to the catalyst logs.

#### *Acid Rejuvenation Washes - Determination of Waste Characteristic and Appropriate Handling Methods*

The third category of wastes generated by this process, i.e., acid rejuvenation washes and rinses, may exhibit the characteristic of corrosivity and possibly metals. At the time and point of generation (common tank), the waste from the acid washes would be tested for RCRA metals and a pH measurement taken prior to deciding how to handle the waste. Waste handling as described below and in the Wastewater section of this document will depend upon the outcome of that test at the time of waste generation. Results of these tests would be maintained in a TVA data base maintained by the staff of Environmental Affairs in the Fossil Power Group. This testing would be conducted through at least one cycle of catalyst replacement for each SCR, or until FPG Environmental Affairs staff have determined and documented that sufficient testing has been conducted to use process knowledge as the basis for the decisions regarding management of the acid wash wastes.

TVA has identified the following environmentally acceptable approaches for managing the acid wash rejuvenation solution and wash rinses. Depending upon results of the site-specific testing and the ultimate recipient of the waste stream, TVA would identify and choose the appropriate method among the following acceptable management approaches prior to waste generation. With the proper use of these approaches as their applicability is herein defined, the generation and handling of these process wastes, whether solid or hazardous, would not result in significant impacts to any resource.

The first approach is to utilize the Bevill exclusion (40 CFR 261.4(b)(4)) and clarifying "Dietrich letter" (Gary Dietrich, USEPA, January 13, 1981, to Paul Emler, Jr., Chairman for the Utilities Solid Waste Act Group), which would interpret these wastes as solid wastes which are excluded from RCRA. Under this approach the rejuvenation/regenerate solution and wash rinses would be accumulated in a single tank system and then co-disposed or co-treated with fly ash, bottom ash, boiler slag or flue gas emission control wastes via hard or flexible piping to the ash pond for ultimate disposal. Since these wastes are being managed under Bevill, they do not count towards the generator status, nor are land disposal restrictions applicable to these wastes. Although the rejuvenation/regenerate solution and wash rinses may be subject to the Bevill Amendment exclusion from disposition as a RCRA hazardous waste, TVA would buffer the solution to a high enough pH so as to ensure that requirements for managing the ash pond under the NPDES

program are met. The details and commitments for this approach are discussed in the Wastewater and Commitments and Mitigation sections of this document.

The second approach would be utilized in the event TVA does not rely on the Bevill exemption. The wastes would be tested to determine whether they exhibit a characteristic making them subject to the hazardous waste management regulations. These wastes are likely to exhibit the characteristic for corrosivity, and may exhibit the toxicity characteristic as well. If the wastes are hazardous only because of corrosivity, they would be handled by on-site neutralization as described below and discharged through the ash pond. If they exhibit the characteristic for toxicity, they would be sent off-site for treatment and disposal.

Should the waste fail solely for corrosivity, onsite neutralization would involve collecting the waste in a tank or tank system as defined at 40 CFR 260.10. A one-time notice to file for land disposal would also apply. Neutralized waste could then be routed to any onsite waste disposal route that is subject to NPDES or CWA standards. The details and commitments associated with this approach are discussed in the Wastewater and Commitments and Mitigation sections of this document. Should the waste exceed RCRA characteristic limits for metals or any other parameter, off-site treatment would be required, whereby the waste would be collected in a tanker truck for transportation to an offsite Environmental Restricted Awards List (ERAL)-listed Treatment, Storage and Disposal Facility (TSDF) for treatment and disposal.

### **Alternative D – Rejuvenation of SCR Catalyst – On-Site, *Ex-Situ* Impacts**

Similar to Alternative C, the on-site *ex-situ* alternative potentially generates solid or hazardous waste in three ways, i.e., 1) vacuuming of loose ash; 2) physical damage to catalyst logs discovered during the process; and 3) as a result of the acid rejuvenation washes. Generation of these wastes would be required on an intermittent, infrequent basis, depending upon the number or operating hours for the particular units and plant (i.e., every few years whenever the life expectancy of the SCR catalyst was being approached).

#### *Vacuumed Ash*

The first step in this process is to vacuum loose ash. EPA has determined that the regulation of ash from the combustion of coal as a hazardous waste is not warranted, and that coal ash retains the hazardous waste exemption provided by the Bevill Amendment to RCRA. The ash would either be disposed of on-site through the existing ash handling system or offsite as a special waste going to an approved Subtitle D landfill.

#### *Damaged Catalyst Logs*

Since the catalyst logs will be left in the reactor modules during this process, a waste determination for the logs is not required. However, if the catalyst logs show sufficient physical damage, replacement of a limited number of logs may be required. In that case, the commitments identified in the section, “Commitments and Mitigation Measures,” for handling and disposal of used catalyst would apply for waste generated by physical damage to the catalyst logs.

#### *Acid Rejuvenation Washes - Determination of Waste Characteristic and Appropriate Handling Methods*

Similar to Alternative C the third category of wastes generated by this process, i.e., acid rejuvenation washes and rinses, may exhibit the characteristic of corrosivity and possibly

metals. At the time and point of generation (common tank), the waste from the acid washes will be tested for RCRA metals and a pH measurement taken prior to deciding how to handle the waste. Waste handling as described below and in the Wastewater section of this document will depend upon the outcome of that test at the time of waste generation.

Results of these tests would be maintained in a TVA data base maintained by the staff of Environmental Affairs in the Fossil Power Group. This testing would be conducted through at least one cycle of catalyst replacement for each SCR, or until FPG Environmental Affairs staff have determined and documented that sufficient testing has been conducted to use

process knowledge as the basis for the decisions regarding management of the acid wash wastes.

TVA has identified the following environmentally acceptable approaches for managing the acid wash rejuvenation solution and wash rinses. Depending upon results of the site-specific testing and the ultimate recipient of the waste stream, TVA would identify and chose the appropriate method among the following acceptable management approaches prior to waste generation. With the proper use of these approaches as their applicability is herein defined, the generation and handling of these process wastes, whether solid or hazardous, would not result in significant impacts to any resource.

The first approach is to utilize the Bevill exclusion (40 CFR 261.4(b)(4)) and clarifying “Dietrich letter” (Gary Dietrich, USEPA, January 13, 1981, to Paul Emler, Jr., Chairman for the Utilities Solid Waste Act Group), which would interpret these wastes as solid wastes which are excluded from RCRA. Under this approach the rejuvenation/regenerate solution and wash rinses would be accumulated in a single tank system and then co-disposed or co-treated with fly ash, bottom ash, boiler slag or flue gas emission control wastes via hard or flexible piping to the ash pond for ultimate disposal. Since these wastes are being managed under Bevill, they do not count towards the generator status, nor are land disposal restrictions applicable to these wastes. Although the rejuvenation/regenerate solution and wash rinses may be subject to the Bevill Amendment exclusion from disposition as a RCRA hazardous waste, TVA would buffer the solution to a high enough pH so as to ensure that requirements for managing the ash pond under the NPDES program are met. The details and commitments for this approach are discussed in the Wastewater and Commitments and Mitigation sections of this document.

The second approach would be utilized in the event TVA does not rely on the Bevill exemption. The wastes would be tested to determine whether they exhibit a characteristic making them subject to the hazardous waste management regulations. These wastes are likely to exhibit the characteristic for corrosivity, and may exhibit the toxicity characteristic as well. If the wastes are hazardous only because of corrosivity, they would be handled by on-site neutralization as described below and discharged through the ash pond. If they exhibit the characteristic for toxicity, they would be sent off-site for treatment and disposal.

Should the waste fail solely for corrosivity, onsite neutralization would involve collecting the waste in a tank or tank system as defined at 40 CFR 260.10. A one-time notice to file for land disposal would also apply. Neutralized waste could then be routed to any onsite waste disposal route that is subject to NPDES or CWA standards. The details and commitments associated with this approach are discussed in the Wastewater and Commitments and Mitigation sections of this document. Should the waste exceed RCRA characteristic limits for metals or any other parameter, off-site treatment would be required, whereby the waste would be collected in a tanker truck for transportation to an offsite Environmental Restricted Awards List (ERAL)-listed Treatment, Storage and Disposal Facility (TSDF) for treatment and disposal.

### **Alternative E – Delayed Rejuvenation of SCR Catalyst On-site, Ex Situ and Interim Replacement with New Catalyst**

The primary difference between Alternatives D and E is that the catalyst modules would be held and rejuvenated at a time between the end of the outage during which replacement

catalyst has been installed and the next time for catalyst replacement in the cycle (up to about two years). Alternative E, as for Alternative B, would generate the approximate volumes of used catalyst indicated in Appendix C Tables C-1 and C-2. However, rather than being handled for disposal, the catalyst modules would be managed for rejuvenation. Impacts would be as identified and described for the rejuvenation process of the removed modules under Alternative D. Commitments for Alternative D also apply to Alternative E.

As the removed catalyst would be held prior to rejuvenation in a stable environment (e.g., at ambient temperatures, but protected from the elements) no additional impacts should occur. Adequate storage facilities are either pre-existing or would be constructed on pre-disturbed areas (such as those heavily re-contoured for original construction of the plant), so no additional solid waste should be generated. In the event that such is not the case regarding availability of storage area, prior to TVA taking action, at that time the appropriate environmental review under NEPA would be conducted for identifying and evaluating any such proposed structures.

Any other solid waste generated during the outage shall be managed in accordance with plant procedures and contracts. These stipulations for Alternative E will insure that no significant impacts occur to any resources from activities associated with management of solid or hazardous wastes.

## ***Wastewater***

### **Existing Wastewater Treatment System - Ash Ponds**

The ash ponds (DSN 001) at ALF, BRF, COF, CUF, KIF, PAF, and WCF serve as the primary method for holding and treating wastewaters generated by the operations of the fossil power plants. These ponds receive a variety of wastewater flows such as ash transport water, nonchemical metal cleaning wastewaters, coal pile runoff, low volume wastes, ammoniated wastewater from the installed NOx removal equipment, equipment cooling and lubricating water, station sump discharges, and storm water runoff. The annualized average flows from the ash ponds at these various fossil plants range from 8.5 MGD to 40.5 MGD. The ash ponds discharge to receiving waters of the State in which they are located, therefore, to maintain compliance with their respective NPDES permits, TVA is required to meet the effluent limits listed in Table 1 for the DSN 001 discharges.

