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GRADUATE COLLEGE

A COMPREHENSIVE SURVEY OF HAZARDOUS WASTE GENERATION IN OKLAHOMA

A DISSERTATION

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in partial fulfillment of the requirements for the

degree of

DOCTOR OF PHILOSOPHY

By

SHELLY JEAN WILLIAMSON

Norman, Oklahoma

1975

A COMPREHENSIVE SURVEY OF HAZARDOUS WASTE GENERATION IN OKLAHOMA

APPROVED BY

Larry Cant

Robert F. Nelson

Gen. W. L. L.

Jama M. Robertson

John W. Bailey

DISSERTATION COMMITTEE

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A COMPREHENSIVE SURVEY OF HAZARDOUS WASTE GENERATION IN OKLAHOMA

CHAPTER I

INTRODUCTION

Until recently, the public and the Government have been concerned with non-hazardous pollutants which appear primarily in the mediums, air or water. In spite of the air and water effluent regulations on waste stream volume and composition, a potential problem exists due to the uncontrolled discharge of a large number of hazardous residues. Uncontrolled discharge may result from release into surface water courses via sanitary sewers or storm sewers, release into the atmosphere via open burning or evaporation, and improper handling, transportation, treatment, disposal, or storage of hazardous waste.

A working definition of hazardous wastes for the purpose of this study was:

. . . those wastes or combinations of wastes which require special management techniques because of their acute and/or chronic effects on human health or welfare or on other living organisms when they are disposed of by waste management processes . . .

General categories of hazardous wastes are identified as those substances that are: toxic chemicals, flammable, explosive, radioactive,

and biological wastes. Other general categories sometimes utilized are: poisons, paint, organics, oil and grease, pesticides, carcinogens, etiologic materials, corrosives, oxidizers, cryogenic materials, irritants, compressed gases, and molten materials. Further explanation of the definition as it has evolved and its interpretation and effects are discussed in chapter II.

The effect of improperly managed hazardous wastes create the potential for health hazards and possible damage to the terrestrial and aquatic environments. By contact with the hazardous waste through accidental spills or disposal, the following might occur: (1) damage from the improper handling of hazardous waste such as burns, fires, or explosions, (2) pollution of water, land, and air from spills of hazardous waste in transit, (3) pollution of groundwater by leachate from landfills, (4) surface water contamination via runoff, and (5) pollution of the atmosphere from open burning, incineration, or evaporation of hazardous waste. Thus, hazardous waste may be discharged into the environment in numerous ways and through several media--air, water, or land.

There are numerous sources of hazardous wastes scattered throughout the Nation. Hazardous waste material is generated by nearly all sectors of the economy. The major sources consist of the manufacturing industry, end users of finished products, storage awaiting disposal mainly by the Federal Government (the Atomic Energy Commission and the Department of Defense), agriculture, and various institutions such as hospitals and laboratories.

The recognition of a national problem of tremendous proportions was established in the Report to Congress of the Federal Hazardous

Waste Study (Report to Congress - Disposal of Hazardous Wastes, 1974).

In the Report it was concluded that management of the nation's hazardous residues was inadequate. Numerous case studies document the fact that inadequate management and absence of legislative controls of hazardous waste disposal has the potential of causing adverse public health consequences and significant environmental impacts.

The U.S. Environmental Protection Agency (EPA) estimated in the Report that in 1970 the nationwide generation of nonradioactive hazardous waste was approximately 10 million tons annually. Since the Report was submitted to Congress, a number of surveys indicate that the volumes reported grossly underestimate (by as much as a factor of five or greater) the total hazardous waste generated. Forty percent of those wastes by weight were inorganic material and 60 percent were organic; approximately 90 percent occur in liquid or semiliquid form.

Hazardous waste generation is growing at an estimated rate of 5 percent to 10 percent annually as a result of several factors: increasing production and consumption rates, bans and cancellations of toxic substances, and energy requirements. The projection for the rate of hazardous waste disposal to the land is also continuing to increase as a result of the overall increase in the rate of hazardous waste generation, air and water pollution controls which capture hazardous wastes from other media and transfer them to land, and the hazardous residues which have been prohibited from disposal via previously accepted techniques, such as ocean disposal or disposal to sanitary landfills.

In 1970, the EPA, in response to Section 212 of the Resource Recovery Act of 1970, Pub.L. 91-521 (an amendment to Pub.L. 89-272),

directed a comprehensive investigation of the storage and disposal of hazardous waste. Consequently, a feasibility study (Program for the Management of Hazardous Wastes, 1973) of a system of national disposal sites for hazardous wastes was directed. The Act, however, authorizes no regulatory activities.

Federal, State, and local legislation and regulations dealing with the treatment and disposal of nonradioactive hazardous wastes are generally isolated or non existent. The Clean Air Act; the Federal Water Pollution Control Act; the Marine Protection, Research, and Sanctuaries Act; and the Transportation Safety Act of 1974 provide federal control over incineration, water and ocean disposal, and transportation of certain hazardous wastes, but not over land disposal of residues. Proposed legislation, if passed, would control the land disposal of hazardous substances and the marketing of toxic substances. Several other Federal Laws deal in a peripheral manner with the management of hazardous wastes. Approximately 25 states have limited hazardous waste regulatory authority. The economic incentives for adequate waste disposal are absent. There is, therefore, scant legal or economic motivation to change from current and inadequate techniques and management despite the documented hazards from uncontrolled discharges of hazardous residues to the Public health and welfare.

Various studies have indicated that the technical means exist to solve the problems of hazardous residues destined for land disposal but are extremely expensive relative to current practice. Current expenditures by generators for treatment and disposal of hazardous wastes are low relative to what is required for adequate treatment and/or

disposal. Ocean dumping and simple land disposal costs are on the order of \$3 per ton, whereas environmentally adequate management may require as much as \$60 per ton or more. Within this permissive legislative climate, generators of hazardous waste are under little or no pressure to expend resources for the adequate management of their hazardous waste. There are few economic incentives (given the high cost of adequate management compared to costs of current practice) for generators to dispose of waste in adequate ways.

Technology is available to treat most hazardous wastes by physical, chemical, thermal, and biological methods to reduce the hazardous wastes to nonhazardous wastes and for the disposal of residues; however, such treatment/disposal facilities are currently non-existent. In the absence of adequate treatment processes, interim storage of wastes on land is possible using methods that minimize hazards to the public and to the environment.

A small private hazardous waste management industry has emerged in the last decade offering disposal, storage, and occasionally treatment services to generators. The industry currently has the capacity to handle about 2.5 million tons of hazardous materials yearly or 25 percent of the capacity required nationally. The industry's current throughput of hazardous waste is about 24 percent of installed capacity or 6 percent of the estimated national total. The low level of utilization of this industry's services results from the absence of regulatory authority and economic incentives for generators to manage their hazardous wastes in an environmentally sound manner.

The lack of current regulation and lack of economic incentive for adequate waste management led to the legislation proposed by the

Administration to Congress, the "Hazardous Waste Management Act of 1973" and to the "Materials and Energy Recovery Act of 1975." The former Act has been tabled in committee and the administration has abandoned all efforts directed toward passage of legislation in that form. A copy of the latter proposed Act appears in appendix A. The proposed Act requires the Administrator in consultation with others to develop and publish suggested guidelines for solid waste management. The proposed Act was submitted to amend the Solid Waste Disposal Act, to authorize State program and implementation grants, to provide incentives for the recovery of resources from solid wastes, to control the disposal of hazardous wastes, and for other purposes. Under Section 212 of the Act, Hazardous Waste Disposal Control, within 18 months after the date of enactment of this Act, the Administrator will be required to:

. . . develop and promulgate regulations designating hazardous wastes and defining those quantities of each such hazardous waste the disposal of which, at such times, locations, circumstances, and conditions as he may determine is likely to be harmful to the public health or the environment.

Existing Hazardous Waste Management in Oklahoma

In the State of Oklahoma the disposal of nonradioactive hazardous waste on land is regulated by the Solid Waste Management Division of the Oklahoma State Department of Health. Section 5.0 through Section 5.7 of the Oklahoma Solid Waste Management Act of 1970 (Oklahoma, 1970) established the regulatory authority for the disposal of nonradioactive hazardous wastes. The Act defines hazardous wastes generally as, "All wastes which present significant hazards to people, animals, or the environment . . . that require special handling and disposal procedures and techniques." There are no specific controls or recommendations in the Act regarding methods of treatment, separation of wastes,

disposal, or storage. Without adequate enforcement of controls or possibly further controls or restrictions, the deposition of certain hazardous wastes on land could present potential threats to operators or the potential of pollution of groundwater or surface water supplies. Given the apparent lack of identification or selection criteria of hazardous wastes and the permissive nature of the disposal methods, there is an obvious lack of adequate control, management guidelines, and adequate information available to estimate the potential hazardous waste generation in the state without a comprehensive survey.

Hazardous Waste Disposal Sites

One privately owned hazardous waste disposal site was issued a permit in September 1972 by the State Department of Health and is authorized to accept hazardous waste in Oklahoma. This site is located in McClain County approximately three-fourths of a mile west of Criner, Oklahoma. On the average, 15 industries or industrial waste haulers dump approximately 350,000 gallons to 750,000 gallons of hazardous waste disposed of at the site are in liquid form, such as: paints, ink, cyanide, grease, thinner, rubber, and metallic sludges.

During April 1975 the site was voluntarily closed for one week by the owner due to adverse publicity; however, the license was not revoked by the State Department of Health. Much concern and controversy resulted from the fact that approximately 60 percent of the hazardous wastes accepted at the site were generated in Texas.

Two other sites were issued permits by the State for the disposal of hazardous wastes in February 1975. One of the sites is located 1 1/2 miles east of Loco in Stephens County. After the license was

issued, many local residents and landowners near the proposed site at Loco objected strongly on the grounds of improper zoning. The license for this site was then suspended by the Deputy Commissioner of Environmental Health Services on April 29, 1975, pending the determination of proper zoning restrictions by the Duncan-Stephens County Metropolitan Area Planning Commission. As of this writing, further plans for development of the proposed site at Loco have been abandoned.

Another potential hazardous waste disposal site, owned by U.S. Pollution Control, Inc., was permitted on February 12, 1975. This site is located south of Slick in Creek County. Litigation against the operators of the site was instituted in Creek County District Court in April 1975. A request was made to the Office of Governor David L. Boren in May 1975 for the permit to be rescinded or suspended until a hearing could be held. Governor Boren requested on May 15, 1975, that the Oklahoma State Department of Health rescind the approval for the permit pending a new hearing on the application. The Deputy Commissioner of Environmental Health Services, Oklahoma State Department of Health, notified officials of U.S. Pollution Control, Inc. on May 19, 1975, that the permit was suspended pending a public hearing on the permit. The public hearing was held during July, 1975.

State Government Agency Regulatory Responsibilities

The Oklahoma Water Resources Board (OWRB) is responsible for control of water pollution from all industries within the state except oil or gas. In compliance with the Federal Water Pollution Control Act (Pub.L. 92-500) and the State Pollution Remedies Act of 1968, EPA issues permits through the Board to any industry that discharges

effluent into navigable waters. Waste treatment, monitoring, and control in industry is generally limited to a number of parameters (i.e., BOD, turbidity, color, pH, COD, hardness, arsenic, sulfate, nitrogen, oil/grease, and heavy metals) rather than a list of specific hazardous substances or content.

The State Corporation Commission has control over water pollution related to the exploration, drilling, producing, refining, and transporting of oil and gas. The refineries are issued permits through the Commission by EPA under the National Pollutant Discharge Elimination System (NPDES) and must report a limited number of parameters (i.e., ammonia, sulfide, phenol, chromium, oil and grease, and flow).

The State Department of Health's Water Quality Service is responsible for controlling pollution by domestic waste from municipalities and other public and private facilities. The Federal Water Pollution Control Act, as amended by Public Law 92-500, prohibits any person from discharging pollutants into a waterway from a point source unless his discharge is authorized by a permit issued by EPA through the Oklahoma State Department of Health. Municipalities and towns are complying with the NPDES, Section 402 of the Act, by collecting data from various industries that discharge wastes into their systems in an attempt to determine the major contributors having a significant impact on the municipal wastewater treatment facility. The NPDES forms require specific information on the activity or wastewater facility and on each discharge. A description and effluent data is required for 19 physical and chemical parameters and flow rates. Additional wastewater characteristics from the major contributing industries in terms of another 34 chemical parameters are identified.

The State Department of Health's Air Quality Service has the responsibility to manage the air quality of the state through administration of the Oklahoma Clean Air Act and the Federal Clean Air Acts. Functions of the Air Quality Monitoring and Compliance Division include evaluation and enforcement of established air quality regulations, inspections of plants to determine compliance, and investigations of violations of air quality standards to prevent or abate air pollution.

The State Department of Agriculture has responsibilities in the areas of pesticide application, regulation, and analysis, and in the control of water pollution from animal feed yards. Pesticides are regulated under the Federal Insecticide, Fungicide, and Rodenticide Act of 1947 and the Federal Environmental Pesticide Control Act of 1972. These Acts protect the user and handler of pesticides by requiring registration with EPA and proper labeling. In addition, the 1972 Act provides for the regulation of pesticide disposal and storage.

Industry in Oklahoma

There are more than 4,600 manufacturing industries located in 77 counties in the State of Oklahoma and the majority of these are concentrated in the two large metropolitan areas, Tulsa and Oklahoma City.

In most cases industry has not made detailed comprehensive analyses of its wastes and cannot provide quantitative data especially with respect to specific compounds or elements contained in its wastes. Most municipalities have not completed or required complete reporting of major contributors, other than flow, that discharge into municipal sewer systems. Unfortunately, the full implementation of the NPDES reporting system will take several years. The nature and extent of

waste treatment and disposal methods are based on economic factors rather than on pollution control considerations. Few municipalities have a municipal waste ordinance and the few that do do not have the manpower, facilities and equipment, or political backing to adequately enforce an ordinance. At the present time, there appears to be no clearcut definition of what constitutes a hazardous waste, criteria for the selection of hazardous wastes, concentration levels or lower limits for the disposal of specific hazardous compounds except for approximately 20 parameters, or guidelines for the management of hazardous wastes within the State of Oklahoma.

Purpose of the Study

The purpose of the study was to survey the nonradioactive, liquid hazardous wastes from manufacturing and selected mining industrial point sources in Oklahoma. Liquid, nonradioactive hazardous wastes from manufacturing industries appear to be the largest contributor from preliminary studies, since manufacturing industries are one of the major sources and approximately 90 percent of the estimated 10 million tons of hazardous wastes produced annually occurs in liquid form.

The comprehensive survey attempted to identify and quantify the industrial, liquid, nonradioactive hazardous wastes based upon EPA guidelines and to serve in the future as a basis for the establishment of a management program for Oklahoma. Such a survey was needed to determine the hazardous waste generation potential and subsequent disposal and treatment facility capacity, recommendations for the location of a treatment/disposal facility, and method(s) of treatment and/or disposal recommended or required.

Objectives of the Study

The principal objectives were structured into four phases based upon an "Action Guide for State Hazardous Waste Surveys" by EPA (USEPA, 1974):

1. Phase I - Industry Characterization

To identify the manufacturing industries and selected mining industries that exist within the State of Oklahoma and determine the categories and quantities of hazardous waste potentially generated. The characterization includes:

- a) Alphabetical listing of the industrial plants
- b) Distribution of the number of firms and plants
- c) Products produced - SIC codes
- d) Location distribution by county
- e) Distribution by size of plants (number of employees)
- f) Age distribution of industries - year established

2. Phase II - Waste Characterization

To estimate or calculate the total amount of hazardous waste presently being generated in the state from manufacturing industries identified in Phase I based upon a hazardous substance list and a list of primary and secondary potential hazardous waste generators; to classify the generated hazardous waste into several categories:

- a) Include, where possible, a detailed chemical analysis of the individual waste streams from an industrial plant that contains hazardous constituents or any substances (hazardous or non-hazardous) which might be suspected to cause a reaction and form a hazardous substance. This method was utilized particularly where there were a small number (less than two) industries of an SIC type on the list of primary and/or secondary hazardous generators.
- b) Quantify and categorize the total annual quantity of sewerable hazardous substances; quantity per unit of product (annual production volume x waste generation factors), total discharge, or raw material of product by:

- (1) Industry type - SIC code number
 - (2) General character of hazardous waste - where possible subdivide into waste categories: toxic chemical (inorganic chemical without heavy metals, inorganic chemical with heavy metals, organic chemical without heavy metals, organic chemicals with heavy metals), explosive, flammable, poison, reactive, including acids, caustics, or corrosives, oil, and other.
 - (3) Organic/Inorganic composition
- c) Identify the waste stream(s) and the hazardous component(s) in the stream that are correlatable to the list of hazardous substances (refer to appendix C). This was based upon the TRW pure compound criteria plus the decision model and data developed by Batelle (volume, constituents, concentrations, hazards, disposal techniques, and data sources). Where the waste stream is noncorrelatable, from the production estimates, develop quantity estimates of industrial waste of each identifiable hazardous substance, using quantification factors (waste generation factors) available in the literature and various other studies; i.e., percentages or ratios of each substance in the waste stream.
 - d) Identify, quantify, and categorize the total volume of non-sewered hazardous wastes, which is accepted at the hazardous waste disposal site(s). Determine:
 - (1) Source - both selected manufacturing and mining industries and/or industrial hauler including identification of individual sources of hazardous waste collected by haulers.
 - (2) Volume of hazardous waste
 - (3) Type of hazardous waste by general category
 - e) Identify, quantify, and categorize the total volume of hazardous wastes, which is accepted at industrial injection wells. Determine:
 - (1) Source - both selected manufacturing and mining industries and/or industrial hauler including identification of individual sources of hazardous waste collected by haulers.
 - (2) Volume of hazardous waste
 - (3) Type of hazardous waste by general category

3. Phase III - Treatment and Disposal

To identify and describe treatment and ultimate disposal processes recommended, which is or may be applicable to hazardous wastes. The following processes were considered:

- a) Determine the prevalence of waste handling of hazardous wastes by private contractors in terms of percent of total wastes, and an identification of:
 - (1) Contractors by name and address
 - (2) Service cost
 - (3) Type of disposal facility utilized (i.e., dump, injection well, landfill, lagoon)
- b) Identify, where possible the prevalence of and recommendations for on-site (point of generation) vs off-site disposal in terms of numbers of locations and percentages of total wastes disposed therein, and identification of off-site facilities utilized:
 - (1) Municipal landfill
 - (2) Special (public/private) landfill for hazardous wastes
 - (3) Dump
 - (4) Deep-well industrial injection
 - (5) Munitions disposal operations
 - (6) Other (specify)
- c) Make recommendations for treatment and/or disposal technologies by SIC for the best practicable control technology currently available (BPCTCA) and the best available technology economically achievable (BATEA) for the following selected processes:
 - (1) Ponding/lagooning
 - (2) Backfill

- (3) Surface piles
- (4) Spoil banks
- (5) Dam construction
- (6) Land reclamation
- (7) Lake or river disposal
- (8) Land burial
- (9) Open dumping
- (10) Land spraying; spray irrigation
- (11) Compost
- (12) Sanitary landfill
- (13) Secure landfill
- (14) Soil additive, conditioner
- (15) Deep mine disposal
- (16) Deep well disposal
- (17) Ocean dumping
- (18) Open burning
- (19) Incineration
- (20) Pyrolysis
- (21) Gasification
- (22) Detonation
- (23) Chemical fixation
- (24) Reclamation

- (25) Fly larvae reduction
- (26) Re-use as feed
- (27) Centrifuging
- (28) Filtration
- (29) Chemical coagulation/polyelectrolytes
- (30) Evaporation
- (31) Freezing-thawing; electrophoresis
- (32) Treat with specific organisms for greater fuel use
- (33) Process modification-designed to decreased waste production

4. Phase IV - Management Guidelines

To recommend administrative procedures which will be effective in insuring the proper and safe storage, handling, treatment and disposal of hazardous wastes for the subsequent establishment of a statewide management program; the waste management system was divided into the following components: generation, transportation, treatment, resource recovery, and disposal/storage.

Scope of the Study

The scope of the study involved the collection of data from approximately 4,600 industries located within the State of Oklahoma. The manufacturing industries with the Standard Industrial Classification (SIC) code numbers 2011 through 3999 represent the majority of the total population. The mining industries with the SIC code numbers 1021, 1031, 1092, 1094, 1099, 1311 and 1321 were also included. The five types of metals mining industries with the major group SIC code number

10 are those establishments engaged in mining, developing mines, or exploring for metallic minerals (ores). The two types of industries with the SIC code numbers 1311 and 1321 are establishments engaged in producing liquid hydrocarbons from oil and gas field gases.

For phase I, the industrial characterization, the data was obtained from several state agencies in order to develop a current listing of the industries operating within the state.

For phase II, the waste characterization, was developed from several data sources in order to quantify and estimate the total hazardous waste generated annually. The waste quantification was divided into two parts: (1) characterization of the non-sewered hazardous wastes including wastes from the hazardous waste disposal site and the industrial injection wells and (2) characterization of the sewerage portion or the wastes that are generated by "potential" hazardous waste generators. In some cases detailed waste stream characterization of various industries were obtained from surveys or consultation with the industries.

Phase III, data regarding treatment and disposal/storage, were obtained from the industrial waste survey, private contractors and the disposal facilities. The recommended treatment and/or disposal technologies were based upon recommendations made by EPA and the available literature review.

The development of management guidelines for the State of Oklahoma was based upon EPA recommendations, current and proposed legislation, previous studies, management guidelines adopted and developed by other states, and the findings from phases I, II, and III of this study.

Assumptions

The following assumptions were made:

1. A hazardous waste management act similar to the "Materials and Energy Recovery Act of 1975" will be enacted by Congress during 1975 or 1976.
2. The amount of waste production does not indicate the hazards which may be produced by such wastes. Hazardous wastes must contain one or more hazardous substances in sufficient concentration to be detrimental to the threatened life system of the media involved.
3. The identification and placement of a manufacturing industry by SIC code number on the list of potentially hazardous waste generators does indicate for the purpose of phase II that the industry is a hazardous waste generator.
4. The list of hazardous substances based on pure constituent criteria is not equivalent to the development of a list of hazardous wastes, largely because of the unknown nature of effects possible from mixed waste streams, especially synergistic effects of a variety of input materials.
5. Where exact hazardous waste stream analysis of each industry is unavailable, the pure compound approach combined with the waste stream decision model (Program Management, 1973) is the next most reliable method of obtaining quantity estimates.

6. Where neither the exact waste stream analysis nor the pure compound approach combined with the waste stream decision model data are not available, the next most reliable method to determine wasteload estimates is by: (1) the use of the production output and waste generation factors.

Limitations

The following limitations to this investigation were made:

1. The survey was limited to the manufacturing industries with the SIC code numbers 2011 through 3999 and the mining industries with the SIC code numbers 1021, 1031, 1092, 1094, 1099, 1311, and 1321 within the State of Oklahoma.
2. The survey was limited to nonradioactive, industrial hazardous wastes.
3. The survey was limited to liquid and semiliquid wastes which included sludges and slurries.
4. The survey was limited to industrial injection wells, but did not include salt water or brine disposal injection wells.

Definitions

1. "Waste" means useless, unwanted, or discarded solid, or liquid materials.
2. As stated in the "Materials and Energy Recovery Act of 1975," Section 9 - Section 203 of the Solid Waste Disposal Act is amended by (c) adding the following new paragraphs:

 . . . (17) The term hazardous waste means a waste or combination of wastes of a solid, liquid, contained gaseous, or semisolid form, excluding source, special nuclear, or by-product material, as defined by the Atomic Energy Act of 1954, as amended, which in the judgment of the Administrator may cause, or contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness, taking into account the toxicity of such waste, its persistence, and degradability in nature, and its potential for accumulation or concentration in tissue, and other factors that may otherwise cause or contribute to adverse acute or chronic effects on the health of persons or other organisms.
3. A definition of "national disposal site" that satisfies the requirements of Section 212 of Public Law 91-512:

. . . A facility open to public use which must have disposal processing capabilities to properly treat and/or permanently store a designated class of wastes. Such facilities would be limited in number and would be responsible to federal, state, and local jurisdictions in ensuring the proper handling and disposal of the wastes such that no harm to the public and/or environment can occur.

CHAPTER II

REVIEW OF THE LITERATURE

The related literature has been subdivided by subject matter into the following sections: definition of hazardous wastes; classification and selection criteria of hazardous wastes; surveys of hazardous wastes; quantification of hazardous waste, legislation, treatment and disposal/storage; and management guidelines. Most large studies touch upon several topic areas within the broad spectrum of the topic hazardous wastes. Studies of this scope, have been reviewed and have been either discussed within the section of this chapter where the major emphasis of the article lies or within several sections where pertinent. Since the research and subsequent documentation has developed rather recently, there have been few studies related directly to the topic of hazardous wastes that appear in the literature. Most of these studies have been broad in nature and will probably be considered classics in the future, however, there remains an inadequacy of information and lack of a data base from which to develop guidelines and specific recommendations from the standpoint of providing an adequate margin of safety to protect the public health.

Definition of Hazardous Wastes

The definition of hazardous waste remains a problem. The use of the adjective "hazardous" implies that there are liabilities, potential problems, or risk probabilities. It could be said that any material may be hazardous in a given context or amount. Currently, there are several definitions of hazardous wastes each varying slightly depending on the source and intended application. One of the first definitions was provided for the purposes of the Booz-Allen study (Booz-Allen Applied Research, Inc., 1974):

Hazardous waste materials are defined as those materials or combinations of materials which require special management techniques because of their acute or chronic effects on the health or welfare of the public (or those individuals who handle them when they are disposed of by waste management processes (e.g. storage, transport, incineration, sanitary landfilling, composting, dumping, industrial water treatment)).

