DRAFT DECISION DOCUMENT FOR DRUM RECONDITIONING INDUSTRY EFFLUENT GUIDELINES DEVELOPMENT

Submitted to:

U.S. Environmental Protection Agency
Industrial Technology Division
401 M Street, S.W.
Washington, DC 20460

Submitted by:

Science Applications International Corporation
8400 Westpark Drive
McLean, VA 22102

December 8, 1987

EPA Contract No. 68-03-3509, WA No. 2
SAIC Project No. 2-835-07-551-02

SAIC
Science Applications International Corporation

December 11, 1987

Mr. Donald F. Anderson (WH-552)
U.S. Environmental Protection Agency
Industrial Technology Division
401 M Street, S.W.
Washington, DC 20460

Subject: EPA Contract No. 68-03-3509, WA No. 2
SAIC Project No. 2-835-07-551-02

Dear Mr. Anderson:

Enclosed are eight copies of the most recent version of the Draft Decision Document for the Drum Reconditioning Industry. If you have any questions, please call me at 734-4359.

Sincerely,

SCIENCE APPLICATIONS
INTERNATIONAL CORPORATION

Maria Skibinski
for Richard Hergenroeder, P.E.
Work Assignment Manager

Enclosures

BH/ms

8400 Westpark Drive, McLean, Virginia 22102 (703) 821-4600
Other SAIC Offices: Albuquerque, Chicago, Dayton, Denver, Huntsville, La Jolla, Los Angeles, Orlando, San Diego, San Francisco, Tucson, and Washington, D.C.

This project has been funded at least in part with Federal funds from the U.S. Environmental Protection Agency (EPA), Industrial Technology Division (ITD), under the Contract No. 68-01-6947, Work Assignment Nos. 13 and 20, and Contract No. 68-03-3509, Work Assignment No. 2. The content of this publication does not necessarily reflect the views or policies of the ITD, nor does mention of trade names, commercial products, or organization imply endorsement by the U.S. Government.

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1. FOREWORD

The Industrial Technology Division (ITD) of the U.S. Environmental Protection Agency (EPA) has conducted a study of the drum reconditioning industry as a result of findings from the Domestic Sewage Study that the quantity of hazardous wastes generated and discharged to publicly owned treatment works (POTWs) by the drum reconditioning industry was unknown. The purpose of this study is to develop information to characterize the drum reconditioning industry as to the scope of the industry, its operations, its dischargers to the Nation's waters, and identification and quantification of the pollutants discharged to the Nation's waters. The Agency will use this information to determine whether effluent limitation guidelines and standards are necessary to control pollutant dischargers from point sources in the industry.

The Agency collected data and information from a variety of sources. The information-gathering efforts of the Agency were coordinated with the Department of Transportation (DOT), five local governments, and the states. Pertinent trade associations were contacted and 16 sites were visited. Wastewater sampling was conducted at four sites and the data collected represent the best available for characterizing the industry. Analyses were conducted for over 400 conventional, nonconventional, priority, and Resource Conservation and Recovery Act (RCRA) pollutants.

This report is organized into nine sections. Section 2 presents the conclusions that were drawn from this study. Section 3 provides an overview of the industry and pertinent regulations. In Section 4, a detailed description of the industry is presented. In Section 5, water usage and wastewater characteristics are discussed. Sections 6 and 7 address control and treatment technologies and costs, respectively. Section 8 presents the results of an environmental assessment conducted for the drum reconditioning industry. References are listed in Section 9.

2. CONCLUSIONS

The following is a listing of the conclusions drawn from the study of the drum reconditioning industry conducted by the Industrial Technology Division (ITD) of the U.S. Environmental Protection Agency (EPA):

- The Domestic Sewage Study, conducted by EPA in response to Section 3018(a) of the Resource Conservation and Recovery Act (RCRA), concluded that the quantity of hazardous wastes generated and discharged to publicly owned treatment works (POTWs) by the drum reconditioning industry was unknown.

- Steel and polyethylene drums are reconditioned for reuse at 450 facilities located throughout the Nation. The EPA Region with the largest number of reconditioners is Region V, with 24 percent of the Nation's facilities. New Jersey, California, and Illinois are the states with the largest numbers of reconditioners.

- The status of the industry's wastewater discharges is as follows:

Discharge Status	Number of Facilities
Direct Discharge	50
Indirect Discharge	200
Zero Discharge	200
TOTAL	450

- The industry is not expected to grow or decline significantly, hence, the waste quantities estimated in this report are reasonable projections of future waste quantities.

- Drum reconditioning facilities are registered under 28 different Standard Industrial Classification (SIC) Codes. Two-thirds of the 40 million drums that are reconditioned annually are tight-head drums that are washed with caustic solution to remove residues. The remaining are open-head drums that are burned in furnaces to remove viscous residues. The following list summarizes the major drum types received by reconditioners:

Drum Type	Percent
Petroleum	36
Chemicals	25
Resins and Adhesives	16
Paint and Ink	15
Other	8
TOTAL	100

- Drum reconditioning facilities may be subcategorized by drum type: either open-head or closed-head.

- The average drum reconditioner handles 427 drums daily and discharges 6.9 gallons of wastewater per reconditioned drum, or 2,946 gallons per day. Raw wastewater results from the washing and rinsing of tight-head drums or the quenching of burning residue on open-head drum surfaces.

- Industry raw wastewater is characterized by high concentrations of conventional, nonconventional, metal, and organic pollutants. The data shown below for selected parameters are representative of a typical raw wastewater sample:

Parameter	Concentration (mg/l)
BOD^5	3,714
TSS	4,709
COD	17,423
Oil and Grease	13,228
TOC	2,991
Iron	106
Lead	14
Zinc	25
2-Butanone	288
Acetone	172
Toluene	18
Ethylbenzene	17

- Forty extractable and volatile organics are detected in industry raw wastewaters and one-third have concentrations greater than 10 mg/l.

- The following pesticide/herbicide compounds are found in industry raw wastewater at levels greater than 1 mg/l: azinphos ethyl, azinphos methyl, fensolfothion, diazinon, dimethoate, leptophos, nemacur, parathion, and TEPP.

- Zero discharge is demonstrated to be a practical control technology for open-head facilities. Furnace quench water typically is reused after simple sedimentation.

- Tight-head facilities generally discharge wastewater, and nearly one-half of the dischargers do not treat wastewater.