### **Alternative A – No Action Impacts**

Under the No Action Alternative TVA would not replace or rejuvenate the SCR catalysts. No wastewater would be generated by this alternative, therefore Alternative A would have no wastewater impacts beyond those created by normal operation of the SCR's themselves.

### **Alternative B – Replacement of SCR Catalyst Impacts**

Under this alternative catalyst elements (logs) would be removed from the catalyst modules, and new elements would be installed. No wastewater would be generated by this alternative therefore, Alternative B would have no wastewater impacts beyond those created by normal operation of the SCR's themselves.

Table 1. Ash Pond Effluent Limits For NPDES Permits at Each Plant With SCR Catalyst

Effluent Characteristic	TVA Fossil Plant							
	Allen Outfalls 001/001A	Bull Run Outfall 001	Colbert DSN001	Cumberland Intn'l Monit. Pt 001	Kingston Outfall 001	Paradise DSN 001		
pH (s.u.)	6.0 - 9.0	6.0 - 9.0	6.0 - 8.5	>= 6.0	>= 6.0	6.0-9.0		
Oil & Grease (mg/L)	15 avg/20 max	12 avg/16 max	7.0 avg/9.0 max	14 avg/19 max	14.4 avg/19.4 max	11 avg/13 max		
TSS (mg/L)	30 avg/100 max	26 avg/84 max	19 avg/55 max	29 avg/96 max	29.9 avg/92 max	30 avg/74 max		
TDS (mg/L)	--	--	--	Report	--	--		
Chloride (mg/L)	--	--	--	Report	--	--		
Fluoride (mg/L)	--	--	--	Report	--	--		
Sulfate (mg/L)	--	--	--	Report	--	--		
Hardness (mg/L CaCO <sub>3</sub> )	--	--	--	Report**	--	Report		
Nitrogen, Ammonia Total - Effluent (mg/L, ppd)	Report	--	--	Report**	Report	Report		
Nitrogen, Ammonia Total - Net Discharge (mg/L, ppd)	Report*	--	--	--	Report***	--		
Nitrogen, Ammonia Total - At Skimmer Wall (mg/L, ppd)	--	--	--	--	Report	--		
Ammonia as Nitrogen (ppd)	--	--	Monitor	--	--	--		
Total Nitrates (ppd)	--	--	Monitor	--	--	--		
Total Phosphorus as P (ppd)	--	--	Monitor	--	--	--		
Copper, Total (mg/L)	Report	Report	Monitor	Report	Report	Report		
Lead, Total (mg/L)	Report	Report	--	Report	Report	--		
Mercury, Total (mg/L)	Report	Report	--	Report	Report	--		
Selenium, Total (mg/L)	Report	Report	--	Report	Report	--		
Cadmium, Total (mg/L)	Report	Report	--	Report	Report	--		
Chromium, Total (mg/L)	Report	Report	--	Report	Report	--		
Iron, Total (mg/L)	Report	Report	Monitor	Report	Report	--		
Manganese, Total (mg/L)	Report	Report	--	Report	Report	--		
Silver, Total (mg/L)	Report	Report	--	Report	Report	--		
Hydrazine (mg/L)	--	--	Monitor	--	--	--		
Arsenic (ppd)	--	--	Monitor	--	--	--		
Total Recoverable Metals (mg/L)****	--	--	Monitor	--	--	Report****		

\* If a calculated value for net addition of ammonia as nitrogen exceeds an action concentration value of 1.0 mg/L, the permittee should investigate . . . and proceed with corrective if necessary.

\*\* If [certain] values are reported corrective action(s) should be taken by TVA.

\*\*\* If a calculated value for net addition of ammonia as nitrogen exceeds an action concentration value of 2.85 mg/L, the permittee should investigate . . . and proceed with corrective if necessary.

\*\*\*\*Total the results of the analyses for each individual parameter, and report that aggregate value on the DMR. Attach the lab bench sheets showing individual results to the D

## **Alternative C – Rejuvenation of SCR Catalyst – On-Site, *In-Situ* Impacts**

Under this alternative the catalyst would be restored using a once-through de-ionized (DI) water wash followed by a recirculated 3 percent by weight H<sub>2</sub>SO<sub>4</sub> and DI water solution wash. An alternative to the acid wash would be a DI water-only wash if it is determined that the acid solution is not needed to attain adequate treatment. In addition, a second recirculation treatment of vanadyl oxalate solution may be conducted to regenerate the catalyst, however, the regeneration process would not generate wastewater, therefore would have no wastewater impacts.

A pilot scale study was conducted by applying the Alternative C rejuvenation process to catalyst elements from the ALF Plant. Laboratory analyses were conducted on the DI water wash wastewater and the acid wash wastewater. The results for the 5-minute once-through DI water wash and the 25-minute acid wash are presented in Table 2. None of the ash ponds have specific NPDES permit effluent limits for the wastewater parameters listed in Table 2, with the exception of pH and the action concentration values for ammonia. Regardless, the wastewater concentrations are relatively insignificant, although the pH is very low (2.2 s.u. for the DI water wash wastewater and 0.65 s.u. for the acid wash wastewater).

Per the considerations in the section titled, *Acid Rejuvenation Washes - Determination of Waste Characteristic and Appropriate Handling Methods* under Alternative C of the Solid and Hazardous Waste portion of this document, the low pH wastewater created from the on-site rejuvenation process would be neutralized at the point of generation. A series of circulating tanks, such as shown in Appendix B Figure B-4 in which the neutralizing agent (probably lime, caustic soda, or a caustic solution) can be slowly introduced would most likely be used for the elementary neutralization (pH adjustment). Using this method to slowly raise the pH would allow the exothermic reaction to occur slowly thereby minimizing undesirable side effects of a fast occurring exothermic reaction. The pH level would be raised to a pH range that was suitable for discharging through the respective plant NPDES-permitted ash pond discharges. To accomplish this condition, the low pH wastewater created from the on-site rejuvenation process would be adjusted at the point of generation to a pH value of greater than 2.0, most typically in the range of 4.0-6.0 depending on site characteristics and the ash pond conditions (e.g., the existing wastewater pH) of the particular plant.

Following elementary neutralization the wastewater would be directed to the ash ponds via existing conveyances such as the ash sluice lines or the station sumps. The tanks for the neutralization process may be temporary and mobile or permanent fixtures located in close proximity to the SCR components and within the existing area of the plant infrastructure previously disturbed for construction of the plant. It is anticipated that the effluent from the tanks would be transferred through a flexible hose such as those used in the washing process. If the tanks are permanently fixed, the transfer piping would need to be rigid and meet all engineering and BMP requirements for a particular location.

Using the process wastewater analytical data, and knowing the current inflows for the ash ponds, the concentrations of the wastewater parameters entering the ash ponds were calculated prior to any additional mixing that might occur in the ash ponds. For the purposes of determining if Alternative C would have significant wastewater impacts, the following conditions were assumed to determine the outfall concentrations:

Table 2. Laboratory Results from Rejuvenation of SCR Catalyst -- On-Site, *In-Situ*

Wastewater Parameters	5 Min. Once-Thru DI Water Concentration (mg/L)	25 Min. Recirc. 3% H <sub>2</sub> SO <sub>4</sub> Concentration (mg/L)
Flow (for 2.5-18 days)	0.019 MGD	0.0106 MGD
pH	2.2 s.u.	0.65 s.u.
Arsenic	--	--
Vanadium	12	32
Molybdenum	<1	<1
Sodium	170	175
Potassium	11	21
Calcium	60	67
Magnesium	13	32
Iron	11	20
Chloride	--	--
Sulfate	--	--
Phosphate	10	11.5

1. the laboratory data obtained using ALF catalyst elements were applicable to all the plants;
2. no other sources of the wastewater constituents were considered; and
3. the process wastewater had complete mixing with other inflows but no additional mixing or settling in the ash ponds was assumed.

The calculated concentrations of the wastewater parameters at the ash pond inflows are summarized in Table 3. All results are less than 1 mg/L and are likely to be even lower at the discharge point due to mixing and settling in the ash ponds. The process wastewaters created by Alternative C would contribute an insignificant incremental increase in the concentration of the wastewater parameters at the DSN 001 discharge point. Based on these data (Table 3) and the use of elementary neutralization for control of pH, Alternative C should have no significant impacts on wastewater characteristics, or on compliance with applicable permit limits, including whole effluent toxicity.

### **Alternative D – Rejuvenation of SCR Catalyst – On-Site, *Ex-Situ* Impacts**

Under this alternative the catalyst would be restored by pre-washing each module with a solution of city water and detergent followed by a 2 percent by weight oxalic acid wash. The modules would then be rinsed using city water.

A pilot scale study was conducted by applying the Alternative D rejuvenation process to catalyst elements from the ALF Plant. Laboratory analyses were conducted on the pre-wash wastewater and the oxalic acid wash wastewater. The results for the pre-wash and the acid wash are presented in Table 4. None of the ash ponds have specific NPDES permit effluent limits for the wastewater parameters listed in Table 4, with the exception of pH and the action concentration values for ammonia. Regardless, the wastewater concentration are relatively insignificant, although the acid wash wastewater pH is low (1.5 s.u.).

Per the considerations in the section titled, *Acid Rejuvenation Washes - Determination of Waste Characteristic and Appropriate Handling Methods* under Alternative C of the Solid and Hazardous Waste portion of this document, the low pH wastewater created from the on-site rejuvenation process would be neutralized at the point of generation. A series of circulating tanks, such as shown in Appendix B Figure B-4 in which the neutralizing agent (probably lime, caustic soda, or a caustic solution) can be slowly introduced would most likely be used for the neutralization (pH adjustment). Using this method to slowly raise the pH would allow the exothermic reaction to occur slowly, thereby minimizing undesirable side effects of a fast occurring exothermic reaction. The pH level would be raised to a pH range that was suitable for discharging through the respective plant NPDES-permitted ash pond discharges. To accomplish this condition, the low pH wastewater created from the on-site rejuvenation process would be adjusted at the point of generation to a pH value of greater than 2.0, most typically in the range of 4.0-6.0 depending on site characteristics and the ash pond conditions (e.g., the existing wastewater pH) of the particular plant.

