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EPA Office of Compliance Sector Notebook Project

Profile of the Transportation Equipment Cleaning Industry

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EPA/310-R-95-009.	Motor Vehicle Assembly Industry	Suzanne Childress	564-7018
EPA/310-R-95-010.	Nonferrous Metals Industry	Jane Engert	564-5021
EPA/310-R-95-011.	Non-Fuel, Non-Metal Mining Ind.	Keith Brown	564-7124
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EPA/310-R-95-017.	Stone, Clay, Glass and Concrete Ind.	Scott Throwe	564-7013
EPA/310-R-95-018.	Transportation Equip. Cleaning Ind.	Virginia Lathrop	564-7057

Industry Sector Notebook Contents: Transportation Equipment Cleaning

Exhibits Index

List of Acronyms

AFS - AIRS Facility Subsystem (CAA database)
AIRS - Aerometric Information Retrieval System (CAA database)
BIFs - Boilers and Industrial Furnaces (RCRA)
BOD - Biochemical Oxygen Demand
CAA - Clean Air Act
CAAA - Clean Air Act Amendments of 1990
CERCLA - Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS - CERCLA Information System
CFCs - Chlorofluorocarbons
CO - Carbon Monoxide
COD - Chemical Oxygen Demand
CSI - Common Sense Initiative
CWA - Clean Water Act
D&B - Dun and Bradstreet Marketing Index
ELP - Environmental Leadership Program
EPA - United States Environmental Protection Agency
EPCRA - Emergency Planning and Community Right-to-Know Act
FIFRA - Federal Insecticide, Fungicide, and Rodenticide Act
FINDS - Facility Indexing System
HAPs - Hazardous Air Pollutants (CAA)
HSDB - Hazardous Substances Data Bank
IDEA - Integrated Data for Enforcement Analysis
LDR - Land Disposal Restrictions (RCRA)
LEPCs - Local Emergency Planning Committees
MACT - Maximum Achievable Control Technology (CAA)
MCLGs - Maximum Contaminant Level Goals
MCLs - Maximum Contaminant Levels
MEK - Methyl Ethyl Ketone
MSDSs - Material Safety Data Sheets
NAAQS - National Ambient Air Quality Standards (CAA)
NAFTA - North American Free Trade Agreement
NCDB - National Compliance Database (for TSCA, FIFRA, EPCRA)
NCP - National Oil and Hazardous Substances Pollution Contingency Plan
NEIC - National Enforcement Investigation Center
NESHAP - National Emission Standards for Hazardous Air Pollutants
NO_2 - Nitrogen Dioxide
NOV - Notice of Violation

NO_X - Nitrogen Oxide
NPDES - National Pollution Discharge Elimination System (CWA)
NPL - National Priorities List
NRC - National Response Center
NSPS - New Source Performance Standards (CAA)
OAR - Office of Air and Radiation
OECA - Office of Enforcement and Compliance Assurance
OPA - Oil Pollution Act
OPPTS - Office of Prevention, Pesticides, and Toxic Substances
OSHA - Occupational Safety and Health Administration
OSW - Office of Solid Waste
OSWER - Office of Solid Waste and Emergency Response
OW - Office of Water
P2 - Pollution Prevention
PCS - Permit Compliance System (CWA Database)
POTW - Publicly Owned Treatments Works
RCRA - Resource Conservation and Recovery Act
RCRIS - RCRA Information System
SARA - Superfund Amendments and Reauthorization Act
SDWA - Safe Drinking Water Act
SEPs - Supplementary Environmental Projects
SERCs - State Emergency Response Commissions
SIC - Standard Industrial Classification
SO_2 - Sulfur Dioxide
SO_x - Sulfur Oxides
TOC - Total Organic Carbon
TRI - Toxic Release Inventory
TRIS - Toxic Release Inventory System
TCRIS - Toxic Chemical Release Inventory System
TECI - Transportation Equipment Cleaning Industry
TSCA - Toxic Substances Control Act
TSS - Total Suspended Solids
UIC - Underground Injection Control (SDWA)
UST - Underground Storage Tanks (RCRA)
VOCs - Volatile Organic Compounds

Message from the Administrator

I. INTRODUCTION TO THE SECTOR NOTEBOOK PROJECT

I.A. Summary of the Sector Notebook Project

Environmental policies based upon comprehensive analysis of air, water and land pollution (such as economic sector, and community-based approaches) are becoming an important supplement to traditional single-media approaches to environmental protection. Environmental regulatory agencies are beginning to embrace comprehensive, multi-statute solutions to facility permitting, compliance assurance, education/outreach, research, and regulatory development issues. The central concepts driving the new policy direction are that pollutant releases to each environmental medium (air, water and land) affect each other, and that environmental strategies must actively identify and address these inter-relationships by designing policies for the "whole" facility. One way to achieve a whole facility focus is to design environmental policies for similar industrial facilities. By doing so, environmental concerns that are common to the manufacturing of similar products can be addressed in a comprehensive manner. The desire to move forward with this "sector-based" approach within the EPA Office of Compliance led to the creation of this document.

The Sector Notebook Project was initiated by the Office of Compliance to provide its staff and managers with summary information for eighteen specific industrial sectors. As other EPA offices, states, the regulated community, and the public became interested in this project, the Office of Compliance expanded the scope of the original project. The ability to design comprehensive, common sense environmental protection measures for specific industries is dependent on knowledge of several inter-related topics. For the purposes of this project, the key elements chosen for inclusion are: general industry information (economic and geographic); a description of industrial processes; pollution outputs; pollution prevention opportunities; Federal statutory and regulatory framework; compliance history; and a description of partnerships that have been formed between regulatory agencies, the regulated community and the public.

