Transportation Equipment Cleaning-
Generic Scenario for Estimating Occupational Exposures and Environmental Releases
-Draft-

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SUBJECT: Transportation Equipment Cleaning Generic Scenario Draft

ERG collected readily available information that could be used to develop a generic scenario to describe facilities that clean transportation equipment, such as tank trucks and rail cars. This memorandum presents a profile of the transportation equipment cleaning industry along with descriptions of widely-used processes. This scoping document also presents recommendations on how to proceed in the development of Transportation Equipment Cleaning (TEC) Generic Scenario. Also included is a list of the readily available resources that were found during this preliminary search.

Much of the information presented in this scoping document and the TEC Generic Scenario were obtained from data submitted by industry to EPA in response to the 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry. This data was used to develop the Effluent Limitations, Guidelines, Pretreatment Standards, and New Source Performance Standards for the Transportation Equipment Cleaning Point Source Category regulation. Due to the focus of this data collection effort, the strength of the TEC Generic Scenario is the estimation of environmental releases, specifically, releases to water.

History of the Transportation Equipment Cleaning Generic Scenario

In the mid-1990's, EPA began collecting data submitted by the TEC industry in response to the 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry with the intent to establish regulatory guidelines for wastewater discharges. This effort culminated in August 2000, when EPA promulgated the effluent limitations and guidelines for the transportation equipment cleaning industry. In support of this regulation, EPA published the TEC Technical Development Document (TDD) in June 2000. The TEC TDD summarized the data collection, data analysis, and engineering assessments that were used to support this effluent limitations guidelines.

As the TEC TDD was being drafted in the mid to late 1990's, ERG was simultaneously drafting the TEC Generic Scenario based on the same data. This draft TEC Generic Scenario was reviewed by CEB staff on several occasions, including September 1996 and March 2000. CEB staff commented on a variety of subjects, including technical content and CEB policies.

ERG incorporated CEB's comments into the revised draft TEC Generic Scenario dated September 30, 2001 (2001 TEC Generic Scenario).

Recently, CEB and ERG staff have developed a list of quality criteria to assure quality and consistency for all generic scenarios developed by CEB. The September 2001 TEC Generic Scenario does not meet these new standards. This scoping document will outline ERG's proposal for revising the TEC Generic Scenario to meet the April 24, 2003 quality criteria.

Industry Background and Process Summary

Transportation equipment cleaning (TEC) facilities are defined as those facilities that clean the interiors of tanks trucks, closed-top hopper tank trucks, intermodal tank containers, intermediate bulk containers, rail tank cars, closed-top hopper rail tank cars, inland tank barges, closed-top inland hopper barges, and ocean/sea tankers (TEC TDD). Tank trucks are motor driven vehicles with a completely enclosed storage vessel. Intermediate bulk containers (IBCs) and intermodal tanks are enclosed storage vessels that may be loaded onto flatbeds for truck transport. IBCs, also referred to as bulk containers or totes, are typically smaller than intermodal tank containers.

IBCs are portable plastic and metal containers with 450 liters (199 gallons) to 3,000 liters (793 gallons) capacity. EPA estimates 500,000 IBCs are cleaned annually in the United States. Of this amount, EPA believes 225,000 IBCs are cleaned by TEC facilities. The remaining 275,000 IBCs are cleaned by drum reconditioning facilities. Available data suggest that IBC use and reconditioning has grown significantly in the 1990s, and continued growth is expected in the future. Both TEC facilities and drum reconditioning facilities consider the IBC cleaning business as an important growth market. IBCs were later removed from the scope of the TEC rule because EPA's assessment suggested IBC cleaning wastewater was more similar to drum cleaning than to TEC wastewater [Preliminary Data Summary for Industrial Container and Drum Cleaning Industry]. However, the IBC cleaning process is similar for both TEC facilities and drum reconditioning facilities.

This effort will focus on facilities that engage in cleaning the interior of transportation equipment containers because the 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry collected data on these types of facilities. Some transportation equipment cleaning facilities may also wash the exterior of the containers. Much of the information in this section of the scoping document summarize the 2001 TEC Generic Scenario.

Industry Profile

The TEC industry is not a "stand-alone" industry; it is typically a sector of the chemical or transportation industries. Finding information specific to transportation equipment cleaning is difficult because no SIC code, NAICS code, or combination of codes can accurately describe the TEC industry.

Based on results from the 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry, the TEC industry is characterized by four business operational segments:

- *Independent facilities* provide commercial cleaning services, either as a primary or secondary business, for tanks which they do not own or operate.