Common elements occur in almost all of the definitions found: "materials that require special management techniques," and "effects on public health." However, these elements are too broad in scope to designate specific hazardous wastes or provide specific criteria for the selection of hazardous wastes. Judgmental decisions would thus determine what constitutes "special" management techniques and what levels of acute or chronic effects require "special" management techniques, and what differentiates "levels" of acute or chronic effects. Such definitions would imply that the use of such management processes as sanitary landfilling, composting, and dumping are acceptable management processes for hazardous wastes when in fact they are not if the substance has not been detoxified or neutralized.

The term "potential hazard" is common to most definitions. Booz-Allen (Ibid.) went on to further characterize "hazardous potential"

based on a number of factors, which can be arbitrarily assigned some importance. These factors are:

1. Route of Disposal
2. Mammalian Toxicity
3. Non-Mammalian Toxicity
4. Chemical and Biochemical Change
5. Imbalances
6. Miscellaneous Factors

. . . materials have been defined as hazardous if they have known inherent ability to produce: (1) toxic effects on mammalian species (whether lethal or only damaging), (2) damaging or lethal effects on non-mammalian systems, and (3) some significant undesirable change in man, such as carcinogen, teratogens, or mutagens.

The shortcomings of this approach are similar to the pure compound approach. The assignment of importance to the above listed factors is subjective and adequate data to develop objective criteria are not available. These factors need to be further defined and quantified. Another disadvantage of the definition of hazardous materials is the failure to recognize the interactions of various waste stream constituents, since it is directed at defining hazardous materials in their pure form rather than as a constituent of a waste stream.

Battelle (Program Management, 1973) has identified two distinct connotations from hazards of concern.

. . . one of which relates to the intrinsic properties of the waste itself, or the amount of damage that it can render to man or the environment. The second connotation relates to extrinsic factors: the degree of exposure of man or the environment to the hazard, including quantity, behavior, delivery mechanism, and circumstances surrounding exposure.

In the first case, the information required for assessing the degree of hazard is specific to the waste; in the latter, the information

depends upon individual disposal situations. Since a general decision model cannot take into account the multitude of variables involved with extrinsic factors, a decision model was developed based upon intrinsic factors or hazards of concern (refer to figure 1).

In the Oklahoma Public Health Code, Article 16, (Oklahoma State Department of Health, 1973) the term "hazardous substance" is defined. It should be emphasized that hazardous substance is not necessarily equivalent to hazardous wastes. The intent of the article is to regulate and control labeling, packaging, and transporting of hazardous substances, but does not address the question of disposal of the substances or the containers.

The State of Oklahoma (Oklahoma, 1971) defines hazardous waste under Section 5.1 of The Oklahoma Solid Waste Management Act of 1970 as:

All wastes which present significant hazards to people, animals or the environment, whether by external contact, inhalation, ingestion or by any other means, require special handling and disposal procedures and techniques. Hazardous wastes may occur in various physical states, including but not limited to (a) off-grade or outdated waste bulk and chemicals and materials such as paper, cloth or wood contaminated with hazardous chemicals; (b) slurries containing such items as heavy metal ions or toxic organic chemicals; (c) sludges such as pond and tank bottoms and oily residues; and (d) spent and waste liquids and semi-liquids such as caustics, acids, solvents, and other miscellaneous chemical liquid-like mixtures containing settleable solids.

The definition does identify various categories of wastes that are to be included as hazardous wastes but is still too broad to provide specific designation of hazardous wastes. The orientation here seems to be directed toward the wastes that have been typically accepted at the hazardous waste disposal site. The definition allows numerous gaps and requires subjective judgment decisions regarding what is a "significant

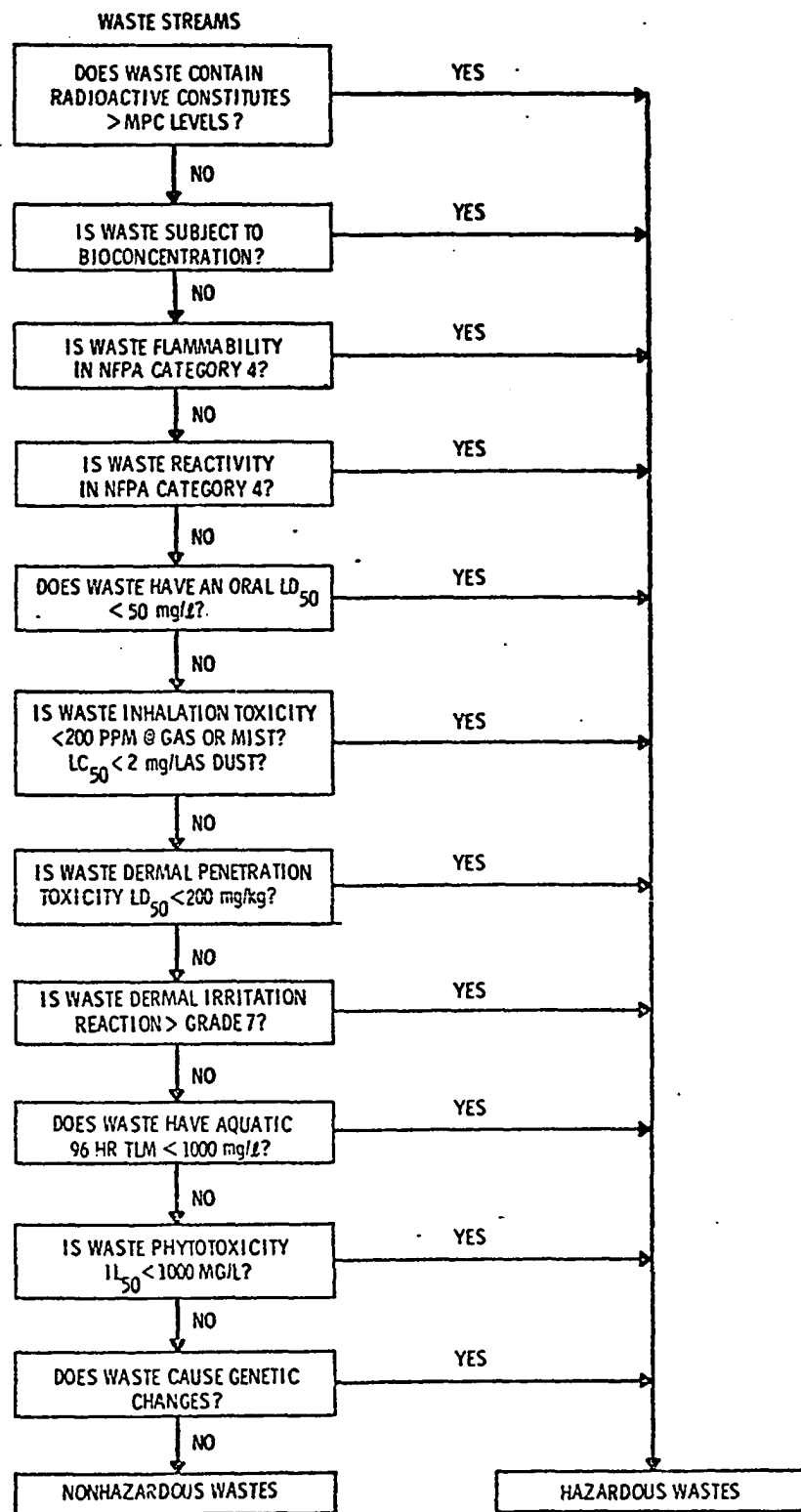


Figure 1. Graphic Representation of the Hazardous Waste Decision Model

hazard" and what requires "special handling and disposal procedures and techniques."

The State of Pennsylvania in Title 25 of The Pennsylvania Solid Waste Management Act, Rules and Regulations of the Department of Natural Resources, (Pennsylvania, 1971) defines hazardous waste as:

. . . any waste which by virtue of its quantity or content presents a hazard to the individuals handling it, a hazard to public health, or potential pollution to the air or waters of the Commonwealth or makes land unfit or undesirable for normal use. This category shall include but is not limited to chemicals, explosives, pathological wastes and radioactive materials.

This definition is extremely broad in scope. Although its breadth allows for flexibility, this could also be the source of weakness. One asset of this definition is that it includes a quantitative as well as a qualitative component. Few other definitions reviewed have provision for the protection of the land.

The definition of hazardous wastes that appears in Section 9 of the proposed Materials and Energy Recovery Act of 1975, S. 1474 (U.S. Congress, Senate, 1975) is also too broad in scope and does not adequately define the term (refer to "Definitions of Hazardous Wastes," in chapter 1 or appendix A). A strong federal role is established in the designation of what is hazardous wastes by the statement:

The term 'hazardous waste' means a waste or combination of wastes . . . which in the judgment of the Administrator may cause, or contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness, taking into account the toxicity of such waste, its persistence, and degradability in nature, and its potential for accumulation or concentration in tissue, and other factors that may otherwise cause or contribute to adverse acute or chronic effects on the health of persons or other organisms.

To designate what is to be considered hazardous within the framework of this definition, a large data base may be necessary regarding the

implications of increased mortality, persistence and degradability, and the "potential" for accumulation or concentration in tissue. Again it is evident that subjective judgment decisions are required to designate hazardous wastes or quantify "potential", in this case the decisions are to be made by the Administrator of EPA, which concentrates a great deal of authority at the federal level.

Therefore, there remains a need for a definition which is more specific and both quantitative and qualitative in nature. Designation and determination of wastes should be based upon the intrinsic properties of the waste as well as the extrinsic elements. Thus, an evaluation system with specific selection criteria developed upon a technical data base is essential.

Classification and Selection Criteria of Hazardous Wastes

Once a definition is chosen to determine hazardous waste, there is a need to classify that waste for the purpose of separation, special handling, treatment, or disposal procedures and techniques.

Most work in the past has focused on the categorizing or grouping materials or pure compounds in a hierarchical relation. The Labeling of various groups or categories of materials has developed, such as Class A and B poisons or Category 1, 2, or 3 as devised by TRW Systems group, Inc. (Ottinger, 1973). Booz-Allen has summarized in Exhibit A-1 (1), "Inventory of Current and Proposed Hazardous Materials Classification Systems," in 1970 30 major classification systems utilized to characterize hazardous substances during transportation operations (Booz-Allen and Hamilton, Inc., 1970). Dawson has summarized eleven classification

system criteria for categorization of hazardous materials (Dawson, et al., 1970):

1. Identification of Hazardous Material
 - a) Name
 - b) Chemical class
 - c) Physical and Chemical properties
 - d) Toxicology
2. Specification of Nature of Hazard
3. Specification of Degree of Hazard
4. Specification of Mode of Transport
5. Specification of Handling Activity Required or Expected
6. Specification of Expected Environmental Stresses in Handling
7. Specification of Corrective Actions to be Taken in Case of Accident
8. Specification of Exemptions and Exceptions to Above
9. Compatibility with Other Substances
10. Detectability
11. Availability of Techniques for Neutralization of a Spill

A number of studies have attempted to determine a system to evaluate or quantify the degree of hazard. The American Insurance Association conducted a hazard survey of chemical and allied industries and developed a systematic method of risk evaluation (Hazard Survey of the Chemical and Allied Industries, 1968). The major focus of the study related to major losses from fire and explosions.

In the report, System for Evaluation of the Hazards of Bulk Water Transportation of Industrial Chemicals (Committee on Hazardous Materials, 1974) a scheme for hazard evaluation is described. Four

classes of hazard are employed: fire, health, water pollution, and reactivity. A numerical rating is given to indicate the relative potential hazard. General guidelines were developed to describe five levels of severity for each. The system was applied to 367 industrial chemicals that are cargoes in bulk water transportation suggested by the Coast Guard. It should be noted that the system for rating was specifically devised to provide parametric and procedural guidelines for making a comprehensive and consistent profile that reflects the inherent hazards of cargoes transported in water. Thus, its application is limited. the fact that the system is based upon the inherent hazards and does not consider external hazards could be considered a weakness of the system. Yet it is an improvement over previous methods of evaluation, because the rating criteria is more precise and less subjective.

Past classification schemes have not addressed themselves to wastes. They have dealt with pure substances and commercial products. Booz-Allen has presented in a table a "Summary of Factors Included in Current Lists of Hazardous materials Developed by Government Agencies and Industrial Associations" (Booz-Allen, 1973). The table presents a summary of seven different lists that vary in size from 200-1900 hazardous materials. Most systems emphasizing toxic or irritating materials typically select dose thresholds at or below that at which given reactions occur such as those in the Toxic Substances List - 1973 (U.S. Dept. of Health, Education, and Welfare, 1974). Radioactivity and carcinogenicity are usually specified in most systems as either present or not present.

Since hazardous wastes exist as mixed waste streams and may pose any or all of the problems associated with the general categories,

no single existing system that classifies pure substances is adequate for classifying all wastes. Thus, there is a need for further specification or specific selection criteria beyond the use of general categories. The pure compound approach and the hazardous waste decision models both were attempts to further quantify and classify hazardous wastes beyond what the previously inadequate classification systems would allow.

The Pure Compound Approach

The development of a hybrid system was attempted by TRW Systems Group, Inc. (Ottinger, 1973) called the pure compound approach. The pure compound approach is predicated on the assumption that the hazardous properties of a waste will be those of the most hazardous pure compound within the waste. Using threshold levels established for the various hazardous properties, wastes containing compounds with threshold limit values less than or equal to these thresholds are classified as hazardous. The criteria for selection of hazardous compounds were chosen to emphasize two major concerns: (1) the existence of a hazard and (2) the inability to sufficiently reduce that hazard onsite. TRW employed four criteria during their selection process:

1. Material has an estimated 24 hour TLV $\leq$ 1ppm.
2. Material is spontaneously combustible in air.
3. Material is highly explosive, rated -5 on the Pictinny Arsenal scale using a 2 Kg drop weight. (The 5 inch level was selected since it differentiates between primary and secondary explosive materials.)
4. Material requires costly or highly sophisticated technology for disposal.

The pure compound approach has one major advantage in that pure compound data is more readily available than waste stream data.

This is also a source of weakness since this system has failed to recognize that interactions of various waste stream constituents can drastically alter the hazardous nature of a waste. Another weakness can be found in the original selection criteria. While explosiveness, flammability, and inhalation toxicity are important considerations, they do not reflect the entire range of significant hazards, namely genetic change potential, oral ingestion, dermal contact, aquatic-toxicity, and phytotoxicity. These properties cannot be deduced from inhalation data. Thus, thresholds must be established for the full range of hazards rather than relying on a single toxicity measurement for extrapolation to other sectors in the environment and alternate routes of exposure.

The pure compound approach was designed to assess treatability, but this is a judgmental decision and is somewhat subjective. Treatability should be based on technical data and the most advanced technology available in the future.

Hazardous Waste Decision Model

A hazardous waste decision model was designed by TRW Systems Group, Inc. (Ottinger, 1973) to reorient the pure compound approach to a more objective selection methodology (refer to figure 1). The use of comparative threshold levels is retained, but the basic criteria for judgment are expanded to cover a full range of hazard types. Constituent interactions are taken into account as fully as possible by use of available waste stream data. A subjective treatability assessment is avoided by evaluating waste streams as they exist and exit the plant's boundaries. This concept allows for continual updating of designations and regulations as new production techniques and treatment systems modify

existing wastes and as new wastes are produced. General categories of hazardous wastes used in the model are: flammability, reactivity, toxicity, radioactivity, bioconcentration, and/or genetically active to an unacceptable degree. To date this decision model is the most refined method of quantifying hazardous wastes. The model requires comprehensive waste stream data which is not currently available and will take several years to generate. A copy of the hazardous waste decision model and definitions for each criteria appears in appendix K.

Other Selection Criteria

In the Minnesota survey, Hazardous Waste Generation - Twin Cities Metropolitan Area (Barr Engineering, Inc., 1973), three alternative specific selection criteria were summarized along with their disadvantages. It was recommended that the selection criteria, (1) not be incorporated into legislation or formal regulations but be flexible enough to allow for new wastes and (2) be specific enough to determine the classification of the numerous and varied waste streams that currently exist. The three selection criteria that were summarized are: (1) listing of hazardous compounds by chemical name, common name or trade name (i.e., carbon tetrachloride, carbon chloride, chlorine), (2) listing of hazardous waste categories by generic name (i.e., acids, caustics, explosives, petroleum derivatives), and (3) listing of hazardous industrial process wastes (i.e., petroleum waste sludge, pickling liquor, hospital infectious waste). Advantages and disadvantages of the criteria used were:

1. Listing of Hazardous Compounds by Chemical Name, Common Name or Trade Name

Advantages:

- a) The list could include a lower limit of hazardous concentration for each compound (lower limit of toxicity, flammability or explosiveness) below which the compound would not be considered hazardous.
- b) Criteria of this type would be relatively easy to administer by a person not highly skilled in chemistry.
- c) The list could be easily amended as new compounds were qualified. . . .
- d) The federal government appears to be going in this direction. Hazardous materials defined under the Occupational Safety and Health Act, (The Federal Water Pollution Control Act, and The Clean Air Act) and under the preliminary recommendations for the National Disposal Site Project are listed by specific compound or chemical name.

Disadvantages:

- a) A complete list of hazardous compounds generated in a county or in a state will be difficult and therefore expensive to develop. A danger exists that some obvious compounds may be left off the list especially in the early stages of the program.
- b) Keeping the list up to date will also be difficult and expensive.
- c) Much of the data necessary to define the lower limit of hazardous concentration for many compounds is presently not available.

2. Listing of Hazardous Waste Categories by Generic Name

Advantages:

- a) The list could include lower limits of hazardous concentration for each category in the form of generalized criteria (flash point of material must be less than X° F, toxic concentration must be less than the toxic dose, etc.).
- b) This more general type of list will probably be less expensive to develop and maintain than the list of specific hazardous compounds. On the other hand, if the list of specific hazardous compounds proposed in the National Disposal Site Study is adopted by Congress and found workable for hazardous waste identification in the eight county study area, the relative cost of developing a separate list of hazardous categories may be greater than adopting the federal criteria.

- c) A list of hazardous waste categories along with generalized criteria will be more inclusive than a list of specific compounds and may resolve questions associated with a single compound being called a variety of names.
- d) The definition of "toxic and hazardous waste" now used by the MPCA as well as regulatory agencies in other states generally follows this format.

Disadvantages:

- a) Much of the data necessary to define the generalized lower limits of hazardous concentrations is not available.
- b) The use of a list of this type will still require a decision as to whether or not a specific material is hazardous. Since it will be necessary to make this decision and classify a waste as hazardous or nonhazardous at the source of generation, a list of specific hazardous compounds may still have to be developed.
- c) All potentially hazardous compounds may not be able to be classified by a commonly used generic name.
- d) As in the previous two formats, much of the data necessary to determine the effect of various process wastes on the public health and the environment is not available.

3. Listing of Hazardous Industrial Process Wastes

Advantages:

- a) The list could include lower limits of hazardous concentration for each waste in the form of generalized criteria below which the waste would not be considered hazardous.
- b) The list would be relatively easy to understand by the waste generator and the decision at the point of generation as to whether a waste is hazardous or nonhazardous may be more positive than in the previous two formats.
- c) The list could be developed especially for process wastes generated in the particular study area to be served by the administrative procedure.

Disadvantages:

- a) All hazardous waste does not originate as process waste. For example, a portion of hazardous waste originates as shelf inventory which has become outdated and

must be discarded. A second set of specific selection criteria will therefore have to be developed for non-process waste.

- b) All waste from a particular process may not be hazardous. This places a decision on the waste generator to unilaterally determine if all or only a portion of the waste is hazardous.
- c) A considerable amount of monitoring will have to be completed to determine the chemical and biological nature of process waste in this area. Very little information is available regarding the hazardous nature of process waste.
- d) As in the previous two formats, much of the data necessary to determine the effect of various process wastes on the public health and the environment is not available.

The California Guidelines for the Handling of Hazardous Wastes

(California, 1974) describes an extensive list of hazardous waste types. The selection criteria utilized was the listing of hazardous waste categories by generic name. Four criteria were listed. The report also includes a list of seven potentially noncompatible wastes which, when mixed at disposal sites, could produce hazardous situations through heat generation, fires, explosions, or release of toxic substances.

In Guidelines for Landfill of Toxic Industrial Sludges (Curry, 1973) the author suggested the following classification to facilitate screening of sludges and separation of the location of sludges received at a landfill disposal site:

1. Acid forming (including sulfides)
2. Oxidizing
3. Reducing
4. Fume and vapor forming
5. Highly exothermic

6. Organic wastes without toxic metals
7. General (hydroxides, oxides, carbonates, etc.)
 - a) High pH (10.0 and higher)
 - b) Intermediate pH (8.5 - 9.9)
 - c) Slightly alkaline pH (7.5 - 8.4)
 - d) Acid and neutral pH (7.4 or less)

Sub-classes of the first six groups based on pH may be required depending upon the specific wastes received at any landfill.

Quantification of Hazardous Wastes

Several methods have been utilized to quantify the distribution and volume of hazardous wastes. Since the available data on actual waste stream constituents and volumes is practically non-existent, the volume data that have been developed on a nationwide basis are gross estimates. With the exception of data on radioactive waste quantities, the reasons for the obvious lack of data was explained in the Booz-Allen study (Booz-Allen, 1973):

. . . historically, there has been no interest or objective in quantifying waste amounts of specific materials, . . . ;

for certain materials, such as pesticides and herbicides, the utilization and disposal cycles were one and the same, but geographic location data were not recorded;

in nearly all waste disposal processes, whether industrial, governmental, or domestic, materials being wasted are thrown together and become streams of mixed wastes; and

predisposal treatment, where employed at all has been applied to a limited number of waste stream characteristics, rather than to characteristics of specific materials. . .

As a result of the latter two factors, the study went on to further point out the following difficulties regarding mixed waste streams:

. . . can have hazardous materials as inputs, are not analyzed in detail, if at all, . . . might be chemically indeterminate,

as a result of unknown reactions, . . . might exhibit some, all, or none of the characteristics of individual input materials, . . . might become hazardous through combinations of non-hazardous input materials . . .

Booz-Allen developed several calculation methods in order to estimate total waste quantities. The calculations were based upon waste generation as a function of production (i.e., pounds of waste per thousand pounds of product). Total quantities of wastes were computed for industry types by multiplying the value added by waste factors. Value added was a scaling factor used to convert ratios of pounds of waste to pounds of product and to pounds of products of waste by industry. Waste production factors are multipliers which can be applied to the production volume of an industry type. The formula used:

$$\frac{WPPP}{VAPP} = \frac{\text{lb. waste/1,000 lb. product}}{\text{\$ value added/1,000 lb. product}} = \frac{\text{pounds waste}}{\text{\$}}$$

and: $\frac{\text{Pounds waste}}{\text{\$}} \times \text{Total \$ value added} = \text{Total lb. waste}$

This method may be adequate for gross estimates of total quantity of wastes on a nationwide basis, however, its shortcomings are numerous:

1. Value added provides a measure of industrial activity and is used as indices of industrial productivity and price, however, it is not as accurate as the actual production volumes and loses its accuracy in smaller geographic areas and for a small number of industrial establishments.
2. The waste production factors utilized were obtained from a survey of the literature. Considerable disagreement exists among the literature and more accurate waste factors have been developed recently.
3. Estimates do not reflect variations in industrial process, any on-site treatment, or waste management practices. In other words, technology within an industry was assumed to be homogeneous.
4. Industry production data utilized were from 1967. It was assumed that these values would still be accurate in 1973 since the changes in production quantity would offset improvements in waste reduction technology.

TRW Systems Group, Inc. (Ottinger, 1973) applied the same methods of calculations for estimating quantities of wastes as the Booz-Allen Study; however, the source of the data base was updated, expanded, and improved. To compute the total quantities of hazardous wastes, actual production volumes were multiplied by production factors. TRW developed waste factors that were obtained from industrial and consultant sources rather than from the literature. To determine regional distribution of hazardous wastes, two types of methods were used to measure the regional production activity: (1) when the production volumes and the locations of the industry were known, distribution was computed from the total production capacity and (2) value added by the manufacturer. TRW also assumes the technology to be homogeneous within an industry. Although a vast improvement over the initial Booz-Allen Study, there remains some voids in the data base. For example, the waste production factors were based upon personal contacts to as few as one plant to as many as approximately thirty, which in the author's opinion may not be a large enough "n" to provide a meaningful, "representative" waste production factor.

In the Minnesota eight county study, Hazardous Waste Generation -- Twin Cities Metropolitan Area, (Barr, 1973) the methods of quantification were based upon the TRW Systems Group, Inc. data. Where available, production data and hazardous waste production factors from the literature were used to estimate hazardous waste being generated. Hazardous waste production factors from the TRW Studies for nine industry types were applied to nationwide production quantities to estimate the total annual hazardous waste generation. The nationwide hazardous waste generation quantities were then broken down into hazardous waste

generation for the U. S. Census Region from the TRW Systems Group Study on the basis of regional value added, regional production, or regional consumption, whichever distribution was the most appropriate. The regional data were then broken down into hazardous waste quantities for the State of Minnesota and then for the eight-county study area by using value added, production, or consumption. Where these data sources were not available, the data were extrapolated by using employment numbers and gross sales volume data, supplemented with field visits and consultations with the major generators to estimate total quantities.

It should be pointed out here that such methods as using the nationwide estimates and distributing the hazardous wastes into regions, states, and counties lose their accuracy as the geographic area diminishes. The methods become less defensible when more than one method is employed.