For any given industry, each topic listed above could alone be the subject of a lengthy volume. However, in order to produce a manageable document, this project focuses on providing summary information for each topic. This format provides the reader with a synopsis of each issue, and references where more in-depth information is desired. Text within each profile was researched from a variety of sources, and was usually condensed from more detailed sources pertaining to specific topics. This approach allows for a wide coverage of activities that can be further explored based upon the references listed at the end of this profile. As a

check on the information included, each notebook went through an external document review process. The Office of Compliance appreciates the efforts of all those that participated in this process and enabled us to develop more complete, accurate and up-to-date summaries. Many of those who reviewed this notebook are listed as contacts in Section IX and may be sources of additional information. The individuals and groups on this list do not necessarily concur with all statements within this notebook.

I.B. Additional Information

Providing Comments

The Office of Compliance plans to periodically review and update notebooks and will make these updates available both in hard copy and electronically. If you have any comments on the existing notebook, or if you would like to provide additional information, please send a hard copy and computer disk to the EPA Office of Compliance, Sector Notebook Project, 401 M St., SW (2223-A), Washington, DC 20460. Comments can also be uploaded to the Enviroene Bulletin Board or the Enviroene World Wide Web for general access to all users of the system. Follow instructions in Appendix A for accessing these data systems. Once you have logged in, procedures for uploading text are available from the on-line Enviroene Help System.

Adapting Notebooks to Particular Needs

The scope of the existing notebooks reflect an approximation of the relative national occurrence of facility types that occur within each sector. In many instances, industries within specific geographic regions or states may have unique characteristics that are not fully captured in these profiles. For this reason, the Office of Compliance encourages state and local environmental agencies and other groups to supplement or re-package the information included in this notebook to include more specific industrial and regulatory information that may be available. Additionally, interested states may want to supplement the "Summary of Applicable Federal Statutes and Regulations" section with state and local requirements. Compliance or technical assistance providers may also want to develop the "Pollution Prevention" section in more detail. Please contact the appropriate specialist listed on the opening page of this notebook if your office is interested in assisting us in the further development of the information or policies addressed within this volume.

If you are interested in assisting in the development of new notebooks for sectors not covered in the original eighteen, please contact the Office of Compliance at 202-564-2395.

II. INTRODUCTION TO THE TRANSPORTATION EQUIPMENT CLEANING INDUSTRY

This section provides background information on the size, geographic distribution, employment, production, sales, and economic condition of the transportation equipment cleaning industry. The type of facilities described within most of the notebooks are also described in terms of their Standard Industrial Classification (SIC) codes. The transportation equipment cleaning sector, however, is not classified under the SIC system and therefore, does not have a designated SIC code number.

The Office of Water (OW) currently has the most extensive amount of data on tank interior cleaning. OW has done over 35 site visits and has performed wastewater sampling at 18 TEC facilities. The site visit reports are available and sampling data are available for all but four facilities. OW has also administered a screener questionnaire (3,240 potential TEC facilities) and a detailed questionnaire to the industry. The detailed questionnaire was mailed in April 1995 to 275 facilities. At the time that this document went to print, results were being received and entered into a database for analysis by EPA. Information is being collected on the following: TEC operations, cargos cleaned out of the tanks and containers, cleaning solutions used, types and sizes of tanks and containers cleaned, wastewater treatment technologies employed by the facility, wastewater sampling data, pollution prevention activities, water conservation activities, air emissions data and air emissions controls, solid waste and heels generation and disposal, and revenues, assets, liabilities, operating and maintenance costs, and employees. All of the data from these two questionnaires will be used to develop survey weights from which to determine the total population characteristics for tank cleaning facilities in the U.S.

II.A. Introduction, Background, and Scope of the Notebook

Because there are no SIC codes that apply only to transportation equipment cleaning, the use of SIC codes to identify the characteristics of these facilities is not possible. A large number of industries with many different SIC codes carry out transportation equipment cleaning activities. For example, transportation equipment cleaning facilities can be located within the petroleum refining industry (SIC 2911) and the marine cargo handling sector of the transportation industry (SIC 4491). Although facilities within both industries clean transportation equipment, the petroleum refining industry predominantly refines crude oil to petroleum products and the marine cargo handling industry by SIC code predominantly loads and unloads cargo from ships and barges.

Furthermore, trade associations are also unable to adequately characterize the industry. Facilities providing transportation equipment cleaning services usually provide numerous other services all of which are of concern to the trade associations, and those associations that represent transportation equipment cleaners do not exclusively represent these facilities.

II.B. Characterization of the Transportation Equipment Cleaning Industry

II.B.1. Product Characterization

The transportation industry moves people and materials between predetermined points using four principal transportation modes: truck, train, vessel, and airplane. Almost all materials and goods in the U.S. are distributed by one of these four modes. Pipelines for crude oil and refined petroleum products are one significant exception. Delivery to pipelines and local distribution from pipelines, however, is by truck, train or vessel. The majority of domestic cargo is bulk freight transported in tank trucks, rail tank cars, and ocean/sea tankers. It is estimated that over 700 different commodities are transported in this manner throughout the U.S., including: petroleum products, coal, organic chemicals, inorganic chemicals, compressed gases, fertilizers, pesticides, food products, paints, inks, glues, and soaps. The transportation equipment cleaning industry (TECI) is a service industry for the cleaning of the interiors of trucks, rail cars, and barges, intermodal tank containers, and intermediate tank containers, and the exterior of aircraft. An important segment of this industry, in terms of wastes generated, deals with the cleaning of tank interiors. In the past, the deicing of aircraft and runways has also been regarded by EPA as part of the transportation equipment cleaning industry. It is important to note that the industry as it is described above, and throughout this notebook, is not meant to reflect the industry as it is defined in a transportation equipment cleaning rule being developed by the Office of Water.