- Wastewater treatment pollutant removal efficiencies were poor at the four plants sampled by the Agency.

- Sedimentation, oil/water separation, and air flotation are the dominant treatment technologies at tight-head plants. Reuse of treated effluent is possible; however, zero discharge is attainable only if wastestreams are segregated and water conservation measures are implemented.

- A model wastewater treatment system would include emulsion breaking technology and treated wastewater reuse. A typical facility would incur a capital cost of $154,000 and an annual operating cost of $47,000 to maintain and operate such a system.

- Approximately 124 million pounds of residue are contained in drums received by reconditioners, annually.

- Wastewater treatment sludges generated by the industry are composed mainly of oil and grease (15 percent) and suspended solids (7 percent). High concentrations of 23 organics are observed.

- Twelve dioxin/furan compounds are found in industry sludges; however, these compounds are not prevalent in raw wastewaters.

- The annualized wastewater control cost is $0.78 per drum reconditioned, which represents about 12 percent of the reconditioning fee.

- The cost-effectiveness of treating the process wastewater is $130 per pound equivalent of pollutant removed.

- Total loadings of priority pollutant inorganics from untreated wastewater are low when compared to raw waste loadings of priority inorganics from regulated BAT/PSES industries.

- Total loadings of priority pollutant organics from untreated wastewater are significant when compared to raw waste loadings from regulated industries.

- Implementation of the model cost technology would result in a net reduction of air emissions, a doubling of the volume of sludge generated from wastewater treatment systems, and a doubling of energy consumption.

3. INTRODUCTION

This section discusses regulatory authority and pertinent regulations, and provides an overview of the industry. Sources of data and information used to support conclusions also are discussed.

3.1 PURPOSE AND AUTHORITY

3.1.1 Clean Water Act

The Federal Water Pollution Control Act Amendments of 1972 established a comprehensive program to "restore and maintain the chemical, physical, and biological integrity of the Nations waters, Section 101 [a]." Under this statute, existing industrial dischargers were required to achieve compliance with "effluent limitations requiring the application of the best practicable control technology currently available (BPT), Section 301(b)(1)(A)." These dischargers are required to achieve "effluent limitations requiring the application of the best available technology economically achievable (BAT)...which will result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants, Section 301(b)(2)(A). New industrial direct discharge performance standards (NSPS) are based on best available demonstrated technology, and existing and new dischargers to publicly owned treatment works (POTWs) are subject to pretreatment standards under Sections 307(b) and (c) of the Act. While the requirements for direct dischargers are to be incorporated into National Pollutant Discharge Elimination System (NPDES) permits issued under Section 402 of the Act, pretreatment standards were made enforceable directly against indirect dischargers to POTWs.

Although Section 402(a)(1) of the 1972 Act authorized the setting of requirements for direct dischargers on a case-by-case basis, Congress intended that control requirements be based on regulations promulgated by the Administrator providing guidelines that consider the degree of effluent reduction attainable through the application of BPT and BAT. Sections 304(c) and 306 of the Act required promulgation of regulations for NSPS, and Sections 304(f), 307(b), and 307(c) required promulgation of regulations for pretreatment standards. In addition to the regulations for designated industry

categories, Section 307(a) of the Act required the Administrator to develop a list of toxic pollutants and promulgate effluent standards applicable to all dischargers of toxic pollutants. Categorical pretreatment standards originally were to be developed for 34 specific industrial categories and 129 pollutants. EPA subsequently exempted several industries and pollutants from regulation. Currently, categorical standards apply to 22 specific industrial categories and over 126 priority pollutants. Finally, Section 501(a) of the Act authorized the Administrator to prescribe any additional regulations "necessary to carry out his functions" under the Act. The U.S. Environmental Protection Agency, Industrial Technology Division (EPA-ITD) is responsible for developing effluent guidelines limitations and standards for the categorical industries.

3.2 REGULATORY OVERVIEW

3.2.1 Resource Conservation and Recovery Act

Congress enacted the Resource Conservation and Recovery Act (RCRA) in 1976 to define a Federal role in solid waste and resource management and recovery. The primary goals of RCRA are to: (1) protect human health and the environment from hazardous and other solid wastes; and (2) protect and preserve natural resources through the implementation of programs emphasizing resource conservation and recovery. The principal regulatory focus of RCRA is to control hazardous waste. To this end, RCRA mandates a comprehensive system to identify hazardous wastes and to track and control their movement from generation through transport, treatment, storage, and ultimate disposal. RCRA subsequently was amended in 1978, 1980, and 1984.

Hazardous waste management under RCRA has often been characterized as "cradle to grave" management. A firm generating solid wastes is required to determine if such waste is hazardous. Any generator of a hazardous waste must notify the EPA. If the generator chooses to move the waste offsite for treatment or disposal, a manifest must be maintained by the generator, transporter, and the receiving treatment, storage, or disposal facility. Any wastes shipped offsite to be treated, stored, or disposed of must be sent to an authorized hazardous waste disposal facility. Wastes managed onsite, like those shipped offsite, must be handled according to specific management and technical requirements in RCRA.

3.2.2 Domestic Sewage Exclusion

Under the Domestic Sewage Exclusion (DSE) [specified in Section 1004 [27] of RCRA and codified in 40 CFR 261.4 (a)(1)], solid or dissolved material in domestic sewage is not, by definition, a "solid waste" and, as a corollary, cannot be considered a "hazardous waste." Thus, the DSE covers:

- "Untreated sanitary wastes that pass through a sewer system"
- "Any mixture of domestic sewage and other wastes that passes through a sewer system to a POTW for treatment."

The premise behind the exclusion is that it is unnecessary to subject hazardous wastes mixed with domestic sewage to RCRA management requirements, since these DSE wastes would receive the benefits of treatment offered by POTWs and are already regulated under Clean Water Act (CWA) programs, such as the National Pretreatment Program and the National Pollutant Discharge Elimination System (NPDES).

The exclusion allows industries to be connected to domestic sewers without having to comply with certain RCRA generator requirements, such as manifesting and reporting requirements. Moreover, POTWs receiving excluded wastes are not subject to RCRA treatment, storage, and disposal facility requirements.