- *Carrier-operated facilities*, or "for-hire facilities," own, operate, and clean tank fleets used to transport commodities for other companies.

- *Shipper-operated facilities* transport or engage carriers to transport their own commodities and clean the fleets used for such transport.

- *Builder/leaser facilities* manufacture and/or lease tanks, and clean the interiors of these tanks after equipment has been placed in service.

Since transportation facilities may perform a variety of business operations, TEC facilities may be classified under more than one of these operational segments. Shipper-operated, carrier-operated, and tank repair and maintenance facilities generally clean fewer tanks than independent tank cleaning facilities.

The TEC industry is additionally classified based on the relationship between the cleaning facility and the customer: public and private. The first category, public facilities, includes independent tank wash facilities and builder/leaser-operated facilities, at which customers "drive-in" and pay a fee for tank cleaning. The arrival of the transportation equipment may or may not be pre-scheduled. The second category is comprised of shipper-operated or carrier-operated facilities that provide tank cleaning facilities to support in-house operations. These facilities are considered private since tank cleaning services may not be offered to non-affiliated transportation equipment.

Reasons for Equipment Cleaning

Tank interiors are cleaned for two primary purposes: (1) to prevent contamination of materials from one cargo shipment to the next, and (2) to facilitate inspection and repair. The tanks are used to transport thousands of different commodities or products. Tank interiors are also cleaned to facilitate internal inspection of the tank and/or inspection of fittings and valves which may be required as part of a routine inspection and maintenance program. In addition, the interior of the tank must be rendered nonexplosive and nonflammable through a cleaning process called "gas-freeing" to provide a safe environment for manual cleaning and for tank repairs that require "hot work" (e.g., welding or cutting).

Cleaning Process - General

Although different types of tanks are cleaned using a variety of procedures, the basic tank cleaning process for each tank is similar. A typical cleaning sequence is as follows:

- Review shipping manifest forms to determine the commodity last transported in the tank;
- Drain the tank heel (product remaining in the container; does not include residue) and if necessary, segregate the heel for off-site disposal;
- Rinse the tank;
- Wash the tank using one or more cleaning methods and solutions;
- Rinse the tank; and
- Dry the tank.

The cleaning facility determines the commodity last transported in the tank to: (1) assess the facility's ability to clean the tank effectively; (2) determine the appropriate cleaning sequence and cleaning solutions; (3) evaluate whether the residue cleaned from the tank will be compatible with the facility's wastewater treatment system; and (4) establish an appropriate level of health and safety protection for the employees who will clean the tank. The facility may decide to reject a tank based on any of the preceding concerns.

Once a tank has been accepted for cleaning, the facility checks the volume of heel in the tank and determines an appropriate heel disposal method. Any water soluble heels that are compatible with the facility's treatment system and the conditions of the facility's wastewater discharge permit are usually combined with other wastewaters for treatment and discharge at the facility. Incompatible heels are segregated into drums or tanks for disposal by alternative means, which may include sale to a reclamation facility, landfill, or incineration. The TEC facility may reuse heels comprised of soaps, detergents, solvents, acids, or alkalis as tank cleaning solutions, as neutralizers for future heels, and for wastewater treatment.

Cleaning processes vary between facilities depending on the available cleaning equipment and the commodities last transported in the tanks to be cleaned. Certain residual materials (such as sugar) only require a water rinse, while other residual materials (such as latexes or resins) require cleaning with a detergent or strong caustic solution followed by a final water rinse. Other cleaning processes include pre-solve (application of solvent to the tank interior for commodities that are difficult to remove), steam cleaning, and forced air drying. The state of the product last transported in the tank affects the cleaning processes used. For example, hardened or caked-on products sometimes require an extended processing time. Some tanks require manual cleaning with scouring pads, shovels, or razor blades to remove residual materials. The cleaning of tanks used to transport gases or volatile material sometimes requires filling the tank to capacity with water to displace vapors, followed by flushing of the wastewater.

Tank washing is typically performed using one of two methods: (1) low-or-high-pressure spinner nozzles, or (2) hand-held wands and nozzles. Spinner nozzles are inserted through the main tank hatch and operate at pressures between 100 pounds per square inch (psi) and 600 psi to deliver hot or cold water rinses and a variety of cleaning solutions. They are designed to rotate around both their vertical and horizontal axes to create an overlapping spray pattern that cleans the entire interior of the tank. Operating cycles range from rinse bursts of a few seconds to detergent or caustic washes of 20 minutes or longer for caked or crystallized residues. The use of hand-held wands and nozzles is similar to washing with high pressure spinner nozzles, but require facility personnel to manually direct the wash solution across the interior surface of the tank.