Most truck, barge and ship tanks are in dedicated service (i.e., carries one commodity only), however, a significant number are non-dedicated and must be cleaned after every trip to prevent contamination of materials from one cargo to the next. A recent incident underscoring the importance of proper tank cleaning resulted in over 400 cases of salmonella poisoning. Tank trucks carrying raw eggs were not adequately cleaned before carrying ice cream mix which was subsequently made into ice cream without additional pasteurization. Truck, barge and ship tanks also must be cleaned prior to inspections and repairs. Almost all rail tank cars are in dedicated service and, therefore, are only cleaned prior to inspection, repairs and refurbishing. Rail car refurbishing operations, in part, involve

the disassembly and cleaning of parts using a number of different cleaning methods prior to reassembly. Aircraft exteriors are cleaned for a variety of reasons including: aesthetics; as part of a routine inspection and maintenance program; and to facilitate repairs. Aircraft deicing is conducted to remove ice from aircraft wings and other areas that may adversely affect the operation of the aircraft.

intermodal tank containers and intermediate bulk containers (IBCs) or "totes" are transportable containers that can be transferred between trucks, barges, ships and rail cars. They are used to transport liquid, solid or gaseous materials. Intermodal tank containers typically hold between 6,000 - 9,000 gallons and are considerably larger than IBCs which are typically between 500 and 800 gallons.

Between 1973 and 1974 a study was conducted by EPA's Industrial Environmental Research Laboratory assessing the environmental impact of air emissions and water pollutants from cleaning rail tank cars, tank trucks, and drums. This initial study found air emissions and wastewater discharges from these operations to be relatively low. Therefore, no regulations were proposed for tank and drum cleaning facilities at that time. A preliminary study conducted in 1985 by EPA's Office of Water examined the wastewater generated by the transportation equipment cleaning industry (which did not include aircraft deicing) to determine whether regulations should be developed for the industry pursuant to the Clean Water Act. As a result of the study, EPA decided to develop effluent guidelines (wastewater regulations) for the TECI. As part of the consent decree with NRDC in January 1992, EPA is under a court-ordered deadline, however, to propose and promulgate effluent guidelines for the industry's wastewater (including aircraft deicing) by the end of 1996 and 1998, respectively. The Office of Water is currently collecting more extensive and up-to-date industry data, through mandatory surveys (CWA §308), site visits to facilities, and sampling, which will be used as a basis for developing the effluent limitations guidelines. Effluent limitation guidelines for aircraft cleaning and deicing will be developed separately, after additional studies specific to aircraft deicing can be conducted.

For the development of the TECI effluent guidelines, in 1993, EPA Office of Water administered about 3,240 screener questionnaires to potential tank interior cleaning facilities. The results of this screener questionnaire and the development of the survey weights will be used to estimate the number and types of facilities in the scope of the industry. From the screener questionnaire, approximately 740 TECI facilities were identified. Some preliminary results, before the development of the survey weights, are presented below. It is important to note that this data may change

significantly depending on the survey weights used. In addition to the screener questionnaire, EPA has sent out approximately 300 detailed questionnaires to obtain information relating to transportation equipment cleaning activities, wastewater treatment technology efficiencies, wastewater treatment technology costs, and various financial and economic data.

Based on the 1993 screener questionnaire, EPA estimates that about 2,729 facilities providing tank interior cleaning services will be affected by the wastewater effluent guidelines. Transportation equipment cleaning facilities are often part of much larger manufacturing, maintenance, depot, or terminal facilities. For this reason economic and pollutant release data specific to transportation equipment cleaning operations is not readily available.

II.B.2. Industry Size and Geographic Distribution

Based on the results of 3,240 EPA screener questionnaires sent out to potential transportation tank interior cleaning facilities, initial estimates of the total number of facilities actually conducting tank interior cleaning activities is approximately 2,729 (before scale-up analysis based on survey weights) (Exhibit 1). The number of aircraft exterior cleaning and/or deicing facilities has not yet been determined. Aircraft cleaning and deicing facilities are expected to approximate the number of commercial airports in the U.S. because almost all airports conduct cleaning and/or deicing activities.

Exhibit 1: Number and Size of Facilities with Tank Cleaning Services

Type of Tank	Number of Facilities
Truck, Land[1]	1,841
Rail, Intermodal Tank Carrier, Intermediate Bulk Container	809
Barge	49
Land-Water[2]	16
Tanker, Water[3]	14
Combination Facilities	162
Total	2,891

Source: Based on U.S. EPA Office of Water, Engineering Analysis Division, screener questionnaire data before scale-up, 1994.

[1] Land facilities are those that clean any combination of the following equipment: tank trucks, rail tank cars, intermediate bulk containers, intermodal tank containers.
[2] Land-water facilities are those that clean a combination of the following types of equipment with no one type of equipment predominating: tank trucks, rail tank cars, intermediate bulk containers, intermodal tank carriers, tank barges, and ocean sea tankers.
[3] Water facilities are those that perform cleaning of both tank barges and ocean/sea tankers with neither type of equipment predominating.

The characteristics of transportation equipment cleaning facilities differ significantly among the various modes of transportation and the forms of ownership. There are four types of facility ownership: independent owner/operators, carriers, builders/leasers, and shippers.

Independent Owner/Operators

Independent owner/operators make up about 33 percent of transportation equipment cleaning (not including aircraft cleaning/deicing) facilities. Independent owner/operators are typically "for-hire" facilities which provide services to any users for a fee. Such facilities are found in all modes of transportation, however, they are most common in the trucking sector of the industry and least common in the aircraft cleaning and deicing sector. Independently owned and operated facilities are much more likely to be dedicated to only tank cleaning than carrier, shipper, and builder/leaser owned facilities which usually provide other services (i.e., depots, repairs, maintenance, fuel, etc.) to their users.