EPA conducted a study in response to Section 3018(a) of RCRA. This provision required that EPA prepare:

> "...a report to the Congress concerning those substances identified or listed under section 3001 which are not regulated under this subtitle by reason of the exclusion for mixtures of domestic sewage and other wastes that pass through a sewer system to a publicly owned treatment works. Such report shall include the types, size and number of generators which dispose of such substances in this manner, and the identification of significant generators, wastes, and waste constituents not regulated in a manner sufficient to protect human health and the environment."

The report, known as the Domestic Sewage Study (USEPA 1986a), is an evaluation of the impacts of wastes discharged to local wastewater treatment plants.

In performing this study, EPA collected information on waste discharges from 47 industrial categories and the residential sector. The evaluation concluded that the quantities of hazardous wastes generated and discharged to POTWs by the drum reconditioning industry were unknown. EPA's regulatory efforts, in the past, have focused on larger, industrial categories. The drum reconditioning industry traditionally has been considered a less significant waste source due to its small size and service-related orientation. Therefore, this industry never has been extensively reviewed, for regulatory purposes, at the national level for possible regulation under the CWA.

3.2.3 Residues of Hazardous Waste in Empty Containers

Any hazardous waste remaining in either an empty container or an inner liner removed from an empty container is not subject to regulation under RCRA. Empty is defined in 40 CFR 261.7 paragraph (b) as follows:

> "(i) all wastes have been removed that can be removed using the practices commonly employed to remove materials from that type of container, e.g., pouring, pumping, aspirating and;
>
> (ii) no more than 2.5 centimeters (one inch) of residue remain on the bottom of the container or inner liner, or
>
> (iii) (a) no more than 3 percent by weight of the total capacity of the container remains in the container or inner liner if the container is less than or equal to 100 gallons in size, or; (b) no more than 0.3 percent by weight of the total capacity of the container remains in the container or inner liner if the container is greater than 100 gallons in size."

This definition does not apply to containers that have held a hazardous waste that is a compressed gas when the pressure of the container approaches atmospheric. Nor does the definition apply to a container or inner liner that

has held an acute hazardous waste listed in 40 CFR Parts 261.31, 261.32, or 261.33(e), unless:

"(i) the container or inner liner has been triple rinsed using a solvent capable of removing the commercial chemical product or manufacturing intermediate;

(ii) the container or inner liner has been cleaned by another method that has been shown in scientific literature, or by tests conducted by the generator, to achieve equivalent removal; or

(iii) in the use of a container, the inner liner that prevented contact of the commercial chemical product or manufacturing chemical intermediate with the container has been removed."

Table 3-1 presents the acute hazardous wastes listed under Parts 261.31, 261.32, and 261.33(e).

3.2.4 Hazardous Materials Transportation Act

The Hazardous Materials Transportation Act of 1975 and its amendments established a program to protect the Nation adequately against the risks to life and property that are inherent in the transportation of hazardous materials in commerce. The key provisions of the Act address the definition of designated hazardous materials handling and the registration of transporters.

Through authority granted by the Act, the Department of Transportation (DOT) requires reconditioners of drums to comply with 49 CFR 173.28. Containers that are used more than once (refilled and reshipped after having been previously emptied) must be in such condition, including closure devices and cushioning materials, that they comply in all respects with the prescribed requirements for those containers. Emptied steel drums may be reused as prescribed in Part 173.28 as packaging for shipment of flammable liquids, flammable solids, oxidizing materials, radioactive materials, and corrosive liquids covered by Sections 173.249 and 173.249(a), only if the following

TABLE 3-1

ACUTE HAZARDOUS WASTES

(e) The commercial chemical products, manufacturing chemical intermediates or off-specification commercial chemical products or manufacturing chemical intermediates referred to in paragraphs (a) through (d) of this section, are identified as acute hazardous wastes (H) and are subject to be the small quantity exclusion defined in § 261.5(e).

[*Comment:* For the convenience of the regulated community the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), and R (Reactivity). Absence of a letter indicates that the compound only is listed for acute toxicity.]

These wastes and their corresponding EPA Hazardous Waste Numbers are:

Hazardous waste No	Substance
P023	Acetaldehyde, chloro-
P002	Acetamide, N-(aminothioxomethyl)-
P057	Acetamide, 2-fluoro-
P058	Acetic acid, fluoro-, sodium salt
P066	Acetimidic acid, N-[(methylcarbamoyl)oxy]thio-, methyl ester
P001	3-(alpha-acetonylbenzyl)-4-hydroxycoumarin and salts
P002	1-Acetyl-2-thiourea
P003	Acrolein
P070	Aldicarb
P004	Aldrin
P005	Allyl alcohol
P006	Aluminum phosphide
P007	5-(Aminomethyl)-3-isoxazolol
P008	4-aAminopyridine
P009	Ammonium picrate (R)
P119	Ammonium vanadate
P010	Arsenic acid
P012	Arsenic (III) oxide
P011	Arsenic (V) oxide
P011	Arsenic pentoxide
P012	Arsenic trioxide
P038	Arsine, diethyl-
P054	Azirdine
P013	Barium cyanide
P024	Benzenamine, 4-chloro-
P077	Benzenamine, 4-nitro-
P028	Benzene, (chloromethyl)-
P042	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-
P014	Benzenethiol
P028	Benzyl chloride
P015	Beryllium dust
P016	Bis(chloromethyl) ether
P017	Bromoacetone
P018	Brucine
P021	Calcium cyanide
P123	Camphene, octachloro-
P103	Carbamimidoselenoic acid
P022	Carbon bisulfide
P022	Carbon disulfide
P095	Carbonyl chloride
P033	Chlorine cyanide
P023	Chloroacetaldehyde
P024	p-Chloroaniline
P026	1-(o-Chlorophenyl)thiourea
P027	3-Chloropropionitrile
P029	Copper cyanides
P030	Cyanides (soluble cyanide salts), not elsewhere specified
P031	Cyanogen
P033	Cyanogen chloride
P036	Dichlorophenylarsine
P037	Dieldrin
P038	Diethylarsine
P039	O,O-Diethyl S-[2-(ethylthio)ethyl] phosphorodithioate
P041	Diethyl-p-nitrophenyl phosphate
P040	O,O-Diethyl O-pyrazinyl phosphorothioate
P043	Diisopropyl fluorophosphate
P044	Dimethoate
P045	3,3-Dimethyl-1-(methylthio)-2-butanone, O-[(methylamino)carbonyl] oxime
P071	O,O-Dimethyl O-p-nitrophenyl phosphorothioate
P082	Dimethylnitrosamine
P046	alpha, alpha-Dimethylphenethylamine
P047	4,6-Dinitro-o-cresol and salts
P034	4,6-Dinitro-o-cyclohexylphenol
P048	2,4-Dinitrophenol
P020	Dinoseb
P085	Diphosphoramide, octamethyl-
P039	Disulfoton
P049	2,4-Dithiobiuret
P109	Dithiopyrophosphoric acid, tetraethyl ester
P050	Endosulfan
P088	Endothall
P051	Endrin
P042	Epinephrine
P046	Ethanamine, 1,1-dimethyl-2-phenyl-
P084	Ethenamine, N-methyl-N-nitroso-
P101	Ethyl cyanide
P054	Ethylenimine
P097	Famphur
P056	Fluorine
P057	Fluoroacetamide
P058	Fluoroacetic acid, sodium salt
P065	Fulminic acid, mercury(II) salt (R,T)
P059	Heptachlor
P051	1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo,endo-1,4:5,8-dimethanonaphthalene
P037	1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo,exo-1,4:5,8-demethanonaphthalene
P060	1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-endo, endo-dimethanonaphthalene
P004	1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-endo,exo-dimethanonaphthalene
P060	Hexachlorohexahydro-exo,exo-dimethanonaphthalene
P062	Hexaethyl tetraphosphate
P116	Hydrazinecarbothioamide
P068	Hydrazine, methyl-
P063	Hydrocyanic acid
P063	Hydrogen cyanide
P096	Hydrogen phosphide
P064	Isocyanic acid, methyl ester
P007	3(2H)-Isoxazolone, 5-(aminomethyl)-
P092	Mercury, (acetato-O)phenyl-
P065	Mercury fulminate (R,T)
P016	Methane, oxybis(chloro-
P112	Methane, tetranitro- (R)
P118	Methanethiol, trichloro-
P059	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-
P066	Methomyl
P067	2-Methylaziridine
P068	Methyl hydrazine
P064	Methyl isocyanate
P069	2-Methyllactonitrile
P071	Methyl parathion
P072	alpha-Naphthylthiourea
P073	Nickel carbonyl
P074	Nickel cyanide
P074	Nickel(II) cyanide
P073	Nickel tetracarbonyl
P075	Nicotine and salts
P076	Nitric oxide
P077	p-Nitroaniline
P078	Nitrogen dioxide
P076	Nitrogen(II) oxide
P078	Nitrogen(IV) oxide
P081	Nitroglycerine (R)
P082	N-Nitrosodimethylamine
P084	N-Nitrosomethylvinylamine
P050	5-Norbornene-2,3-dimethanol, 1,4,5,6,7,7-hexachloro, cyclic sulfite
P085	Octamethylpyrophosphoramide
P087	Osmium oxide
P087	Osmium tetroxide
P088	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
P089	Parathion
P034	Phenol, 2-cyclohexyl-4,6-dinitro-
P048	Phenol, 2,4-dinitro-
P047	Phenol, 2,4-dinitro-6-methyl-
P020	Phenol, 2,4-dinitro-6-(1-methylpropyl)-
P009	Phenol, 2,4,6-trinitro-, ammonium salt (R)
P036	Phenyl dichloroarsine
P092	Phenylmercuric acetate
P093	N-Phenylthiourea
P094	Phorate
P095	Phosgene
P096	Phosphine
P041	Phosphonic acid, diethyl p-nitrophenyl ester
P044	Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl]ester
P043	Phosphorofluoric acid, bis(1-methylethyl)-ester
P094	Phosphorothioic acid, O,O-diethyl S-(ethylthio)methyl ester
P089	Phosphorothioic acid, O,O-diethyl O-(p-nitrophenyl) ester
P040	Phosphorothioic acid, O,O-diethyl O- pyrazinyl ester
P097	Phosphorothioic acid, O,O-dimethyl O-[p-((dimethylamino)-sulfonyl)phenyl]ester
P110	Plumbane, tetraethyl-
P098	Potassium cyanide
P099	Potassium silver cyanide
P070	Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl]oxime
P101	Propanenitrile
P027	Propanenitrile, 3-chloro-
P069	Propanenitrile, 2-hydroxy-2-methyl-
P081	1,2,3-Propanetriol, trinitrate- (R)
P017	2-Propanone, 1-bromo-
P102	Propargyl alcohol
P003	2-Propenal
P005	2-Propen-1-ol
P067	1,2-Propylenimine
P102	2-Propyn-1-ol
P008	4-Pyridinamine
P075	Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts
P111	Pyrophosphoric acid, tetraethyl ester
P103	Selenourea
P104	Silver cyanide
P105	Sodium azide
P106	Sodium cyanide
P107	Strontium sulfide
P108	Strychnidin-10-one, and salts
P018	Strychnidin-10-one, 2,3-dimethoxy-
P108	Strychnine and salts
P115	Sulfuric acid, thallium(I) salt
P109	Tetraethyldithiopyrophosphate
P110	Tetraethyl lead
P111	Tetraethylpyrophosphate
P112	Tetranitromethane (R)
P062	Tetraphosphoric acid, hexaethyl ester
P113	Thallic oxide
P113	Thallium(III) oxide
P114	Thallium(I) selenite
P115	Thallium(I) sulfate
P045	Thiofanox
P049	Thioimidodicarbonic diamide
P014	Thiophenol
P116	Thiosemicarbazide
P026	Thiourea, (2-chlorophenyl)-
P072	Thiourea, 1-naphthalenyl-
P093	Thiourea, phenyl-
P123	Toxaphene
P118	Trichloromethanethiol
P119	Vanadic acid, ammonium salt
P120	Vanadium pentoxide
P120	Vanadium(V) oxide
P001	Warfarin
P121	Zinc cyanide
P122	Zinc phosphide (R,T)

requirements, in addition to the other requirements of this section, are complied with prior to each reuse:

- Visual inspection - Drums must be cleaned thoroughly to remove all residue and foreign matter. Deterioration or defects, and parts that are weak, broken, or otherwise deteriorated, must be replaced.
- Air pressure test for leakage - The entire surface of each closed-head and open-head drum, except for its removable head and adjacent chime area, must be tested for leakage by constant internal air pressure.
- Markings - All previous markings, commodity identification markings, and labels must be removed. All drums that qualify for reuse must be marked on the body within 10 inches of the top of the work, "Tested," the month and year it was tested, and the DOT registration number of the reconditioner.