Following elementary neutralization the wastewater would be directed to the ash ponds via existing conveyances such as the ash sluice lines or the station sumps. The tanks for the neutralization process may be temporary and mobile or permanent fixtures located in close proximity to the SCR components and within the existing area of the plant infrastructure previously disturbed for construction of the plant. It is anticipated that the

effluent from the tanks would be transferred through a flexible hose such as those used in the washing

Table 3. Concentrations in Inflows to Ash Ponds for Selected Wastewater Parameters -- On-Site, *In-Situ*

Wastewater Parameters	ALF Ash Pond Q Conc (ug/L)	BRF Ash Pond Q Conc (ug/L)	COF Ash Pond Q Conc (ug/L)	CUF Ash Pond Q Conc (ug/L)	KIF Ash Pond Q Conc (ug/L)	PAF Ash Pond Q Conc (ug/L)	WCF Ash Pond Q Conc (ug/L)
Arsenic	--	--	--	--	--	--	--
Vanadium	54.79	30.96	66.88	25.75	14.00	17.09	17.26
Molybdenum	2.86	1.62	3.49	1.34	0.73	0.89	0.90
Sodium	491.19	277.55	599.56	230.81	125.51	153.21	154.71
Potassium	41.69	23.56	50.89	19.59	10.65	13.00	13.13
Calcium	178.72	100.99	218.15	83.98	45.67	55.75	56.29
Magnesium	56.62	32.00	69.12	26.61	14.47	17.66	17.83
Iron	40.67	22.98	49.64	19.11	10.39	12.68	12.81
Chloride	--	--	--	--	--	--	--
Sulfate	--	--	--	--	--	--	--
Phosphate	30.13	17.02	36.78	14.158	7.70	9.40	9.49

Table 4. Laboratory Results from Rejuvenation of SCR Catalyst -- On-Site, *Ex-Situ*

Wastewater Parameters	Pre-Wash Discharge Concentration (mg/L)	Oxalic Acid Discharge Concentration (mg/L)
Flow (for 2.8-20 days)	0.058 MGD	0.0064 MGD
pH	5.4 s.u.	1.5 s.u.
Ammonium-N	<0.3	0.8
Nitrate-N	3.9	4.7
Nitrite-N	<0.03	<0.3
Chloride	9.6	33.7
Sulfate	131	41.5
o-Phosphate	<0.3	<3
Sodium	22.4	31.2
Potassium	3.9	7.1
Calcium	49.5	17
Magnesia	9.9	14
Arsenic	<0.01	0.04
Barium	<0.02	<0.02
Lead	<0.01	0.056
Cadmium	<0.001	<0.001
Chromium	<0.01	0.014
Iron	0.078	1.96
Molybdenum	<0.02	0.097
Nickel	0.015	0.052
Silver	<0.02	<0.02
Thallium	0.084	0.15
Titanium	<0.02	1.43
Zinc	0.915	0.78
Tin	<0.1	0.18
Selenium	<0.02	0.084
Vanadium	0.031	8.32
Mercury	<0.01	<0.01

process. If the tanks are permanently fixed, the transfer piping would need to be rigid and meet all engineering and BMP requirements for a particular location.

Using the process wastewater analytical data, and knowing the current inflows for the ash ponds, the concentrations of the wastewater parameters entering the ash ponds were calculated prior to any additional mixing that might occur in the ash ponds. For the purposes of determining if Alternative D would have significant wastewater impacts, the following conditions were assumed to determine the outfall concentrations:

1. the laboratory data obtained using ALF catalyst elements were applicable to all the plants;
2. no other sources of the wastewater constituents were considered; and
3. the process wastewater had complete mixing with other inflows but no additional mixing or settling in the ash ponds was assumed.

The calculated concentrations of the wastewater parameters at the ash pond inflows are summarized in Table 5. All results are less than 1 mg/L and are likely to be even lower at the discharge point due to mixing and settling in the ash ponds. The process wastewaters created by Alternative D would contribute an insignificant incremental increase in the concentration of the wastewater parameters at the DSN 001 discharge point. Based on these data (Table 5) and the use of elementary neutralization for control of pH, Alternative D should have no significant impacts on wastewater characteristics, or on compliance with applicable permit limits, including whole effluent toxicity.

### **Alternative E – Delayed Rejuvenation of SCR Catalyst On-site, Ex Situ and Interim Replacement with New Catalyst**

Under this alternative entire catalyst modules would be removed from the SCR, and new modules would be installed. No wastewater would be generated by this portion of the activities under this alternative. The anticipated potential for impacts and commitments identified for the rejuvenation activities under this alternative are the same as for Alternative D.

## **Summary of Commitments and Mitigation Measures**

The following commitments and mitigation measures were identified as necessary to ensure that no significant impacts result from the proposed actions.

### **Commitments Which Apply to All Action Alternatives**

For replacement of catalyst logs, whether under the replacement alternative or in the event that damaged logs are identified during the alternatives for rejuvenation processes, due care will be taken during removal of the logs to not break or otherwise crumble the used catalyst logs and modules, and therefore, minimize the potential for fugitive dust. Logs will be placed in a lined, covered container compatible with the anticipated waste hazards.

While handling used catalyst, workers will wear respiratory protection to prevent inhalation of the minor, insignificant amount of dust or fines that could be generated during removal and handling. The contractor shall address specific Industrial Hygiene issues in the site Work Safety Plan.

Table 5. Concentrations in Inflows to Ash Ponds for Selected Wastewater Parameters -- On-Site, *Ex-Situ*

Wastewater Parameters	ALF Ash Pond Q Conc (ug/L)	BRF Ash Pond Q Conc (ug/L)	COF Ash Pond Q Conc (ug/L)	CUF Ash Pond Q Conc (ug/L)	KIF Ash Pond Q Conc (ug/L)	PAF Ash Pond Q Conc (ug/L)	WCF Ash Pond Q Conc (ug/L)
Ammonium-N	2.17	1.23	2.65	1.02	0.56	0.68	0.69
Nitrate-N	24.67	13.96	30.10	11.61	6.32	7.72	7.79
Nitrite-N	0.35	0.20	0.43	0.17	0.09	0.11	0.11
Chloride	74.46	42.13	90.83	35.05	19.08	23.28	23.51
Sulfate	756.56	428.11	922.87	356.12	193.86	236.58	238.87
o-Phosphate	3.53	2.00	4.31	1.66	0.91	1.11	1.12
Sodium	144.32	81.66	176.04	67.93	36.98	45.13	45.56
Potassium	26.16	14.80	31.91	12.31	6.70	8.18	8.26
Calcium	286.69	162.23	349.72	134.95	73.46	89.65	90.52
Magnesia	63.91	36.17	77.96	30.08	16.38	19.99	20.18
Arsenic	0.08	0.05	0.10	0.04	0.02	0.03	0.03
Barium	0.12	0.07	0.15	0.06	0.03	0.04	0.04
Lead	0.09	0.05	0.11	0.04	0.02	0.03	0.03
Cadmium	0.01	0.00	0.01	0.00	0.00	0.00	0.00
Chromium	0.06	0.04	0.08	0.03	0.02	0.02	0.02
Iron	1.65	0.93	2.01	0.78	0.42	0.52	0.52
Molybdenum	0.17	0.10	0.21	0.08	0.04	0.05	0.05
Nickel	0.12	0.07	0.14	0.05	0.03	0.04	0.04
Silver	0.12	0.07	0.15	0.06	0.03	0.04	0.04
Thallium	0.56	0.32	0.69	0.26	0.14	0.18	0.18
Titanium	1.00	0.57	1.22	0.47	0.26	0.31	0.32
Zinc	5.59	3.16	6.82	2.63	1.43	1.75	1.76
Tin	0.67	0.38	0.82	0.32	0.17	0.21	0.21
Selenium	0.16	0.09	0.20	0.08	0.04	0.05	0.05
Vanadium	5.33	3.02	6.51	2.51	1.37	1.67	1.68
Mercury	0.06	0.04	0.08	0.03	0.02	0.02	0.02

Should the logs be removed for disposal, a representative sample will be taken in order to make a determination of waste characteristic (i.e., non-hazardous or hazardous). The analysis will be conducted by TVA's Environmental Chemistry Laboratory in Chattanooga, or TVA-designated equivalent laboratory, (analyzing for TCLP Metals with the Inorganic Underlying Hazardous Constituents at non-wastewater detection levels). The results of these analyses shall be sent to FPG-Environmental Affairs for future determinations utilizing process knowledge.

Preliminary testing of the spent catalyst logs show them to be non-hazardous despite the presence of minute amounts of vanadium pentoxide in the spent logs. Therefore, these logs could appropriately be disposed at a Subtitle D landfill for non-hazardous wastes. Due to the paucity of data, TVA would continue to test the spent logs, as SCRs are commissioned, to confirm the non-hazardous nature of the spent logs. Testing of the spent logs would be performed until sufficient data is obtained to use generator knowledge to determine the RCRA status of the spent catalyst logs. Alternatively, out of an abundance of caution, the logs could be disposed at a Subtitle C landfill for hazardous wastes.

Should TVA be a co-generator or generator of hazardous waste associated with the replacement of catalyst (whether under the replacement alternative or ancillary to the rejuvenation alternatives), a qualified hazardous waste disposal facility that is on TVA's Environmental Restricted Awards List (ERAL) at the time of the project would be used for the ultimate disposal.

### **Commitments Which Apply To On-site, *In Situ* (C) and On-site *Ex-Situ* (D) Rejuvenation and Delayed Rejuvenation of SCR Catalyst On-site, *Ex Situ* and Interim Replacement with New Catalyst (E) Alternatives**

The vacuuming of dust from the catalyst will be done with equipment equipped with bagfilters to prevent the discharge of dust particles during this activity.

Vacuumed ash will either be disposed of onsite through the existing ash handling system or offsite as a special waste going to an approved Subtitle D landfill.