Carrier Owned Facilities

Carrier facilities make up about 27 percent of transportation equipment cleaning facilities. Such facilities are owned and operated by transporting companies and provide services to their own vehicles. Carrier operated facilities are usually located at shipping and receiving terminals and provide maintenance and repair services as well as tank cleaning. Many carrier facilities also operate as "for-hire" facilities to outside transporters. Carrier owned facilities are found in all transportation modes and are the most common form of ownership for rail tank car and tank truck cleaning facilities. In the aircraft sector, cleaning and deicing is almost exclusively carried out by the carrier companies.

Shipper Owned Facilities

Shipper facilities make up about 20 percent of transportation equipment cleaning facilities and are owned by large manufacturing companies (i.e., petroleum and chemical companies) that ship their own or other companies' products and clean and repair their own equipment. Shipper operated facilities are typically located at the manufacturer's shipping and receiving terminals. The facilities provide maintenance and repair services as well as tank cleaning. Some shipper facilities also operate as "for-hire" facilities to outside transporters. Shipper owned facilities are found in the rail, and barges sectors, however, they are most common in the trucking sector.

Builder/Leaser Owned Facilities

Builder/leaser facilities are owned by those transportation equipment manufacturers (i.e., rail car manufacturers and leasers, barge manufacturers and leasers, etc.) and leasing companies that also provide repairs and cleaning services for the equipment that they sell or lease. Such facilities make up about six percent of transportation equipment cleaning facilities. Some builder/leaser facilities also operate as "for-hire" facilities to outside transporters. Equipment cleaning services provided by builders/leasers are usually part of an inspection, maintenance and repair facility. Builder/leaser tank cleaning facilities are found in the barges and trucks sectors, however, they are most common in the rail transport sector. Another 14 percent of transportation equipment cleaning facilities are combinations of two or more of the four types ownership described above.

The distribution of transportation equipment cleaning facilities across the U.S. varies depending on the mode of transportation. Tank truck cleaning facilities are concentrated in five major petrochemical and manufacturing regions, and population centers of the U.S.: 1) California; 2) the Texas-Louisiana Gulf coast; 3) the Mississippi, Missouri, and Ohio Rivers; 4) Southern Lake Michigan, Lake Erie, and Lake Huron; and 5) eastern Pennsylvania and New Jersey. Rail tank cleaning facilities are located primarily in the industrialized central, south central and eastern regions of the U.S. Tank barge cleaners are located predominantly along the Gulf Coast and along the Mississippi River and its tributaries (Exhibit 2). Aircraft cleaning and deicing operations are carried out at most airports and, therefore, follow population distributions closely with deicing facilities more common and used more frequently in the northern regions (Exhibit 2).

Exhibit 2. Primary Location of Facilities Cleaning Tanks and Deicing Aircraft

Tank Type	Primary Areas of Operation
Tank Truck	California; Texas-Louisiana Gulf coast; Mississippi, Missouri, and Ohio Rivers; Southern Lake Michigan, Lake Erie, and Lake Huron; eastern Pennsylvania and New Jersey
Rail Tank Car	Industrialized central, south central and eastern regions
Barge/Tanker	Gulf Coast and along the Mississippi River and its tributaries
Aircraft Cleaning/Deicing	Follows population distributions with deicing facilities more common in the northern regions

Source: U.S. EPA Office of Water, Engineering Analysis Division, 1994.

Exhibit 3: Geographic Distribution of Tank and Interior Cleaning Facilities in the TEC Screener Questionnaire Database

Available from EPA Office of Water.

II.B.3 Economic Trends

The economic health of the transportation equipment cleaning industry is highly dependent on the health of the industries it serves. The railroads, trucking, and water transportation sectors are expected to have modest growth in the next few years as the economy continues to grow. The North American Free Trade Agreement (NAFTA) is also expected to have a positive impact on the industry by increasing international freight traffic, especially between the U.S. and Mexico.

III. INDUSTRIAL PROCESS DESCRIPTION

This section describes the major industrial processes within the transportation equipment cleaning industry, including the materials and equipment used, and the processes employed. The section is designed for those interested in gaining a general understanding of the industry, and for those interested in the inter-relationship between the industrial process and the topics described in subsequent sections of this profile -- pollutant outputs, pollution prevention opportunities, and Federal regulations. This section does not attempt to replicate published engineering information that is available for this industry. Refer to Section IX for a list of reference documents that are available.

This section specifically contains a description of commonly used production processes, associated raw materials, the byproducts produced or released, and the materials either recycled or transferred off-site. This discussion, coupled with schematic drawings of the identified processes, provide a concise description of where wastes may be produced in the process. This section also describes the potential fate (via air, water, and soil pathways) of these waste products.

III.A. Industrial Processes in the Transportation Equipment Cleaning Industry

Tank trucks, rail tank cars, barges, tankers, IBCs, and intermodal tank containers all differ significantly in volume (Exhibit 4). In addition, the configuration, mean distances traveled, and types of materials transported vary among the various container types. Therefore, the volumes of water used, the types of wastes generated, and the cleaning time can vary widely depending on the mode of transport. The basic steps of the tank cleaning process, however, do not vary substantially regardless of the transportation mode or type of container. The process used can differ significantly depending on the residues to be cleaned and the extent to which a tank needs to be cleaned prior to reuse. Exterior cleaning of rail cars and aircraft cleaning and deicing differ considerably from tank cleaning in both method and wastes generated and are described separately below. Pollutant outputs from each of the processes is described in Section III.C.