Tank cleaning solutions are generally reused in the TEC industry. Make-up solution is periodically added to replace lost solution. Spent cleaning solutions may be hauled off site for disposal or discharged to the on-site wastewater treatment system.

After cleaning, tanks may be dried by applying ambient or heated air using a blower. Cleaning personnel may enter and inspect tank interiors and perform manual cleaning as required. Valves and fittings may be removed and cleaned by hand. Hoses are generally cleaned in a separate hose bath using the same cleaning solutions as those used to clean tank interiors.

The TEC TDD separated transportation equipment into three groups based on the size of the container, amount of heel (product remaining in the container; does not include residue), and location of cleaning operation: 1) tank truck, hopper tank truck, intermediate bulk, and intermodal tank containers; 2) rail tank cars and hopper rail tank cars; and 3) tank barges, hopper barges, and ocean/sea tanker. The next three sections will discuss the cleaning process for each group in more detail.

Cleaning Process - Tank Truck, Intermediate Bulk, and Intermodal Tank Containers

Tank trucks, intermediate bulk containers, and intermodal tank containers are generally considered empty when they arrive at the facility, but may contain between one quart and ten gallons of heel. Tank interior cleaning is typically performed in wash racks (or cleaning bays), but may also occur in designated wash areas which are not constructed specifically for tank interior cleaning. Facilities may have separate, dedicated cleaning bays, cleaning solutions, and equipment for cleaning tanks which previously contained chemical and food-grade commodities. On average, tank trucks, IBCs, or intermodal tank containers requires two hours for cleaning. One-half hour is for moving the tank in and out of the cleaning bay, and one and one-half hours is for cleaning time, which includes a visual inspection and any manual cleaning.

Cleaning Process - Rail Tank Cars

Rail tank car cleaning processes are similar to the processes used for tank truck cleaning. However, rail tank cars are more likely to be cleaned using steam than using caustic or detergent cleaning solutions and they typically generate between 3 and 121 gallons of heel. Of particular concern during rail tank car cleaning is the potential to damage the interior tank lining, which is designed to protect the tank wall from corrosion by the tank contents. Tank cleaning must be performed carefully to prevent or minimize damage to the tank lining.

Cleaning Process - Tank Barge Cleaning

Tank barges are generally considered empty when they arrive at the cleaning facility, but typically contain about 1,000 gallons of heel (<1% of capacity). Tank barge cleaning facilities typically perform six basic operations:

- Strip liquid free;
- Strip and blow;
- Clean for a Marine Chemist's Certificate;
- Cold water manual wash;
- Cold water (Butterworth brand) wash; and
- Hot water (Butterworth brand) wash.

Depending on the specifications of the cleaning request, any one of these operations is performed or repeated in any sequence. The most common cleaning operation involves heel stripping followed by a Butterworth wash and rinse. Heel, wash, and rinse waters are removed from the tanks using vacuum pumps. Cleaning time for tank barges typically ranges from four to eight hours.

Ocean tankers are sometimes cleaned at sea by the tanker crew. Heel and cleaning waste may be discharged at sea or at a ballast water cleaning facility. Relatively few ocean tankers are cleaned shore side.

Wastewater Generation, Collection, and Treatment

The amount of wastewater generated by tank interior cleaning is highly variable based on tank type and size, commodity last transported, cleaning method, and the presence of caked, solidified, or crystallized residues. Between 35 and 1,124 gallons of wastewater per tank were reportedly generated during tank truck cleaning, between 76 and 2,399 gallons of wastewater per tank during rail tank car cleaning, and between 3,000 and 30,000 gallons of wastewater per tank during tank barge cleaning. The amount of residual chemical is the wastewater is unknown.

Wastewater generated by tank cleaning facilities, except for tank barge cleaning facilities, is typically collected in the tank wash rack or wash area drain system. Interior cleaning wastewater from tank barges is continually removed from the tank barge compartments using vacuum pumps. Since many tank cleaning facilities also perform exterior cleaning in the same wash racks or wash areas, TEC wastewater may contain both exterior and interior cleaning wastewater. The tank cleaning wastewater collected in the wash areas is often routed to holding tanks prior to treatment.