At the time and point of generation (common tank), the waste from acid washes will be tested for RCRA metals and a pH measurement taken (for corrosivity) prior to deciding how to handle the waste. Waste handling will depend upon the outcome of that test at the time of waste generation. Results of these tests would be maintained in a TVA data base maintained by the staff of Environmental Affairs in the Fossil Power Group. This testing would be conducted through at least one cycle of catalyst replacement for each SCR, or until FPG Environmental Affairs staff have determined and documented that sufficient testing has been conducted to use process knowledge as the basis for the decisions regarding management of the acid wash wastes.

Should the acid wash and rinse wastes from either rejuvenation alternative exhibit corrosivity (low pH), onsite neutralization would involve collecting the waste in a tank or tank system as defined at 40 CFR 260.10, and then co-disposed or co-treated with the fly ash, bottom ash, boiler slag or flue gas emission control wastes via hard or flexible piping to the ash pond for ultimate disposal. If the tank(s) are permanently fixed, the transfer piping would need to be rigid and meet all engineering and BMP (Best Management Practices) for a particular location.

TVA would buffer the common acid wash and rinse solution to a high enough pH so as to ensure that requirements for managing the ash pond under the NPDES program are met. Low pH wastewater created from the on-site rejuvenation process would be adjusted at the point of generation to a pH value of greater than 2.0, most typically in the range of 4.0-6.0 depending on site characteristics and the ash pond conditions (e.g., the existing wastewater pH) of the particular plant.

Neutralized waste would be routed to any waste disposal route that is subject to NPDES or CWA standards (e.g. the ash ponds) via flexible or hard piping to existing conveyances such as the ash sluice lines or the station sumps.

Should the waste exceed RCRA characteristic limits for metals or any other parameter, off-site treatment would be required, whereby the waste would be collected in a tanker truck for transportation to an offsite Environmental Restricted Awards List (ERAL)-listed Treatment, Storage and Disposal Facility (TSDF) for treatment and disposal.

For Alternative E, the removed catalyst would be held for re-use in a stable environment (e.g., at ambient temperatures, but protected from the elements), such as in temporary or permanent on-site storage structures. In the event that additional holding facilities for the temporary protection of catalyst modules are needed for Alternative E, prior to TVA taking action, subsequent environmental review under NEPA will be required for identifying and evaluating any such proposed structures.

## Preferred Alternative(s)

The specific nature of deactivation of the SCR catalyst may vary between fossil plants, therefore, favoring one method of replacement and disposal, or rejuvenation, over another at different plants. Among the rejuvenation alternatives, determination of the appropriate cleaning, rejuvenation and/or regeneration process and timing would be based upon economics and the particular catalyst deactivation mechanisms at the specific plant. As of the SCR systems, only ALF Unit 2 has undergone their first cycling through maintenance of the catalyst, the site-specific nature of deactivation at the other facilities cannot be determined until just prior to the time the catalyst would need replaced or rejuvenated. TVA prefers to maintain the flexibility to select among the entire suite of proposed action alternatives, as economically and technologically appropriate, to address the plant-specific nature of catalyst deactivation.

## TVA Contributors

Anne Aiken  
Angela Ballew

Steve Barnes  
Larry Bowers  
Mark Hill  
Darlene Keller  
Jennifer Moses  
Roy Quinn  
Denise Thacker  
Bruce Yeager

Wastewater  
Hazardous and Solid Waste  
Determinations  
Wastewater Permitting  
Solid Waste Permitting  
Project Manager, SCR Catalyst Project  
FPG NEPA Coordinator  
Aquatic Toxicology  
Wastewater  
Hazardous Waste Permitting  
NEPA Project Management

## **Appendix A**

### **Material Safety Data Sheets for SCR Catalyst, Detergent, and Regeneration Compound**

**CORMETECH, INC.** Page 1 of 5  
**Environmental Technologies**  
**SCR Systems NOx Catalyst**  
**Material Data Safety Sheet**  
Effective Date: 10/03 Supercedes: 11/92

## **CORMETECH**

### **Section 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

**Product Name:** SCR Systems NOx Catalyst **For Additional Product Information:** (919) 620-3000

**Chemical Family:** Ceramic **In Emergency:** (919) 620-3000

**Manufacturer:** Cormetech, Inc. **Approved by:** H Terry McTernan, PE

**Address:** 5000 International Dr

Durham, NC 27712

**HMIS/NFPA Ratings** H: 2 F: 0 R: 0

### **Section 2: COMPOSITION/INFORMATION ON INGREDIENTS**

FOR EXPOSURE LIMITS SEE SECTION 8

FOR OTHER TOXICOLOGICAL INFORMATION SEE SECTION 12

Exposure Limit Sec 12 INFO

CAS # COMPONENT NAME % YES NO YES NO

13463-67-7 Titanium dioxide < 85 X X

1314-35-8 Tungsten oxide < 24 X X

Not Available Fibrous glass,

continuous filament

< 10 X X

14808-60-7 Silicon dioxide 0 - 5 X X

1314-62-1 Vanadium pentoxide 0 - 5 X X

### **Component Information/Information on Non-Hazardous Components**

This product has been evaluated under the criteria specified in 29 CFR 1910.1200 (Hazard Communication Standard). The exact composition of each product may vary slightly. All components listed above may not be present in each product.

### **Section 3: HAZARDS IDENTIFICATION**

#### **Emergency Overview**

**WARNING!** This product contains a component that is poisonous. Harmful or fatal if swallowed.

This is a non-combustible, non-reactive solid material. It is supplied in the form of ceramic honeycombs. Use methods suitable to fight surrounding fire. Exposure to ceramic dusts may be irritating to eyes, nose, and throat. At very high levels the ceramic dust may have an effect on the lungs. The metallic elements contained in the ceramic may be biologically available if ingested or inhaled.

#### **Potential Effects of Acute Exposure:**

**Eye:** Ceramic dust or powder may irritate eye tissue. Rubbing may cause abrasion of cornea.

**Skin Contact:** Ceramic dust or powder may irritate the skin. Mechanical rubbing may increase skin irritation.

**Skin Absorption:** No components are known to be available for absorption through the skin.

**Ingestion:** Harmful or fatal if swallowed. May cause temporary irritation of throat, stomach, and gastrointestinal tract.

**Inhalation:** Dust from this product may cause irritation of the nose, throat, and respiratory tract.

When inhaled in very large amounts, damage to the lung can occur.

## **CORMETECH**

### **Potential Effects of Chronic Exposure:**

Long term exposure to vanadium pentoxide dusts or fumes may cause lung damage, damage to the blood-forming elements, and central nervous system effects. IARC has classified the ceramic fibers used in this product as category 2B carcinogens (sufficient evidence of carcinogenicity in animals but insufficient evidence in humans).

### **Section 4: FIRST AID MEASURES**

**Eyes:** Immediately flush eyes with large amounts of water, continue to flush for 15 minutes. Seek medical attention immediately.

**Skin:** Cuts or abrasions should be treated promptly with thorough cleansing of the affected area. Get medical attention if irritation persists. Launder contaminated clothing before reuse.

**Inhalation:** If mists, vapors or fumes of this product are inhaled, remove person immediately to fresh air. Seek medical attention if symptoms develop or persist. If breathing is difficult, give oxygen.

**Ingestion:** If conscious give 2-4 glasses of water and induce vomiting. Nothing by mouth if unconscious.

**Notes to Physician:** None.

### **Section 5: FIRE-FIGHTING MEASURES**

**General:** Not expected to be a fire hazard.

**Flashpoint:** Not applicable.

**Flammability Limits:** Not applicable.

**Auto ignition Temperature:** Not applicable.

**Means of Extinction:** As for the surrounding fire.

**Hazardous Combustion Products:** Material forms irritating and toxic gaseous metallic oxides at high temperatures.

**Fire-Fighting Instructions:** Wear full protective clothing; including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.

### **Section 6: ACCIDENTAL SPILL/RELEASE MATERIALS**

**General:** Avoid creating dust. Prevent entry into sewers or waterways.

**Large/Small Spill:** Collect spill using a vacuum cleaner with a HEPA filter. Place in a closed container.

**Waste Disposal:** Clean up and dispose of waste in accordance with all Federal, State, and Local regulations. Regulations vary. Consult local authorities before disposal.

### **Section 7: HANDLING AND STORAGE**

**General Handling Precautions:** Avoid inhalation of dust. Avoid contact with skin and eyes. Wear appropriate protective equipment during handling. Wash thoroughly after handling.

**Storage Requirements:** Store in a dry area.

### **Section 8: EXPOSURE CONTROL/PERSONAL PROTECTION**

**Ventilation:** If material is ground or cut use appropriate local exhaust ventilation to keep exposures below the regulated limits.

**Exposure Limits:**

OSHA ACGIH Other

## **CORMETECH**

**Chemical Name** TWA STEL TWA STEL TWA STEL  
**Titanium dioxide** 10 mg/m<sup>3</sup> 10 mg/m<sup>3</sup>  
**Tungsten oxide** 5 mg/m<sup>3</sup> 10 mg/m<sup>3</sup> 5 mg/m<sup>3</sup> 10 mg/m<sup>3</sup>  
**Silicon dioxide** 6 mg/m<sup>3</sup> 6 mg/m<sup>3</sup>  
**Vanadium pentoxide** 0.05 mg/m<sup>3</sup> 0.05 mg/m<sup>3</sup> ceiling = 0.55 mg/m<sup>3</sup> (NIOSH)  
**Ceramic fiber** 1 fibre/cm<sup>3</sup> (supplier TWA)

### **Particulates**

**(not otherwise regulated)**

OSHA: total dust: 15 mg/m<sup>3</sup>  
respirable fraction: 5 mg/m<sup>3</sup>

### **Personal Protective Equipment:**

**Eye Protection:** Wear safety glasses with side shields.

**Skin Protection:** Wear impervious gloves, if necessary for type of operation. Use of coveralls and long sleeves is recommended to prevent skin contact.

**General Protection:** Eye wash fountain and emergency showers are recommended. Use good hygiene practices when handling this material including changing and laundering work clothing after use.