Retest of polyethylene carboy packages must have been made by or for shippers, or their authorized agents, as required by applicable provisions of the specifications of 49 CFR 178.19, before carboys that are to be offered for transportation are filled. Requirements for reconditioners of carboys are similar to those for steel drum reconditioners. However, registration with DOT is not required for carboy reconditioners.

3.3 OVERVIEW OF THE INDUSTRY

The drum reconditioning industry is not included in a specific U.S. Department of Commerce, Bureau of Census Standard Industrial Classification (SIC). DOT regulates facilities that clean or recondition steel or polyethylene drums, after having been previously emptied, for the purpose of resale or reuse. As of May 1986, 770 facilities were registered with DOT and EPA identified 337 additional facilities that were not registered with DOT. From a combined list of 1,107 facilities, EPA estimates that only 450 are actively engaged in drum reconditioning. Thirty-five DOT registrants are listed in the EPA Industrial Facilities Database (IFD) as NPDES permit holders. Two of these registrants identify their business as SIC No. 3412 - Metal Shipping Barrels, Drums, Kegs and Pails. The remaining registrants that are listed in IFD files under the numerous SIC numbers are shown in Table 3-2. Little information is available on the age of drum reconditioning facilities or on the number of employees per facility.

TABLE 3-2. SIC INDUSTRY CODES FOR DOT REGISTRANTS THAT ARE LISTED IN IFD FILES

Industry Number	Description
1044	Uranium - Radium - Vanadium Ores
2041	Flour and Other Grain Mill Products
2711	Newspapers
2812	Alkalies and Chlorine
2813	Industrial Gases
2822	Synthetic Rubber
2823	Cellulosic Man-Made Fibers
2831	Biological Products
2834	Pharmaceutical Preparations
2851	Paints, Varnishes, Lacquers, Enamels and Allied Products
2869	Industrial Organic Chemicals, Not Elsewhere Classified
2911	Petroleum Refining
2999	Products of Petroleum and Coal, Not Elsewhere Classified
3111	Leather Tanning and Finishing
3412	Metal Shipping Barrels, Drums, Kegs and Pails
3471	Electroplating, Plating, Polishing, Anodizing and Coloring
3499	Fabricated Metal Products, Not Elsewhere Classified
3662	Radio and Television Transmitting, Signaling and Detection Equipment
3671	Radio and Television Receiving Type Electronic Tubes
3676	Resistors, for Electronic Applications
3679	Electronic Components, Not Elsewhere Classified
3731	Ship Building and Repairing
3822	Automatic Controls for Regulating Residential and Commercial Environments and Appliances
4952	Sewerage Systems
4961	Steam Supply
7041	Organization Hotels and Lodging Houses
7397	Commercial Testing Laboratories
8999	Services, Not Elsewhere Classified

Data on effluent discharges from the 450 active drum reconditioners are limited, since most of the reconditioners are regulated by local pretreatment authorities that do not require extensive monitoring. EPA estimates that wastewater is directly discharged from approximately 50 facilities. POTWs receive indirect discharges from an estimated 200 facilities. The remaining 200 active facilities are believed not to discharge process wastewater (SAIC 1987a).

3.4 DATA AND INFORMATION GATHERING

EPA sought to obtain a broad and accurate understanding of the drum reconditioning industry and to evaluate wastewater characteristics and treatment practices. This involved a review of the literature, meetings with trade associations and Federal and local agencies, site visits, and information from all facilities potentially in the drum reconditioning universe. In summary, the major sources of data and information are as follows:

- The Touhill Reports
- State and local agencies
- Department of Transportation
- Trade associations
- Facility site visits
- Other sources of information.

3.4.1 The Touhill Reports

In 1981, the EPA Office of Research and Development (ORD) completed a program to assess barrel and drum reconditioning processes (Touhill 1981a and b). The intent of the program was to provide recommendations for upgrading and optimizing drum reconditioning processes.

An industry profile was developed, which was based on the results of a questionnaire distributed by the National Barrel and Drum Association (NABADA). The status profile was intended to be indicative of average practice without reference to any specifically identified facility. In addition, the questionnaire dealt primarily with environmental and process considerations. Items concerning business, personnel, and proprietary matters

were not included. NABADA received 49 responses to the 119 questionnaires that were distributed.

3.4.2 State and Local Agencies

EPA contacted state hazardous waste offices by telephone and mail to identify names of drum reconditioners. In some cases, no information was available, since some states do not regulate drum reconditioners as hazardous waste facilities. In other cases, the state's hazardous waste facility data base did not indicate the nature of an activity of a facility.

Hazardous waste agencies, for 18 states, do not track drum reconditioners. Eighty-three facility names were collected through contacts at the remaining states. Attempts were made to contact United States territories; however, information was not readily available.

In conjunction with presampling site visits, EPA contacted and met with local regulatory agencies. Permit applications, industrial user permits, and monitoring data were obtained for drum reconditioners that indirectly discharge wastewater. The following agencies provided information:

- The Metropolitan Sanitary District of Greater Chicago
- City of Detroit Water and Sewage Department
- County Sanitation District of Los Angeles County
- City of San Antonio Department of Wastewater Management
- State of Washington, Department of Ecology.

3.4.3 Department of Transportation

The Research and Special Programs Administration of DOT manages the registration of drum reconditioning facilities. A single list is updated monthly and is readily available for the production of mailing labels. Only half of the 770 registrants are believed by DOT officials to be active facilities and the remainder are thought to be brokers or drum dealers. DOT also maintains lists of new steel and polyethylene drum manufacturers.

3.4.4 Trade Associations

Membership directories and address lists were requested, by mail, from 12 associations that are active in the waste management field. Lists were received from the following five associations:

- Association of Petroleum Re-refiners
- Chemical Waste Transportation Council
- Institute of Chemical Waste Management
- National Association of Solvent Recyclers
- Spill Control Association of America.

Five other trade associations also were contacted by telephone. Based on conversations with association directors, these five associations are not believed to be pertinent to this study.

NABADA did not submit a current membership list, but did meet with EPA. During this meeting, NABADA representatives stated that the industry profile presented by Touhill (1981a) is still representative. Later, NABADA assisted the Agency in its selection of sampling candidates.