In a Report on Industrial and Hazardous Wastes conducted by the Department of Ecology, State of Washington (Washington, 1974) waste quantities were projected from total employment factors derived from inventory data. In other words, a total employment figure and a total waste figure were obtained from inventories of an SIC industry type. From this data, employment waste factors (i.e., amount of waste per employee for an industry type) were derived and applied to the total statewide employment of the same SIC industry type. This method is often favored since employment data are more easily obtained than production volumes.

In the survey conducted by the Department of Environmental Quality, State of Oregon (Oregon, 1974) 110 facilities were visited to obtain information regarding hazardous waste sources, volumes, types and disposal methods. Once the waste volumes were determined for each plant visited a projected waste volume for the state was determined by industry type. The projected volumes were based upon a percentage, which was included in the survey. For example, 80 percent of the total employment for an SIC industry type was included in the survey, and it was assumed that the total waste volumes from the surveys represented eighty percent of the total hazardous waste for the entire state of the same industry type. The methods used and their accuracy were subject to several limitations aside from the fact that total employment is not an accurate indicator of production volumes. If the volume of certain wastes could not be determined during the survey, then the volumes were assigned a zero value. The total number of industries may not have been included in the survey. It is probable then that the total waste volume projections were less than the actual hazardous waste volumes.

In the second draft of the Industrial Solid Waste Management Plan - Volume II conducted by the Texas Water Quality Board (Texas, 1973), it was stated that employment of manufacturing industries is not closely correlated with location and is not a precise measure of plant size. Data collected during the survey were utilized to develop waste generation factors and applied to the number of firms and total employment in order to estimate wastes on a "per firm" basis and on a "per employee" basis in two forms tons and gallons. The original survey has been revised from a statewide study area to an in-depth

comprehensive survey of Harris County, which is scheduled for completion in the latter part of 1975. It appears that an in-depth survey will show approximately four times more hazardous waste actually generated (Fleming, 1974) than was estimated via the use of employment figures.

The Battelle study (Program Management, 1973) relied heavily upon Booz-Allen and TRW studies for their volume data. Where these sources failed, waste stream determinate factors were developed through consultations with trade associations and typical producers. Estimates of waste production per unit of product were derived by such consultations.

In summary, Battelle has stated that:

There can be little doubt that a comprehensive waste inventory is necessary to develop the data required for the proper assessment and management of the hazardous waste problem. Such an inventory must be based on detailed analysis of waste volumes of all types, their physical-chemical characteristics, and their significant constituents. The data is required on a per industry basis at a seven-digit SIC level or better and should include geographic distribution information. Approaches short of these requirements will add little to the sketchy collection of data presently available.

The author basically agrees with this statement in theory, but has serious reservations about the practicality or feasibility of obtaining and quantifying data at a seven-digit SIC level.

Surveys

National Surveys

The first nationwide survey was done by Booz-Allen (Booz-Allen, 1973) for the purpose of quantifying the hazardous waste problem. From a literature survey and contacts with various trade and technical associations, government agencies, and industry, a list of hazardous

materials was compiled, and each candidate substance on the list was rated according to the nature and severity of its hazardous properties. Volume and distribution data (both by geography and by industry groups) were determined. The current hazardous waste handling and disposal practices were surveyed. It was concluded in the study that a comprehensive body of knowledge describing hazardous effects of most substances does not exist; the technology for a variety of disposal processes exists, but is not widely used; accurate characterization of waste streams is essential; and disposal of hazardous materials is best handled at the point where the hazardous material is produced or released. Recommendations were for a national control system as well as extensive further research.

TRW Systems Group, Inc. (Ottinger, 1973) conducted a more detailed and technical study on the properties of hazardous materials, treatment, and disposal method. The initial study was expanded to include the determination of waste forms together with their quantities and geographic distribution and the evaluation of waste management procedures. The review of this study will be discussed in further detail under the disposal and treatment sections.

Waste Age conducted a nationwide survey on waste control practices and collection and transportation of waste ("Exclusive Waste Age Survey of U. S. Collection Practices," 1975). The sources of information were state officials and indicated a lack of data. Only nine states reported having actual regulations for the collection of hazardous wastes. Most states indicated the need for more stringent controls of liquid waste and sludge collection.

State Surveys

A great deal of interest, publicity and activity regarding hazardous waste has developed at the state level within the past year. After a thorough literature search, correspondence with every state health department, consultation with other state officials conducting similar surveys and EPA officials of the state implementation branch of the Office of Hazardous Waste Management Division, the following subsection was developed (refer to appendix J).

Twenty-two states have begun or are conducting surveys dealing with some phase of hazardous wastes. The type of surveys, size of the sample, methods utilized, geographic area covered, and agency(ies) conducting the surveys varies greatly.

The Arizona State Department of Health sent out 500 questionnaires to manufacturing industries, obtained a very poor response (221 questionnaires were returned and 142 were completed), and are revising their method of collecting data and planning another survey. The Georgia Department of Natural Resources has begun a statewide survey focusing on solid waste of all industries. The questionnaire includes questions regarding waste streams. The Hawaii Department of Health sent out 290 questionnaires to manufacturing and several service industries (laundries and cleaning, automobile repair services and garages, medical and other health services, educational services, and crop sprayers) and obtained only a 37 percent response. They are revising their methods and are making another attempt. Indiana is developing a limited inventory of sludges, which is to be the beginning of a state survey that will be conducted over the next two years. Kentucky is conducting a survey and has sent a questionnaire to approximately 200

industries. The State Board of Health is currently inventorying hazardous waste generation and disposal in the State of Mississippi. The Bureau of Solid Waste within the Department of Natural Resources in Missouri has begun a hazardous waste survey. In North Carolina an inventory of hazardous waste is being conducted through the cooperative efforts of a local health department and officials of a large metropolitan area. In New York a preliminary study of hazardous wastes began approximately a year ago. The study area is the tri-county area near Albany and focuses on manufacturing industries.

In general, most of the state surveys are being conducted by the solid waste branch of state health departments and are utilizing a questionnaire to obtain the necessary data on a voluntary response basis. The percentage of return is very low.

Of the 22 state surveys only eight have been completed:

California	Minnesota
Florida	Oregon
Idaho	Pennsylvania
Maryland	Washington

The surveys done in Florida and Pennsylvania focused primarily on hospital and industrial wastes, respectively. The remaining six have published reports and are the only available state reports to date that focus on hazardous wastes.

In the "1968 Industrial/Agricultural Solid Waste Inventory Survey" conducted by Pennsylvania, data were obtained on hazardous solid wastes, however, a report has not been published.

The University of Florida obtained a grant from EPA to conduct the survey "Non-Industrial Sources of Hazardous Waste Material," (U. of Florida, 1974), but the report is not yet available. The primary focus of this study was upon hospital wastes.

Idaho added a hazardous waste section to the Idaho Solid Waste Management Survey in 1972 entitled Idaho Solid Waste Management - Industrial Survey Report (Idaho, 1973). However, data reported on hazardous wastes was limited and too sporadic to determine volumes of hazardous materials.

Maryland did a statewide survey of all manufacturing industries. Out of 3,000 mail surveys, approximately 45 percent were returned (Maryland, 1975). The state is continuing the survey effort by on-site personal contacts to the industries.

The California State Department of Public Health (California, 1972) conducted a survey of hazardous waste disposal. The report presents a summary of the industrial, agricultural, and medical waste sources as well as an inventory of industrial disposal sites and their waste characteristics and quantities. On the basis of the survey, it was recommended that: environmental monitoring programs be developed; the State Department of Public Health be empowered with necessary management responsibilities for hazardous waste, the surveillance of hazardous waste handling and disposal operations and the development of standards for hazardous waste management; development and operation of new sites or modifications of existing sites should conform with guidelines as contained in the report Tentative Guidelines for Hazardous Waste Land Disposal Facilities (California, 1972); further investigation of disposal of hazardous industrial wastes at general refuse disposal sites; and further investigation to identify hazards associated with certain wastes.

The Department of Environmental Quality, State of Oregon (Oregon, 1974) conducted a survey to determine the existing statewide

hazardous waste situation with respect to sources, types, quantities, and current disposal methods; and to develop a strategy for implementation of a hazardous waste management plan. The main survey effort focused on manufacturing industries, electric utilities, oil terminals, and other commercial facilities considered to be a potential source of hazardous wastes. Estimated waste volumes and disposal methods of industry type were determined by 110 plant visits and consultations (Wicks and Synak, 1974). It was determined by the survey that approximately 2,100,000 cubic feet of various types of hazardous waste plus an estimated 2,200,000 "empty" pesticide and other toxic chemical containers was disposed of annually by environmentally unacceptable methods. It was clearly established by this survey that there was a need for a hazardous waste site, for improvement of hazardous waste disposal practices, and for increased attention by the State to all aspects of hazardous waste management.

A Report on Industrial and Hazardous Waste (Washington, 1974) was developed by the Department of Ecology, State of Washington. An inventory of manufacturing industries was conducted and the total population of 5,000 manufacturing plants was reduced by selection. Of over 600 voluntary interviews conducted, 450 were completed. It was determined as a result of this initial inventory that:

Hazardous wastes produced in the state are of sufficient quantity to warrant special attention in their handling and disposal . . . Both industrial wastes and hazardous wastes require some form of waste management systems in order to safeguard public health and the environment. Further study and inventory of industrial and hazardous waste sources were recommended in order to provide the necessary information needed to complete a hazardous waste management system.

The Minnesota survey, Hazardous Waste Generation-Twin Cities Metropolitan Area (Barr, 1973) is the most comprehensive and complete

of the state surveys. The study area encompassed the Twin Cities Metropolitan Eight-County Area and the industries included the manufacturing, transportation, wholesale, retail, and service groups. An Industrial waste inventory questionnaire was sent to approximately 353 industrial dischargers who had indicated the presence of one or more potentially hazardous constituents in an earlier inventory. Approximately seventy percent or 240 questionnaires were returned. It was determined that approximately 38,000 tons of potentially hazardous non-oil wastes (includes sewered and non-sewered disposal routes) and 32,500 tons of waste oil were generated annually. Approximately 30 percent of the potentially hazardous non-oil wastes was disposed of through use of methods other than through the sanitary sewer system, approximately 60 percent or 9,000 tons of the total quantity of the waste oil generated by industry was discharged by methods other than through the sanitary sewer system, and approximately 75 percent of the potentially hazardous non-oil waste discharged through non-sewered routes was being disposed of in an unregulated manner. Recommendations were made to change the existing hazardous waste regulatory program and to devise specific rules and regulations regarding definition, labeling, storage, transportation, handling, treatment and disposal. Recommendations regarding administrative procedures, planning agencies, and program implementation steps were also included.

Thirteen other states are planning to conduct a survey of some type within the next year. They are: Colorado, Florida, Illinois, Indiana, Iowa, Kansas, Louisiana, Missouri, Montana, New Hampshire, North Dakota, Ohio and Vermont.

Other Surveys

Public Attitudes Toward Hazardous Waste Disposal Facilities

(Lackey, 1974) was a survey conducted to determine community reactions to a proposed national disposal system (NDS) and to develop a behavioral model as a means of predicting citizens' reactions to a national disposal site in a particular location. Sampling methods included both random and selection of key influential respondents. The study was conducted in 10 counties. The questionnaire obtained information about three classes of variables: (1) contextual variables (physical/economic environment), (2) situational variables (social environment), and (3) individual variables (personal attitudes/beliefs). Results showed that the majority of respondents have positive attitudes toward an NDS, would accept one in their county, and believe an NDS would be beneficial to their area. However, approximately 50 percent of the respondents wanted additional information before agreeing to a nearby NDS.

The study Physical, Chemical and Biological Analysis of a Disposal Site for Hazardous Waste (Kapustka, 1974) was conducted during the summer months at the licensed hazardous waste site in Oklahoma. The primary method of ultimate disposal utilized at the site are lagoons with no separation or treatment of the wastes. The wastes received at the site were grouped into four categories: non-volatile organics, volatile organics, pesticides, and inorganics. Chemical analysis confirmed the accumulation of the insoluble metals in the sediment layer of the lagoons. The cations Hg^{+} , As^{+} , and Ag^{+} were not present. The waste would have to be diluted at least by 10^6 fold with the nearby

Washita River in order to reduce the toxicity to a negligible degree. Upon examination of the vegetation, a narrow zone of one to twenty-five meters in width surrounding each of the lagoons showed signs of damage, which was presumed to be due to exposure to volatile hydrocarbons. Extremely high concentrations (in excess of minimum dietary levels that are toxic to animals) of selected metals, particularly Cr, Cu, and Cd, were found in the vegetation at considerable distances from the lagoons. These results were attributed to the fact that the aqueous portion from the lagoons was pumped through a sprayer to enhance evaporation and reduce the volume in the lagoons. In all cases, except Pb, the vegetation had much higher concentrations of metals than the aqueous solution in the pit or the soil. It appears then that the vegetation are receiving the metals by intercepting the mist from the sprayer rather than by uptake from the soil. Recommendations based upon the data included cessation of the spraying process; separation of waste materials into lagoons for organic volatiles, oils, and inorganics; burial separately in sealed containers of cyanide compounds; use of a black plastic tarp as a liner; and the addition of a retaining dike.

Legislation

The treatment, storage, and land disposal of hazardous wastes is currently not regulated at the federal level and only superficially at the state level except for radioactive wastes and pesticides. The discharge of effluents and emissions from industrial point sources is currently regulated for a limited number of parameters. The transportation of hazardous substances, although not strictly controlled, is the one phase of the management system which is regulated by a number

of federal statutes. Legislation that relates to radioactive materials has not been reviewed in this report, since it is not within the scope of this study.

Federal Legislation

There are fifteen federal statutes that directly impact various aspects of hazardous waste management and a number of statutes that are either directly or potentially applicable to hazardous wastes. The Transportation Safety Act of 1974 and The Safe Drinking Water Act are two bills that were passed within the past year which may have an impact on hazardous wastes. Two other bills, the Toxic Substances Control Act and the Materials and Energy Recovery Act, were proposed and are intended to give the EPA the authority to strictly regulate and control marketing of toxic substances and the disposal of hazardous wastes.

The National Environmental Policy Act of 1969, Pub.L. 91-190 (The National Environmental Policy Act of 1969, 1970) was established to declare a National policy encouraging harmony between man and his environment. The Act requires that the Federal Government use all practical means to attain the widest range of uses of the environment without degrading the environment or risking health or safety. Environmental impact statements are required for all federal actions significantly affecting the environment before the construction of projects. This would include all hazardous waste management activities. To date, there have not been any federal construction of hazardous waste disposal sites (Personal communication, June, 1975) and, therefore, there has not been an environmental impact statement written on a hazardous waste site.

The Federal Hazardous Substances Act, Pub.L. 86-613 (The Federal

Hazardous Substances Act, 1960) authorizes the Department of Transportation Secretary to identify hazardous substances if their containers have been misbranded or the labels removed. This Act has been amended by The Child Protection and Toy Safety Act of 1966 and 1969, The Poison Packaging prevention Act of 1970, and The Consumer Product Safety Act.

The Child Protection and Toy Safety Act of 1969, Pub.L. 91-113 (The Child Protection and Toy Safety Act of 1969, 1969) was created to protect the public health and safety from special hazards presented by hazardous substances. The control strategy was through labelling regulation that:

. . . prohibit introduction into interstate commerce of any misbranded or banned hazardous substance, prohibit alteration or removal of labels, establish label requirements by regulation, and direct that records be kept of the movement in interstate commerce of any hazardous substances.

The Poison Packaging Prevention Act of 1970, Pub.L. 91-601 (The Poison Packaging Prevention Act, 1970) authorizes the Secretary of the Department of Health, Education and Welfare (HEW) to establish special packaging standards for hazardous household substances whenever it can be shown that serious personal injury or illness to children can result from handling, using, or ingesting such substances.

The Consumer Product Safety Act, Pub.L. 92-573 (The Consumer Product Safety Act, 1972) transferred from the Secretary of HEW to the Consumer Product Safety Commission functions under the Federal Hazardous Substances Act. The Commission reviews and reissues the regulations as set forth in Chapter II, Subchapter C (Federal Register, 1973).

The Food, Drug, and Cosmetic Act, Pub.L. 75-717, (The Federal Food, Drug and Cosmetic Act, 1938) prohibits the sale or manufacture of

adulterated or misbranded food, drug, or cosmetic and requires the destruction or sale of any item seized under the Act.

The Hazardous Cargo Act, Pub.L. 76-809, (The Dangerous Cargo Act, 1940) places regulatory control on the water transport of explosives or dangerous substances. The Transportation of Explosives Act, Pub.L. 86-710, (Explosives and Combustible Act, 1960) formulated regulations for the safe interstate and foreign transport on both land and water of explosives and other dangerous articles. Dangerous articles include radioactive materials, etiological agents, flammable liquids, flammable solids, oxidizing materials, corrosive liquids, compressed gases, and poisonous substances. The Armed Forces Appropriation Authorization Act of 1969, Pub.L. 90-500, and 1970, Pub.L. 91-121, (The Armed Forces Appropriation Act of 1969, 1968; The Armed Forces Appropriation Authorization Act of 1970, 1969) prohibit use of funds for transportation, open air testing disposal of any lethal chemical or biological warfare agent in the U.S. except under specifically defined conditions. The Federal Aviation Act, Pub.L. 85-726 (The Federal Aviation Act of 1958, 1958) authorizes the FAA to establish transportation standards necessary to national security and safety in air commerce. The Hazardous Materials Transportation Act of 1970, Pub.L. 91-458 (The Hazardous Materials Transportation Act of 1970, 1970) authorizes the Secretary of the Department of Transportation to evaluate hazards associated with hazardous waste transport, establish a central accident system, and recommend improved transportation controls.

The Transportation Safety Act of 1974, Pub.L. 93-633 (The Transportation Safety Act of 1974, 1975) gives the Secretary of the Department of Transportation discretion to set regulations and to control transportation. Under Title I - Hazardous Materials Transportation Act,

Section 105 (a), the Secretary "may issue" regulations that would apply:

. . . to any person who transports, or causes to be transported or shipped, a hazardous material, or who manufactures, fabricates, marks, maintains, reconditions, repairs, or tests a package or container which is represented, marked, certified, or sold by such person for use in the transportation in commerce of certain hazardous materials.

The measure further states that:

Such regulations may govern any safety aspect of the transportation of hazardous materials which the Secretary deems necessary or appropriate, including but not limited to, the packing, repacking, handling, labeling, marking, placarding, and routing (other than with respect to pipelines) of hazardous materials, and the manufacture, fabrication, marking, maintenance, recondition, repairing, or testing of a package or container which is represented, marked, certified, or sold by such person for use in the transportation of certain hazardous materials. . .

The Act is fairly vague about what constitutes a hazardous material in Section 104:

Upon a finding by the Secretary, at his discretion, that the the transportation of a particular quantity and form of material in commerce may pose an unreasonable risk to health and safety or property, he shall designate such quantity and form of material or group or class of such materials as a hazardous material. The materials so designated may include but are not limited to, explosives, radioactive materials, etiologic agents, flammable liquids or solids, combustible liquids or solids, poisons, oxidizing or corrosive materials, and compressed gases. . .

The Act also authorizes the Secretary to set criteria for handling hazardous materials.

The Occupational Safety and Health Act of 1970, Pub.L. 91-596 (Williams-Steiger Occupational Safety and Health Act of 1970, 1970) created the Occupational Health and Safety Administration (OSHA) and authorized the Secretary of the Department of Labor to set mandatory standards to protect the occupational safety and health of all employers and employees of businesses engaged in interstate commerce. Under provisions of this Act, the Secretary of Labor is required to promulgate and

publish in the Federal Register standards designed to apply to employments performed in a workplace of the United States. The National Institute for Occupational Safety and Health (NIOSH), which is in the Department of HEW, has recommended to the Labor Department a standard for "an identification system for occupationally hazardous materials." (Toxic Materials News, 1975). In the recommended standard, NIOSH states that employees should be "informed about the nature of the chemical hazards, both potential and actual, to which they may be exposed." NIOSH defines a hazardous material as, "a substance or mixture of substances having intrinsic properties capable of producing adverse effects on the health or safety of the worker."

The Coastal Zone Management Act of 1972, Pub.L. 92-583 (The Coastal Zone Management Act of 1972, 1972) declares a national policy to preserve and protect the resources of the Nation's coastal zone and recognizes waste disposal as a "competing demand" on coastal zone lands which caused "serious environmental losses." This Act would not directly affect the State of Oklahoma since it is neither a coastal state nor has coastal waters. The Marine Protection, Research, and Sanctuaries Act of 1972, Pub.L. 92-532 (The Marine Protection, Research, and Sanctuaries Act of 1972, 1972) prohibits transport and the unregulated dumping from the U.S. of any material into ocean waters (except by Federal permit) that endangers human health, welfare, and amenities, and the marine environment, ecological systems, or economic potentialities. Material includes but is not limited to:

. . . dredged material, solid waste, incinerator, residue, garbage, sewage, sewage sludge, munitions, radiological, chemical, and biological warfare agents, radioactive materials, chemicals, biological and laboratory waste, wreck or discarded equipment, rock, sand, excavation debris, and industrial, municipal, agricultural, and other waste . . .

There are no industries within the State of Oklahoma that have been issued permits to dump any material under the provisions of this Act.

The Federal Pesticide Control Act of 1972, as amended, Pub.L. 92-516 (The Federal Insecticide, Fungicide, and Rodenticide Act, 1972) requires the EPA Administrator to establish procedures and regulations for the packaging, labeling, coloring, adulteration, and disposal or storage of "economic poisons."

The Resource Recovery Act of 1970, Pub.L. 91-512 (The Resource Recovery Act of 1970, 1970) amended the Solid Waste Disposal Act.

Section 212 of the Act mandated:

. . . a comprehensive report and plan for the creation of a system of national disposal sites for the storage and disposal of hazardous wastes, including radioactive, toxic chemical, biological, and other wastes which may endanger public health or welfare. Such a report shall include: (1) a list of materials which should be subject to disposal in any such site; (2) current methods of disposal of such materials; (3) recommended methods of reduction, neutralization, recovery, or disposal of such materials; (4) an inventory of possible sites including existing land or water disposal sites operated or licensed by Federal agencies; (5) an estimate of the cost of developing and maintaining sites including consideration of means for distributing and short- and long-term costs of operating such sites among the users thereof; . . .

As a result of this mandate the Report to Congress - Disposal of Hazardous Wastes (Report, 1974) was submitted.

The Clean Air Act of 1963 (Pub.L. 88-206), The Air Quality Act of 1967 (Pub.L. 90-148), and The Clean Air Amendments of 1970 (Pub.L. 91-604), (The Clean Air Act Amendments of 1970, 1970) authorizes the EPA Administrator to set national emission standards for hazardous air pollutants to protect the quality of the Nation's air resources and to promulgate national primary and secondary ambient air quality standards. The term "hazardous air pollutant" is defined in the Act as:

. . . an air pollutant to which no ambient air quality standard is applicable and which in the judgement of the Administrator may cause, or contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness.

The Water Quality Act of 1964, The Water Quality Improvement Act of 1970, and the Federal Water Pollution Control Act as amended, Pub.L. 92-500 (The Federal Water Pollution Control Act Amendments, 1972) are laws aimed to enhance the quality and value of our water resources and to establish a national policy for the prevention, control, and abatement of water pollution. EPA is required by this act to promulgate rules and regulations to be published in the Federal Register related to effluent limitation and pretreatment requirements for industrial point sources. Under Section 307 the Administrator of EPA is required to promulgate and publish a list of toxic pollutants for which an effluent standard will be established. Such standards will describe applicable conditions and describe set maximum concentrations or effluent limitations for toxicants in industrial discharges to receiving waters. To date proposed standards for only nine such toxic pollutants have been issued in the Federal Register under the provisions of the Act (40 CFR 129). "Proposed Toxic Pollutant Effluent Standards" (Federal Register, December, 1973) were issued for the toxic substances:

Aldrine/Dieldrin	Cadmium	DDT	PCB's
Benzidine	Cyanide	Mercury	Toxaphene

Under Section 402 the NPDES requires the issuance of a permit for the discharge of a pollutant for dischargers into the navigable waters and for discharges from publicly owned treatment works. Under Section 304 (f) of the Act, the EPA developed Federal Guidelines for the purpose of

assisting states in carrying out NPDES and for "pretreatment of pollutants which he, the Administrator, determines are not susceptible to treatment by publicly owned treatment works" (Pretreatment of Pollutants Introduced into Publicly Owned Treatment Works, 1973). These guidelines provide general information on industrial processes, wastewater characteristics, and pretreatment operations. The guidelines and 40 CFR Part 128 are supplemental to the federal pretreatment standards and neither document includes specific pollutant limitations. However, Part 128 does provide regulations for the protection of the municipal treatment facility. Regulation of "compatible pollutants" is left entirely to the discretion of local or state authorities.

Under Section 301 - Effluent Limitations, Section 306 - National Standards of Performance, and Section 307 - Pretreatment Effluent Standards, effluent limitation guidelines for existing sources, standards of performance for new sources and pretreatment standards for new and existing sources have been and are being published (Federal Register, February-July, 1975). The categories of sources refer to categories of industry types and are listed as 40 CFR Parts 401-699 in Section 306(b). To date guidelines or proposed rules have been issued for Parts 401 - 450.