**Respiratory Protection:** If ventilation is not sufficient to effectively prevent buildup of dust, appropriate NIOSH respirator protection must be provided. Respirators should be selected by and used under the direction of a trained health and safety professional following requirements found in OSHA's respirator standard (29 CFR 1910.134) and ANSI's standard for respiratory protection (Z88.2-1992).

## **Section 9: PHYSICAL AND CHEMICAL PROPERTIES**

**Physical State:** Solid **Softening Point:** > 1,800°C

**Odor and Appearance:** Yellowish green to gray, odorless **pH:** not applicable

**Specific Gravity:** 4.26 gm/cm<sup>3</sup> (density) **Solubility (in water):** Slight

**Boiling Point:** not applicable **Freezing Point:** not applicable

**Vapor Pressure:** not applicable **Evaporation Rate:** not applicable

**Percent Volatile:** not applicable **Viscosity:** not applicable

**Vapor Density:** not applicable

## **Section 10: STABILITY AND REACTIVITY**

**Stability:** Product is stable under recommended storage conditions.

**Conditions to Avoid:** Keep away from moisture.

**Hazardous Polymerization:** None known.

**Incompatibility:** None known.

## **Section 11: TRANSPORT INFORMATION**

This product is not regulated as a hazardous material by the United States (DOT) or Canadian (TDG) transportation regulations.

## **Section 12: TOXICOLOGICAL INFORMATION**

**General:** No information available for product. Components of this product are harmful by ingestion and/or inhalation if excessive dusts are generated. Components may also cause moderate to severe irritation to the eyes and skin. Vanadium pentoxide is a poisonous material. It is highly toxic and may be fatal by ingestion. It also causes irritation to the skin, eyes and respiratory tract. Inhalation may result in pulmonary edema.

## **CORMETECH**

### **Component Analysis:**

**Tungsten oxide** Oral LD50 Rat: 1059 mg/kg

**Titanium dioxide**

**Vanadium pentoxide** Oral LC50 Rat: 10-12 mg/kg

**Carcinogenicity:** No information available for product.

### **Component**

#### **Carcinogenicity:**

**Titanium oxide** ACGIH: A4 – Not classifiable as a Human Carcinogen

NIOSH: Occupational carcinogen

IARC: Monograph 47, 1989 (Group 3 (Not classifiable))

**Silicon dioxide** IARC: Monograph 68, 1997 (Group 3 (Not classifiable))

**Fibrous glass:** ACGIH: A4 – Not classifiable as a Human Carcinogen (related to Continuous filament glass fibers)

IARC: Monograph 43, 1988 (related to Glass filaments) (Group 3 (Not classifiable))

**Epidemiology:** No information available for product.

**Neurotoxicity:** No information available for product.

**Mutagenicity:** No information available for product.

**Teratogenicity:** No information available for product.

### **Other Toxicological**

#### **Information:**

No additional information.

## **Section 13: REGULATORY INFORMATION**

**TSCA Status:** A component of this product is not listed on the TSCA Inventory List. However, this component is a naturally occurring chemical substance and is therefore automatically included on the TSCA Inventory

List. All other components are on the TSCA Inventory List.

**CERCLA/SARA:** This material contains a chemical that is identified under SARA Section 313.

Vanadium pentoxide CERCLA RQ = 1000 lbs SARA RQ = 1000 lbs

**RCRA:** This product does not contain any components in quantities that meet 40 CFR 261.24. All Users of this product must test your waste using methods described in 40 CFR Part 261 to determine if it meets these or other applicable definitions of hazardous waste. Waste must be handled in accordance with all applicable regulations. Purchaser is advised to review regulations referenced for applicability as determined by purchaser's use of product.

## **Section 14: OTHER INFORMATION**

Revision information: 9/03/03

Reasonable care has been taken in the preparation of this information, but CORMETECH makes no warranty of merchantability of any other warranty, expressed or implied, with respect to this information. CORMETECH makes no representations and assumes no liability for any direct, incidental or consequential damages resulting from its use.

**CORMETECH, INC.** Page 5 of 5

**Environmental Technologies**

**SCR Systems NOx Catalyst**

**Material Data Safety Sheet**

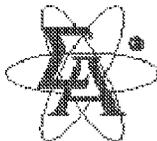
Effective Date: 10/03 Supercedes: 11/92

**CORMETECH**

**Key/Legend**

ACGIH = American Conference of Governmental Industrial Hygienists. CERCLA = Comprehensive Environmental Response, Compensation and Liability Act. CFR = Code of Federal Regulations. DSL = Canadian Domestic Substance List. EINECS = European Inventory of New and Existing Chemical Substances. EPA = Environmental Protection Agency. HEPA = High Efficiency Particulate Air. HMIS = Hazardous Material Identification System. IARC = International Agency for Research on Cancer. NFPA = National Fire Protection Association. NIOSH = National Institute of Occupational Safety and Health. NJTSR = New Jersey Trade Secret Registry. NTP = National Toxicology Program. OSHA = Occupational Safety and Health Administration. NA = Not Available or Not Applicable. SARA = Superfund Amendments and Reauthorization Act. TLV = Threshold Limit Value. TSCA = Toxic Substance Control Act. WHMIS = Workplace Hazardous Materials Information System.

**CORMETECH**



# SIGMA-ALDRICH

## Material Safety Data Sheet

Date Printed: 01/07/2003  
Date Updated: 09/02/2002  
Version 1.10

### Section 1 - Product and Company Information

<b>Product Name</b>	TERGITOL MIN FOAM 1X NONIONIC		
<b>Product Number</b>	T1135		
<b>Brand</b>	Sigma Chemical		
<b>Company</b>	Sigma-Aldrich		
<b>Street Address</b>	3050 Spruce Street		
<b>City, State, Zip, Country</b>	SAINT LOUIS, MO 63103 US		
<b>Technical Phone:</b>	314 771 5765	<b>Emergency Phone:</b>	414 273 3850 Ext. 5996
<b>Fax:</b>	800 325 5052		

### Section 2 - Composition/Information on Ingredient

<u>Substance Name</u>	<u>CAS #</u>	<u>SARA 313</u>
TERGITOL MIN FOAM 1X NONIONIC	None	No

**Formula**  
**Synonyms**

### Section 3 - Hazards Identification

#### Emergency Overview

Irritant.  
Irritating to skin. Risk of serious damage to eyes.

For additional information on toxicity, please refer to Section 11.

### Section 4 - First Aid Measures

#### Oral Exposure

If swallowed, wash out mouth with water provided person is conscious. Call a physician.

#### Inhalation Exposure

If inhaled, remove to fresh air. If breathing becomes difficult, call a physician.

#### Dermal Exposure

In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

#### Eye Exposure

In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

### Section 5 - Fire Fighting Measures

**Autoignition Temp:** N/A

## Extinguishing Media

### Suitable

Water spray. Carbon dioxide, dry chemical powder, or appropriate foam. Foam and water spray are effective but may cause frothing.

### Unsuitable

Do not direct a solid stream of water or foam into burning molten material; this may cause spattering and spread the fire.

## Firefighting

### Protective Equipment

Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.

---

## Section 6 - Accidental Release Measures

---

### Procedure(s) of Personal Precaution(s)

Wear respirator, chemical safety goggles, rubber boots, and heavy rubber gloves.

### Methods for Cleaning Up

Absorb on sand or vermiculite and place in closed containers for disposal. Ventilate area and wash spill site after material pickup is complete.

---

## Section 7 - Handling and Storage

---

### Handling

#### User Exposure

Avoid inhalation. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

### Storage

#### Suitable

Keep tightly closed. Store in a cool dry place.

---

## Section 8 - Exposure Controls / PPE

---

### Engineering Controls

Safety shower and eye bath. Mechanical exhaust required.

### Personal Protective Equipment

#### Respiratory

Government approved respirator.

#### Hand

Compatible chemical-resistant gloves.

#### Eye

Chemical safety goggles.

### General Hygiene Measures

Wash thoroughly after handling.

---

## Section 9 - Physical/Chemical Properties

---

### Appearance

#### Physical State

Liquid

**Molecular Weight:** N/A

**pH** N/A

**BP/BP Range** N/A

**MP/MP Range** N/A

**Freezing Point** N/A

Vapor Pressure	N/A
Vapor Density	N/A
Saturated Vapor Conc.	N/A
SG/Density	N/A
Bulk Density	N/A
Odor Threshold	N/A
Volatile%	N/A
VOC Content	N/A
Water Content	N/A
Solvent Content	N/A
Evaporation Rate	N/A
Viscosity	N/A
Partition Coefficient	N/A
Decomposition Temp.	N/A
Flash Point °F	N/A
Flash Point °C	N/A
Explosion Limits	N/A
Flammability	N/A
Autoignition Temp	N/A
Solubility	N/A

N/A = not available

---

## Section 10 - Stability and Reactivity

---

### Stability

#### Stable

Stable.

#### Materials to Avoid

Strong oxidizing agents.

### Hazardous Decomposition Products

#### Hazardous Decomposition Products

Carbon monoxide, Carbon dioxide.

### Hazardous Polymerization

#### Hazardous Polymerization

Will not occur.

---

## Section 11 - Toxicological Information

---

### Route of Exposure

#### Skin Contact

Causes skin irritation.

#### Eye Contact

Causes severe eye irritation.

#### Inhalation

Material may be irritating to mucous membranes and upper respiratory tract.

#### Multiple Routes

May be harmful by inhalation, ingestion, or skin absorption.

### Signs and Symptoms of Exposure

Exposure can cause: Nausea, headache, and vomiting. Heavy or prolonged skin exposure may result in the absorption of harmful amounts of material.

**RTECS Number:**

---

## Section 12 - Ecological Information

---

No data available.

---

## Section 13 - Disposal Considerations

---

### Appropriate Method of Disposal of Substance or Preparation

Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

---

## Section 14 - Transport Information

---

### DOT

**Proper Shipping Name:** None

**Non-Hazardous for Transport:** This substance is considered to be non-hazardous for transport.

### IATA

**Non-Hazardous for Air Transport:** Non-hazardous for air transport.

---

## Section 15 - Regulatory Information

---

### EU Additional Classification

**Symbol of Danger:** Xi

**Indication of Danger**

Irritant.