3.4.5 Facility Site Visits

EPA contacted numerous drum reconditioners to identify candidates for wastewater sampling. Site visits were conducted to locate sampling points in the facilities and to collect file information. Facilities that did not treat wastewater or did not have accessible sampling points were not selected for sampling. Presampling site visits were conducted at the following 16 facilities:

- ABC Drum and Barrel Company - Detroit, Michigan
- Acme Barrel and Drum Company - Chicago, Illinois
- Allied - Hastings Drum Company - Chicago, Illinois
- Columbus Steel Drum Company - Livonia, Michigan
- Cooper Drum Company - South Gate, California
- Dixie Drum Company - San Antonio, Texas
- Duke Refining Corporation - High Point, North Carolina

- Hansen-Sterling Drum Company - Chicago, Illinois
- Midwestern Drum Service Inc. - Venice, Illinois
- Myers Container Corporation - Emeryville, California
- Myers Container Corporation - Oakland, California
- Northwest Cooperage Company, Inc. - Seattle, Washington
- Pacific Coast Drum Company - South El Monte, California
- United Drum/Reliance - High Point, North Carolina
- United Steel Drum Company - East St. Louis, Illinois
- West Cooperage Company - Detroit, Michigan.

3.4.6 Other Sources of Information

EPA conducted a search of commonly used data bases to locate pertinent literature on the drum reconditioning industry. Titles published before 1980 were not sought. Since the publication of the Touhill reports, in 1981, no significant publications have appeared in these data bases.

Telephone books available at the Library of Congress were inspected to compile a list of drum vendors and reconditioners. Three hundred and thirty-seven facilities were identified in telephone books from 112 metropolitan areas that were not on the DOT list.

EPA did not conduct an extensive effort to verify the discharge status of drum reconditioners, since most reconditioners are believed to be indirect dischargers. Telephone contacts were made only to identify presampling trip candidates in geographically key areas.

The Chemical Engineering Branch of EPA's Office of Toxic Substances is conducting a study of the drum reconditioning industry to assess worker exposure to new chemicals and the potential for the chemical to be released to the environment.

In summary, EPA coordinated its information-gathering efforts with DOT, five local governments, and the states. Pertinent trade associations were contacted and a meeting was held with NABADA, the primary industry representative. Site visits were made to 16 facilities and a literature search was conducted. EPA believes that the conclusions presented in this report reflect the best information available.

4. DESCRIPTION OF THE INDUSTRY

This section discusses industry products and processes, as well as facility characteristics. This information is necessary to establish groupings within the industry. These groupings should reflect differences in wastewater generation, control, treatment, and discharge.

4.1 INDUSTRY PROFILE

Drum reconditioning is a general term for the cleaning or reconditioning of steel or polyethylene drums for resale or reuse. In 1985, approximately 50 million drums were reconditioned (Rich 1986). Table 4-1 presents a distribution of the types of products used in drums received by reconditioners (Touhill 1981a). Drums formerly containing oil and petroleum are the most prevalent type of drum reconditioned. Drums that previously contained paint, ink, and industrial chemicals are also significant. About 95 percent of the drums reconditioned are 55-gallon steel drums, while the remaining 5 percent are 30-gallon steel drums (Touhill 1981a). Despite increased use of plastic (polyethylene) containers, reconditioners have concluded that these containers present no serious competitive threat to the use of steel drums due to the difficulty of reconditioning and problems with disposing spent plastic containers (Touhill 1981a). Drums are reconditioned either as a service or for resale. In 1979, about 45 percent of washed drums were offered for resale, 52 percent were laundered, and 3 percent were discarded. About 62 percent of burned drums were resold, 33 percent were laundered, and 5 percent were discarded (Touhill 1981a).

Approximately 450 drum reconditioners are active in the United States. This number is based on a revision to the number of active facilities estimated by the U.S. Environmental Protection Agency (EPA) in 1979, 250 drum reconditioners (Touhill 1981a). At that time, 429 active and inactive facilities were registered by the Department of Transportation (DOT); however, in May 1986, 770 facilities were registered. Therefore, 250 was multiplied by a ratio, 770:429, to derive approximately 450 active facilities. EPA identified 337 facilities that are not included in the May 1986 DOT registration list. Therefore, the estimate of 450 active facilities is believed to be

TABLE 4-1. TYPES OF PRODUCTS USED IN DRUMS RECEIVED BY RECONDITIONERS

Product	Percent
Oil and Petroleum	36.2
Industrial Chemicals	15.6
Paint and Ink	14.8
Cleaning Solvents	8.8
Resins	8.8
Adhesives	6.8
Food	6.8
Other	1.7
Pesticide	0.5

believed to be conservative. Table 4-2 lists the estimated 450 drum reconditioners by state. The three states with the largest numbers of drum reconditioners are New Jersey, California, and Illinois. Table 4-3 lists the estimated 450 drum reconditioners by EPA Region. Of the facilities identified, about 24 percent are located in EPA Region V. The DOT list of 770 facilities is provided in Appendix A. The list of 337 additional facilities identified by the Agency is provided in Appendix B.

There are three types of drum reconditioning facilities: (1) those that wash drums only (39 percent), (2) those that burn drums only (18 percent), and (3) those that both wash and burn drums (43 percent). Of all drums reconditioned, approximately two-thirds are the tight-head, or bung-top type, which must be washed. The remainder are open-head drums that are burned. The average commercial tight-head plant reconditioned 700 drums in 1979, while the average commercial open-head plant reconditioned 550 drums. Combined plants washed and burned a daily total of 1,400 drums. Facilities that recondition their own drums for in-house use wash about 50 drums daily and burn very few (Touhill 1981a).

Wastewater treatment and control practices employed by drum reconditioners depend on their mode of processing. Since most washing facilities reuse caustic wash solutions, their discharges to publicly owned treatment works (POTWs) usually consist only of rinse waters (Touhill 1981a). Many washing plants have moved to complete recycle systems. Some burning facilities discharge quench water from post-furnace drum cooling. However, the majority of burning plants are believed to recycle this cooling stream after solids are settled. There is wide variability in wastewaters, depending on the types of drums processed. The most commonly used water pollution control equipment includes screens, oil/water separators, flocculation and sedimentation tanks, filters, and dissolved air flotation units. Operating procedures such as preflushing, stream segregation, and cascading water use are important adjuncts to pollution control equipment.