Pretreatment standards apply to "major contributing industries" discharging pollutants to a publicly owned treatment works. "Major contributing industry" is defined in 40 CFR Part 128.124 (Federal Register, December, 1973) as an industrial discharger meeting any of the following conditions:

. . . (a) has a flow of 50,000 gallons or more per average work day; (b) has a flow greater than five percent of the flow carried by the municipal system receiving the waste; (c) has in its waste a prohibited concentration of a toxic pollutant . . . (as specified in 40 CFR Part 129); or (d) (is found) . . . to have significant impact, either singly or in combination with other contributing industries, on that treatment works or upon the quality of effluent from that treatment works.

"Incompatible pollutants" are defined in 40 CFR Part 128.121 and 128.122 as any pollutant other than BOD, suspended solids, pH and fecal coliform, plus any other pollutant which the sewage plant is specifically designed to remove and does remove . . . to a substantial degree . . ." (Ibid., 1973).

Under Section 311(B), the Administrator is required to publish in the Federal Register a determination of designated hazardous substances and their removability. The EPA proposed rules for the "Designation and Determination of Removability of Hazardous Substances From Water" appear as 40 CFR Part 116 (Federal Register, August, 1974).

The Safe Drinking Water Act, Pub.L. 93-523 (Safe Drinking Water Act, 1974) was enacted to amend the Public Health Service Act and to assure the public is provided with safe drinking water. The Act requires that the Administrator shall promulgate and publish in the Federal Register national primary and secondary drinking water regulations. A report shall be issued which includes: (1) recommended maximum contaminant levels for national primary drinking water regulations and (2) a list of contaminants (the level of which in drinking water cannot be determined but which may have adverse effects on the health of a person). The Act applies to public water supply systems and designates the states with primary enforcement responsibility. Preliminary draft interim primary drinking water standards have been issued in the Federal Register March 14, 1975 (Federal Register, March 1975). Standards have been issued for bacteria, turbidity, inorganic chemicals, and a composite standard for organic chemicals, but no standards for various organics have been issued. Proposed maximum contaminant levels for inorganic

chemicals in mg/l are as follows:

arsenic	0.05 mg/l
barium	1.00 mg/l
cadmium	0.01 mg/l
chromium	0.05 mg/l
cyanide	0.20 mg/l
lead	0.05 mg/l
mercury	0.002 mg/l
nitrate as N	10.00 mg/l
selenium	0.01 mg/l
silver	0.05 mg/l

Limits to fluoride concentrations range from 1.1 to 1.8 dependent on maximum daily air temperatures. Maximum contaminant levels for organic chemicals, as determined by the carbon chloroform extract method, are not to exceed 0.7 mg/l.

The proposed "Toxic Substances Control Act," S. 776 (U.S. Congress Senate, 1975) was scheduled for hearing to resume in the Senate April 15, 1975, and it appears that it will be late summer before Congress finishes work on the legislation. The legislation gives the EPA the authority to regulate and control the testing of new chemical substances and to regulate use and distribution of chemical substances. The basic control strategy is based upon premarket testing; issuance of regulations on use and distribution, processing, or importing the chemical substance; issuance of standards for test protocols; and inspection of manufacturers. "Chemical substance" is defined as any organic or inorganic substance of a particular molecular identity or any chemical radical or element.

The proposed "Materials and Energy Recovery Act of 1975," S. 1474 (U.S. Congress, Senate, 1975) is proposed to amend the Solid Waste Disposal act as amended by the Resource Recovery act and to encourage resource recovery through conservation of waste. The Act would authorize State program and implementation grants, would encourage full recovery of energy and resources from solid wastes, and would reduce waste and would control the disposal of hazardous wastes. The proposed law would prohibit "the disposal of any designated hazardous waste in harmful quantities as determined by the Administrator" of EPA. There would be a system of controls and permits that would prevent disposal of hazardous wastes. Under Section 209 the Administrator will be required to:

. . . promulgate standards for collection, handling, disposal, and recovery of all hazardous and other solid wastes that may cause air or water pollution or other environmental degradation.

(b) Such standards shall:

- (1) identify hazardous and other wastes to be regulated;
- (2) be specific in terms of allowable quantities, concentrations, and the physical, chemical, or biological properties of such waste, taking into account likely disposal sites and methods of disposal or recycling;
- (3) contribute to the achievement and maintenance of Federal, State, and local emission or effluent limitations, air quality implementation plans, and established or proposed land use plans.

Section 211 states that the Administrator:

. . . may require the operator of any disposal system for hazardous or other designated solid wastes to:

- (1) establish and maintain records which identify type and quantity of wastes identified in Section 209.
- (2) make reports semiannually to the appropriate state agency to identify type and quantity of wastes identified in reports in paragraph (1);
- (3) install, use, and maintain monitoring equipment and provide methods designed to protect the environment against unauthorized discharge of hazardous or other designated wastes; and . . .

Under Section 213 the Administration would be required to establish and publish within one year guidelines for resource recovery.

These guidelines would specify:

. . . percentages of energy and resources that can be recovered from solid waste by use of the best recovery management practices and technology that are reasonably available. These guidelines shall specify those materials which constitute a significant portion of the solid waste stream, including but not limited to:

- aluminum;
- copper;
- glass;
- iron and steel;
- paper, lumber, and other wood products;
- petroleum and other petroleum products;
- plastics and other synthetic materials;
- rubber; and
- zinc.

State Legislation

Only five states have enacted hazardous waste management legislation, and Oklahoma is not among those on the list. However, there are several state laws which regulate certain phases of the hazardous wastes system.

The Oklahoma Solid Waste Management Act of 1970 (Oklahoma, 1971) regulates the disposal of hazardous waste (other than radioactive waste). Under Section 5.2 of the Act, disposal of hazardous waste must be in a site or facility operating under a permit issued from the State Department of Health. In Section 5.3 it is stated that an impervious lining "may be required" for a disposal site. There are general regulations regarding soil characteristics, criteria, thickness, and continuity of clay strata, security, special unloading operations, site

monitoring, closure of sites and facilities, permit procedures, and collection and transportation procedures. There are no specific controls or recommendations in the Act regarding separation of wastes, methods of treatment, disposal, and storage.

Article 16, Section 1601-1602 of the Oklahoma Public Health Code (Oklahoma, 1973) defines hazardous substances and specifies regulations regarding labels, packaging, and introduction into commerce of hazardous substances. The regulations conform to the Federal Hazardous Substances Labeling Act but do not deal with the disposal, treatment, handling, or storage of hazardous materials.

Under the authority of the Oklahoma Clean Air Act, Title 63, Section 2001-2003 (Oklahoma, 1971) the Air Quality Service of the State Department of Health is designated as the administrative agency and authorized after public hearing:

. . . to adopt, amend, or repeal rules and regulations for the control and abatement of air pollution . . . standards for discharge of air contaminants to the atmosphere and such additional rules and regulations as it deems necessary to protect the public health, safety, and welfare of the public.

Under the statutory authority of this Act, nineteen regulations have been adopted. Regulation No. 19 - Control of Emissions of Hazardous Air Contaminants (Oklahoma, State Department of Health, 1974) has been adopted and approved on December 1, 1974. Under Section 19.2 of the regulation, the definition of hazardous air pollutants conforms to the definition stated in Section 112 of the Clean Air Act as amended in 1970 (The Clean Air Act Amendments of 1970, 1970).

The National Hazardous Pollutant Emission Standards as published in the Federal Register are adopted in Section 19.3 of the regulations and apply to both existing and new sources of contaminants. Statutory responsibilities that stipulate requirements of the Federal Clean Air Act with respect to state implementation plans are found in Title 40, Chapter 1, Sub-chapter C, Part 52, Subpart LL, paragraphs 52.1920 through 52.1925 in the Federal Register.

The Oklahoma Statutes that delineate the authority to state agencies to control and monitor the water environment can be found in Title 63, Article 9, Sections 1-901 to 1-913, and Article 19, Section 1701; Title 59, Sections 1101-1116; (Oklahoma, 1963). The statutes and numerous amendments have established various state agency's regulatory authority, have provided for water and wastewater monitoring and the development of quality standards as well as effluent standards. Under the amendments of 1974 to Title 63, Article 9 - Sewage, Section 1-908 (Environmental Reporter, 1975) the State Commissioner of Health must be notified by a manufacturer or industrial waste processor 60 days prior to discharging waste into a sewer.

Said notice shall include such information regarding the volume, strength, and chemical constituents of the wastes as the State Commissioner of Health may determine to be necessary to evaluate treatment and the receiving waters. No change shall be made in operation which will exceed the approved volume, strength, or chemical constituent of the waste without a further sixty days notice . . .

The Water Quality Service of the State Department of Health has developed a proposed Model Industrial Waste Ordinance (Oklahoma State Department of Health, 1975). Section 4 (b) - Heavy Metals and Toxic Materials states:

The following concentrations of toxic substances may not be exceeded in the receiving stream and are included herein as a guideline for discharge to the collection system.

<u>Element</u>	<u>mg/l</u>	<u>Element</u>	<u>mg/l</u>
Arsenic	0.05	Mercury	0.002
Barium	5.0	Nickel	1.0
Boron	1.0	Selenium	0.05
Cadmium	0.04 soft 0.01 hard	Silver	0.1
Chromium	0.5	Zinc	0.5
Copper	0.05 soft 1.0 hard	Iron	3.0
Lead	0.1	Cobalt	0.5
Manganese	0.5		

Land use regulations and zoning are under local or municipal jurisdiction and control.

The appropriation bill to the State Department of Health, Senate Bill No. 76 (Oklahoma, 1975), contains an amendment which restricts the use of the permitted hazardous waste sites in Oklahoma. The Act was signed June 12, 1975 by the Governor. Section 2262 of the Act states that:

Hazardous waste disposal sites may not be used as disposal sites for hazardous materials, as defined by the Department of Health, brought into Oklahoma from any state for the purpose of disposal unless the state of origin enters into a reciprocity agreement with substantially similar standards for hazardous waste disposal with the State of Oklahoma. Said agreement must be approved by Joint Resolution of the Oklahoma House of Representatives and Senate and must be signed by the Governor of Oklahoma. No person shall be issued a permit for a hazardous waste disposal site, nor shall any permit be valid, unless the applicant or recipient of the permit has on file with the State Department of Health a current corporate security bond in the amount of One Hundred Thousand Dollars (\$100,000.00)

guaranteeing that the permittee has the resources to properly close the site, in accord with the rules and regulations of the State Board of Health, and to answer for damages to any person, property or animals due to the violation of any standard or regulation established by the State Board of Health for the location and operation of a hazardous waste disposal site. Any hazardous waste disposal site operating in violation of this section shall, by action of the State Department of Health, and in addition to any other penalties provided herein, be prohibited from further operation through revocation of its permit.

Treatment and Disposal

Both the quantity and composition of today's wastes are changing rapidly as a result of the implementation of pollution abatement legislation. Air, water, and thermal pollution abatement practices by industries are responsible for the increased volume of industrial sludges and slurries. Process residuals are being removed from their former waste stream media (i.e. air and/or water) and are being concentrated for disposal. Various studies have stated that technology is available to physically, chemically, or biologically treat hazardous wastes, however, the technologies in existence have allowed minor emissions and effluent concentrations depending upon the environmental regulations and the degree of enforcement and control. It appears that there needs to be a reassessment of the present technologies with the zero pollutant discharge criteria included and with the increased volume and more concentrated residuals considered (Eldredge, 1974).

The review of related literature has been limited to the various SIC industry types and the process wastes typically produced by these industries found in the state. Included is a general discussion of treatment and disposal/storage alternatives. Recommendations for treatment and disposal technologies for specific industries and the source references are included in chapter 4 (USEPA, 1975). It was not considered within the scope of this study to review the literature dealing

with treatment of non-hazardous wastes or total process residuals from the selected industries in the study.

Any discussion of current treatment practices and control devices ought to encompass methods utilized to handle wastes in various media - i.e. water, air, or solid.

The wastewater treatment methods used in industry are similar to the basic municipal sewage treatment methods and are usually divided into three phases: primary, secondary, and tertiary:

<u>Primary</u>	<u>Secondary</u>	<u>Tertiary</u>
Screening	Activated sludge	Ammonia stripping
Equalization or Neutralization of pH adjustment	Extended aeration Trickling filters	Coagulation and Precipitation
Oil Separation	Aerated lagoons	Filtration and Microscreening
Floatation, Flocculation or Clarification	Waste stabilization ponds Chemical oxidation	Carbon Adsorption Disinfection Electrodialysis Ion exchange Reverse osmosis Evaporation

The sludges that are created by water treatment processes are subject to the same treatment methods applied to the water streams and are typically treated by the following methods: (1) aerobic stabilization, (2) anaerobic digestion, (3) lagooning, and (4) heat treatment. Dewatering methods include: (1) filter processes, (2) vacuum filters, (3) centrifuges, and (4) sand-drying beds.

For the control of air pollutants, unlike water treatment methods, there is no simple set of treatments which can insure clean air. The "Status of Current Technology in the Control of Emissions to the Atmosphere" was presented in hearings on the Air Quality Act, Part IV (Subcommittee on Air and Water Pollution of the Senate Committee on Public Works, 1967).

Because of the wide variety of toxic compounds that are emitted from industrial processes, each control system must be designed for a specific industrial process for specific emission standards.

The basic control equipment for gaseous pollutants includes mechanical centrifugal cyclones, wet scrubbers, fabric filter devices, electrostatic precipitation, and direct flame and catalytic afterburners as shown in figure 2 (Bowen, 1973). Other control strategies proposed by the U.S. Department of Health, Education and Welfare have included plant relocation, plant shutdown, fuel substitution, and process changes.

Generally adequate control technology has been available since 1967, but its application has lagged behind due to economics and the lack of adequate means for enforcement.

As the methods used to treat and control wastewater and pollutants find increased application, the disposal of solid wastes becomes a greater problem. In the early 1960's control technology for solid waste management was limited to the open dump, a few incinerators and a handful of composting operations. Most of the recent technology has developed since passage of the Solid Waste Management Act of 1965. Booz-Allen (Booz-Allen, 1973) diagrams the handling, treatment, and disposal options utilized as shown in figure 3.

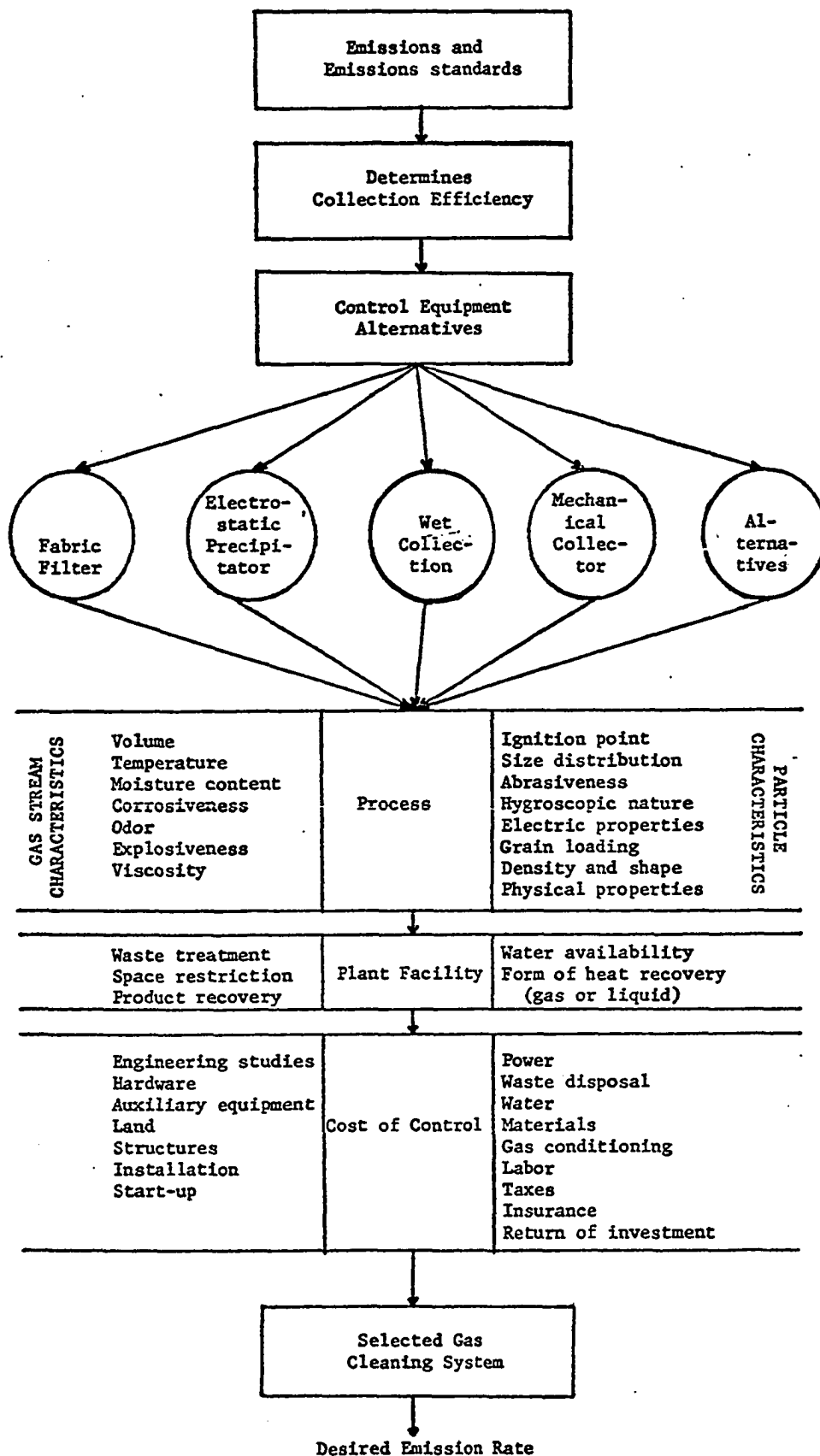


Figure 2. Criteria for Selection of Gas Cleaning Equipment

Source: HEW

PRE-TREATMENT	THICKENING	TREATMENT	DEWATERING	TRANSPORT	PARTIAL DISPOSAL	ULTIMATE DISPOSAL
Polyelectrolytes	Gravity	Aerobic Stabilization	Filter Press	Pipe	Incineration	Land Reclamation
Lime	Centrifuge	Anaerobic Digestion	Vacuum Filter	Truck		Landfill
Ferric Chloride	Flotation	Lagooning	Centrifuge	Rail		Ocean
Alum		Heat (Porteous)	Sand Drying Beds	Barge		
Diatomaceous Earth		Heat (Zimmerman)				
Fly Ash		Heat (Farrer)				

Figure 3. The Handling, Treatment, and Disposal Options for Solid Waste

Alternatives to the Management of Hazardous Wastes at National Disposal Sites (Little, 1973) limited their consideration to eight general categories of waste types and rely upon TRW for suggested methods of treatment. The eight categories of chemical types used in the study were:

1. Concentrated heavy metals
2. Dilute heavy metals
3. Heavy metals with organics
4. Heavy metal sludges
5. Concentrated cyanide
6. Dilute cyanide with heavy metals
7. Liquid waste with chlorinated hydrocarbons
8. Organic wastes requiring rotary kiln

Further review and recommendations from the study by Arthur D. Little, Inc. will be incorporated into following subsections that deal with hazardous wastes by SIC industry group.

The TRW Systems Groups, Inc. study (Ottinger, 1973) considered 45 basic waste treatment techniques employed in pollution abatement as shown in table 1. The criteria for selection from the list of 45 were:

1. The process should be one that is applicable to the treatment of hazardous wastes.
2. The process should be one that is a candidate process for National Disposal Site utilization (not a municipal or common industrial type).
3. The process should be a major unit treatment component. Pretreatment processes and add-on facilities for subsequent treatment should not be included.
4. Processes that are standard chemical engineering unit operations and are applicable to a wide variety of other uses should not be included.

5. Chemical treatment processes that are not "equipment oriented" should not be included.

Using the five criteria listed, fifteen processes were selected and appear in table 1.

Battelle (Program Management, 1973) made recommendations for a model facility (a national disposal site (NDS)) capable of processing a wide variety of hazardous wastes. Of 39 potential physical, chemical and biological treatment processes reviewed for an NDS, the biological processes were rejected because of the toxic nature of hazardous waste, expected variable character, and throughput. The following physical and chemical processes were selected to provide broad treatment capabilities for a model NDS:

1. Neutralization (of acids and bases)
2. Oxidation (of cyanides and other reductants)
3. Reduction (of chromium-6 and other oxidants)
4. Precipitation (removal of heavy metals)
5. Flocculation, sedimentation and filtration (separation of solids from liquids)
6. Carbon sorption (removal of organics)
7. Incineration (of combustible wastes)
8. Ammonia stripping (removal of ammonia)
9. Evaporation (concentration of waste brines)

Disposal storage methods recommended were incineration, land burial, and sanitary landfilling. Disposal for the liquid and solid wastes generated by the NDS "include ocean dumping and deep well injection for liquid brine wastes which do not contain hazardous constituents and landfilling for solid wastes." Landfilling consists of two types:

TABLE 1

PROCESS DESCRIPTION LOCATIONS

Process Category	Process Description	Volume No.	Page No.
Ultimate Disposal Processes	Deep Well Disposal	III	1
	Land Burial	III	19
	Landfill Disposal	III	45
	Ocean Dumping	III	69
	Incineration	III	99
Biological Treatment Processes	Activated Sludge	IV	1
	Aerated Lagoons	IV	27
	Oxidation Ponds	IV	43
	Trickling Filters	IV	55
Physical Treatment Processes	Dialysis	IV	69
	Electrodialysis	IV	91
	Reverse Osmosis	IV	129
	Radioactive Waste Solidification	IV	145
Chemical Treatment Processes	Pyrolysis	III	291
	Ion Exchange	IV	113

SOURCE: TRW Systems Group, Inc.

1. Secured landfills especially designated for the disposal of sludges containing significant concentrations of hazardous substances (e.g., arsenic), and
2. Conventional landfills for burial of solid wastes which do not contain significant concentrations of hazardous substances. Perpetual surveillance will be maintained over the secured landfill as in a radioactive waste burial site.

Management Guidelines

The fact that there is a growing problem and potential for severe adverse impact both to public health and the environment has been substantiated by numerous studies and surveys previously reviewed. This points to the need for the development of a hazardous waste management system and the development of guidelines and standards. The related literature that has been reviewed will be discussed and presented into two subsections, management and guidelines.

Management

The first two studies dealing with the management question as it relates to hazardous waste were conducted in response to Section 212 of the Resource Recovery Act. Alternatives to the Management of Hazardous Wastes at National Disposal Sites (Funkhauser, 1973) describes the basic alternative approaches to the management of hazardous wastes as:

1. process hazardous wastes "on-site" (i.e., at the plant where they are generated)
2. process "off-site" at some regional facility (either public or private)
3. combine on-site pretreatment with off-site treatment and disposal

The basic alternatives were evaluated with respect to the economics associated with waste treatment, immediate risk to human safety, as well as the eventual hazard to the environment, and legal and institutional

issues that would have an impact on a national treatment system. The study concluded that on the basis of economics alone, option (2) is preferable with the possible exception of those who handle explosives and dilute aqueous wastes. Option (3) is preferable for dilute aqueous toxic metal wastes.

Battelle's study (Program Management, 1973) dealt with five key areas: (1) identification and designation of hazardous wastes, (2) waste management methods and costs, (3) radioactive wastes, (4) siting considerations for waste treatment and disposal, and (5) implementation. Conceptual design and cost estimates were considered for a complete waste management system. Parts of summaries of thirteen conclusions and findings of the second area, waste management methods and costs are as follows:

1. Hazardous wastes are generally complex mixtures of several chemical species. Therefore, more than one treatment method is frequently required to convert the waste to a form suitable for disposal and/or reuse. Treatment for non-hazardous constituents within a hazardous waste may dictate the type of process used and may entail the most significant operational costs (e.g., acid neutralization).
2. Major site types required for a national hazardous waste management system include a processing site to treat the wastes and a disposal site for burial of the hazardous residue generated at the processing site. Processing sites may be located near the sources of the wastes while the disposal sites may be located in arid regions of the Western United States to avoid potentially high costs of non-leachable containment.
3. Regulations should be considered for specifying incineration or some other form of destructive disposal for all wastes defined as hazardous solely on the basis of explosivity or flammability.
4. Thirty-nine potential physical, chemical, and biological treatment processes were reviewed for possible use in the model processing facility. Because of the toxic nature of the hazardous wastes, expected variable chemical character, and throughput, biological processes were rejected and the physical/chemical processes were selected to provide broad treatment capabilities in the model processing facility: . . .

5. Using the best technology that has been demonstrated on an engineering or plant scale, conceptual designs were prepared for a medium-sized model processing facility capable of treating 122,000 gallons per day of wastewater and 74 tons per day of combustible water.
6. Preliminary capital and operating cost estimates for the medium-sized processing facility are \$24,000,000 and \$39,000 per day, respectively. Wastewater processing costs were estimated to average 20 cents per gallon and incineration costs to average \$175 per ton.
7. Preliminary capital and operating cost estimates were prepared for a small facility capable of processing 25,000 gallons per day of wastewater and 15 tons per day of combustible waste. A capital cost of \$7,300,000 and an operating cost of \$14,000 per day was estimated. Wastewater processing cost was estimated at 35 cents per gallon and incineration cost at \$400 per ton.
8. Preliminary capital and operating cost estimates were also prepared for a large facility capable of processing 1,000,000 gallons per day of wastewater and 600 tons per day of combustible waste. A capital cost of \$86,000,000 and an operating cost of \$186,000 per day were estimated. Wastewater processing cost is 12 cents per gallon and the incineration cost is \$100 per ton.
9. On an overall national basis it is expected that plant sizes and geographic distribution will evolve as a consequence of market forces. A reasonable prediction, however, is that the national needs can be met in the near term by five large-sized and fifteen medium-sized processing plants. On this basis, the overall national costs will be about \$800 million in capital investment and about \$580 million per year for operating costs.
10. It is anticipated that private processors will design treatment facilities to process both hazardous and non-hazardous (polluting) wastes to benefit from economies of scale. The volume of non-hazardous wastes may exceed the volume of hazardous wastes by considerable margins in many areas.
11. Resource recovery is expected to be practiced in the non-hazardous waste processing area, particularly for waste solvent recovery. Heavy metal and oil recovery may also be economically attractive.
12. Further studies on burial of waste sludges in landfills are recommended to determine the long term stability and leachability of the sludges under a variety of conditions, including the admixture of fixation agents.