**Risk Statements**                      **R:** 38 41

Irritating to skin. Risk of serious damage to eyes.

**Safety Statements**                      **S:** 26 36

In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing.

### US Classification and Label Text

**Indication of Danger**

Irritant.

**Risk Statements**

Irritating to skin. Risk of serious damage to eyes.

**Safety Statements**

In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing.

### United States Regulatory Information

**SARA Listed:** No

### Canada Regulatory Information

**WHMIS Classification**

This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.

**DSL:** No

**NDSL:** No

---

## Section 16 - Other Information

---

### Disclaimer

For R&D use only. Not for drug, household or other uses.

### Warranty

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale. Copyright 2003 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only.



# MATERIAL SAFETY DATA SHEET

*Fax*  
 To: Mr. Darrell Pauls  
 From: SCR-Tech  
 Re: As discussed MSDS

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

## PART I What is the material and what do I need to know in an emergency

### 1. PRODUCT IDENTIFICATION

TRADE NAME (AS LABELED):  
 SUPPLIER/MANUFACTURER'S NAME:  
 ADDRESS:

**VANADYL OXALATE SOLUTION**

**Pechiney World Trade (U.S.A.), INC.**

333 Ludlow Street  
 Stamford, CT 06902  
 (203) 541-9190  
 CHEMTREC: 800/424-9300  
 April 1, 1997  
 March 12, 2002

BUSINESS PHONE:  
 EMERGENCY PHONE:  
 DATE OF PREPARATION:  
 DATE OF REVISION:

*423-751-4619*

### 2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	% w/w	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH IDLH mg/m <sup>3</sup>	OTHER mg/m <sup>3</sup>
			TWA mg/m <sup>3</sup>	STEL mg/m <sup>3</sup>	TWA mg/m <sup>3</sup>	STEL mg/m <sup>3</sup>		
Vanadium Oxalate (Vanadyl Oxalate) There are no exposure limits for this compound; it is recommended that the following limits for Vanadium respirable dust or fume, as V <sub>2</sub> O <sub>5</sub> be followed.	14974-48-2	40-50%	0.05	NE	Vacated 1989 PELs: 0.05 (dust, respirable)	0.5 ceiling (respirable dust); 01 ceiling (fume) 0.05 ceiling (Vacated 1989 PEL)	35 (as V)	NIOSH REL: STEL = 0.05 (ceiling), 15 min., total dust as V DFG MAKs: TWA = 0.05 (respirable fraction) PEAK = 5 MAK, 30 min., average value.
Water	7732-18-5	Balance	NE	NE	NE	NE	NE	NE

NE = Not Established

See Section 16 for Definitions of Terms Used

NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR

### 3. HAZARD IDENTIFICATION

**EMERGENCY OVERVIEW:** This product is an odorless, dark blue liquid. Vanadium compounds, such as Vanadium Oxalate, can be highly toxic via inhalation and ingestion and can irritate and redden exposed tissue. If involved in a fire, this product may decompose to produce irritating vapors and toxic gases, including vanadium and carbon oxides. This product is not flammable. Emergency responders must wear personal protective equipment suitable for the situation to which they are responding.

**SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE:** This product may be irritating to skin, eyes, and respiratory system. Adverse effects on the kidneys and liver may occur after over-exposure.

**INHALATION:** If mists or sprays of this product are inhaled, they may irritate the nose, throat, and lungs. Symptoms may include nasal congestion, runny nose, nose bleeds, coughing, chest discomfort, bronchitis, bronchia-spasms, asthma-like symptoms. This product contains a Vanadium salt. Lung and kidney damage can occur after severe over-exposure to Vanadium salts. Lung injury may include pulmonary edema or laryngitis; severe inhalation over-exposure to Vanadium salts may be fatal. Vanadium salts can cause respiratory sensitization resulting in asthma-like symptoms on subsequent exposure. Effects of inhalation exposure may be delayed.

**CONTACT WITH SKIN or EYES:** Contact with the eyes may cause irritation, pain, and reddening. Vanadium compounds can cause conjunctivitis. Symptoms of over-exposure can include tearing and redness. Skin contact may cause reddening, discomfort, and irritation. Due to the presence of Vanadyl Oxalate, prolonged or repeated skin contact can cause dermatitis or sensitization (rashes, welts or other allergic skin reactions). Toxic effects by skin contact may be those as described under "Inhalation" and may be delayed.

**3. HAZARD IDENTIFICATION (Continued)**

**SKIN ABSORPTION:** Although there is no direct data as to whether Vanadyl Oxalate can be absorbed via intact skin, it is known that many vanadium compounds can skin absorb. Skin absorption should be viewed as a possible route of exposure for this product. Symptoms of skin absorption may include those described under "inhalation".

**INGESTION:** Ingestion is not anticipated to be a significant route of occupational over-exposure to this product. If this product is swallowed, gastric distress may result. Symptoms of such over-exposure may include nausea, vomiting, and diarrhea. Ingestion of Vanadium compounds, such as Vanadium Oxalate, may cause nervous disturbances, respiratory failure, convulsions, bloody diarrhea, and death. Severe ingestion over-exposure may be fatal.

**INJECTION:** Accidental injection of this product, via laceration or puncture by a contaminated object, may cause pain and irritation in addition to the wound. Symptoms described for "Contact with Skin or Eyes" may occur.

**HEALTH EFFECTS OR RISKS FROM EXPOSURE:** An Explanation in Lay Terms. In the event of over-exposure, the following symptoms may be observed:

**ACUTE:** Vanadium compounds, such as Vanadium Oxalate, can be highly toxic. This product may be irritating to eyes, skin, mucous membranes, and any other exposed tissue. If vapors or mists of this product are inhaled, irritation and damage to the tissues of the nose, throat, and other areas of the respiratory system may occur, including pulmonary edema or laryngitis. Irritation of Vanadium compounds may cause nervous disturbances, respiratory failure, convulsions, bloody diarrhea, and death. Inhalation of Vanadium salts can be fatal.

**CHRONIC:** Eye contact can cause conjunctivitis. This product contains a vanadium salt, inhalation of vanadium salts may cause chronic respiratory disease, respiratory sensitization, or kidney or liver damage. Skin contact may result in sensitization and allergic reaction. The severity of injuries depends on concentration and duration of exposure. See Section 11 (Toxicology Data) for additional information.

**TARGET ORGANS:** Acute: Respiratory system, skin, eyes. Chronic: Liver, kidneys, skin, respiratory system.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH		(BLUE)	3
FLAMMABILITY		(RED)	0
REACTIVITY		(YELLOW)	0
PROTECTIVE EQUIPMENT		X	
EYES	RESPIRATORY	HANDS	BODY
	SEE SECTIONS		
For Routine Industrial Use and Handling Applications			

**See Section 16 for Definition of Ratings**

**PART II** *What should I do if a hazardous situation occurs?*

**4. FIRST-AID MEASURES**

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take a copy of label and MSDS to health professional with victim.

**SKIN EXPOSURE:** If this product contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

**EYE EXPOSURE:** If vapors, mists, or sprays of this product enter the eyes, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate medical attention.

**INHALATION:** If vapors, mists, or sprays of this product are inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Remove or cover gross contamination to avoid exposure to rescuers.

**INGESTION:** If this product is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, do not induce vomiting. Victim should drink milk, egg whites, or large quantities of water. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow.

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Acute or chronic existing eye, skin or gastrointestinal system and kidney and liver disorders involving the "Target Organs" (see Section 3, "Hazard Identification") may be aggravated by overexposure to this product.

#### 4. FIRST-AID MEASURES (Continued)

**RECOMMENDATIONS TO PHYSICIANS:** Treat symptoms and eliminate overexposure. Provide oxygen, if necessary. Pulmonary function tests, chest X-rays, and nervous system evaluations may prove useful. Consultation with an ophthalmologist is recommended if eye exposure leads to tissue damage. The following recommendations can be used to treat poisoning from Vanadium compounds:

Give Ascorbic Acid, 1 gram/day. Calcium disodium edentate may be useful. If Calcium disodium edentate is available, administer in 5 mL ampoules as a 20% solution. Give 15-25 mg/kg (0.08-0.125 ml of 20% solution per kilogram of body weight) in 250-500 ml of 5% dextrose intravenously over a 1 to 2 hour period twice daily. The maximum dose should not exceed 50 mg/kg/day. The drug should be given in 5-day courses. After the first course, subsequent courses should not exceed 50 mg/kg/day. Daily urinalyses should be done during the treatment period. The dosage should be reduced if any unusual urinary findings appear. Intravenous administration is contraindicated in the presence of elevated cerebrospinal fluid pressure. For intramuscular administration, give 20% solution (200 mg/mL), 12.5 mg/kg body weight every 406 hours. Dilute each dose with an equal volume of 1% procaine. Dose limitation is the same as that given above (Dreisbach, Handbook of Poisoning, 11th Ed.). Antidote should be administered by qualified medical personnel. Get medical attention immediately.

#### 5. FIRE-FIGHTING MEASURES

**FLASH POINT:** Not flammable.

**AUTOIGNITION TEMPERATURE:** Not flammable.

**FLAMMABLE LIMITS (in air by volume, %):**

Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

**FIRE EXTINGUISHING MATERIALS:**

Water Spray: YES

Foam: YES

Halon: YES

Carbon Dioxide: YES

Dry Chemical: YES

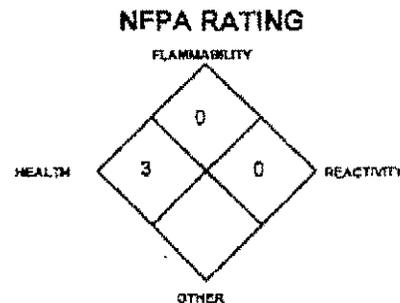
Other: Any "ABC" Class.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** The Vanadium Oxalate component of this product is highly toxic via inhalation and ingestion; therefore, this product presents a significant health hazard to firefighters. When involved in a fire, this material may decompose and produce severely irritating vapors and toxic gases of oxides of carbon and vanadium.