Most tank interior cleaning facilities accumulate TEC wastewater in the wash rack or wash area drain systems, then route the wastewater to a wastewater treatment or disposal system. Tank barge cleaning facilities pump their wastewater directly to the wastewater treatment or disposal system. At facilities where TEC operations are not the primary business operation, such as large chemical manufacturers, TEC wastewater may comprise only a small percentage of the wastewater treated or disposed on-site. TEC wastewater is combined with wastewater from manufacturing operations, maintenance operations, stormwater, and/or service operations. Facilities that are primarily TEC facilities have wastewater treatment systems that typically include equalization, pH adjustment, physical settling, and oil/water separation. Most facilities discharge treated wastewater to a Publicly Owned Treatment Works (POTW). Facilities with very efficient treatment systems may discharge treated wastewater directly to surface waters.

Releases to Other Media

The tank heel is collected separately, before the container is washed. Some facilities may perform a short water rinse prior to heel removal to rinse residual product from the interior walls. Once the heel is collected, it can be disposed to any media of release, or it may be recycled and/or reused. For example, if the product is a cleaning solution, the heel may be used by the facility to clean other transportation equipment.

The media of release for the heel is dependent upon the characteristics of the product. The following table lists the number of facilities using various heel disposal methods. Furthermore, the 2001 TEC Generic Scenario presents the percent of heel disposed for each disposal method by commodity type (petroleum products, soaps and detergents, inorganic chemicals, etc.). This data is not presented in this scoping document.

Heel Disposal Methods

Disposal Method	Number of Facilities	% of Facilities Using This Method
Wastewater Treatment	149	23.7
Land Disposal	124	19.7
Reuse/Recycle	118	18.9
Hazardous Disposal*	86	13.6
Incineration	57	9.2
Heat Recovery	46	7.3
Indirect Discharge	26	4.2
Land Application	15	2.4
Evaporation	5	0.8
Deep Well Injection	1	0.2

*To hazardous waste treatment, storage, and disposal facility.
Data obtained from 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry and presented in the 2001 TEC Generic Scenario.

Treatment Technologies

A number of commonly used treatment technologies were grouped according to responses from the TEC questionnaire data. The levels of treatment and treatment units assigned are listed below:

- No Treatment Technologies: no treatment, chlorination, deep well injection, evaporation ponds, and aerated lagoons, ponds, or basins.

- Pretreatment Technologies: equalization, grit chambers, pH adjustment, and racks or screens.

- Primary Treatment Technologies: coagulation, dissolved air flotation, filtration, gravity separation, oil/water separation, sedimentation or settling ponds, chemical precipitation, sludge dewatering, and clarification (only if no secondary treatment technology is in use).

- Secondary Treatment Technologies: biological treatment and/or clarification (if biological treatment technology is in use).

- Advanced Treatment Technologies: carbon adsorption, chemical oxidation, hydrolysis, ion exchange/resin adsorption, reverse osmosis, solvent extraction, ultrafiltration and/or microfiltration, and steam stripping/air stripping.

The following table presents the percentage of TEC questionnaire facilities that reported the use of a treatment technology corresponding to the treatment levels described above. Note that the sum of the percentages exceeds 100 because facilities may use multiple treatment technologies.

Level of Wastewater Treatment	Percent of Rail Car Cleaning Facilities	Percent of Tank Truck Cleaning Facilities
No Treatment	13.0	5.9
Pretreatment	58.7	67.7
Primary Treatment	82.6	87.1
Secondary Treatment	13.0	0.8
Advanced Treatment	2.2	0.3

Data obtained from 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry and presented in the 2001 TEC Generic Scenario.

Unfortunately, information about the efficiency for each level of treatment is not available in the 2001 TEC Generic Scenario or the TEC TDD. The efficiency is expected to vary depending upon the characteristics of the wastewater and operating conditions.

Worker Exposure

Relatively little readily available information was found for making quantitative estimates of worker exposure. The TEC TDD focused on pollutants released to water sources, but did not provide much information about exposure of workers to pollutants and/or chemicals. The TEC TDD did collect data on the number of working days, number of operating days, number of worker hours per day, and number of workers per site. The TEC TDD also provides a brief description of worker activities. No other data sources were found to provide estimates of worker exposure.

The greatest potential for worker exposure to materials last transported occurs during heel removal. Facility personnel typically wear coveralls, safety shoes, protective glasses, and protective gloves during tank cleaning operations. The 2001 TEC Generic Scenario uses standard CEB methodologies to estimate worker exposure.