13. A paucity of data exists on the concentration of specific hazardous substances (e.g., pesticides) in the gaseous wastes from different incineration systems under variable operating conditions.

The "Federal Program for Hazardous Waste Management" and the strategy behind the development of that program is discussed in an article by the Director of Solid Waste Management Programs (OSWMP), EPA (Lehman, September 1974). The thrust of the Federal Program has been divided into three main areas: (1) development of a data base including studying incineration, chemical treatment, and special landfill as technical options for hazardous waste management, (2) development of guidelines and standards, and (3) program implementation. Mr Lehman stated that the:

. . . main strategy will be to concentrate hazardous waste of the source rather than to dilute them into the environment. Hazardous waste concentration minimizes handling and transport problems, makes resource recovery from these wastes economically more attractive, and allows better management control. Such concentration will occur naturally as air and water pollution control systems extract . . . pollutants . . .

The concept of a hazardous waste clearing house is supported, however, no details of this concept were given. Since the responsibility and mission of the OSWMP is to protect the land and minimize the hazardous waste disposal to the land, it is understandable that there would be strong support for hazardous waste recycling or detoxification treatment prior to land disposal whenever possible. The following recommendations were stated:

1. Primary emphasis on material recovery both for resource conservation and reduction of environmental impacts
2. If hazardous waste cannot be used or materials recovered from it, and if it can be safely burned, the next method recommended would be destruction by incineration with energy recovery during this operation, if possible

3. Non-burnable wastes should be detoxified and neutralized by chemical or biological treatment, where possible, to minimize the amounts of toxic materials destined for land disposal
4. For hazardous wastes not amenable to recovery or destruction, volume reduction to minimize land use requirements is recommended, followed by isolation techniques, such as encapsulation, prior to land burial in specially designated landfills which in turn may be isolated from ground water supplies by natural geologic formations or artificial membranes.

Hazardous Waste Management Facilities in the United States is a publication which will be issued periodically in the future by EPA (USEPA, 1974). The first publication included a list of enterprises that are in the business of accepting and disposing of various hazardous wastes and a summary table of hazardous waste disposal operations listed by state.

Guidelines

The development of guidelines for hazardous waste management practices is relatively new. To date there are no "official," Federal guidelines that have been issued on the topic, although hazardous waste guidelines are being developed by OSWMP, EPA (Lehman, June 1974), similar to those for sanitary landfilling operations and thermal processing operations. The few publications that exist have primarily been generated by states.

Under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act as amended in 1972, EPA has issued procedures and regulations concerning the disposal and storage of excess pesticides and pesticide containers entitled "Regulations for the Acceptance of Certain Pesticides and Recommended Procedures for the Disposal and Storage of Pesticides and Pesticide Containers," Part 165 (Federal Register, May, 1974).

Under the authority of the Solid Waste Disposal Act, as amended by the Resource Recovery Act of 1970, EPA has issued guidelines for solid

waste management practices. Part 120 is "Guidelines for the Thermal Processing of Solid Wastes" and Part 241 is "Guidelines for the Land Disposal of Solid Wastes" (Federal Register, August, 1974). These guidelines "do not apply to hazardous, agricultural, and mining wastes because of the lack of sufficient information upon which to base recommended procedures."

The Solid Waste Management Division of the Oklahoma State Department of Health has issued "Guidelines #2 - Sanitary Landfill Standards Compliance and Reason" (Oklahoma, State Department of Health, 1974). Section 4.1.15 relates to hazardous wastes:

Sewage solids or liquids, and other hazardous wastes shall not be disposed of in a sanitary landfill except when special permission by the Commissioner of Health has been given. . .

Guidelines for Landfill of Toxic Industrial Sludges was presented at the Twenty-Eighth Industrial Waste Conference (Curry, 1973). To develop guidelines for landfilling of this type of wastes, it was suggested that information be obtained on details of composition (including all of the information that could affect its reaction with other sludges), conditions for removal or the process to produce acceptable effluent concentrations, refusal of unacceptable wastes (especially wastes of unknown composition and characteristics), pretreatment of some wastes, precautions to be taken to maintain incinerability, segregation into safely mixed classes, protection against water infiltration, surveillance of handling to prevent leachates, and treatment of leachate if toxic or contaminated. It is recommended that the same effluent limits be maintained on leachate from an industrial or hazardous waste landfill as would be required for any other industrial discharge to groundwater or to intermittent streams.

Guidelines for the Management of Hazardous Solid Wastes was prepared by the Solid Waste Management Section for the State of Georgia (Georgia, 1974). The guidelines govern the handling and the disposal of hazardous wastes in approved locations. The guidelines include criteria for the management of empty hazardous waste containers, procedure for rinsing or detoxification of empty hazardous waste containers, criteria for disposal site approval, criteria for hazardous site operation, and criteria for hazardous waste site monitoring. The establishment of "fair share" services charges based upon weight or estimated volume in cubic yards was recommended to implement and maintain such a management program.

The State of California has been one of the leaders in efforts to control disposal of hazardous wastes and the development of guidelines. Several reports have been published as a result. Guidelines for Hazardous Waste Land Disposal Facilities (California, 1973) was published as a supplement to the Hazardous Waste Disposal Survey - 1971 (California, 1972). The guidelines were developed for the planning, development, and management of disposal operations of hazardous waste sites to be used by disposal site planners and operating personnel. The report includes a section relating to operating methods, prerequisite planning functions, site management procedures, operational safety precautions, and considerations governing reuse of a completed disposal area.

California Guidelines for the Handling of Hazardous Wastes (California, 1974) includes in the appendix the regulations for haulers and operators of disposal sites as specified in Article 5, Chapter 2, of Title 22 of the California Administrative Code. The report includes a copy of the Liquid Waste Haulers Record to be submitted monthly, a

schedule of fees, criteria for the identification of hazardous wastes, and a summary of potentially noncompatible waste materials with a list of guidelines to be used in their handling and disposal.

Summary

Based upon the review of the available related literature, it can be said that there is no adequate definition or classification system of hazardous wastes. There are a number of definitions and classifications systems in use; however, it is apparent that the selection criteria based upon the chemical name or chemical compound in pure form is the basis upon which the Federal legislation has developed and is developing. A number of methods have been employed to quantify hazardous wastes, but these methods are crude and can only result in gross estimates. A number of surveys have been conducted, but only a few have been successfully completed. Those completed had a very percentage of return. The surveys have pointed out that there is a substantial amount of hazardous wastes being generated, there is a need for control of the disposal of hazardous wastes, and there is a need for the development of hazardous waste management. There currently is not adequate Federal or state legislation to control the disposal of hazardous wastes. However, if the proposed Federal legislation is passed and implemented, there may be adequate controls. The technology is available to treat most types of hazardous wastes but is economically not feasible. There are a number of feasible management alternatives that have been proposed. A few guidelines have been developed at the state level, but no Federal guidelines have been issued to date. There is a definite need for the development of the guidelines at the state and Federal level for the management of hazardous wastes.

CHAPTER III

METHODS AND PROCEDURES

The methods and procedures described in this chapter should allow for the replication of the data by the same methods utilized; in other words, the characterization of selected industries, the determination of the quantities of hazardous wastes presently being generated on an annual basis by the various selected industries within the State of Oklahoma, recommended treatment and disposal/storage methods, and the development of management guidelines. The following chapter has been subdivided into several sections including the four phases described in chapter I. The sections have been organized and presented in chronological order as follows: selection of industries, list of hazardous substances, phase I, phase II, phase III, and phase IV.

Selection of Industries

The Standard Industrial Classification (SIC) System that was developed by the Federal Government was used to classify the various industries selected for this study. The Standard Industrial Classification Manual - 1972 (Executive Offices of the President, 1972) was the reference used since it was the most recent edition. This system

provides for uniformity in the classification of industrial establishments by type of activity. The structure of the system allows for classification of industries on a two-digit, three-digit, four-digit, etc., industrial group basis according to the level of detail considered most appropriate. Industries selected for the study were classified and characterized by four-digit SIC numbers where possible. The two-digit SIC major group numbers and their corresponding product description are listed in table 2. A complete list of the three and four-digit SIC code numbers and corresponding product descriptions of the selected industries that are in operation in Oklahoma appears in appendix B.

The industries which were selected to be included in the study were all the manufacturing industries and seven types of mining industries within the state. SIC code numbers for manufacturing industries are #2011 through #3999 (Ibid., 1972). The mining industries that were selected for inclusion in the study were those with the SIC code numbers 1021, 1031, 1092, 1094, 1099, 1311, 1321. The following list describes these SIC numbers by products and at the same time is an example of the SIC classification system:

<u>Major Group 10 - Metal Mining</u>		
<u>Group No.</u>	<u>Industry No.</u>	<u>Description</u>
102		Copper Ores
	1021	Copper Ores
103		Lead and Zinc Ores
	1031	Lead and Zinc Ores
109		Miscellaneous Metal Ores
	1092	Mercury Ores
	1094	Uranium-Radium-Vanadium Ores
	1099	Metal Ores-Not Elsewhere Classified
<u>Major Group 13 - Oil and Gas Extraction</u>		
131		Crude Petroleum and Natural Gas
	1311	Crude Petroleum and Natural Gas
132		Natural Gas Liquids
	1321	Natural Gas Liquids

TABLE 2

MAJOR GROUP NUMBERS OF THE STANDARD INDUSTRIAL CLASSIFICATION
FOR SELECTED INDUSTRIES IN OKLAHOMA

Major Group No.	Description
<u>Division B: Mining</u>	
10	Metal Mining
13	Oil and Gas Extraction
<u>Division D: Manufacturing</u>	
20	Food and Kindred Products
22	Textile Mill Products
23	Apparel and Other Finished Products Made from Fabrics and Similar Materials
24	Lumber and Wood Products, Except Furniture
25	Furniture and Fixtures
26	Paper and Allied Products
27	Printing, Publishing, and Allied Industries
28	Chemicals and Allied Products
29	Petroleum Refining and Related Industries
30	Rubber and Miscellaneous Plastics Products
31	Leather and Leather Products
32	Stone, Clay, Glass, and Concrete Products
33	Primary Metals Industries
34	Fabricated Metal Products, Except Machinery and Transportation Equipment
35	Machinery, Except Electrical
36	Electrical and Electronic Machinery, Equipment and Supplies
37	Transportation Equipment
38	Measuring, Analyzing, and Controlling Instruments; Photographic, Medical, and Optical Goods; Watches and Clocks
39	Miscellaneous Manufacturing Industries

There were no metals mining industries operating within the State of Oklahoma of the SIC code numbers 1092, 1094, and 1099 (Oklahoma, Department of Mines, 1974; Personal Communication, 1974). There were two industries of the SIC code number 1021 - copper ores and one industry of the SIC code number 1031 - lead and zinc ores on the original list of industries.

The five metals mining industries were considered for inclusion in the study because they were on the Group I list of specific industries studied by the Hazardous Waste Management Division of the CSWMP, EPA (refer to appendix C). The series of studies was designed to identify and quantify potentially hazardous wastes and applicable treatment/disposal technology. The selection of industries included on the Group I list was based upon two criteria: (1) the number of hazardous constituents appearing in industry waste streams, and (2) the estimated total annual quantity of hazardous waste generated. After examination of a number of industry categories, the occurrence of eleven materials deemed hazardous were necessary to qualify the industry under the first criterion. The second criterion was obtained from two EPA contract studies by TRW Systems Group, Inc. (Ottinger, 1973) and Battelle Northwest Laboratories (Program Management, 1973) that included preliminary estimates of hazardous volumes. The industries were again ranked by the volume of hazardous waste found in waste streams. To obtain a composite rank, the rank scores were used in choosing which industries were studied. The thirteen industries chosen to be studied in detail are listed in appendix C and the SIC code numbers and descriptions appear in table 3.

TABLE 3

LIST OF INDUSTRIES THAT ARE POTENTIAL HAZARDOUS WASTE GENERATORS

SIC	Description
<u>Division B: Mining</u>	
1021	Copper Ores
1031	Lead and Zinc Ores
1092	Mercury Ores
1094	Uranium-Radium-Vanadium Ores
1099	Metal Ores, Not Elsewhere Classified
<u>Division D: Manufacturing</u>	
223	Broad Woven Fabric Mills, Wool (Including Dyeing and Finishing)
226	Dyeing and Finishing Textiles, Except Wool Fabrics and Knit Goods
281	Industrial Inorganic Chemicals
282	Plastics Materials and Synthetic Resins, Synthetic Rubber, Synthetic and Other Man-Made Fibers, Except Glass
283	Drugs
285	Paints, Varnishes, Lacquers, Enamels, and Allied Products
286	Industrial Organic Chemicals
2879	Pesticides and Agricultural Chemicals, Not Elsewhere Classified
2892	Explosives
291	Petroleum Refining
301	Tires and Inner Tubes
302	Rubber and Plastics Footwear
303	Reclaimed Rubber
304	Rubber and Plastics Hose and Belting
306	Fabricated Rubber Products, Not Elsewhere Classified
311	Leather Tanning and Finishing
331	Blast Furnaces, Steel Works, Rolling and Finishing Mills
3321	Gray Iron Foundries
3322	Malleable Iron Foundries
3324	Steel Investment Foundries
333	Primary Smelting and Refining of Nonferrous Metals
3341	Secondary Smelting and Refining of Nonferrous Metals
3399	Primary Metal Products, Not Elsewhere Classified
3471	Electroplating, Plating, Polishing, Anodizing and Coloring
355	Special Industry Machinery, Except Metalworking Machinery
357	Office, Computing, and Accounting Machines
3691	Storage Batteries
3692	Primary Batteries, Dry and Wet

SOURCE: EPA

The two types of oil and gas extraction mining industries were included in the study, because of the large number of oil and gas wells and consequently the large volume of production of petroleum, natural gas, and associated products in Oklahoma.

List of Hazardous Substances

The list of hazardous substances utilized in this study is a composite of several lists and appear in appendix F. The list was compiled from several sources identified in the appendix by the letters A, B, or C:

- A. Report to Congress - Disposal of Hazardous Waste, 1974, pp. 47-8.
- B. Federal Register "Designation and Determination of Removability of Hazardous Substances from Water," vol. 39, no. 164, 22 August 1974, pp. 30467-71.
- C. U.S. Environmental Protection Agency, "Action Guide for State Hazardous Waste Survey" 1974. (Mimeographed.) Appendix C - Potentially Hazardous Waste Constituents and Industrial Sources.

The list of hazardous constituents identified as "C" above in the Action Guide was compiled from three different literature sources:

- 1. Program for the Management of Hazardous Wastes, Battelle Memorial Institute Pacific Northwest Laboratories, 1973
- 2. Recommended Methods, Neutralization, Recovery or Disposal of Hazardous Wastes, TRW Systems Group, Inc., 1973.
- 3. The various proposals submitted by prospective contractors for the Group I and II industry studies (appendix C)

The list "C" above is recommended in the Action Guide to be used by the States as a starting point. It includes the potentially hazardous waste constituents which would be found in the waste streams of the thirteen industries in Group I and II currently under study. The list

was not intended by EPA to be all inclusive and the States are expected to add or subtract to the list where deemed necessary.

The list "B" (Federal Register, August, 1974) was an advance notice of proposed rulemaking by EPA of the intent to create a new Part 116 of Title 40 of the Code of Federal Regulations. A list of substances which the Agency is considering for designation as hazardous under Public Law 92-500, Section 311(B), is included (pp. 30467-71). The substances listed are under consideration because of their harmful effects when released into the aquatic environment in spill situations.

Until the EPA issues an official list of hazardous substances with corresponding maximum toxic effluent or emission standards for industrial point sources under the provisions of The Clean Air Act and amendments, Federal Water Pollution Control Act and amendments, and/or the proposed Materials and Energy Recovery Act, any list of hazardous substances must be considered an interim working list and is not binding. For this reason, the three most recently published lists of hazardous substances have been included in appendix F and are utilized in this study as a reference to answer the question of whether a particular compound or substance was considered hazardous.

Phase I - Industry Characterization

The manufacturing and mining industries selected for the study within Oklahoma were identified and characterized.

Data Sources

The data was obtained from several sources. A copy of a computer tape was obtained from the Public Health Statistics office at the

Oklahoma State Department of Health, which contained the following data regarding all manufacturing industries in the state: (1) SIC code number of the major product of the industry, (2) address of the parent firm, (3) county code number, and (4) total number of employees. The source of the information on the computer tape was obtained from the files of the Oklahoma Employment Security Division, State of Oklahoma.

From the Oklahoma Directory of Manufacturers and Products, 1974 and the Supplement to the Geographical Section - Oklahoma Directory of Manufacturers and Products, 1974 Edition (Oklahoma Industrial Development Department, 1974; Oklahoma, Industrial Development Department, 1975), the data: (1) name of firm, (2) local and/or mailing address, (3) number of production workers, (4) the year established, (5) the market served and (6) the SIC code numbers up to six were obtained. The list of industries on the computer tape was cross-checked against the list in the Directory for completeness and accuracy of information.

The list of industries from the previously mentioned two sources was cross-checked and compared with the 1974, 4th Quarter list of industries maintained at the Oklahoma Employment Security Division offices, State of Oklahoma, for accuracy. The total employment figures as of March, 1974, were obtained from the Oklahoma Employment Security Division.

From the City of Tulsa, Water and Sewer Department, a list of manufacturing industries was obtained. The City of Tulsa independently had initiated its own survey to identify "major" contributing industries within the Regional Metropolitan Utility Authority in order to fulfill the requirements for a grant for construction of a sewer treatment plant from EPA. The list of industries was developed from several

sources:

1. INCOG - Indian Nations Council of Governments
2. 1974 Tulsa Area Manufacturers Directory, Chamber of Commerce
3. City of Tulsa, Water and Sewer Department
4. City Directory
5. Telephone Directory
6. Consultation with city officials and industry management personnel.

The list of industries from Tulsa was cross-checked and compared with the two previously mentioned sources for accuracy.

Data regarding the metals mining industries in the State were obtained from the 1973 Annual Report and the 1974 Annual Report of the Department of Mines, Chief Mine Inspector (Oklahoma, Department of Mines, 1974).

Data regarding the oil and gas extraction industries in the state were obtained from the Oklahoma Corporation Commission. The data from this source were cross-checked and compared to the data from the Oklahoma Employment Security Division.

Data Recording Form

An "Industry Data" form was developed for the compilation of the data for phase I. During the time that the data were collected, the methods used to calculate hazardous waste volumes were changed. Therefore, it was necessary to revise the original "Industry Data" form. The revised "Industry Data Form I" appears in appendix D.

The original list of selected industries obtained from all sources contained approximately 5300 manufacturing and mining industries.

This list was utilized to provide the necessary data, such as name, mailing address, and location, for the industrial waste survey, which is described in phase II. Data obtained from the industrial waste survey were utilized to update the data on the original list, such as change of the name of an industrial firm or change of location. Information regarding the industries that had gone out of business was obtained via the industrial waste survey and the original list was updated accordingly. A complete alphabetized updated list of the names of the selected industries included in the study appears in appendix E.

Phase II - Waste Characterization

The second phase of the study was developed to characterize and describe the hazardous wastes of the various industries selected as determined in phase I. The hazardous wastes of the selected industries were then quantified in order to determine the total volume of hazardous wastes generated annually within the state.

Due to the complexity of the problem, the exact determination of the quantity of hazardous waste being generated from all individual point sources was not possible. A number of factors resulted in the establishment of constraints which required the development of various methods of obtaining data and limited the determination and quantification of hazardous waste generation:

1. No common or "official" definition exists for the term "hazardous waste." The definition in the state statutes in Section 5.1 of the Oklahoma Solid Waste Management Act of 1970 is not specific enough to allow for designation of a list of hazardous wastes difficult and subject to protest by the potential hazardous waste generators.

2. There is very little information available regarding quantities of hazardous wastes generated by various industry types. TRW Systems Group, Inc. and Battelle developed some data on hazardous waste volumes, however, the data should be used with caution, since the estimates were derived from gross and extrapolated data. Current research on the assessment of industrial waste practices is being developed on thirteen industry types through EPA contracts. Two of the thirteen reports from the Group I studies became available during this study (refer to appendix C).
3. There is no common or "official" classification system, selection criteria, list of hazardous wastes, or list of hazardous substances. Without "official" selection criteria any list of hazardous substances must be considered an interim working list, remain flexible, and be updated frequently.
4. Hazardous and non-hazardous wastes are generally thrown together into mixed waste outputs discharged as gas, as liquid, and as solid waste. The mixed waste outputs can have hazardous waste as inputs, may exhibit some, all, or none of the characteristics of the individual hazardous waste inputs and can become hazardous through combinations of non-hazardous waste inputs. The potentially hazardous characteristics of the mixed waste outputs are generally not known or are not available (Barr, 1973).
5. Production processes used by individual industrial establishments within a larger industrial group often differ. For this reason, some industrial plants within an industrial group may generate hazardous wastes while other plants within the same group may not (Ibid., 1973).
6. Methods of recording or reporting certain types of data had not been standardized, such as production volumes. This makes it difficult to combine data that is either not compatible or for which conversion factors do not exist.
7. Much of the data requested on the survey forms could not be obtained or was not known or recorded, such as:
 - a) Water usage, particularly if the source was a private well
 - b) Volume of discharge, if the effluent enters a municipal system or is recirculated
 - c) Production volumes
 - d) Location of disposal sites, if an industrial hauler is contracted to haul wastes to a disposal site

Due to these constraints, the large number of industries in the study, the difficulty in obtaining proprietary information or data held

confidential by industries such as production volumes, and the lack of available data, exact quantification of the hazardous waste being generated from individual point sources was not possible.

In most cases it was necessary to determine the quantity of hazardous wastes for an industry SIC type rather than an individual industrial plant. Where exact characterization of a waste stream from an individual industry plant was not available, an estimation of the quantity of "potentially" hazardous wastes generated was made. That is, the term "potentially" requires the use of the assumption of homogeneous production processes and subsequent generation of typical wastes within an industry SIC type. Therefore, the total quantities of hazardous wastes generated annually were estimations of quantities of "potentially" hazardous wastes and is subsequently referred to as the "sewered" portion of the hazardous wastes generated in the state to distinguish it from the "non-sewered" portion.

It was originally intended that hazardous waste generation factors for each hazardous substance and/or category be applied to available annual production output data of the various industries or SIC groups in order to estimate the total annual hazardous waste generation potential. However, due to the lack of available production output data in sufficient detail, and the reluctance of most hazardous waste generators to reveal production quantities, additional methods were required to calculate production volumes of hazardous wastes.

Selected Industries

The quantification and determination of the total volume of hazardous wastes generated by selected manufacturing and mining industries

as determined in phase I, was limited further in scope for phase II.

The industries selected for phase II were those major SIC numbers (major products) of industries known typically to contain hazardous wastes or hazardous substances. The manufacturing industries selected for phase II were derived primarily from two sources:

1. List of Industries that are Potential Hazardous Waste Generators (refer to table 3)
2. Industries that May Generate Secondary Potentially Hazardous Wastes (refer to table 4)

Three other three-digit and four-digit SIC's each were included in phase II (201, 208, 243, 2452, 3273, and 3531). The data for hazardous waste volumes of these six SIC's appeared in the Washington Report (Washington, 1974). There were a total of 186 four-digit SIC numbers from these two sources that were selected for phase II waste characterization, however, for some of these SIC code numbers there were no industries of that type in operation in Oklahoma. The first list was developed by the use of two criteria: (1) number of hazardous constituents and (2) total annual production, as previously explained. The second list appears in the Program for the Management of Hazardous Wastes, (Program Management, 1973), appendices C and E by Battelle. The data in the second list were compiled from the two previous studies: (1) TRW Systems Group, Inc., and (2) Booz-Allen Applied Research. Appendix C and appendix E includes waste stream data for wastes which qualify as hazardous under both the pure compound approach and the hazardous waste decision model. The manufacturing industries not included on the two previously mentioned lists and known not to typically contain hazardous wastes, such as SIC code numbers 2011-2099 for the food and kindred products, were not considered for waste characterization in phase II. There were 170 such SIC four-digit numbers for selected industries from all sources not included.