**Explosion Sensitivity to Mechanical Impact:** Not sensitive.

**Explosion Sensitivity to Static Discharge:** Not sensitive.

**SPECIAL FIRE-FIGHTING PROCEDURES:** Move containers from fire area if it can be done without risk to personnel. Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Chemical resistant clothing may be necessary. If necessary, decontaminate with soapy water or discard fire response equipment. If possible, prevent run-off water from entering storm drains, bodies of water, or other environmentally sensitive areas.



**See Section 16 for  
Definition of Ratings**

#### 6. ACCIDENTAL RELEASE MEASURES

**SPILL AND LEAK RESPONSE:** Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a spill, clear the affected area, protect people, and respond with trained personnel. In the event of a non-incident release, minimum Personal Protective Equipment should be **Level B: triple-gloves (nitrile gloves and nitrile gloves over latex gloves), chemical resistant suit and boots, hard-hat, and Self-Contained Breathing Apparatus.** Absorb spill with poly pads or other non-reactive absorbing material. Triple rinse area with water. Decontaminate the area thoroughly. Place all spill residue in a suitable container and seal. Dispose of in accordance with U.S. Federal, State, and local hazardous waste disposal regulations and those of Canada and its Provinces (see Section 13, Disposal Considerations).

### PART III *How can I prevent hazardous situations from occurring*

#### 7. HANDLING and STORAGE

**WORK PRACTICES AND HYGIENE PRACTICES:** As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat or drink while handling this material. Avoid breathing mists or sprays generated by this product. Clean up spills promptly. Remove contaminated clothing immediately.

**STORAGE AND HANDLING PRACTICES:** All employees who handle this material should be trained to handle it safely. Use in a well-ventilated location or in a fume hood. Open containers slowly on a stable surface. Containers of this product must be properly labeled. Empty containers may contain residual amounts of this product; therefore, empty containers should be handled with care. (continued on following page)

### 7. HANDLING and STORAGE (Continued)

**STORAGE AND HANDLING PRACTICES (continued):** Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Store away from incompatible materials (see Section 10, Stability and Reactivity). Material should be stored in secondary containers or in a diked area, as appropriate. Keep container tightly closed when not in use. Storage areas should be made of fire resistant materials. If appropriate, post warning signs in storage and use areas. Inspect all incoming containers before storage to ensure containers are properly labeled and not damaged.

**PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:** Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely if necessary. Decontaminate equipment using soapy water before maintenance begins. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

### 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

**VENTILATION AND ENGINEERING CONTROLS:** Use with adequate ventilation to ensure exposure levels are maintained below the limits provided in Section 2 (Composition and Information on Ingredients), if applicable. Ensure eyewash/safety shower stations are available near areas where this product is used.

**RESPIRATORY PROTECTION:** Maintain airborne contaminant concentrations below exposure limits listed in Section 2 (Composition and Information on Ingredients), if applicable. If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134 or applicable State regulations. Use supplied air respiration protection if oxygen levels are below 19.5% or are unknown. The following respirator selection guidelines from NIOSH are provided:

#### VANADIUM DUST OR FUME

#### CONCENTRATION RESPIRATORY PROTECTION

Up to 0.5 mg/m<sup>3</sup>: Any Air-Purifying Respirator with a high-efficiency particulate filter, or any Supplied-Air Respirator (SAR).

Up to 1.25 mg/m<sup>3</sup>: Any SAR operated in a continuous-flow mode, or any Powered, Air-Purifying Respirator (PAPR) with a high-efficiency particulate filter.

Up to 2.5 mg/m<sup>3</sup>: Any Air-Purifying, Full-Facepiece Respirator with a high-efficiency particulate filter, or any PAPR with a tight-fitting facepiece and a high-efficiency particulate filter, or any Self-Contained Breathing Apparatus (SCBA) with a full facepiece, or any SAR with a full facepiece.

Up to 35 mg/m<sup>3</sup>: Any SAR that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions: Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any SAR that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode.

Escape: Any Air-Purifying, Full-Facepiece Respirator with a high-efficiency particulate filter, or any appropriate escape-type, SCBA.

**EYE PROTECTION:** Splash goggles or safety glasses. A full face shield should be used when handling more than 1 gallon of material. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

**HAND PROTECTION:** Use rubber, neoprene, or polyvinyl chloride gloves. Use triple gloves for spill response, as stated in Section 5 (Accidental Release Measures) of this MSDS. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

**FOOT PROTECTION:** Use body protection appropriate for task. An apron, or other impermeable body protection is suggested. Full-body chemical protective clothing is recommended for emergency response procedures. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

### 9. PHYSICAL and CHEMICAL PROPERTIES

**RELATIVE VAPOR DENSITY (air = 1):** Similar to water.

**SPECIFIC GRAVITY (water = 1):** Not established.

**SOLUBILITY IN WATER:** Soluble.

**VAPOR PRESSURE, mm Hg @ 20°C:** Not established.

**ODOR THRESHOLD:** Not established.

**COEFFICIENT WATER/OIL DISTRIBUTION:** Not established.

**APPEARANCE, ODOR AND COLOR:** This product is an odorless, dark blue liquid.

**HOW TO DETECT THIS SUBSTANCE (warning properties):** The color of this product may be a distinctive property.

**EVAPORATION RATE (n-BuAc = 1):** Similar to water.

**FREEZING/MELTING POINT:** Not established.

**BOILING POINT:** Not established.

**pH:** Not established.

1:24 FAX 203 964 0365

PECHINEY ORES & CONCS

007

## 10. STABILITY and REACTIVITY

STABILITY: Stable under conditions of normal temperature and pressure.  
COMPOSITION PRODUCTS: Carbon and vanadium oxides.  
MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Water reactive materials. This product may also be incompatible with strong oxidizers.  
HAZARDOUS POLYMERIZATION: Will not occur.  
CONDITIONS TO AVOID: Avoid exposure or contact to extreme temperatures, incompatible chemicals.

## PART IV Is there any other useful information about this material?

## 11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: Not established. Currently, there are no toxicological data available for Vanadium Oxalate.  
SUSPECTED CANCER AGENT: The components of this product are not on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, and CAL/OSHA and therefore are not considered to be, nor suspected to be, cancer causing agents by these agencies.  
IRRITANCY OF PRODUCT: This product may be an eye, skin, and respiratory system irritant.  
SENSITIZATION TO THE PRODUCT: Vanadium Oxalate is a Vanadium salt. Vanadium salts are respiratory sensitizers and skin sensitizers.  
REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this product and its components on the human reproductive system.  
Mutagenicity: This product is not reported to produce mutagenic effects in humans.  
Embryotoxicity: This product is not reported to produce embryotoxic effects in humans.  
Teratogenicity: This product is not reported to cause teratogenic effects in humans.  
Reproductive Toxicity: This product is not reported to cause reproductive effects in humans.  
*A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.*  
BIOLOGICAL EXPOSURE INDICES: Currently, there are no Biological Exposure Indices (BEIs) determined for the components of this product.

## 12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.  
ENVIRONMENTAL STABILITY: Vanadium Oxalate is a vanadium salt. Vanadium salts can remain in sediments indefinitely.  
EFFECT OF MATERIAL ON PLANTS or ANIMALS: This product may be harmful or fatal to plant and animal life in low concentrations.  
EFFECT OF CHEMICAL ON AQUATIC LIFE: This product can adversely affect aquatic environments if large quantities are released into water.

## 13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority.  
EPA WASTE NUMBER: Not applicable to wastes consisting only of this product.

## 14. TRANSPORTATION INFORMATION

THIS PRODUCT IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

<u>PROPER SHIPPING NAME</u> :	Vanadium compound, solution, n.o.s (Vanadium Oxalate)
<u>HAZARD CLASS NUMBER and DESCRIPTION</u> :	6.1 (Toxic)
<u>UN IDENTIFICATION NUMBER</u> :	UN 3285
<u>PACKING GROUP</u> :	II
<u>DOT LABEL(S) REQUIRED</u> :	Class 6.1 (Toxic)
<u>NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER, 2000</u> :	151
<u>MARINE POLLUTANT</u> : The components of this product are not designated by the Department of Transportation to be Marine Pollutants (49 CFR 172.101, Appendix B).	

### 14. TRANSPORTATION INFORMATION (Continued)

**TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:** This product is considered as dangerous goods, per regulations of Transport Canada. Use the above U.S. DOT information for the preparation of Canadian shipments.

**INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA) DESIGNATION:** This product is considered as dangerous goods, under rules of IATA. As applicable, use the following information for the preparation of shipments of this product.

**PROPER SHIPPING NAME:** Vanadium compound, solution, n.o.s.  
**HAZARD CLASS NUMBER and DESCRIPTION:** 6.1 (Toxic)  
**UN IDENTIFICATION NUMBER:** UN 3285  
**PACKING GROUP:** II  
**HAZARD LABEL(S) REQUIRED:** Class 6.1 (Toxic)  
**EMERGENCY RESPONSE CODE:** 6 L

The following Packaging Information is applicable to this product:

PROPER SHIPPING NAME	PASSENGER AND CARGO AIRCRAFT				CARGO AIRCRAFT ONLY	
	Limited Quantity		Packing Instruction	Max. Qty per Pkg	Packing Instruction	Max. Qty per Pkg
	Packing Instruction	Max. Qty per Pkg				
Vanadium compound, solution, n.o.s.	Y513	1 kg	613	25 kg	615	100 kg

### 15. REGULATORY INFORMATION

**ADDITIONAL U.S. REGULATIONS:**

**U.S. SARA REPORTING REQUIREMENTS:** The components of this product are subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 302.4 Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 313.10)
Vanadium Oxalate (as a Vanadium Compound)	NO	NO	YES Category Code N770

**U.S. SARA THRESHOLD PLANNING QUANTITY:** There are no specific Threshold Planning Quantities for any component of this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lbs. (4,540 kg) therefore applies, per 40 CFR 370.20.

**U.S. TSCA INVENTORY STATUS:** The components of this product are listed on the TSCA Inventory.

**U.S. CERCLA REPORTABLE QUANTITY (RQ):** In the CERCLA regulations, the Vanadium Oxalate component of this product has \*\*\* given as it's CERCLA RQ, under "Vanadium Compounds". \*\*\* indicates that no RQ is assigned to this generic broad class, although the class is listed as a CERCLA Hazardous Substance, but are not required to be reported under CERCLA unless otherwise listed under CERCLA with an RQ.. See 50 CFR 134.56 (April 4, 1985).