Exhibit 4: Tank Volumes Vary Significantly	
Type of Tank	**Typical Volume in Gallons**
Tank Truck	3,500-8,000
Rail Tank Car	20,000-30,000
Barge	420,000-1,470,000
Ocean/Sea Tanker	3-147 million
Intermodal Tank Container	2,500-10,000
Intermediate Bulk Container	500-800
Source: American Waterways Operators Fact Sheet, 1994, and U.S. EPA Office of Water, Engineering Analysis Division.	

III.A.1. Tank Interior Cleaning

Most tank cleaning facilities will handle all types of tank residues. Some facilities, however, will not accept certain residues (i.e., highly odorous residues or materials not compatible with the on-site wastewater treatment system), and others will only accept certain types of tank residues (i.e., petroleum products or food grade products). Regardless of the type of tank or last cargo transported, the following tank cleaning procedures are typically carried out at tank cleaning facilities.

- shipping papers are checked to identify the cargo last carried;
- next cargo is determined, if possible;
- residual cargo heel is removed and segregated for off-site disposal;
- tank is rinsed;
- tank is washed;
- tank is rinsed; and
- tank is dried.

Identification of the last cargo carried is necessary to determine the appropriate level of health protection for those employees cleaning the tank and to determine the appropriate cleaning method and materials. In addition, it is important to understand the characteristics of the wastewater that will be generated in order to determine the appropriate treatment or disposal method.

Determination of the next cargo to be transported is useful for deciding the level of cleaning that is needed. Certain cargos, such as foods and highly pure chemicals, will require a much cleaner container than most cargos.

Before beginning the rinsing and washing of the tank, any residual cargo, or heel, must be removed and segregated. Heels can be removed using the vehicle's own cargo transfer piping, pumps supplied by the cleaning facility, or manually. Heel volumes vary significantly between modes of transport (Exhibit 5). In barges and ships, volumes can be relatively large and their removal, called "stripping," is often carried out using a built-in vessel stripping system. Stripping of heels from barges and ships can be facilitated by pumping ballast water into some of the tank compartments to tilt the vessel.

Washing, rinsing and drying methods vary depending on the facility's equipment, the last cargo carried, and the next cargo to be carried. Some cargos may require only a water rinse, and other cargoes may require a series of washing and rinsing cycles using different wash solutions. Washing solution may consist of: detergent solution, caustic solution, organic solvents, or steam. Tanks can be rinsed with hot or cold water, and drying can be passive or with forced air.

Washing is performed either manually with hand held sprayers, or automatically with high pressure spinner nozzles or “butterworths.” Any wash solution can be used with either method, however, worker safety is a concern when manually spraying solvent and caustic wash solutions. High pressure spinner nozzles are inserted through the main tank hatch, and wash solution and rinse water is automatically sprayed onto the tank surface at 100-600 psi while rotating around vertical and horizontal axes. Some facilities have the capability to recycle washing solutions within a closed system and periodically change to fresh wash solution. Wastewater is then either treated in the facility wastewater treatment system, discharged to a publicly-owned treatment works (POTW) via a sewer system, discharged directly to surface waters, or piped to an underground injection well. Hazardous wastewater is disposed of off-site or treated separately on-site.

III.A.2 Rail Car Refurbishing and Maintenance

The processes used to clean rail car (tank and freight) interiors and exteriors prior to repairs and refurbishing, and to clean certain parts during repairs and refurbishing, are significantly different from those used to clean tank interiors. At a typical rail car refurbishing or maintenance facility, the initial cleaning of the cars involves two steps: a mechanical

cleaning and water wash. Both steps remove dirt and other residues prior to removal of the damaged parts and systems to be replaced. Mechanical cleaning consists of the physical shaking and vibrating of the rail cars to loosen dirt and debris. Dirt and debris may fall through a steel grate in the floor and are intermittently collected for disposal. The wash step consists of a high pressure water cleaning, collection of wastewater, and treatment at an on-site wastewater treatment facility. Refurbishing operations usually start with paint removal using a steel grit blast system or other methods. The paint chips and grit are typically collected through a steel grate in the floor and the mixture is conveyed to a cyclone and filter system for separation of reusable grit and paint. Next, the cars are disassembled and wheel sets and air brakes are rebuilt. Axles from wheel sets that can be reused are first washed in a caustic solution to remove grease and dirt. External debris is removed from the air brakes using a grit or bead blast system or other methods. The brakes are then disassembled and cleaned with solvents or caustic solutions. Finally, the cars are reassembled and repainted using spray guns. Maintenance and repair operations consist of disassembly, cleaning, and repair; or the disassembly and replacement, of damaged parts. Parts cleaning may include the removal of paints, cleaning with solvents or caustics, and repainting.

III.A.3. Aircraft Cleaning and Deicing

Aircraft cleaning is carried out using hand held spray nozzles, hoses and brushes. Exterior cleaning typically consists of washing with detergent solutions and a water rinse. For large aircraft, wet cleaning is usually limited to wheel wells and landing gear and is conducted to facilitate inspections. It is more economical to dry polish aircraft fuselages rather than wash them with water and cleaning solutions. Aircraft deicing is carried out at the gate area and occasionally additional deicer is applied just prior to take-off while the aircraft is on the runway. Airport runways and gate areas are also sprayed with deicer to prevent the build-up of ice and snow. Deicers are usually one, or a mixture of two or more, of: ethylene glycol, urea, potassium acetate, and sand (for runway deicing only). Some airports are using or planning remote deicing areas away from the gate areas. Remote deicing areas facilitate collection to deicing fluids for reuse, recycling, and treatment. Deicing is almost exclusively performed using hand held nozzles and hoses. However, automatic deicer spray machines, called "deicing gantries," have been developed in recent years. Deicing gantries are large structures holding numerous spray nozzles which pass over the aircraft spraying deicer. The deicing gantries are computer controlled and, depending on the type of aircraft, spray specific amounts of deicer over particular areas with very little wasted material.