TABLE 4

INDUSTRIES THAT MAY GENERATE SECONDARY POTENTIALLY HAZARDOUS WASTE

SIC	Description
<u>Division A: Agriculture, Forestry, and Fishing</u>	
011	Cash Grains
0175	Decisuous Tree Fruits
02	Agriculture Production - Livestock
07	Agricultural Services
08	Forestry
<u>Division B: Manufacturing</u>	
2491	Wood Preserving
2499	Wood Products, Not Elsewhere Classified
26	Paper and Allied Products
27	Printing, Publishing, and Allied Industries
2841	Soap and Other Detergents, Except Specialty Cleaners
287	Agricultural Chemicals
2899	Chemicals and Chemical Preparations, Not Elsewhere Classified
2992	Lubricating Oils and Greases
2999	Products of Petroleum and Coal, Not Elsewhere Classified
321	Flat Glass
322	Glass and Glasswear, Presses or Blown
3231	Glass Products, Made of Purchased Glass
3351	Rolling, Drawing, and Extruding of Copper
3355	Aluminum Rolling and Drawing, Not Elsewhere Classified
3362	Brass, Bronze, Copper, Copper Base Alloy Foundries (Castings)
34	Fabricated Metal Products, Except Machinery and Transportation Equipment
3479	Coating, Engraving and Allied Services, Not Elsewhere Classified
3585	Air Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment
3612	Power, Distribution, and Specialty Transformers
3632	Household Refrigerators and Home and Farm Freezers
3662	Radio and Television Transmitting, Signaling, and Detection Equipment and Apparatus
3671	Radio and Television Receiving Type Electron Tubes, Except Cathode Ray
3672	Cath Ray Television Picture Tubes
3673	Transmitting, Industrial, and Special Purpose Electron Tubes

SOURCE: Program for the Management of Hazardous Wastes, July 1973, by Battelle Pacific Northwest Laboratories, Volume II, Appendices C and E.

TABLE 4-Continued

SIC	Description
3674	Semiconductors and Related Devices
3679	Electronic Components, Not Elsewhere Classified
3721	Aircraft
3724	Aircraft Engines and Engine Parts
3728	Aircraft Parts and Auxiliary Equipment, Not Elsewhere Classified
376	Guided Missiles and Space Vehicles and Parts
<u>Division E: Transportation Communications, Electric, Gas and Sanitary Services</u>	
40	Railroad Transportation
41	Local and Suburban Transit and Interurban Highway Passenger Transportation
42	Motor Freight Transportation and Warehousing
44	Water Transportation
45	Transportation by Air
47	Transportation Services
491	Electric Services
493	Combination Electric and Gas, and Other Utility Services
496	Steam Supply

Data Sources

The data for phase II were obtained from several sources. The data required to determine the total volume of hazardous wastes were dictated by the method of calculation used.

Where available, the exact chemical analysis of the industry's effluent was used. There were a number of sources of this type:

1. The EPA NPDES permits issued through the OWRB
2. The EPA NPDES permits issued through the Oklahoma State Department of Health
3. Industrial Surveys
 - a) Data Form II - survey form sent to all counties except Oklahoma and Tulsa (refer to appendix G)
 - b) City of Tulsa, Water and Sewer Department, "Industrial Influent Source Information," Tul-1676 (refer to appendix H)
 - c) Survey of Oklahoma County and parts of Oklahoma City by TECHRAD and the State Department of Health (refer to appendix I)
4. In a few cases industries had the data

Where the exact waste stream characterization had not been made or where there was more than one industry of a particular SIC code number, production volume data were required in order to calculate the volume of potential hazardous waste generated per unit of product. The annual production volumes were obtained from a number of sources:

1. Corporation Commission for the SIC code number 2911
2. EPA National Emissions Data System (NEDS) from (CMB No. 158-R0095) through the Air Quality Service, State Department of Health for approximately 216 industries which have a point source of air pollutant emissions
3. The EPA NPDES permits issued through the OWRB for approximately 10 industries, that discharge into navigable streams
4. The EPA NPDES permits issued through the Oklahoma State Department of Health for those industries that discharge into municipalities

5. Industrial Surveys (a), b), and c) same as listed on previous page)
6. Personal contacts and interviews with engineers and industry personnel

Data regarding water intake and consumption were obtained from several sources. Where available, municipal water records were checked to obtain volume data of water intake during a twelve-month period. Some industries have additional or private water supplies, which is usually not metered. The industrial waste survey Data Form II was used to identify additional sources of water supply, estimated volume, and total volume of discharge or effluent. The EPA permits issued through the OWRB provided effluent volumes for approximately 512 industries that discharge into navigable streams.

Data regarding volumes and sources of hazardous wastes accepted at the licensed hazardous waste site were obtained from several sources. Question No. 14 and 16 on the survey Data Form II requested information about the method of disposal and location. These volumes and source names were compared and crosschecked for accuracy with the monthly reports from the licensed hazardous waste site. The monthly reports were submitted by the owner of the site to the Solid Waste Management Division of the Oklahoma State Department of Health. The monthly reports included the source of the waste (industry name or private waste hauler name), estimated volumes classified by type (acid, caustic, oil, other), and a general description. After consultation with the owner of the site and the Director of the Solid Waste Management Division, the sources of wastes were identified and classified by location (Texas or Oklahoma). If the source of hazardous waste was identified as an industrial or commercial waste hauler or processor as opposed to a single industrial

plant, the private contract waste hauler was contacted (refer to appendix M) and asked to identify each manufacturing source of hazardous wastes, type, and total volume of the waste hauled per month to a hazardous waste disposal site.

Industrial Waste Survey

A comprehensive survey of selected mining and manufacturing industries was conducted in order to obtain the data necessary to identify and quantify the liquid hazardous wastes from point sources in the State of Oklahoma.

A survey was conducted by the Oklahoma State Department of Health for all counties except Oklahoma and Tulsa. Authority was granted by the Deputy Commissioner for Environmental Health Services for the survey to be conducted. Memorandum No. EH-74-32, which appears in appendix G, is a directive from the Deputy Commissioner to the district and county sanitarians to conduct the survey.

The survey forms, Data Form II and instructions, that were utilized for all counties except Oklahoma and Tulsa appear in appendix G. The survey forms were developed after a review of other questionnaires utilized by other states and government agencies and consultation with Environmental Health Services, Oklahoma State Department of Health, personnel. Numerous revisions were made prior to printing of the final forms that appear in appendix G.

The survey forms were mailed to the county health departments between December 6, 1974, and January 2, 1975. There are 77 counties in the State of Oklahoma, but only 59 counties have county health departments. The survey forms were mailed to 57 county health departments

(Oklahoma and Tulsa counties were omitted). The survey was conducted by four district sanitarians and one sanitarian (Canadian County does not have a county health department, but one sanitarian is assigned to work in the county) in the remaining 18 counties.

The survey forms were mailed to the county health departments in a single packet containing:

1 or more copies of Memorandum No. EH-74-32 (number of copies corresponded to the number of sanitarians in a county health department plus one extra copy)

2 or more copies of the Industrial Waste Survey Instructions (number of copies correspond to the number of sanitarians and the number of industries that were surveyed within the county plus extra copies)

1 copy of the list of industries that were selected to be surveyed

x number of copies of the survey form "Data Form II" (number corresponded with the number of industries selected to be surveyed plus extra copies)

The survey forms were distributed to the district sanitarians at a monthly meeting held at the Oklahoma State Department of Health on December 6, 1974.

The name of the industry and its SIC code number(s) were filled in the appropriate blanks on all "Data Form II" survey forms prior to mailing or delivery of the forms. Also the date which indicated the deadline for returning the survey forms was filled in the appropriate blank on the instruction sheet. The number of survey forms sent to each county was determined by the actual number of manufacturing and mining industries on the original list from the combined sources (refer to table 5) minus the number omitted. The industries omitted from the survey were those industries that had four or less total employment, if there was no conflict in the SIC code data from the various sources. No

TABLE 5

NUMBER OF INDUSTRIES SURVEYED IN ALL COUNTIES EXCEPT OKLAHOMA AND TULSA

County Code Number	County Name	Number Surveys Mailed To County	Number of Industries Omitted From Survey	Number SIC's 1311 and 1321 Deleted	Actual No. Surveys To Be Returned	Number Industries Added	Number Surveys Returned	Surveys Not Returned
01	Adair	14			14		14	--
02	Alfalfa	8			8		8	--
03	Atoka	12			12		12	--
04	Beaver	5		2	3		5	--
05	Beckham	23	5	1	22		22	1
06	Blaine	22	3		20		19	2
07	Bryan	48	1		48	1	49	--
08	Caddo	35	5	2	32	2	36	--
09	Canadian	56			54		49	5
10	Carter	75	3	8	67		67	--
11	Cherokee	22	1		21		20	--
12	Choctaw	18			17		17	--
13	Cimarron	6			6		6	--
14	Cleveland	103	2	2	98		98	2
15	Coal	4	1		4		4	--
16	Comanche	65	6		62		62	--
17	Cotton	9	1		9		9	--
18	Craig	14			13		13	--
19	Creek	73	7	2	71	5	71	9
20	Custer	39	4		39		39	--
21	Delaware	15			15		15	--
22	Dewey	7	2		7		6	1
23	Ellis	6	2		6		6	--
24	Garfield	80	10	4	76		0	76
25	Garvin	45	2		45		44	1
26	Grady	74	5	2	70	2	72	--
27	Grant	12	2		12		0	12

TABLE 5---Continued

County Code Number	County Name	Number Surveys Mailed To County	Number of Industries Omitted From Survey	Number SIC's 1311 and 1321 Deleted	Actual No. Surveys To Be Returned	Number Industries Added	Number Surveys Returned	Surveys Not Returned
28	Greer	13	3		12		12	1
29	Harmon	6			6		6	--
30	Harper	9	2		9		9	--
31	Haskell	14			14		13	1
32	Hughes	16		1	15		16	--
33	Jackson	25	5	1	24		17	7
34	Jefferson	15	1	3	12		15	--
35	Johnston	10			11		11	--
36	Kay	108	4	6	101		69	32
37	Kingfisher	17	2	2	15		17	--
38	Kiowa	20	4		19		19	--
39	Latimer	4	1		4		4	--
40	LeFlore	45	2		44		43	1
41	Lincoln	30	1	2	28		0	28
42	Logan	32	1		32		0	32
43	Love	9		2	7		9	--
44	McClain	16	1		16		16	--
45	McCurtain	51	3		50		37	13
46	McIntosh	16			16		16	--
47	Major	13	1	1	12		13	--
48	Marshall	24	1	2	21		23	--
49	Mayes	54	1		54		54	--
50	Murray	15			15	1	16	--
51	Muskogee	114	1		110		100	10
52	Noble	11			11		2	9
53	Nowata	20			20		20	--
54	Okfuskee	11		1	10		11	--
56	Okmulgee	45	4	4	41		10	31
57	Osage	34		7	27		0	27
58	Ottawa	70	7		70	3	73	--

TABLE 5---Continued

County Code Number	County Name	Number Surveys Mailed To County	Number of Industries Omitted From Survey	Number SIC's 1311 and 1321 Deleted	Actual No. Surveys To Be Returned	Number Industries Added	Number Surveys Returned	Surveys Not Returned
59	Pawnee	14	2		14		0	14
60	payne	44	3	2	42		44	--
61	Pittsburg	37		2	35		35	1
62	Pontotoc	61	3	4	57		61	--
63	Pottawatomie	63	3	2	61		17	44
64	Pushmataha	13			13		13	--
65	Roger Mills	3	1		3		3	--
66	Rogers	39	3		35		35	--
67	Seminole	50	2	4	46		33	17
68	Sequoyah	33			33		33	--
69	Stephens	62	2	8	54		47	15
70	Texas	18	3		18		18	--
71	Tillman	17	6		16		15	1
73	Wagoner	20			21	2	22	--
74	Washington	61	2	5	56		4	52
75	Washita	30			29		29	--
76	Woods	20	3		20		20	--
77	Woodward	21	4		21		21	--
Total		2363	144	85	2251	16	1864	444

industry was omitted that had an SIC code number considered a potential hazardous waste generator (refer to table 3). The actual number of surveys to be returned in each county represents the total number of selected industries surveyed minus the number of industries with the SIC code numbers 1311 and 1321 and the duplicated listings that were deleted.

A different approach was taken in obtaining the necessary data and conducting the survey in Oklahoma and Tulsa counties since each county had more than one thousand industries on the original list. It was immediately apparent that the city-county health departments in Oklahoma and Tulsa counties did not have the personnel to conduct a survey of that magnitude by the same methods utilized in all other counties.

The City of Tulsa, Water and Sewer Department, had independently begun an industrial survey of all industries within the Regional Metropolitan Utility Authority in August 1974. The survey was conducted in an effort to determine the "major" contributing industries and to develop an industrial wastewater inventory, which is required for Federal funding from EPA for construction of a new sewage treatment plant. The area of the survey encompassed parts of the following six counties: Creek, Mayes, Osage, Rogers, Tulsa, and Wagoner. The survey forms developed and utilized by the City of Tulsa, Water and Sewage Department, appears in appendix H. Survey forms were sent via registered mail to the selected industries. The result of the data from the chemical analysis of the waste streams were recorded and submitted on the NPDES permits.

The survey forms were mailed to approximately 1200 industries within the Regional Metropolitan area (refer to table 6). Approximately 50 percent that did not respond received a follow-up letter. The

TABLE 6

SUMMARY OF THE NUMBER OF INDUSTRIES SURVEYED IN OKLAHOMA AND TULSA COUNTY

County Code	County Name	Segment of County Surveyed	Conducted By	Estimated Number of Industries	Number Surveyed	Number Omitted	Number Returned	No Re-sponse
55	Oklahoma			1150				
		Oklahoma City ^a	TECHRAD		104		59	48
		Oklahoma City ^b	State Dept. of Health		132		92	40
		Oklahoma County	Oklahoma City-County Health Department		106	0	106	0
Total					342	800		
72	Tulsa							
		INCOG (Creek, Mayes, Osage, Rogers, Tulsa, Wagoner)	City of Tulsa, Water and Sewer Dept.	1350	1200			400

^aIncludes 33 major water users (50,000 gal/day or), 66 potentially hazardous waste generators, and 21 industries with reported high BOD₅ (350 mg/l or)

^bIncludes all potential hazardous waste generators not surveyed by TECHRAD, all industries with total employment 50, and all industries that are secondary potential hazardous waste generators (refer to table 4) with total employment 25 and 50

^cSegment of Oklahoma County surveyed outside Oklahoma city included Bethany, Choctaw, Del City, Edmond, Harrah, Luther, and Midwest City

^dIncludes 3 industries returned forms by mail but did not respond, 5 forms returned for which address was not correct or could not be located (assumed industry had moved or gone out of business), and 40 industries that did not return the survey forms

follow-up letter was addressed to the president of the firm and the letter was written specifically for the industry type. A copy of the follow-up letter appears in appendix H. At the time of this writing follow-up of the industries that did not respond to the first or second letter is continuing.

To obtain additional information and information on those industries not responding, a cooperative survey effort to contact various industries is being undertaken. This survey effort was the combined effort of the City of Tulsa, Water and Sewer Department, the sanitarians of the Tulsa County Health Department, TECHRAD (the Research and Development Division of Benham-Blair & Affiliates, Inc.) and W.R. Holway & Associates (a division of Benham-Blair & Affiliates, Inc. located in Tulsa). Benham-Blair & Affiliates, Inc. and Black & Veatch were contracted by the Regional Metropolitan Utility Authority of Tulsa to provide an industrial wastewater inventory required for Federal funding from EPA for construction of new sewage treatment plants.

Similar methods of approach were utilized in the development and conduct of the survey in Oklahoma County. A combined survey effort by the Oklahoma City Public Works Department, Water Pollution Control Division, sanitarians of the Oklahoma City-County Health Department, and TECHRAD (the Research & Development Division of Benham-Blair & Affiliates, Inc.). Benham-Blair & Affiliates, Inc. had been contracted by the City of Oklahoma City (City Manager, Howard McMahan) to provide an industrial wastewater inventory required for Federal funding from EPA for the construction of the new North Canadian sewage treatment plant.

Survey forms were developed by the author and TECHRAD jointly for the survey in Oklahoma county. The survey forms were developed

based upon the experiences and knowledge gained from use of "Data Form II" utilized in all counties, except Oklahoma and Tulsa, and the "Industrial Influent Source Information" - Tul-1676 utilized by Tulsa. The survey forms utilized in Oklahoma County appear in appendix I. In the author's opinion, these forms are the most precise and comprehensive devised for the study.

The survey forms were sent via certified mail by TECHRAD to the following industries in Oklahoma City: (1) the 33 "major" water users (defined as an industry which has a flow of 50,000 gallons or more per average work day), (2) 66 industries whose SIC types are potential hazardous waste generators (refer to table 3), and (3) approximately 21 industries that had reported high BOD₅ (determined to be 350 mg/l or greater BOD₅). The survey forms were mailed to 120 industries between February 5, 1975, and February 7, 1975. The surveys were returned by mail to TECHRAD for coding and analysis.

In addition to the 120 industries surveyed by TECHRAD in Oklahoma City, another 132 manufacturing industries were sent survey forms from the State Department of Health. The 132 industries were selected from the total list of industries in Oklahoma City based upon the following criteria: (1) all manufacturing industries with total employment $\geq$ 50, and (2) all manufacturing industries that may possess secondary potentially hazardous wastes (refer to table 4) with total employment $\geq$ 25 and < 50 .

All 106 manufacturing industries located outside of Oklahoma City, but within Oklahoma County were surveyed by the Environmental Health Division of the Oklahoma City-County Health Department. The surveys were sent to the industries via mail and the information and

completed survey forms were obtained by personal visits (refer to table 6).

General Categories of Hazardous Wastes

The broad categories selected for use in this study were: explosives, flammables, poison, reactive, oil (hydrocarbons), and other. Since most wastes occur as mixed waste streams containing both hazardous and non-hazardous, broad categories were utilized to classify potentially hazardous wastes in order to facilitate the presentation of data and estimation of total volumes. Each broad category is identified by the first letter of the category name, except where two categories begin with the same letter. The categories were defined as follows:

EXPLOSIVES "E" - This category includes any materials which by either rapid burning or detonation may produce a high level compression or explosive force. Explosive wastes are mainly obsolete ordnance, waste explosives, fireworks, pyrotechnic materials, or explosives. These materials are capable of detonation or of explosive decomposition or reaction at normal temperature and pressures. Explosives present a severe handling problem and their disposal must be carried out using special handling techniques to prevent detonation. Open burning of explosives, which is widely practiced on a national level, can result in the emission of harmful nitrogen oxides and other pollutants (Report, 1974).

FLAMMABLES "F" - Flammables consist mainly of contaminated petroleum products, solvents, compressed gases or very volatile flammable liquids. Flammable wastes can pose handling and disposal hazards. It has been determined that drums of flammable wastes have the potential of igniting upon being compacted in a landfill. Land disposal of flammable wastes has also been shown to contaminate groundwater aquifers (Barr, 1973). Flammables are usually expressed in terms of pounds of flammable material.

POISON "P" - This category includes materials that are toxic or may cause death. Most hazardous wastes are poisonous to man. The other categories could theoretically be considered sub-headings of poisonous wastes. This category is composed mainly of pesticides, phenols, cyanide, assorted industrial chemicals, and similar toxic metals. Waste quantities are usually expressed in

terms of pounds of metals, phenols, cyanides, and quantities do not include the solvent in which the metal or other hazardous substance is dispersed. The principal hazard inherent in these wastes is improper disposal resulting in contamination of the surface and groundwater systems. Improper incineration can also lead to air pollution.

REACTIVE "R" - This category includes the irritants, corrosives, and oxidizers as determined by the decision model. Examples include caustics, acids, and peroxides. Due to the reactive nature, these wastes present a special hazard during handling and storage. Reactive wastes can also alter conditions in a sanitary landfill, thereby increasing the possibility of releasing other potential pollutants which may not have been released under normal conditions. Since many of the reactive wastes are soluble in water, the potential exists for these wastes to contaminate groundwater and surface water when land disposal is used. Many of these wastes are non-flammable so incineration is difficult. This category was divided into various sub-categories where possible and identified by: R_a = acid and R_c = caustic.

OIL "O" - Also termed hydrocarbons, this category includes all petroleum derived materials with no chemically defined structure. Examples include fuel oil, gasoline, kerosene, and lubricating oil. While the hazards associated with handling, storage, and disposal of oil may not be as extreme as wastes in other categories, oil still presents a potential problem which requires special handling. Oils and greases derived from non-petroleum sources such as animal fat are not considered "oil" for the purposes of this study under the above definition.

OTHER "X" - This category is a "catch-all" category to account for the "non-sewered" mixed waste output from the various SIC groups. The other category includes various percentages of chemical sludge, flammables, paint, poisons, reactives, and oil not included or classified in other categories. This category was divided into several sub-categories where possible and identified by: X_p = paint and X_m = sludge containing heavy metals.

There is some overlap between the six hazardous waste categories listed above. Due to the mixing of wastes, on-site, by the hauler, or at the disposal site, it is impossible to neatly separate and quantify the wastes in each category. For example, due to the presence of chromium or other heavy metals, metallic sludge may be classified in the poison category or in the reactive category due to the acid characteristic of the waste. It may be classified in the 'other' category if the

constituents are not known. The data availability and the method of reporting categories utilized at the waste disposal sites, dictated to a certain extent the use of the categories selected and the method of reporting the data. The data was recorded in such a way to avoid listing a substance in more than one category even though it may possess more than one characteristic.

Waste Generation Factors

Waste generation factors are multipliers that can be applied to production data of a SIC industry type in order to estimate volumes of hazardous waste produced. These factors indicate the amount of hazardous substance in ppm or pounds typically found in the waste stream for a manufacturing process. The factors are based on units of production volume. The hazardous waste generation factors selected for this study were summarized in tables 7 and 8. These factors were obtained from several sources and are designated by the letters A, B, or C:

- A. A Study of Hazardous Waste Materials, Hazardous Effects and Disposal Methods, vol. I, by Booz-Allen Applied Research, Inc., 1973, pp. III-19-III-27.
- B. Recommended Methods of Reduction, Neutralization, Recovery, or Disposal of Hazardous Waste, vol. 14 by TRW Systems Group, Inc., 1973.
- C. Program for the Management of Hazardous Wastes, vol. II, appendices C and E, by Battelle Memorial Institute, 1973.

Another important source of information became available during the time this study was conducted. Three of the EPA OSWMP Group I industry studies (refer to appendix C) were utilized as references:

- 1. Assessment of Industrial Hazardous Waste Practices, Storage and Primary Batteries Industries by Versar, Inc. (Versar, Inc., 1975).

TABLE 7

SUMMARY OF HAZARDOUS WASTE GENERATION FACTORS

Waste Source SIC Description	No. of SIC's		Hazardous Constituent Compound	H. W. Generation Factor	Unit Product	Refer- ence Source
	Total Listings	Major SIC				
22 Textile Mill Product						
2231 Wool Dyeing	2	1	Raw Waste	Up to 70,000 gal/ 1,000 lbs product	10 ⁶ gal	A
			Hydrogen Fluoride			C
			Oxalic Acid			C
			Barium Compounds			C
			Acetic Acid	24 ppm = 12 lbs	1,000 lb	A
			Chromium Waste	10 lbs	1,000 lb	A,B
			Chrome (Na ₂ Cr ₂ O ₇);			
			Chrome Mordant (Na ₂ Cr ₃ O ₇ +(NH ₄) ₂ SO ₄)			
			Sulfuric Acid	4 ppm = 2 lbs	1,000 lb	A
			Monochlorobenzene	4 ppm = 2 lbs		C
			Soaps and Detergents	150 ppm		C
226 Cotton Dyeing	4	2	Raw Waste	55,000 gals	1,000 gals	A
			Caustic Soda	512 ppm = 256 lbs	1,000 gals	A
			Zinc	0.7 lbs for cot- ton goods dyed	1,000 lbs	A
			Copper	3 lbs from sulfur	1,000 lbs	A
28 Chemicals and Allied Products						
281 Industrial Inorganic Chemicals	51	37		No hazardous wastes are produced		Versar
2813 Industrial Gases-Products: Acet- ylene, Air Separation products includ- noble gases-Carbon Dioxide, Hydrogen, Carbon Monoxide, Helium and Nitrous Oxide				No hazardous wastes are produced		Versar
28193 Sulfuric Acid						Versar
28196 Aluminum Compounds-Mfg. of Aluminum Fluoride			Calcium Fluoride	81 ppm	1,000 unit capacity	Versar
28199 Other Inorganic Chemicals, NEC			Too numerous to mention each compound Waste stream types are:		20 % (w/w dry basis)	
			Chromates			
			Iron Cyanide Compounds			
			Nickel Sulfate			
			Phosphorous			
			Phosphorous Pentasulfide			
			Phosphorous Trichloride			

A - Booz-Allen Applied Research, Inc.

B - TRW Systems Group, Inc.