Recommendations for Further Work

As stated earlier, a generic scenario for TEC was first created in 1996 and has been improved since then, including the incorporation of CEB's comments. ERG recommends using the 2001 TEC Generic Scenario as a starting point for developing a new scenario. However, significant revisions are required to meet the April 24, 2003 quality criteria. This section highlights revisions recommended by ERG.

First, the source of all data used in the TEC Generic Scenario must be properly referenced. Previous versions of this generic scenario do not reference the data source. Most of the data originated from the TEC TDD, but some data originated from independent analysis of responses to the 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry.

Since PMN chemicals are typically new chemicals manufactured in the United States or imported in small quantities, it is assumed that most PMN chemicals will be transported via rail tank cars and tank trucks. Therefore, ERG suggests that data pertaining to cleaning inland tank barges, closed-top inland hopper barges, and ocean/sea tankers should be excluded from the development of this generic scenario. Additionally, because few PMN chemicals are expected to be present in food grade products, data pertaining to the food grade commodity group could also be excluded. These recommendations are identical with assumptions made in previous versions of the TEC Generic Scenario.

ERG proposes dividing the types of containers into two groups: tank truck cleaning and rail tank car cleaning. Release quantities and the final disposition of releases vary between rail tank cars and tank trucks. Intermodal tank containers would be categorized under tank truck cleaning. This recommendation is consistent with assumptions made in earlier versions of the TEC Generic Scenario.

The categorization of IBCs remains uncertain. Initially, the TEC TDD concluded that IBCs transported by flatbed truck result in releases and exposures similar to that of tank trucks, but later excluded IBCs from the TEC rule in response to comments from the drum reconditioning industry. According to "Preliminary Data Summary for Industrial Container and Drum Cleaning Industry," a report published by EPA Office of Water in June 2002, the IBC cleaning market is almost equally divided between TEC facilities and drum reconditioning facilities, and the cleaning process is similar for both types of facilities. The argument could be made to include IBCs in either the TEC Generic Scenario or the Drum Reconditioning Generic Scenario. ERG suggests further investigation is necessary to determine which generic scenario should include IBC cleaning.

The 2001 TEC Generic Scenario does not distinguish between solid and liquid commodities, except for dermal exposure estimates. Based on a discussion with Deb Falatko from ERG Inc., all closed-top hopper tank trucks and closed-top hopper rail tank cars transport solid materials only. ERG suggests that future analysis of the TEC surveys should assume that survey data for hopper trucks is associated with solid commodities and data associated with all other types of containers are liquid commodities.

The TEC TDD and the 2001 TEC Generic Scenario do not provide extensive data about the release of volatile chemicals and vapor inhalation exposure. The TEC Generic Scenario does provide release estimates for volatile tank heel and fugitive emissions of volatile chemical during the heel removal process. Releases from the volatile tank heel are based on data collected from sampling episodes for the TEC effluent limitations guidelines effort. Additionally, the 2001 TEC Generic Scenario states that if the chemical is volatile, workers may fill the container with water to displace vapors. The displaced vapors are vented to the atmosphere or are sometimes collected and incinerated. The TEC Generic Scenario estimates the amount of displaced vapors using AP-42 emission factors for analogous chemicals. This approach is limited because emission factors for only five chemicals are listed and the PMN chemical may not have properties similar to one of these listed chemicals. As an alternative approach, ERG suggests using Raoult's Law and the Ideal Gas Law to estimate the amount of volatile chemical in a container. This approach is based on the vapor pressure and molecular weight of the chemical, and assumes that the liquid and vapor phases are in equilibrium.

The 2001 TEC Generic Scenario identified two sources of environmental releases, tank heel and container residue, and determined the media of release for each source separately. ERG suggests adopting a similar approach for the new TEC Generic Scenario. A significant amount of empirical data is readily available to estimate tank heel, but little data is available to estimate container residue. Standard CEB methodologies will need to be utilized to estimate container residue.

ERG recommends doing a detailed statistical analysis of the raw data from the 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry. The 2001 TEC Generic Scenario presents the averages of the raw data, but generally does not present the median, range, or 90th percentile. This information may be useful for determining default values or may better represent the data set. For example, most containers come in standard sizes; therefore, reporting the median tank size, not the average tank size, would be a more realistic representation of the data. Please note that this recommendation will take a significant level of effort.