III.B. Raw Material Inputs and Pollution Outputs

III.B.1. Tank Cleaning

The primary pollutant output of tank cleaning operations is wastewater contaminated with tank residues and cleaning solutions. More specifically, outputs include: spent cleaning fluids, fugitive volatile organic compound (VOC) emissions, water treatment system sludges, and tank residues. The quantities of these outputs will vary widely from facility to facility depending on the mode of transport, types of cargoes, and cleaning methods. For example, an independent owner/operator tank truck cleaning facility serving a large number of different users will generate a much greater volume of wastewater containing many more different contaminants, than a shipper operated facility serving fewer trucks all carrying the same cargo.

Tank Heels

Tank heels volumes vary substantially depending on the size and configuration of the tank, and on the nature of the last cargo carried (Exhibit 5). Disposal and treatment of tank heels can pose a problem for tank cleaning facilities. Tank heels of hazardous waste greater than 0.3 percent by weight of the tank capacity continue to be regulated by RCRA after the discharge of the waste at a TSDF. Under these regulations, the use of solvents (including water) could be viewed as treatment, and therefore, may not be allowed to remove these heels. Under such conditions, the only means available to remove the heels may be manually (e.g., scooping, shoveling, scraping) A facility's wastewater treatment system may be adversely affected by, and may not adequately treat, a slug of concentrated tank residue. In addition, the heel material may be inconsistent with the facility's wastewater discharge permit. Water soluble heels that are compatible with the facility's treatment system and the conditions of its wastewater discharge permit are sometimes combined with other wastewaters for treatment and disposal. Incompatible heels are typically segregated and, depending on the volumes generated at the facility and the value of product, the heel can be either sold back to a reclaimer or shipped off-site for disposal. The resale of tank heels is more common at facilities that generate large volumes of a small number of products, as is often the case at tank barge cleaning facilities. Heels that are comprised of detergents, solvents, acids, or alkalis can be stored on-site and used as a tank cleaning fluid or to neutralize other tank heels.

Exhibit 5: Tank Heel and Wastewater Volumes		
Type of Tank	Typical Heel Volume (gallons/tank)	Estimated Average Wastewater Generated (gallons/tank)
Tank Truck	5-10	500-1,000
Rail Tank Car	10-30	3,000-5,000
Tank Barge	5-500	10,000-12,000
Source: EPA Office of Water and *Preliminary Data Summary for the Transportation Equipment Cleaning Industry* , U.S. EPA, 1989 and EPA Office of Water, Engineering Analysis Division, 1995.		

Wastewater

The primary source of wastewater from equipment cleaning facilities is from the cleaning of tank interiors. Relatively small amounts of wastewater are generated from exterior washing of vehicles. Wastewater volumes and characteristics vary depending on the last cargo transported, the cleaning solution used, the tank size, and the presence of caked, solidified, or crystallized residues. The volumes of wastewater generated per tank cleaning will vary substantially depending on the cleaning solution, the residues present and the degree of cleanliness needed. For example, the cleaning of a tank coated with a viscous, water insoluble residue will require more washing and rinsing time than a tank that last carried a water soluble material. In addition, washing with a detergent solution will, in general, generate more wastewater than a steam wash (Exhibit 5).

Washing and rinsing wastewater compatible with facility treatment systems or discharge permits is pumped or drained from the tank or recycling system to wastewater storage tanks. Cleaning solutions that are not compatible with the treatment systems or discharge permits, such as solvent washing solutions, are stored in drums for off-site disposal.

Information on the types and extent of wastewater treatment at transportation equipment cleaning facilities is limited. EPA's Office of Water has information on wastewater treatment at 700 facilities. Each wastewater treatment plant is designed for certain types of wastewater and to meet the requirements of a downstream treatment works and/or a National Pollutant Discharge Elimination System (NPDES) permit. Approximately 90 percent of transportation equipment cleaning facilities discharge wastewater to POTWs or combined treatment works (privately