TABLE 4-2. ESTIMATED DRUM RECONDITIONERS BY STATE

State	Estimated Number of Plants
Alabama	9
Alaska	12
Arkansas	2
Arizona	8
California	33
Colorado	5
Connecticut	6
Florida	11
Georgia	13
Hawaii	2
Illinois	30
Indiana	11
Iowa	4
Kansas	7
Kentucky	10
Lousiana	9
Maine	1
Maryland	5
Massachusetts	13
Michigan	20
Minnesota	12
Mississippi	1
Missouri	19
Nebraska	2
New Hampshire	2
New Jersey	35
New Mexico	2
New York	24
Nevada	1
North Carolina	14
Ohio	24
Oklahoma	9
Oregon	5
Pennsylvania	17
Rhode Island	2
South Carolina	3
South Dakota	1
Tennessee	15
Texas	22
Utah	4
Virginia	4
Washington	7
West Virginia	2
Wisconsin	9
Wyoming	1
(District of Columbia)	1
(Puerto Rico)	1
Total	450

TABLE 4-3. ESTIMATED DRUM RECONDITIONERS BY EPA REGION

EPA Region	Estimated Number of Plants
I	24
II	60
III	29
IV	76
V	106
VI	44
VII	32
VIII	11
IX	44
X	24
Total	450

4.2 RECONDITIONING PROCESSES

The reconditioning process type strictly depends on the previous usage of a given drum. Open-head drums are used primarily for viscous materials that do not readily pour through a tight-head bung. Tight-head drums are used for liquids that flow freely, although some tight-head drums are cut into open-heads if drum residue is difficult to remove during reconditioning. For example, solvents and some petroleum products are less viscous liquids; therefore, they are stored in tight-head drums that eventually are reconditioned by washing. Open-head drums are used for high-viscosity liquids, such as paints and adhesives, and these drums are reconditioned by burning. Food products often are stored in lined, open-head drums. Liners are discarded before drums are burned.

Steel drums are processed by either washing or burning. Each processing method has several variations. Since tight-head drums are almost always washed, reconditioners frequently refer to washing facilities as "tight-head plants." Conversely, open-head drums are processed almost exclusively by burning; hence, burning operations often are referred to as "open-head plants." Figure 4-1 illustrates a typical tight-head drum. An open-head drum looks similar, except the top is replaced by a lid. The flanged lid and top chime are joined by a compression-type steel ring fitting. Neoprene or similar material gaskets are used to create a seal. The open-head drum lid sometimes does not contain bung holes. Appendix C is a copy of a DOT Information Bulletin on specifications for reconditioned steel drums.

Touhill (1981a, 1981b) describes a large majority of drum reconditioning processes. Through site visits to 16 drum reconditioners, EPA has uncovered only one operation that was not addressed by Touhill. This includes preflushing with steam or solvents instead of caustic solutions.

4.2.1 Tight-Head Drums

Despite common usage of caustic washing, no tight-head reconditioning plants are identical (Touhill 1981a). Although many similarities exist among reconditioning plants, the maintenance or enhancement of environmental quality standards must be evaluated separately for each plant. A process diagram,

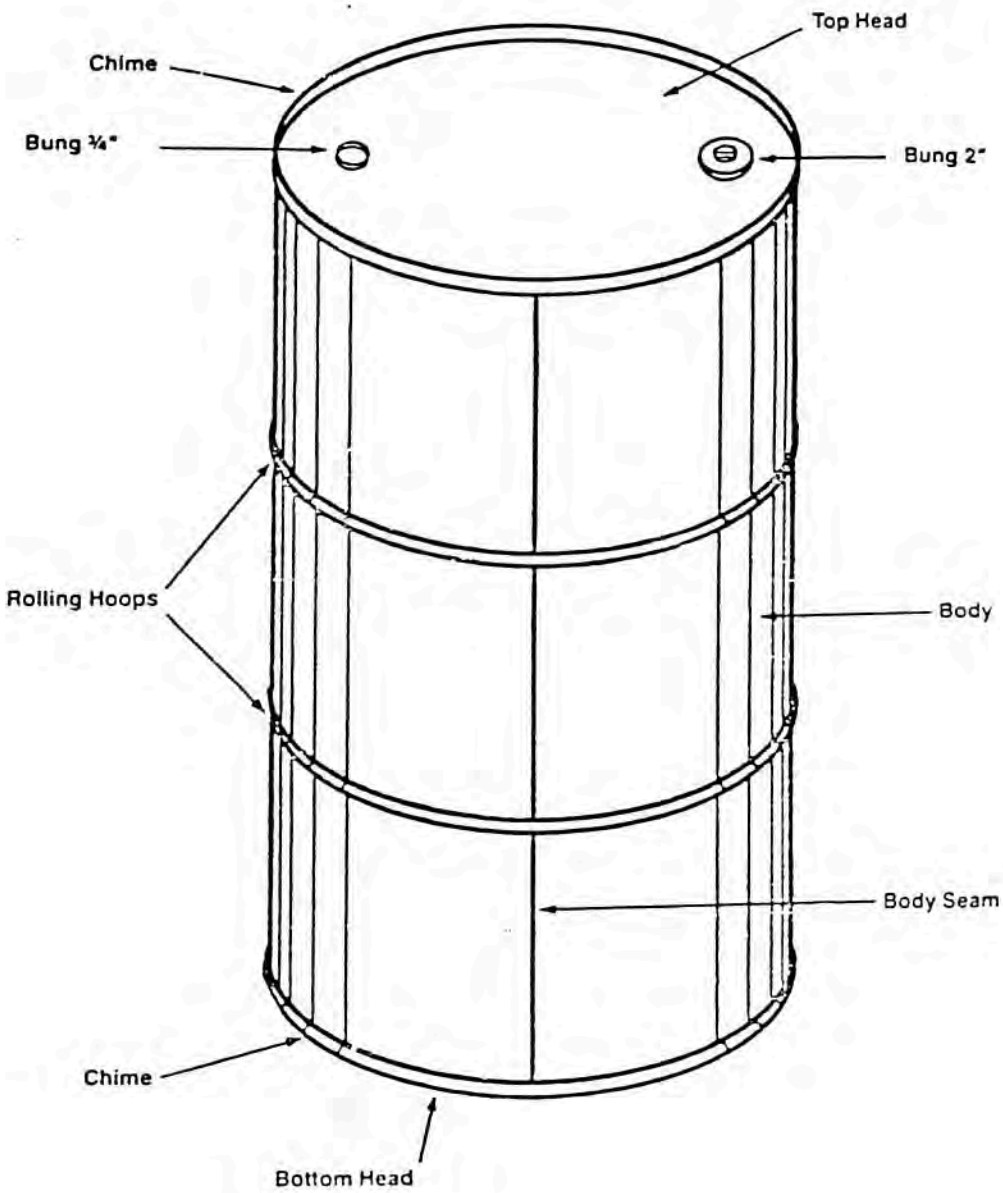

FIGURE 4-1

TYPICAL TIGHT HEAD DRUM

which represents the general caustic washing process and its many variations, is shown in Figure 4-2.