Limitations and Data Gaps

Evaluation of the TEC questionnaire shows that facilities reported the quantity of heel collected per tank type and commodity, and the volume of wastewater that was generated during the cleaning process. However, it is not possible to determine the amount of residual commodity that remains in the tank after draining the heel and prior to cleaning (i.e., adhered to the tank walls). Therefore, while the typical amount of wastewater generated can be determined, the concentration of commodity (and the corresponding quantity of PMN chemical) in wastewater from the tank residual cannot be determined from the TEC questionnaire. However, the total release to water estimate can be greatly improved compared to the current CEB methodology by combining the TEC questionnaire heel release data with current CEB methods, as done in the 2001 TEC Generic Scenario.

Evaluation of the TEC questionnaire shows that data was not collected quantitatively estimating worker exposure. The TEC questionnaire did collect information about number of workers per facility and number of working days. Further investigation into other readily available resources revealed no more useful information. However, current CEB methods can be used to estimate occupational exposures associated with specific worker activities.

Readily Available Resources Searched

ERG searched readily available and Internet resources for additional information about cleaning transportation equipment. The TEC TDD is the single most readily available source for process information and environmental releases from cleaning transportation equipment. The most recent draft of the TEC Generic Scenario relies heavily on data presented in the TEC TDD, but some data analysis was done independent of the TDD analysis. ERG searched other readily available sources for more information. Relatively few non-EPA sources were found, presumably because transportation equipment cleaning is not defined as a stand-alone industry, but as a sector of chemical manufacturing or transportation industries. ERG did not yet search the SRI Chemical Engineering Handbook in EPA's EPAB library. If desired, ERG can search this resource for additional information about the TEC industry.

Relevant Chemical Engineering Branch Generic Scenarios:

1) Revised Draft Generic Scenario for Transportation Equipment Cleaning, ERG Inc., September 30, 2001.

This document will serve a good starting point for drafting a new TEC Generic Scenario.

<u>EPA Sources</u>

2) Final Development Document for Effluent Limitations Guidelines and Standards fro the Transportation Equipment Cleaning Category, EPA-821-R-00-012. US EPA Office of Water, June 2000.

This document summarizes and analyzes the data obtained from responses to the <u>1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry</u>, which focused on water releases.

3) Preliminary Data Summary for Industrial Container and Drum Cleaning Industry, EPA-821-R-02-011. US EPA Office of Water, June 2002.

This document summarizes the drum reconditioning industry and analyzes data collected from several sampling trips in year 2000. This document includes a chapter comparing the TEC and drum reconditioning industries. The most relevant topic is cleaning intermediate bulk containers.

4) AP-42, Vol. I, CH 4.8: Tank And Drum Cleaning

Section 4.8 discusses emission factors and evaporative losses from tank and drum cleaning for nine chemicals.

<u>CEB Library Sources:</u>

5) Kirk-Othmer Encyclopedia of Chemical Technology

This resource did not provide any information specific to the cleaning of transportation equipment.

6) Memorandum from Fredric Arnold titled "Review of Draft Generic Scenario for Transportation Equipment Cleaning," December 15, 2000.

These comments were provided on an earlier draft of the TEC Generic Scenario. These comments could be incorporated into future versions.

7) Memorandum from Greg Macek titled "Comments on TEC Generic Scenario (9/27/99 version)," June 26, 2001.

These comments were provided on an earlier draft of the TEC Generic Scenario. These comments could be incorporated into future versions.

8) Memorandum from Scott Prothero titled "Scott's Notes on TEC Generic Scenario Draft dated 27 Sept 1999," December 21, 2000.

These comments were provided on an earlier draft of the TEC Generic Scenario. These comments could be incorporated into future versions.

Internet Sources and Trade Associations:

9) National Transportation Equipment Association: http://www.ntea.org/
This association focuses on the broad topic of transportation equipment, not solely on transportation equipment cleaning. However, occasionally an article about equipment cleaning may be posted.

10) Canadian Transportation Equipment Association: http://www.ctea.on.ca/
This association also focuses on the broad topic of transportation equipment, not solely on transportation equipment cleaning. However, occasionally an article about equipment cleaning may be posted.

11) Texas Natural Resource Conservation Commission (TNRCC) - Draft Technical Guidance Package for Chemical Sources: Tank Truck and Rail Car Cleaning, March 2001.
This resource was developed to streamline the TNRCC permitting process. It discusses best available control technologies (BACT) and methods for estimating chemical releases. Much of this information is similar to the TEC TDD.

Technical Contacts:

12) ERG Inc. employs several people who participated on sampling episodes and prepared the TEC TDD. These people may be contacted to clarify or elaborate on relevant information.