owned by multiple facilities) after some amount of treatment. Some

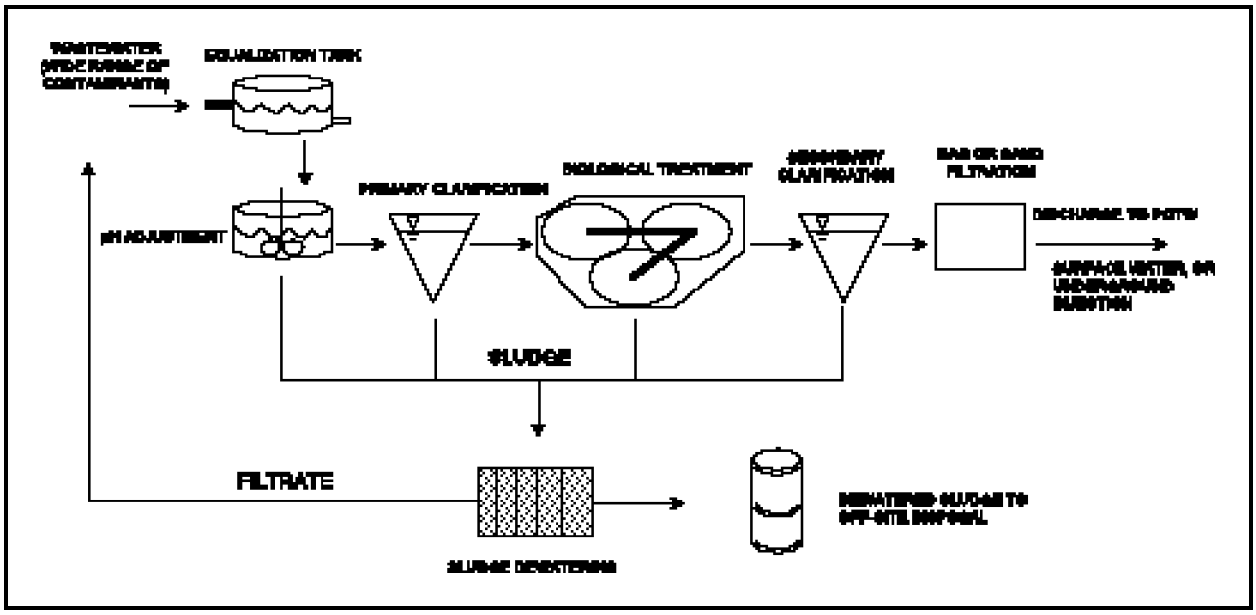

Exhibit 6: Typical Wastewater Treatment System Treating
A Wide Range of Contaminants

facilities discharge directly to surface

waters under NPDES permits or to underground injection wells under Safe Drinking Water Act Permits. Wastewater treatment, therefore, ranges from no treatment to a simple settling tank for removal of suspended solids and oil and grease, to elaborate treatment systems to remove biological oxygen demand, and metals. Most facilities rely on physical-chemical treatment methods rather than biological treatment, however, biological treatment methods are becoming more and more common. Wastewater treatment systems that treat a wide range of contaminants will, in general, be more complex. A typical system could consist of pH adjustment, an equalization or aerated equalization tank, primary clarification, activated sludge, secondary clarification, and bag or sand filtration. Sludges are dewatered and shipped off-site for disposal (Exhibit 6). Typical wastewater treatment for facilities that primarily treat oily wastes may consist of a holding or equalization tank, gravitational oil water separation, bag or sand filtration, and coalescing filtration. Sludges are then removed from the equalization tank, oil-water separator, and bag or sand filters; and disposed of off-site (Exhibit 7). To reduce the volume of hazardous waste generated, some facilities dewater sludges in a sludge press prior to disposal off-site. The

water generated is typically recycled back to the equalization tank. In addition, some facilities with very stringent local limits have such advanced treatment as carbon absorption with steam or air stripping for removal of organic chemicals.

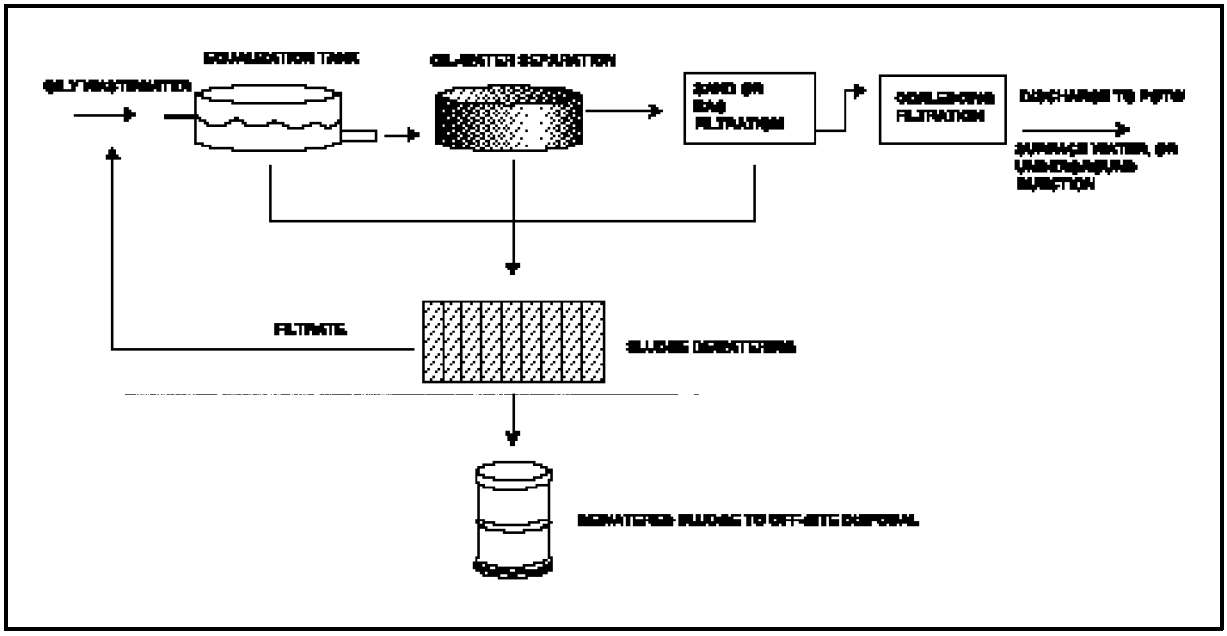

Exhibit 7: Typical Oily Wastewater Treatment System

Air Emissions

Air emissions from transportation equipment cleaning facilities arise from fugitive emissions through tank hatches of VOCs from the tank heels and residues, from solvent cleaning solutions, and from wastewater treatment facility tanks. Closed, recycled washing systems for tank trucks, tank cars, and barges, have very low air emissions. Emissions of VOCs are higher in the case of manual cleaning methods. The specific VOCs emitted will depend on the cargo last carried and the cleaning solution used. A source assessment study for rail tank car, tank truck and drum cleaning conducted in 1973 and 1974 by the U.S. EPA Industrial Environmental Research Laboratory found that air emissions from rail car and tank truck cleaning are relatively low.

Residual Waste

Residual wastes are generated as sludges from residues removed from the inside of tanks and from wastewater treatment systems. Sludges are typically drummed and shipped off-site as hazardous wastes. Sludge from a primary clarifier at a truck tank cleaning facility was analyzed for the 1989 preliminary study of transportation equipment cleaning facilities. The sludge was found to be RCRA hazardous due to high concentrations of organic compounds and metals.