C - Battelle Memorial Institute

TABLE 7—Continued

Waste Source SIC Description	No. of SIC's		Hazardous Constituent Compound	H. W. Generation Factor	Unit Product	Refer- ence Source
	Total Listings	Major SIC				
28—Continued						
282 Plastic Materials and Synthetic Resins, Synthetic Rubber, Synthetic & Other Man-Made Fibers, Except Glass	14	8	Acetic Acid	N.A.		C
2821 Plastics, Materials, Synthetic Resins, and Nonvulcanizable Elastomers			Sulfuric Acid	N.A.		C
Cellulose Esters			Mercury Chlorides	0.15-.1 ppm Hg	1b	C
Vinyl Resins			Nelsal	1,000-1,500 ppm	1b	C
2822 Synthetic Rubber			Styrene	20-40 ppm	1b	C
Metal Wastes from Rubber Mfg.						
2821-Plastics, Resins, & Elastomers;			Vinyl Chloride			
2824-Synthetic Fibers			Allyl Chloride	50,000 ppm	1b	A,C
Residues from Mfg. of Ethylene Dichloride			Methyl Mercuric Chloride	15-20 ppm	1b	A,C
2821-Plastics, Resins, & Elastomers;			Adiponitrile	20,000-1,000,000		C
2822-Synthetic Rubber; & 2824-Synthetic Fibers			Polymer Solids	ppm		
Aqueous or Organic Liquid or Slurry			Water or Org. Solvent	50,000-100,000 ppm		C
			Hydrogen Cyanide	N.A.		C
			Phosgene	N.A.		C
283 Drugs - Organic Pharmaceutical Wastes			Dimethyl-Formamide	N.A.		C
			Methylethyl-Ketone			C
			Acetonitrile			C
			Caustic			C
			Benzyl-Chloride			C
			Fluorobenzoic Acid			C
			Dichlorobenzene			C
			Tribhlorobenzene			C
			Diphenylamine			
Mercurial Pharmaceutical Wastes			Mercury			C
			Aliphatic Mercury Compounds			C
			Aromatic Mercury Compounds			C

TABLE 7—Continued

Waste Source SIC Description	No. of SIC's		Hazardous Constituent Compound	H. W. Generation Factor	Unit Product	Refer- ence Source
	Total Listings	Major SIC				
28—Continued						
283 Drugs—Organic Pharmaceutical Wastes			Phosgene			C
Nitrite Containing Pharmaceutical Wastes			Chlorogenzene	50,000–300,000 ppm		C
Organic Pharmaceutical Wastes			Toluene			C
			Methanol			C
			Methylene Dichloride	–600,000 ppm		C
			Pyridine	–200,000 ppm		C
			Tetrachloroethane			C
			Trichloroethylene			C
			Benzo-Trifluoride			C
			Chlorosulfonic Acid			C
Pharmaceutical Arsenic Wastes			Inorganic Arsenites	20,000–30,000 ppm		C
			Organic Arsenites	10,000–20,000 ppm		C
			Arsenylic Acid	10,000–20,000 ppm		C
			Sodium Chloride	10,000 ppm		C
2841 Soap, Detergents, and Cleaning Preparations, Perfumes, Cosmetics, and Other Toilet Preparations	9	4	Nickel Sulfate	100–200 ppm		C
			Sulfuric Acid	50,000–100,000 ppm		C
			Zinc Sulfate	30,000 ppm		C
			Stannous Chloride	20,000 ppm		C
			Hydrochloric Acid	70,000 ppm		C
			Surfactants	Trace		C
2851 Paint and Allied Products	20	17	Sludge (Chromium and Mercury)	1 gal 170 gals water-based paint	170 gals	C
			Sludge (Lead, Chromium, Cadmium, Cyanide, Selenium)	1 gal 120 gals solvent-based paint	120 gals	C
286 Industrial Organic Chemicals	3	3	Copper	900 ppm		C
2865 Industrial Organic Chemicals			Chromium	100 ppm		C
Dye Manufacturing Wastes			Phenols	400 ppm		C
			Hydrogen Cyanide			C
			Aniline			C
			Disulfonic			C

TABLE 7 —Continued

Waste Source SIC Description	No. of SIC's		Hazardous Constituent Compound	H. W. Generation Factor	Unit Product	Refer- ence Source
	Total Listings	Major SIC				
28—Continued						
2865 Industrial Organic Chemicals Chromate Wastes from Pigments & Dyes			Chromates (Cr ⁺³) Chromic Hydroxide Sludge Sulfides Diphenylamine Dinitrotoluene Nitroaniline Phosgene	58 ppm 221 ppm		C C C C C C
2879 Pesticide Mfg. and Formulation	8	6	Pesticide Active Ingredient; too numerous to mention each compound	3 lbs 1,000	1,000 lbs	B
2892 Explosives-Smokeless Powder	4	3	Sulfuric Acid Nitric Acid Sulfuric Acid Nitric Acid Lead Carbonate Lead Acetate Lead Nitrate Barium Carbonate Barium Nitrate Sodium Sulfite Sodium Nitrite Nitrotoluene Dinitrotoluene Trinitrotoluene Acetic Acid HMX TDX, PETN, TETRYL	1 lb 1 lb 5,100 100,000 lb 5,740 100,000 lb 2.3% 3.5% 17.3% 34 lbs 160 lbs 2 lbs	1b 1b 100,000 lbs 100 lbs 100 tons 100 tons	A A A A C C C C C C C C C C C C C
29 Petroleum Refining and Related Industries						
2911 Petroleum Refining	12	12	Refer to table 8			
2992 Lubricating Oils and Greases, Reclaimers, Residues	7	5	Lead Oxide Arsenic Chromium Cadmium Antimony Tetraethyl Lead Tin	15,000 ppm 50 ppm 16 ppm 10 ppm N.A. N.A. N.A.		C C C C C C C

TABLE 7—Continued

Waste Source SIC Description	No. of SIC's		Hazardous Constituent Compound	H. W. Generation Factor	Unit Product	Refer- ence Source
	Total Listings	Major SIC				
29—Continued						
2999 Petroleum Rerefining	4	2	Petroleum Sludge	1 gal sludge	15 gals-repros. oil	C
30 Rubber and Miscellaneous Plastics Products						
3011-Tires and Inner Tubes;	9	9	Polychlorinated Biphenyls - PCB's Aldehydes Styrene Nekal Diphenyl; Diphenyl Oxide Butyl Rubber (Selenium)	50,000-990,000 ppm 27.7 ppm 109 ppm 437 ppm N.A. N.A.		C
3069 Fabricated Rubber Products, NEC	25	17				C
						C
						C
						C
31 Leather and Leather Products						
3111 Leather Tanning	2	2	Chromium Waste	1,800 lbs hides tanned	2,500 lbs	B
			Chromium Sulfides	9 lbs (40-lb hides) 3 lbs	1,000 hides 1,000 hides	A A
33 Primary Metals Industries						
331 Blast Furnaces, Steel Works, and Rolling and Finishing Mills	29	16	Phenols Sodium Cyanide Sodium Fluorides Ammonia Sulfuric Acid Chromic Acid Zinc Chloride Hydrochloric Acid Cyanide Iron Chromium (Total) Hexavalent Chromium Zinc	1.37 x 10 ⁸ gals mil- lon \$ value added 824 lb M\$VA 365 lb M\$VA 397 lb M\$VA 997 lb M\$VA 414 lb M\$VA 556 lb M\$VA 172 lb M\$VA 1.71 M\$VA	10 ⁹ gals	A
Consolidated Steel Plant Waste Sludge						A
						A
						A
						A
						A
						A
						A
						A
						A
						A
Cold Finishing Waste						A

TABLE 7—Continued

Waste Source SIC Description	No. of SIC's		Hazardous Constituent Compound	H. W. Generation Factor	Unit Product	Refer- ence Source
	Total Listings	Major SIC				
33—Continued						
331 Blast Furnaces, Steel Works, and Rolling and Finishing Mills Pickling Wastes			Rinse Water Hydrochloric Acid Sulfuric Acid Pickle Liquor Sulfuric Acid Hydrochloric Acid	2.5 lb ton 2.5 lb ton	ton ton	A A A A
3312 Blast Furnaces & Coke Plants Raw Waste Sludge			Phenol Sodium Cyanide Ammonia Tar Acids Thiocyanate Thiosulfate Nitrogen Bases as Pyridine Hydrogen Cyanide	150-3,000 ppm 60 ppm 300-10,000 ppm 25-1,400 ppm 80-1,300 ppm 20-1,300 ppm 100 ppm		C C C A A A A
Iron Mfg. Waste Sludge			Phenol Ammonia Sodium Cyanide	.02 ton .025 ton .09 ton		A A A
3321 Gray Iron Foundries	19	14	N.A.	N.A.		A
3322 Malleable Iron Foundries	3	2	N.A.	N.A.		
333 Primary Smelting and Refining of Nonferrous Metals Brass Mill Wastes	8	5	Copper Sulfate Zinc Sodium Dichromate Sulfuric Acid Bright Dip Liquor - Sulfuric Acid; Copper; Zinc; and Chromium	80,000 ppm 10,000 ppm 10,000 ppm 20,000 ppm N.A.		C C C C C
3332-Lead; 3333-Zinc			Arsenic Trioxide Selenium Sulfuric Acid Hydrochloric Acid Copper	Solid 3,000-4,000 ppm 70,000 ppm 40,000 ppm 150 ppm		C C C C C

TABLE 7 —Continued

Waste Source SIC Description	No. of SIC's		Hazardous Constituent Compound	H. W. Generation Factor	Unit Product	Refer- ence Source
	Total Listing	Major SIC				
33—Continued 3332-Lead; 3333-Zinc 3339-Nonferrous Metals, NEC	13	6	Lead, Mercury, and Antimony Selenium Thallium Beryllium Compounds Others too numerous to mention Fluoride Aluminum Phosphate	Trace N.A. N.A. N.A.		
3334-Aluminum; Primary Smelting Waste Plate and Sheet Waste Rinse Water and Pickle						
3341 Secondary Smelting and Refining of Nonferrous Metals	10	8	N.A.	N.A.		
3351 Rolling, Drawing, & Extruding of Copper	1	1	N.A.	N.A.		
3351 & 3352 Aluminum and Copper Rolling Mill			Copper Chromium Aluminum Sulfuric Acid Bichromate	30,000 ppm Trace Trace		C C C
3399-Primary Metals, NEC; 3331-Primary Smelting and Refining of Copper; 3351-Rolling, Drawing, and Extruding Copper; 3362-Brass, Bronze, Copper Base Alloy Foundries (Castings)			Copper Nickel Hydrofluoric Acid-Nitric Acid	40,000 ppm 200 ppm 140,000 ppm		C C C
34 Fabricated Metal Products, Except Machinery and Transportation Equipment						
3471 Metal Plating & Polishing	44	35	Cadmium Waste Copper Waste Cyanide Waste Chromium Waste Copper Pickling Waste	18% of total Cd input is lost 18% of total Cu input is lost 8170 lb yr - mean cyanide load per plant 85% of total Cr input is lost .1% - .2% of total Cu input is lost		B B B B B
3471 & 3479 Aluminum Anodizing Bath with Drag Out			Chromium Aluminum Sulfate Sulfuric Acid	3,000 ppm 200,000 ppm 300,000 ppm		C C C

TABLE 7—Continued

Waste Source SIC Description	No. of SIC's		Hazardous Constituent Compound	H. W. Generation Factor	Unit Product	Refer- ence Source
	Total Listings	Major SIC				
35 Machinery, Except Electrical						
355 Special Industry Machinery, Except Metal Working Machinery	50	25	Copper	80,000 ppm		C
3555 Printing Machinery			Nickel	1,000 ppm		C
Rotogravure Printing Plate Wastes			Lead	1,000 ppm		C
			Sodium Hydroxide	3,000 ppm		C
			Complex Organic Acids	N.A.		C
			Zinc	N.A.		C
			Chromium	N.A.		C
3555-Printing Trades Machines; 3579- Office Machines			Selenium	3,000-50,000 ppm		C
Duplicating & Photo Equipment Mfg. Wastes			Sodium Hydroxide	100,000 ppm		C
			Arsenic	1,000-30,000 ppm		C
			Arsenic Triselenide	10,000-100,000 ppm		C
357 Office Computing, and Account- ing Machines	18	15				
Computer Mfg. Wastes			Sodium Cyanide	150,000 ppm		C
			Sodium Ferricyanide	50,000 ppm		C
			Sodium Ferrocyanide	50,000 ppm		C
			Freon	10,000 ppm		C
			Aluminum Fluoride	20,000 ppm		C
			Hydrofluoric Acid	20,000 ppm		C
			Cadmium Chromate	300-500 ppm		C
			Nickel and Zinc	Trace		C
			Thallium	N.A.		C
36 Electrical and Electronic Machinery, Equipment and Supplies						
3691 Storage Batteries - Lead Acid	3	3				
Wastewater Treatment Sludge (Caustic Soda Neutralization)			Pb Raw Waste Factor	0.331 kg	1,000 kg batteries	Versar
			Pb Effluent Factor	0.01 kg	1,000 kg batteries	Versar
			Pb Sludge Factor	0.324 kg	1,000 kg batteries	Versar

TABLE 7—Continued

Waste Source	No. of SIC's		Hazardous Constituent Compound	H. W. Generation Factor	Unit Product	Reference Source
SIC Description	Total Listings	Major SIC				
36—Continued						
3691 Storage Batteries - Lead Acid			Composition of Sludge			
			PbSO ₄	0.293 kg	1,000 kg batteries	Versar
OR			Pb(OH) ₂	0.140 kg	1,000 kg batteries	Versar
			Water	20 to 65%		
			80 % Solids Total Sludge	0.541 kg	1,000 kg batteries	Versar
Wastewater Treatment Sludge (Lime Neutralization)			CaSO ₄ Factor	735 kg (dry basis)	1,000 kg batteries	Versar
				2101 kg sludge		
				basis (35% solids)	1,000 kg batteries	Versar
				17,298,163 kg	kg per year	Versar
				17,298 metric tons	metric ton per year	Versar
			Sludge Characterization			
			CaSO ₄	2101 kg	1,000 kg batteries	Versar
			Pb(OH) ₂	0.140 kg	1,000 kg batteries	Versar
			PbSO ₄	0.293 kg	1,000 kg batteries	Versar
			Pb	150 mg	per liter	Versar

TABLE 8

SUMMARY OF MEDIAN CONCENTRATIONS AND TOTAL QUANTITIES FOR PETROLEUM REFINERY WASTES*

Number of Samples		3	2	9	4	12	5	3	2
Parameters	Typical Background	Sludge from Clarified Once Through Cooling Water	Exchanger Bundle Clearing Sludge	Shop Oil Emulsion Solids	Cooling Tower Sludge	API/Primary Clarifier-Separator Bottom	Dissolved Air Flotation Float	Kerosene Filter Clays	Lube Oil Filter Clays
Phenols	0.54 7)	2.0	8.2	15	3.3	15.4	6.5	2.0	3.2
Cyanide	2.6 7)	0.11	1.6	0.001	0.1	0.001	0.28	0.0005	0.11
Selenium	0.5 8)	1.6	27.2	0.2	0.0015	1.0	2.0	0.01	1.1
Arsenic	5 8)	5.4	10.6	8.6	8.1	6.2	2.0	2.2	0.7
Mercury	0.1 8)	0.51	1.9	0.59	0.09	0.4	0.46	0.0004	0.18
Beryllium	6 8)	0.24	0.17	0.0425	0.0012	0.0025	0.0025	0.2	0.25
Vanadium	140 8)	39	25	25	7.7	9.8	0.05	35	32
Chromium	200 8)	63	310	525	554	252	140	2.88	23.1
Cobalt	25 8)	6.3	1.5	10	1.2	5.7	2.0	0.62	3.1
Nickel	80 8)	35	115	50	6.5	19.3	0.025	0.04	11.1
Copper	200 8)	153	71	31.5	49	19.5	7.0	11.4	4.2
Zinc	200 8)	125	194	250	675	298	104	25	57.6
Silver	0.1 8)	0.5	0.005	0.4	0.25	0.55	0.25	0.5	0.5
Cadmium	0.2 8)	0.003	1.2	0.12	0.3	0.42	0.005	0.25	0.72
Lead	16 8)	57	72	17	38	17.5	7.5	8.3	1.28
Molybdenum	1 8)	2.5	6.5	5	1.1	5	0.05	0.025	0.038
Ammonium Salts (as NH ₄)	No Value 7)	6	8.5	9	6.0	6	18	0.01	2
Benz-a-pyrene	< 0.01 7)	0.003	2.2	0.003	0.004	0.004	0.002	1.7	0.1
Oil (Weight %)	2.9 7)	0.43	10.5	36	0.36	35.7	14.4	3.5	3.9
Total Weight									
Metric tons/yr									
1000 BSD unit capacity		16.8 2)	0.9 2)	2.3 2)	0.12 2)	4.7 2)	20.2 2)	0.98 2)	392.3 3)

*All values in milligram per kilogram except where noted; Source: Assessment of Industrial Hazardous Waste Practices, Petroleum Refining Industry August 1975, by Jacobs Engineering Co., 1975, pp. 6-29-30

1) Values represent median

2) Values are listed as metric tons (wet basis)/year per 1000 BSD crude capacity (BSD = Barrels/Stream Day)

3) Values are listed as metric tons (wet basis)/year per 1000 BSD lube capacity

4) Values are listed as metric tons (wet basis)/year per 1000 BSD cokes capacity

5) Values are listed as metric tons (wet basis)/year per 1000 BSD HF alkylation capacity

6) Values are listed as metric tons (wet basis)/year per 1000 BSD FCC throughput capacity

7) Result from a background soil sample taken from a refinery field visit analyzed by Jacobs Engineering Co.

8) Average values taken from Table 5

9) Values for fluoride are not included in the table but are as follows: 48,300

TABLE 8 —Continued

Number of Samples	5	5	2	2	2	2	4	10	11
Parameters	Waste Biosludge	Coke Fines	Silt from Storm Water Runoff	Leaded Tank Bottoms	Non-leaded Product Tank Bottoms	Neutralized HF Alkylation Sludge (CaF ₂) 9)	Crude Tank Bottoms	Spent Lime from Boiler Feedwater Treatment	Fluid Catalytic Cracker Catalyst Pines
Phenols	4.5	2.0	9.8	126	1.8	9.3	10.9	2.1	2.1
Cyanide	0.001	0.001	0.72	0.0009	7.3	2.4	.02	0.001	0.16
Selenium	0.01	0.01	1.6	1.6	12	0.9	21.1	0.01	0.01
Arsenic	3.8	2.0	5.5	255	0.007	2.3	21.1	0.1	2.0
Mercury	0.18	0.001	0.30	0.57	.42	0.07	0.48	.022	0.0004
Beryllium	0.0013	0.003	0.0019	.0025	0.26	0.07	0.0023	.0012	0.5
Vanadium	0.5	455	69	5.4	21.9	2.6	17.4	0.05	240
Chromium	300	0.02	338	11.4	12.9	0.38	19.4	2.2	82.5
Cobalt	0.2	4.0	11.2	49	7.1	0.35	15	0.005	6.5
Nickel	0.025	580	80	314	26.7	55.2	16.1	2.5	241
Copper	9.5	4.0	28.3	140	85.1	14.2	65.4	3.8	17.5
Zinc	122	14	228	2000	285	9.0	145	10.9	50
Silver	0.3	0.001	0.5	0.85	0.6	0.19	0.18	0.3	1.8
Cadmium	0.3	1.0	0.26	6.3	0.32	0.06	0.31	0.003	0.12
Lead	5.0	13.0	53.2	630	24.7	7.0	18	3.8	50
Molybdenum	2.5	0.1	6.9	59	9.2	0.0025	5.0	0.0025	6
Ammonium Salts (as NH ₄)	30	No Value	1.0	No Value	0.2	0.002	2.0	0.015	---
Benz-a-pyrene	0.003	0.002	1.27	0.21	0.6	No Value	0.012	0.002	0.005
Oil (Weight %)	0.28	0.001	3.8	20	64.2	6.9	47.5	0.32	0.21
Total Weight Metric tons/yr 1000 BSD unit capacity	6.1	0.28	2.7 2)	0.75 2)	55.9 2)	47.4 5)	0.2 1)	70.4 1)	5.45 6)

2. Assessment of Industrial Hazardous Waste Practices, Inorganic Chemicals Industry by Versar, Inc. (Versar, 1975).
3. Assessment of Industrial Waste Practices, Petroleum Refining Industry by Jacobs Engineering Company, August 1975 (Jacobs, 1975).

These three studies and other reference sources were indicated by the author's name in table 7. A summary of the petroleum refining waste generation factors derived from a comprehensive study by the Jacobs Engineering Company can be found in table 8. Unfortunately, the waste generation factors vary by the methods utilized to obtain the data, specificity, and sample size. The three EPA OSWMP Group I contract studies are by far the most comprehensive and offer the greatest accuracy and detail of waste streams and their constituents. The other six contracts of the Group I industry studies were not available for use in this study. The data on waste characterization and waste generation factors from the six Group I and four Group II contract studies will provide in the future greater accuracy in the calculations of waste volumes. As these studies are published, the data in this study could be modified.

In table 9 can be found a summary of the SIC's for which either the hazardous waste generation factors or the production volumes were lacking. Most of the SIC's listed in table 9 are the SIC's for the secondary hazardous waste generators and the six SIC's from the Washington State Report. If the production data and waste volumes were available these SIC's would probably represent a small portion of the total hazardous waste generated annually in the state. Even though the concentrations or waste volumes were not known, the hazardous constituents that have been identified in previous studies are included

TABLE 9

SUMMARY OF SECONDARY HAZARDOUS WASTE SIC's, HAZARDOUS CONSTITUENTS, AND ESTIMATED GENERATION FACTORS

Waste Source		No. of SIC's		H. W. Generation Factor/Employee/ Month (Tons)	Hazardous Constituents		Refer- ence Source
SIC	Description	Total Listings	Major SIC		Compound	Volume	
201	Meat Products	169	149	.046097	Pathogens		D
208	Beverages	59	54	.011982	Caustics & Inorg. Chem. used in Breweries		D
243	Millwork, Veneer, Plywood, and Structural Wood Members	89	73	.000816	Glue Waste; Waste Varnishes, Lacquers, & Other Organics		D
2452	Prefabricated Wood Building & Components	1	1	.670348	Caustics, Glue Naptha, Organic Chemicals		D
249	Miscellaneous Wood Products	74	53	.0206	Wood Coating Sprays; Urea; Formalde- hyde; Pentachlorophenol		D
	2491-Wood Preserving; 2499-Misc. Wood Products; 2865-Wood Preserving: Ind. Org. Chem.				Sodium Sulfate Sodium Phenol Sulfonate Pentachlorophenol Mercury Aliph. Mercury Compound Aromat. Mercury Compound	280,000 ppm 180,000 ppm .005 gal/ft ²	C C A,C C C C
26	Paper and Allied Products				Barium Sulfide Zinc Hydrosulfide Mercury Aliph. Hg. Compounds Aromat. Hg. Compounds Sulfur Dioxide Hexone Black Liquor Black Liquor Solids Methyl Mercaptan Hydrogen Sulfide	Trace 400 gal/ton 605 lbs/ton 5.3 lbs/ton 0.66 lbs/ton	C C C C C C C A A B B
	2631 & 2641						
2711	Newspapers: Publishing, Publishing & Printing	263	242	.043157	Ink; Etching & Plating Baths Photo Chemicals Printing Sludge-Lead	3,000-6500 ppm 1,500-3,225 lb	D C

A - Booz-Allen Applied Research, Inc.

B - TRW Systems Group, Inc.