Almost all reconditioners at washing plants perform some type of screening upon drum pickup or delivery at the reconditioning facility. Most reconditioners (more than 90 percent) will return to the shipper damaged drums, drums that are not empty, or drums that contain unacceptable materials. Many reconditioners have lists of the types of drums that they will not accept for processing. Moreover, the National Barrel and Drum Association (NABADA) and EPA have issued guidelines defining drum "emptiness." Both topics will be discussed later in this section as part of operating criteria and processing procedures.

Drums (especially oil drums) often are drained and preflushed before they enter the process lines. Some plants have oil siphons especially for oil recovery. After draining, drums receive a caustic preflush to remove the bulk of readily loosened material. Sometimes steam or, rarely, a solvent is used as a preflush agent. Prior to caustic preflushing, plant employees judge whether drums should proceed directly to a submerged caustic washer, should be chained to remove difficult adhering material, or should be converted by deheading to open-head drums, which are subsequently burned. In some cases, trained employees can detect drums that require conversion to open-head before the preflushing step. In some smaller plants, drums are transferred directly from trucks to a submerged caustic washer without draining, preflushing, and chaining steps.

Most washing plants dedent drums after all caustic washing and rinsing has been completed, usually just before chime sealing and leak testing. However, some plants prefer to dedent drums immediately after draining or caustic preflushing. Presumably, dedenting is conducted at this stage so that drums can be classified earlier. Also, some reconditioners believe that it is easier to find dents as drums are rolled off of the trucks.

When the contents of a drum are difficult to remove using caustic alone, chains are inserted into the drum, along with caustic, and the drum is tumbled to dislodge adhering materials. Chaining typically occurs as a separate step

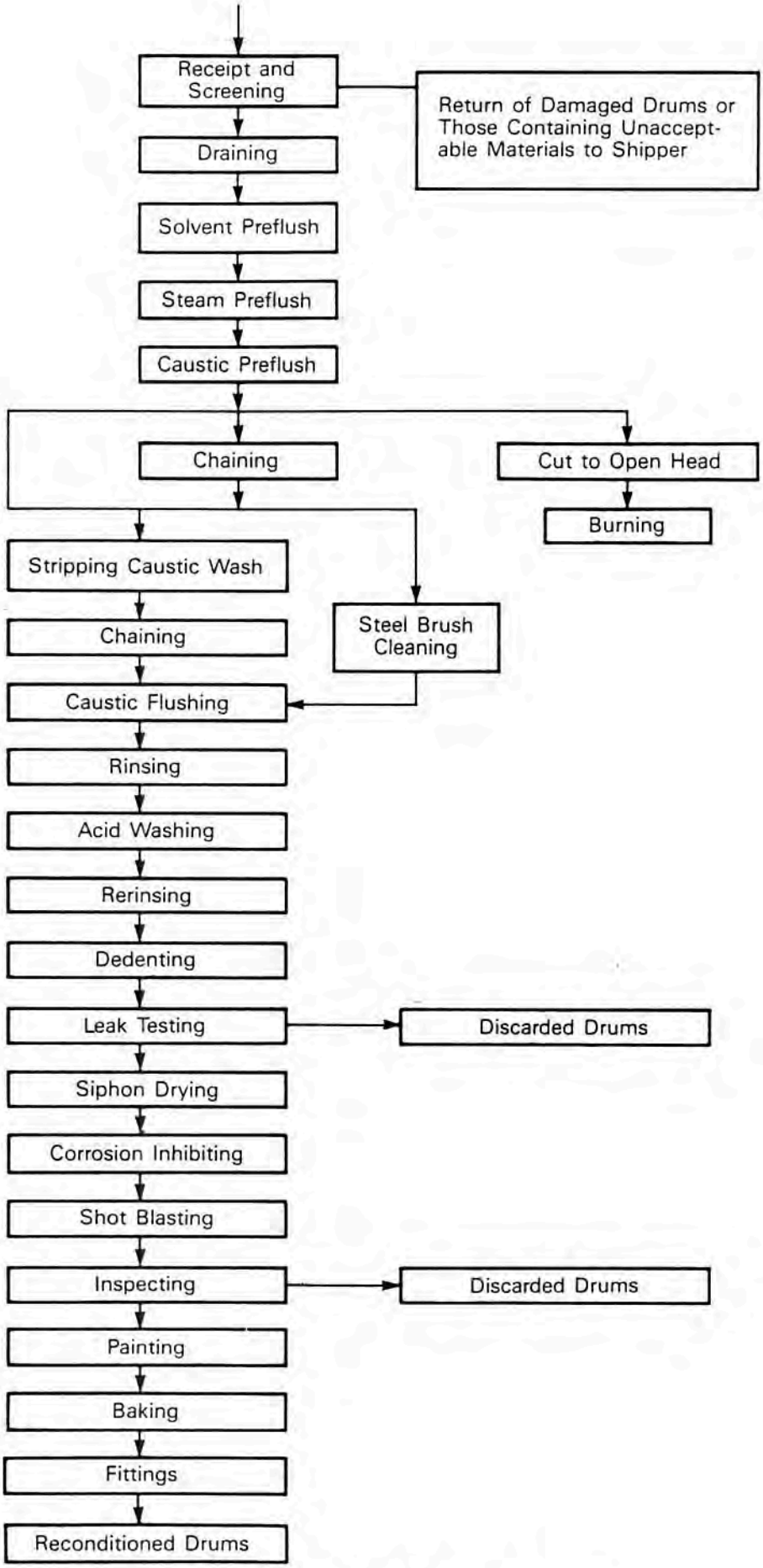

Figure 4-2. Drum Washing Process Diagram