III.B.2. Rail Car Refurbishing and Maintenance

Pollutant outputs from the rail car refurbishing and maintenance sector are generally in the form of wastewater from preliminary cleaning of interiors and exteriors and hazardous wastes generated from painting, paint removal, and cleaning of parts. Typical hazardous wastes generated include: spent solvents and solvent sludges from solvent cleaning operations; spent caustics and caustic sludges from caustic washing operations; paint chips; and paint sludges (Exhibit 8). VOC air emissions are also generated during the use of solvents and paints. Wastewater from preliminary cleaning of the rail cars and spent caustic solution is treated in an on-site wastewater treatment system and then discharged to a POTW. Hazardous wastes are typically drummed and shipped off-site as RCRA hazardous waste. Spent solvents, however, can be sent off-site for reclaiming.

Exhibit 8: Hazardous Wastes from Rail Car Refurbishing and Maintenance Operations

Typical Process/ Operation	Typical Materials Used	Types of Waste Generated
Oil and grease removal	Degreasers, carburetor cleaners, engine cleaners, varsol, solvents, acids/alkalies	ignitable wastes, spent solvents, combustible solids, waste acid/alkaline solutions
Engine, parts and equipment cleaning	Degreasers, carburetor cleaners, engine cleaners, solvents, acids/alkalies, cleaning fluids	ignitable wastes, spent solvents, combustible solids, waste acid/alkaline solutions
Rust removal	naval jelly, strong acids, strong alkalies	waste acids, waste alkalies
Paint preparation	paint thinners, enamel reducers, white spirits	spent solvents, ignitable wastes, ignitable paint wastes, paint wastes with heavy metals
Painting	enamels, lacquers, epoxys, alkyds, acrylics, primers	ignitable paint wastes, spent solvents, paint wastes with heavy metals, ignitable wastes

Spray booth, spray guns, and brush cleaning	paint thinners, enamel reducers, solvents, white spirits	ignitable paint wastes, heavy metal paint wastes, spent solvents
Paint removal	solvents, paint thinners, enamel reducers, white spirits	ignitable paint wastes, heavy metal paint wastes, spent solvents

Source: U.S. EPA Office of Solid Waste, 1993.

III.B.3. Aircraft Cleaning and Deicing

The primary pollutant output from aircraft cleaning and deicing is wastewater from the cleaning of aircraft exteriors and spent deicer from deicing operations. Wastewater from cleaning operations usually drains to catch basins and is mixed with other airport wastewater and treated in an on-site treatment facility. Water use in cleaning is estimated to be approximately 2,000 gallons per aircraft. Analysis of wash water from one cleaning operation showed only a few organic pollutants at relatively low levels and high concentrations of metals. The source of the metals was thought to be from the many special alloys used in aircraft manufacturing.

Deicing operations generate waste deicer fluids that drain from the aircraft surfaces or from the runway surfaces to storm drains. The deicing fluids are often mixed with storm water runoff and then either treated in the facility wastewater treatment system or discharged directly to surface waters (Exhibit 9). Deicing fluid can also be released directly to the environment through runoff to surface waters or infiltration to groundwater. Some airports have constructed deicing fluid collection systems which segregate used deicer from other wastewater for reuse, recycling, on-site treatment or disposal off-site.

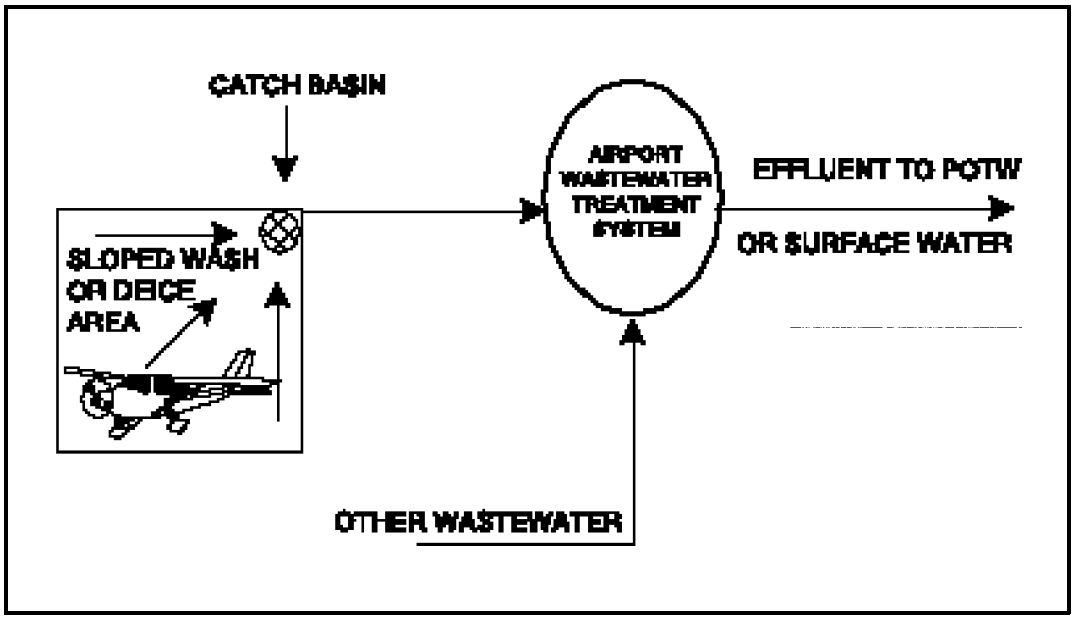

Exhibit 9: Aircraft Cleaning and/or Deicing Wastewater Treatment