**OTHER U.S. FEDERAL REGULATIONS:** Not applicable.

**U.S. STATE REGULATORY INFORMATION:** Components of this product are covered under specific State regulations, as denoted below:

- aska - Designated Toxic and Hazardous Substances: None.
- alifornia - Permissible Exposure Limits for Chemical Contaminants: None.
- Florida - Substance List: None.
- Illinois - Toxic Substance List: None.
- Kansas - Section 302/313 List: None.
- Massachusetts - Substance List: None.
- Minnesota - List of Hazardous Substances: None.
- Missouri - Employer Information/Toxic Substance List: None.
- New Jersey - Right to Know Hazardous Substance List: None.
- North Dakota - List of Hazardous Chemicals, Reportable Quantities: None.
- Pennsylvania - Hazardous Substance List: None.
- Rhode Island - Hazardous Substance List: None.
- Texas - Hazardous Substance List: None.
- West Virginia - Hazardous Substance List: None.
- Wisconsin - Toxic and Hazardous Substances: None.

**CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65):** No component of this product is on the California Proposition 66 lists.

**ANSI LABELING [Z129.1] (Precautionary Statements):** DANGER! HARMFUL OR FATAL IF INHALED OR INGESTED. CONTAINS RESPIRATORY AND SKIN SENSITIZER. MAY CAUSE ALLERGIC RESPIRATORY AND SKIN REACTIONS. CAUSES EYE AND SKIN IRRITATION. Do not get on skin or eyes. Do not breath mists or sprays. Do not taste or swallow. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves, goggles, faceshield, and suitable body protection, as necessary: FIRST-AID: In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If ingested, do not induce vomiting. Get medical attention immediately. IN CASE OF FIRE: Use water fog, dry chemical, or alcohol foam. IN CASE OF SPILL: Absorb with polypads or other suitable absorbent material. Place in a suitable container. Refer to MSDS for additional information.

### 15. REGULATORY INFORMATION (Continued)

**ADDITIONAL CANADIAN REGULATIONS:**

**CANADIAN DSL/NDSL INVENTORY STATUS:** The components of this product are listed on the DSL/NDSL Inventory.

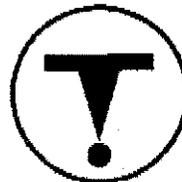
**OTHER CANADIAN REGULATIONS:** Not applicable.

**CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS:** The components of this product are not on the CEPA Priorities Substances Lists.

**CANADIAN WHMIS SYMBOLS:**

**CLASS D1A:** Material Causing Immediate and Serious Effects.

**CLASS D2A/B:** Material Causing Other Toxic Effects.



### 16. OTHER INFORMATION

**PREPARED BY:**

CHEMICAL SAFETY ASSOCIATES, Inc.  
PO Box 3519, LA Mesa, CA 91944-3519  
619/670-0609

**DATE OF PRINTING:**

March 19, 2002

Information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Pechiney assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, Pechiney assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

## DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these, which are commonly used, include the following:  
CAS #: This is the Chemical Abstract Service Number that uniquely identifies each constituent.

### EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association that establishes exposure limits.

TLV - Threshold Limit Value - an airborne concentration of a substance that represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (TWA), the 15-minute Short Term Exposure Limit, and the Instantaneous Ceiling Level (C). Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration.

PEL - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register, 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL, which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. The DFG - MAK is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. NIOSH is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (OSHA). NIOSH issues exposure guidelines called Recommended Exposure Levels (RELs). When no exposure guidelines are established, an entry of NE is made for reference.

### HAZARD RATINGS:

#### HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard:

0 (minimal acute or chronic exposure hazard); 1 (slight acute or chronic exposure hazard); 2 (moderate acute or significant chronic exposure hazard); 3 (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); 4 (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: 0 (minimal hazard); 1 (materials that require substantial pre-heating before burning); 2 (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); 3 (Class IB and IC flammable liquids with flash points below 38°C [100°F]); 4 (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: 0 (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); 2 (materials that are unstable but do not detonate or which can react violently with water); 3 (materials that can detonate when initiated or which can react explosively with water); 4 (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); 1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure could cause serious temporary or residual injury); 4 (materials that under very short exposure could cause death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

### FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (NFPA). Flash Point: - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL: - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL: - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

### TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: LD<sub>50</sub> - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; LC<sub>50</sub> - Lethal Concentration (gases) which kills 50% of the exposed animals; ppm concentration expressed in parts of material per million parts of air or water; mg/m<sup>3</sup> concentration expressed in weight of substance per volume of air; mg/kg quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: IARC - the International Agency for Research on Cancer; NTP - the National Toxicology Program; RTECS - the Registry of Toxic Effects of Chemical Substances; OSHA and CAL/OSHA. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include TDLo, the lowest dose to cause a symptom and TCLo, the lowest concentration to cause a symptom; TD0, LDLo, and LD0, or TC, TCo, LCo, and LCo, the lowest dose (or concentration) to cause lethal or toxic effects. BEI - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: EC is the effect concentration in water.

### REGULATORY INFORMATION:

U.S. and CANADA: This section explains the impact of various laws and regulations on the material. EPA is the U.S. Environmental Protection Agency. WHMIS is the Canadian Workplace Hazardous Materials Information System. DOT and TC are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (SARA); the Canadian Domestic/Non-Domestic Substances List (DSL/NDL); the U.S. Toxic Substance Control Act (TSCA); Marine Pollutant status according to the DOT; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund); and various state regulations. This section also includes information on the precautionary warnings that appear on the material's package label.

## **Appendix B**

**Photos of an SCR catalyst log, SCR catalyst module, spray headers, catch basins and collection tanks (frac tank)**

# SCR-Tech Spray Header



# SCR-Tech Catch Basin



# SCR-Tech Collection Tanks



# ALF Catalyst Log



# Top View Of Catalyst Module



## Appendix C. Amount and type of waste generated by replacement or rejuvenation alternatives

Table C-1. Number of SCR catalyst modules per layer, bypass capability, volume of catalyst generated as waste per layer by the alternative for **Replacement of Catalyst** and characteristics of effluent generated by the alternative for **On-site, *in-situ*** rejuvenation of catalyst for each plant

Plant	Unit	Catalyst Volume Per Layer, M3	Modules Per Layer	SCR Bypass Capability	SCR-Tech				SCR-Tech	
					Modules Per Day	Days	Once Through DI Water, Gal/day	Recirc Acid Solution, Gal/day	Once Through DI Water, Total Gallons	Recirc Acid Solution, Total Gallons
ALF	1-3	190	90	No	20	4.5	38,000	10,600	171,000	47,700
BRF		481	224	Yes	20	11.2	38,000	10,600	425,600	118,720
COF	5	301	152	No	20	7.6	38,000	10,600	288,800	80,560
CUF	1	583	360	Yes	20	18.0	38,000	10,600	684,000	190,800
CUF	2	773	360	Yes	20	18.0	38,000	10,600	684,000	190,800
KIF	1-4	105	50	No	20	2.5	38,000	10,600	95,000	26,500
KIF	5-8	128	60	No	20	3.0	38,000	10,600	114,000	31,800
PAF	1-2	365	180	Yes	20	9.0	38,000	10,600	342,000	95,400
PAF	3	590	280	Yes	20	14.0	38,000	10,600	532,000	148,400
WCF	7-8	295	140	Yes	20	7.0	38,000	10,600	266,000	74,200

Gallons per Minute      190  
 Minutes                      10  
 Gallons per  
 Module                              530

Table C-2. Number of SCR catalyst modules per layer, volume of catalyst generated as waste per layer by the alternative for **Replacement of Catalyst** and characteristics of effluent generated by the alternative for **On-site, ex-situ** rejuvenation of catalyst for each plant

Plant	Unit	Catalyst Volume Per Layer, M3	Enerfab			Days	Enerfab			
			Modules Per Layer	Modules Per Day	Pre-Wash Water/ Detergent, Gal/day		Acid Solution Wash, Gal/day	Pre-Wash Water/ Detergent, Total Gallons	Acid Solution Wash, Total Gallons	
ALF	1-3	190	90	18	5.0	57,960	6,440	289,800	32,200	
BRF		481	224	18	12.4	57,960	6,440	721,280	80,142	
COF	5	301	152	18	8.4	57,960	6,440	489,440	54,382	
CUF	1	583	360	18	20.0	57,960	6,440	1,159,200	128,800	
CUF	2	773	360	18	20.0	57,960	6,440	1,159,200	128,800	
KIF	1-4	105	50	18	2.8	57,960	6,440	161,000	17,889	
KIF	5-8	128	60	18	3.3	57,960	6,440	193,200	21,467	
PAF	1-2	365	180	18	10.0	57,960	6,440	579,600	64,400	
PAF	3	590	280	18	15.6	57,960	6,440	901,600	100,178	
WCF	7-8	295	140	18	7.8	57,960	6,440	450,800	50,089	

Gallons per Module      3220                      358

Table C-3. Capacity of Common Tank Needed and Assumptions for Filling and Emptying for **Catalyst Rejuvenation Alternatives** at Each Fossil Plant. Assumptions for Filling and Emptying During Activities

**Catalyst Rejuvenation  
Common Tank Capacity**

Plant	Unit	SCR-Tech Gallons	Enerfab Gallons
ALF	1-3	2,430	32,200
BRF		2,430	32,200
COF	5	2,430	32,200
CUF	1	2,430	32,200
CUF	2	2,430	32,200
KIF	1-4	2,430	32,200
KIF	5-8	2,430	32,200
PAF	1-2	2,430	32,200
PAF	3	2,430	32,200
WCF	7-8	2,430	32,200
SCR-Tech	1900 gallons of once through DI water plus 530 gallons of acid solution per module. Fill and empty the common tank once per module.		
Enerfab	3220 gallons of prewash water/detergent solution per module X 9 modules plus 3220 gallons of acid solution for 9 modules. Fill and empty the common tank after 9 modules (i.e twice per day).		