C - Battelle Memorial Institute

D - Washington, 1974

TABLE 9 --Continued

Waste Source		No. of SIC's		H. W. Generation Factor/Employee/ Month (Tons)	Hazardous Constituents		Refer- ence Source
SIC	Description	Total Listings	Major SIC		Compound	Volume	
2841	Soap & Detergent Mfg.	9	4	N.A.	Nickel Sulfate Sulfuric Acid Zinc Sulfate Stannous Chloride Hydrochloric Acid Surfactants	100-200 ppm 50,000-100,000 ppm 30,000 20,000 70,000 Trace	C C C C C C
2851	Paints, Varnishes, Lacquers, Enamels, & Allied Products	20	17	.099956	Sludge-Water Based Paint Cr Hg Sludge-Solvent Based Paint Pb Cr CN Se Cd	1 gal/170 gals 9,800 lb 1,800 lb 1 gal/120 gal 637,000 lb 137,000 lb 44,900 lb 370 lb 5,100-trace	D B C C B C C C C C
286	Industrial Organic Chemicals	3	3	.005435	Toxic Tar (used by one plant)		D
	2865-Enamels, Inks; 285-Paints; 2821-Plastics; 2822-Rubber Cadmium-Selenium Pigments				Cadmium Selenates Selenium Copper Chromium Phenols HCN	900 ppm 100 ppm 400 ppm	C C C C C C C
	2865-Dye Mfg. Wastes				Aniline Disulfonic Acid Chromates Cr+3 Chromic Hydroxide Sludge Sulfides Diphenylamine Dinitrotoluene Nitrobenzene Nitroaniline Phosgene	58 ppm 221 ppm	C C C C C C C C C C
	Chromate Wastes from Pigments and Dyes						

TABLE 9 —Continued

Waste Source		No. of SIC's		H. W. Generation Factor/Employee/ Month (Tons)	Hazardous Constituents		Refer- ence Source
SIC	Description	Total Listings	Major SIC		Compound	Volume	
287	Agricultural Chemicals Intermediate Agric. Production Wastes-Nitric Acid Agricultural Pesticide Arsenic Mfg. Chlorinated Hydrocarbon Pesticide Production	49	31	.41337	Pesticides Nitric Acid Sodium Chromate Zinc Chloride Arsenic Trioxide Arsenic Acid Chlordane Endrin Heptachlor DDT Plus other compounds too numerous to list	1,000 lbs/1,000 T prod. 39 lbs/1,000 T prod. 10 lbs/1,000 T prod. 30,000 ppm Trace 100,000 ppm 25,000 50,000-25,000 ppm	D C C C C C C C C
289	Miscellaneous Chemical Products 2899-Misc. Chem. Products; 2892-Explosives Waste from Nitrocellulose & Smokeless Powder Waste from Mfg. of Electrical "Match Head Type" Fuses	33	28 ^a	.847539	Org. Chemicals- Solvents; Inorg. Chemicals Sulfuric Acid; Explosives Nitrocellulose Cuprous Acetylide		D C C
299	Miscellaneous Products of Petroleum and Coal 2999-Petroleum sludge from Rerefining 2992-Reclaimers Residue	11	7	.296875	Waste Oil Sludge (reprocessed oil) Lead Oxide Arsenic Chromium Cadmium Tetroethyl Lead Tin Antimony	1 gal/15 gal 15,000 ppm 50 ppm 16 ppm 10 ppm	D C C C C C C C
32	Stone, Clay, Glass, and Concrete Products 3211-Flat Glass; 322-Glass & Glassware, Pressed or Blown; 3231-Glass Products Made of Purchased Glass Glass Etching Wastes	50	39 ^b	N.A.	Hydrofluoric Acid Hydrochloric Acid Alcohols Silica	80,000 ppm 50,000 ppm trace trace	C C C C

^aIncludes number of major SIC 2899-Misc. Chem. Products^bIncludes number of major SIC's for 3211, 322, and 3231

TABLE 9 --Continued

Waste Source		No. of SIC's		H. W. Generation Factor/Employee/ Month (Tons)	Hazardous Constituents		Refer- ence Source
SIC	Description	Total Listings	Major SIC		Compound	Volume	
32 (Continued)							
3231	Glass Products						
	Mirror Production Wastes				Chromic Sulfate	.019 lb	C
						1,000 ft ² prod.	
					Ferrous Sulfate	.069 lb	C
						1,000 ft ² prod.	
3273	Ready-Mixed Product	158	145	.0008408	Org. Chemicals		D
333	Primary Smelting and Refining of Nonferrous Metals	8	5	.0866357	Waste Oils or Org. Chem.; Sludges- Inorg. Chem. Copper Sulfate	80,000 ppm	D C
3341	Secondary Smelting & Refining of Nonferrous Metals	10	8	.002446	Reclamation of Tin Cans		D
3351	Rolling, Drawing, and Extruding of Nonferrous Metals	1	1	.0924	Inorg. Chem.; Org. Chem.- Solvents & Lubricants		D
	3351, 3331, 3362, 3399-Copper Tube Extruding Waste				Copper	40,000 ppm	C
					Nickel	200 ppm	C
					Hydrofluoric Acid-Nitric Acid	140,000 ppm	C
	3351, 3352-Aluminum & Copper Rolling Mill				Copper	30,000	C
					Chromium	Trace	C
					Aluminum	Trace	C
					Sulfuric Acid		C
					Bichromate		C
3362	Brass, Bronze, Copper, Copper Base Alloy Foundries (Castings)	23	8	N.A.			
339	Miscellaneous Primary Metal Products	17	7	.4367999	Oils & Cleaners, NaCN, CaF		D
347	Coating, Engraving & Allied Services	40	20 ^c	.067598	Inorg. Chem.-Inorg. Salts & sulfides, various acids-chromic & sulfuric; Plating sludges & spent plating solutions		D
	34-Fabricated Metal Products Finishing Effluents				Copper Cyanide	6-300 ppm	C
					Copper Sulfate	N.A.	
					Ferrous Sulfate	2-21 ppm	C

^cIncludes only major SIC 3479

TABLE 9 --Continued

Waste Source		No. of SIC's	H. W. Generation Factor/Employee/ Month (Tons)	Hazardous Constituents		Refer- ence Source
SIC	Description	Total Listings	Major SIC	Compound	Volume	
34	(Continued)			Nickel Cyanide	0-300 ppm	C
				Nickel Sulfate	No	C
				Zinc Cyanide	0-300 ppm	C
				Sodium Dichromate	.5-700 ppm	C
				Chromic Hydroxide	30,000 ppm	C
				Zinc Ferrocyanide	25,000 ppm	C
				Calcium Fluoride	20,000 ppm	C
347	Metal Cleaning Wastes			Copper Salts	2,000 ppm	C
				Nitric Sulfuric, Hydrochloric Acids	500,000 ppm	C
				Cyanide	Trace	C
				Chromium	Trace	C
				Lead	Trace	C
				Nickel	Trace	C
				Zinc	Trace	C
				Cadmium	Trace	C
				Iron	Trace	C
				Oxalic Acid		C
				Copper Salts	2,000 ppm	C
347	Plating Preparation			Chromium	5,000 ppm	C
				Copper	400 ppm	C
				Nickel	600 ppm	C
				Hydrofluoric Acid	50,000 ppm	C
3471 & 3479	Phosphate Sludges from Metal Coating Operations			Phosphates	51% Dry Basis	C
				Iron	20%	C
				Zinc	7.5%	C
				Sodium	3.5%	C
				Nickel	0.6%	C
				Lead	0.5%	C
				Calcium	.16%	C
				Manganese	.15%	C
				Hexane Solubles	3.5%	C
3471 & 3479	Aluminum Anodizing Bath With Drag Out			Chromium	3,000 ppm	C
				Aluminum Sulfate	200,000 ppm	C
				Sulfuric Acid	300,000 ppm	C

TABLE 9 —Continued

Waste Source		No. of SIC's		H. W. Generation Factor/Employee/ Month (Tons)	Hazardous Constituents		Refer- ence Source
SIC	Description	Total Listings	Major SIC		Compound	Volume	
3531	Construction Machinery and Equipment	40	28	.007	Cutting & Lubricating Oils, HCl, NaCN, & Alkaline Cleaners		D
3585	Air Conditioning & Warm Air Heating Equipment & Commercial & Industrial Refrigeration Equipment	25	19	N.A.	Assume 1% as active sludge & Contaminated Wastes-rest is cooling water	200 gal waste/unit	C
3585	Refrigeration Machinery; 3632-Refrigerators & Freezers				Fluoride		C
	Refrigeration Equipment Mfg. Wastes				Chromates		C
					Aluminum		C
					Heavy Metals		C
					Acid		C
36	Electrical & Electronic Electronic Circuitry Mfg. Wastes	95	65 ^d	N.A.	Potassium Ferrocyanide	10,000 ppm	C
					Sodium Hydroxide	100,000 ppm	C
					Lead	10-1,500	C
					Nickel	10-1,500	C
					Chromium	10-50	C
					Copper	3,000-50,000	C
					Hydrochloric Acid	150,000	C
					Sulfuric Acid	10,000-250,000	C
					Hydrocyanide Acid		C
					Carbon Tetrachloride		C
	3662,3671, 3672, 3673-Electronic Tube Production Wastes				Cupric Hydroxide	4.5% Solid	C
					Nickel	.3% Solid	C
					Calcium Phosphate	70% Solid	C
					Mercury	Trace	C
					Barium Compounds		C
					Hydrogen Fluoride		C
	3679-Magnetic Tape Productions				Ammonium Dichromate (Dichromate Solid)	10-50%	C
					Chromic Oxide (Sludge)	5-50%	C
					Chromic Oxide (In waste Filtes)	5-10%	C
	3674-Semiconductor Mfg. Wastes				Ethylene Dichloride	100,000 ppm	C
					Dirt & Organics	Trace	C
					Boric Acid		C

^dIncludes all major SIC's 3612, 3662, 3671, 3672, 3673, 3674, 3679 and does not include major SIC 3691

TABLE 9 --Continued

Waste Source		No. of SIC's		H. W. Generation Factor/Employee/ Month (Tons)	Hazardous Constituents		Refer- ence Source
SIC	Description	Total Listings	Major SIC		Compound	Volume	
37	Transportation Equipment 3721 & 3728-Aircraft; Aircraft Parts & Auxiliary Equipment, NEC Aircraft Plating Wastes				Cadmium Cyanide Sodium Cyanide Sodium Hydroxide	Assume typical plating loss of 50% 15,000 ppm 85,000 ppm 30,000 ppm	A,C A,C A,C

in the table. A few volumes are included in the table for waste generation factors by SIC that were lacking production volumes.

Waste Quantification

The quantification of hazardous wastes within the state was twofold: (1) "sewered" hazardous wastes "potentially" generated by the selected manufacturing industries, and (2) "non-sewered" hazardous wastes. The "non-sewered" hazardous wastes include the known quantities of hazardous wastes disposed of at the hazardous waste site and the industrial injection wells.

Due to the constraints previously described and the lack of available data, several methods were required to quantify the potential volume of "sewered" hazardous waste.

Waste quantification for selected industries was determined by application of hazardous waste generation factors to annual production volumes of an industry or a three or four-digit SIC industry type. This method was used primarily for the list of industries that are potential hazardous waste generators or the major source of hazardous waste (refer to table 3). When production volumes were not available for major SIC listings within an SIC category, the missing data were estimated by several methods:

- 1) the production volumes were estimated from effluent volumes
- 2) the production volumes were estimated from influent volumes of water, which was utilized to determine the effluent volume, minus consumptive usage typical for an SIC industry type.
- 3) the hazardous waste generation/employee was calculated from the available production volume data and the amount of hazardous waste generated/employee was projected for the remaining major SIC listings lacking production volume data

Another method was utilized for the selected SIC's which were lacking either waste generation volumes or production volumes. A hazardous waste generation factor per employee per month was calculated for the SIC's shown in table 8. The formula used to determine these hazardous waste generation factors was:

$$\frac{\text{tons of hazardous waste}}{\text{tons of waste}} \times \text{waste/employee/month} = \text{hazardous waste/employee/month}$$

The data source for the total tons of hazardous waste and the total tons of waste by SIC were obtained from a survey conducted in the State of Washington (Washington, 1974). The hazardous waste generation factor per employee per month was then multiplied by the total employment of the major SIC's to determine the total volume of hazardous wastes in the state by SIC. To estimate the total annual volume of hazardous waste by SIC, the total volume of hazardous waste per month was multiplied by twelve months.

Although this method is not as accurate as the method which applies waste generation factors to production volumes, it is the best estimate that could be made until more data becomes available. A word of caution is appropriate here regarding the use of the data from the Washington Report (tons of hazardous waste, tons of waste, and waste/employee/month). The data in the Report was derived by a small number of industries sampled, the less likely the data is representative of the waste generated by that SIC industry type.

Phase III - Treatment and Disposal/Storage

Phase III was developed to determine the types of treatment and disposal currently in use in the state and to recommend treatment and disposal/storage processes applicable to the hazardous wastes that were characterized in Phase II.

Data Sources

In order to determine the current methods and prevalence of treatment and disposal/storage practices and the prevalence of waste handling by private contractors a number of data sources were obtained and compared.

The OWRB issues permits for an industrial waste hauler to haul wastes within the state. A list of the permits issued to waste haulers, including the name of the firm and a description of the type of waste hauled was provided by the OWRB. This list was cross-checked with the information provided on the industrial survey forms and the monthly reports from the hazardous waste site. Each of the private contract waste haulers was consulted and asked their service cost and the type and location(s) of the disposal facility utilized (refer to appendix M).

From the industrial waste survey, question no. 14 and 16, information regarding on-site vs off-site disposal was obtained. This information was compared to the various data sources that indentified the manufacturing sources of hazardous waste and the prevalence of use of the off-site disposal facilities, such as: (1) the monthly reports from the hazardous waste site, (2) list of the industrial injection wells permitted, (3) the monthly reports from the owners of the industrial injection wells, and (4) the private contract waste haulers. To determine

the percentage of total wastes disposed of at off-site facilities, the total volumes of non-sewered wastes from off-site disposal facilities as determined in phase II, was divided by the estimated total annual volume of hazardous waste potentially generated. The same method was utilized to determine the percentage of hazardous waste handled by private waste contractors except this volume was divided by the total volume of hazardous wastes disposed of at "non-sewered" sources as well as the estimated total annual volume of hazardous wastes potentially generated.

Since the selected industries in the study included mining and manufacturing industries, only the disposal facilities utilized by these industry types were identified. It was not considered within the scope of this study to identify disposal facilities utilized by other industry types even though they may generate hazardous wastes. For example, the military installations located within the state generate a considerable volume of hazardous waste, particularly the U.S. Naval Ammunitions Depot located at McAlester and Tinker Air Force Base located East of Oklahoma City. In some cases the military of other industry types may use disposal facilities and the percentage of total wastes disposed therein applies only to the selected industries in the study and should not be interpreted as a complete list of disposal facilities located in the state.

The total annual potential volumes as determined in phase II were the data, which formed the basis for recommending selected treatment processes. It was originally intended to utilize data from

phase II to recommend the following treatment processes:

1. neutralization
2. oxidation
3. reduction
4. precipitation
5. separation
6. incineration
7. ammonia stripping

Due to the lack of available data on description of hazardous waste, the exact total volumes for each treatment process could not be determined.

The total annual potential volume of hazardous wastes from phase II were the data, which formed the basis for recommending selected disposal processes and the potential for resource recovery by SIC.

The selected process were: (1) burial, (2) deep well injection, (3) lagooning, (4) incineration, and (5) resource recovery and reuse.

Since the volumes for recovery and reuse require actual analysis of materials balance and greater specificity than the study could provide, the recommendations for recovery and reuse did not include quantities or volumes. The industries which have been identified as having the potential for recovery or reuse of materials were identified by SIC type and an approximate percentage reported for material recovery where available.

The recommendations for treatment and/or disposal technologies were made based upon the most current EPA recommendations, research

studies, and the most advanced and economical disposal/storage technology. The primary data source utilized was an unpublished "Report of the Non-Sewage Sludge/Residuals Work Group" Appendix A (USEPA, 1975). Other data sources, which formed the basis for the recommendations were shown in table 27, appendix N. The underlying functions and basis for the recommendations were: (1) reduction of volume, (2) resource or material recovery, (3) component separation, and (4) detoxification.

The treatment and/or disposal technologies selected were:

- | | |
|---|---|
| 1. Ponding/Lagooning | 19. Incineration |
| 2. Backfill | 20. Pyrolysis |
| 3. Surface Piles | 21. Gasification |
| 4. Spoil Banks | 22. Detonation |
| 5. Dam Construction | 23. Chemical Fixation |
| 6. Land Reclamation | 24. Reclamation |
| 7. Lake or River Disposal | 25. Fly Larvae Reduction |
| 8. Land Burial | 26. Reuse as Feed |
| 9. Open Dumping | 27. Centrifuging |
| 10. Land Spraying;
Spraying Irrigation | 28. Filtration |
| 11. Compost | 29. Chemical Coagulation/
Polyelectrolytes |
| 12. Sanitary Landfill | 30. Evaporation |
| 13. Secure Landfill | 31. Freezing-Thawing;
Electrophoresis |
| 14. Soil Additive, conditioner | 32. Treat with Specific
Organisms for Greater
Fuel Use |
| 15. Deep Mine Disposal | 33. Process Modification-
Designed to Decrease
Waste Production |
| 16. Deep Well Disposal | |
| 17. Ocean Dumping | |
| 18. Open Burning | |

The two, three, and four-digit SIC industry types selected for phase II were the SIC industry types for which recommendations were made. The recommendations in this study were for residuals that were subdivided into hazardous waste residuals including hazardous residuals from air and water pollution control systems, air pollution control residuals, water pollution control residuals, total pollution control residuals, and other waste residuals. Only the recommendations for the hazardous waste residuals were included in this study. Where the data were available, recommendations were made for the Best Practical Control Technology Currently Available (BPCTCA) and the Best Available Technology Economically Achievable (BATEA), which corresponds to Pub. L. 92-500 and other pertinent legislation.

Phase IV - Management Guidelines

Phase IV recommends management guidelines for various aspects of a system of waste management which will meet the requirements of the proposed EPA recommendations and legislation, specifically the Materials and Energy Act of 1975. The management guidelines form a basis for the development of further research and the establishment of a statewide system of control of treatment, recycling and recovery, handling, and disposal/storage of hazardous wastes.

Data Sources

The state-of-the-art relating to the management of hazardous wastes was reviewed. Previous research studies, state and federal legislation, management guidelines and data from phase I, II, and III were reviewed and formed the basis of the recommended management guidelines.

State Survey

A state survey was conducted in order to obtain and assess other states' management guidelines. The survey forms that were developed included a cover letter and a blank State Questionnaire (refer to appendix J). The survey forms and a self addressed return envelope were mailed September 20, 1974, to the other 49 states. The letters were addressed personally to the administrator of the solid waste division of the state health departments or comparable agency. A second follow-up letter (refer to appendix J) was mailed October 24, 1974, to states that had not responded by that date to the first letter.

Systems Approach

The general objective was to establish management guidelines for the control of hazardous wastes in the State of Oklahoma. The large system of waste management has the following components: the generation, treatment, transportation, recycling and recovery, handling, and disposal/storage of hazardous wastes. Management guidelines for this study were developed within the framework of four components of the waste management system identified above excluding generation and transportation components. A separate set of guidelines is necessary to adequately deal with the problems associated with these two components. Recent legislation in the form of the Safety Transportation Act of 1974 may place controls on the transportation of hazardous materials as well as set up criteria for the handling of hazardous materials. The proposed Toxic Substances Control Act as well as Pub. L. 92-500 and the Clean Air Acts may control the marketing of hazardous substances and the generation of hazardous wastes from point sources respectively. The remaining four

components of the large system of waste management were utilized as major topic areas in the development of management guidelines.

CHAPTER IV

ANALYSIS OF DATA

The data presented and analyzed were divided into four major sections that correspond to the four phases described in chapter I and III. The data were sorted and displayed in the tables by SIC code numbers or by county rather than both, since the amount of data was too cumbersome to display by SIC and county in the same table.

Phase I - Characterization of Industries

The data for phase I have been presented, for the most part, in the following tables according to the recommended data display format as outlined in the "Action Guide for State Hazardous Waste Survey" by EPA (USEPA, 1974). The use of a common data display format was recommended for all states to insure uniformity in the display of the information generated from all of the studies and to provide a common base for the compilation and analyses of the data acquired. The information gathered by the States could be used as documentation that may be needed to enact State legislation, where appropriate, or to issue regulations for control of hazardous waste management practices.

Several minor changes in the recommended data display forms were made. Table 12, Summary of the Age of the Industry by SIC, was based upon the age of the industrial plants rather than the age of the

processing equipment. The age of the plant was determined by the year when the plant was registered with the Secretary of State to do business within the State. The age of the processing equipment was not available.

A summary of the process type as recommended in the Action Guide was omitted for several reasons. It was recommended in the Action Guide that the data be divided by the categories: mixing, grinding, packing, cooking, filtering, and cleaning up. These categories were not defined in the Action Guide and it was unclear exactly what was meant by the terms used. A second reason for the omission of the process type was the method of data recording. It was interpreted by the author that the response from an industry must be singular and each category type was mutually exclusive. Thus, an industry could not be recorded with a multiple process type even if, in reality, the industry utilized several process types, e.g. mixing, packing and cleaning up. Certainly most industries have a clean-up process as well as other processes.

Scoring of Data

The data: (1) name of the firm, (2) address of the firm, (3) county, (4) number of production workers, (5) total number of employees, (6) the year established, (7) the market served and (8) the SIC code numbers were recorded on the "Industry Data Form I" forms. One Industry Data Form I was used for each industry in the study. The industries were sorted by each county and then numbered serially, the numbers were recorded on the forms, and the numbers henceforth are referred to as the study I.D. numbers. All references to an industry and subsequent presentation of the data were by the use of the SIC code numbers or the study I.D. numbers on the "Industry Data Form I" in

order to prevent the identification of individual industrial plants and revealing of confidential or sensitive information. A complete alphabetized list of the names of the industries included in the study appears in appendix E. The name of an industry was listed only once in the appendix regardless of the number of plants or locations.

On the original list there was slightly more than 5,300 industries. The support phases and activities of the manufacturing industries, such as warehouses, distribution centers, sales offices, office buildings, and service stations or individual gas wells as determined by the survey or consultation with industry personnel were deleted from the study. The industries that had gone out of business either permanently or temporarily were deleted from the study. Also, all the industries that had zero total employment were assumed to have gone out of business and were deleted from the original list.

During the study all three of the metals mining industries that were on the original list of industries (two with the SIC code number 1021 and one with the SIC code number 1031) went out of business. For this reason there were no metals mining four-digit SIC industry code numbers listed in appendix B.

During the study it became apparent that it was not possible or feasible to survey all industries listed under the SIC code numbers 1311 and 1321. Many of the listings from the Oklahoma Employment Security Office data were individual gas or oil wells and the crude product was piped to another location for processing and refining. The ownership of many of the listings for these two industry types was either individuals or small companies. The owners often were not cooperative and unwilling to give out proprietary information and many times did not

know or have access to the data. Consequently, it was decided to limit the listings for the SIC code numbers 1311 and 1321 to the gas plants and petroleum refineries. The list of gas plants and refineries was obtained from the Oklahoma Corporation Commission and cross-checked with the original list for the SIC code numbers 1311, 1321, and 2911. All other listings not on the list from the Corporation Commission were deleted as shown in table 5.

Reliability of the Data

The discussion in this section deals with the reliability of the data from the researcher's empirical observation based upon experience rather than statistical reliability. When cross-checking the various lists for accuracy it became apparent that the SIC code numbers for a given industry were not in agreement from every source. In some cases it was possible to resolve the conflict, if one of the sources listed an SIC code that did not exist in the 1972 Manual. By checking the list of described products produced in the Manufacturer's Directory, it was sometimes possible to resolve the conflict. In most cases where different SIC code numbers were listed for a given industry it was not possible to determine which source was accurate. Since the SIC code numbers are extremely important for obvious reasons, all SIC code numbers were recorded and identified by source. From empirical observation and after checking numerous listings, it appeared that the SIC code numbers from the Manufacturer's Directory were most accurate. Since the Manufacturer's Directory provided greater detail and accuracy, these numbers were assumed to be correct for the purposes of this study. The SIC code numbers from other sources were recorded only if they differed

from the first SIC code numbers listed in the Manufacturer's Directory.

Several SIC code numbers listed were either erroneous or non-existent numbers and did not appear in the 1972 Manual. Where possible another SIC number was assigned to a particular industry, if the correct SIC four-digit number could be determined by consulting officials of the industry, other sources, or a description of the products from the Manufacturer's Directory. In some cases, the SIC code numbers were found in the 1967 SIC Manual which was revised in 1972. The SIC code numbers that could be found in the 1967 Manual were updated and replaced by the 1972 revised SIC code numbers.

One of the reasons it was difficult to resolve differences between the data from various sources was that the sources varied by the methods used to collect the data and the amount of detail. For example, the data obtained from the Oklahoma Employment Security Division contained only one SIC code number for each industry. The data obtained from the Manufacturer's Directory contained at least one SIC code number and as many as six corresponding to the number of products manufactured. These SIC code numbers were listed in order of importance.

The data regarding the number of industries is very accurate and reliable for most counties; since each industry was contacted by a county sanitarian except for a few counties. In several of the larger counties such as Kay, Muskogee, Okmulgee, Seminole, and Stephens counties the survey forms were mailed to the industries and returned by mail. The number of industries reported in the table may be slightly higher than the actual number in the counties where the surveys were not completed or where a sample was selected from the total population, such as Oklahoma and Tulsa counties.

The employment data is reliable since it was obtained from a single source and was not subject to errors introduced by the data collection process.

In general, the data reported in phase I was not of a proprietary nature and was readily available. The difficulties encountered in obtaining reliable data resulted from the economic pressures and large reductions in the labor force during the time the study was conducted. A large number of industries either went out of business or reduced the number of employees, which made it difficult to obtain and report employment data that would be both accurate and reliable.

Analysis of the Data

The SIC data was presented in table 10-A and table 10-B. Table 10-A is a summary of the total number of SIC listings from all sources and should not be interpreted as being the total number of industries. A majority of the industries had multiple SIC code numbers listed. If several sources had different SIC code numbers for the same industry each SIC was recorded. The total number of SIC listings reported in table 10-A may be slightly higher than the actual number due to the disagreement of the data sources.

There were twelve SIC code numbers that had over a hundred listings. The largest number of SIC listings reported was the 385 listings for the SIC 2751 (commercial printing). The SIC 3599 (machinery, electrical, NEC) had 303 total listings and SIC 2711 (newspaper publishing) had 263 total listings. All other total listings were less than 160.

TABLE 10-A

SUMMARY OF THE TOTAL NUMBER OF SIC LISTINGS FROM ALL SOURCES

SIC	Total	SIC	Total	SIC	Total	SIC	Total	SIC	Total
1311	35	2281	1	2492	1	2823	1	327	1
1321	28	2283	1	2499	63	2824	2	3271	22
201	9	2291	2	2511	37	2831	3	3272	80
2011	123	2293	1	2512	80	2833	2	3273	158
2013	37	2294	1	2514	6	2834	8	3274	5
2021	5	2295	1	2515	34	2841	9	3275	5
2022	4	2299	2	2517	1	2842	28	3281	35
2023	5	2311	6	2519	5	2843	3	3291	3
2024	24	2321	5	2521	6	2844	4	3292	2
2026	33	2322	5	2522	6	2851	20	3293	13
2032	7	2323	2	2531	7	2861	2	3295	46
2033	18	2327	16	2541	32	2865	1	3296	3
2034	7	2328	16	2542	17	287	13	3297	2
2035	6	2329	9	2591	19	2873	2	3299	6
2037	14	2331	3	2599	8	2875	26	3312	17
2038	1	2335	20	2621	1	2879	8	3315	3
204	110	2337	2	2631	2	2892	4	3316	1
2041	12	2339	18	2641	1	2893	2	3317	8
2043	1	2341	7	2642	2	2895	1	332	6
2045	4	2342	2	2643	5	2899	33	3321	19
2046	2	2352	3	2545	2	2911	12	3322	3
2048	3	2361	8	2649	3	2951	30	3332	1
2051	89	2363	2	2651	6	2952	6	3333	2
2052	4	2369	6	2652	2	2992	7	3334	2
2062	3	2381	1	2653	7	2999	4	3339	3
2065	12	2384	1	2654	1	3011	9	3341	10
2066	1	2386	1	2655	4	3069	25	335	1
2076	3	2387	1	2661	3	3079	133	3351	1
2077	17	2389	2	2711	263	3111	2	3356	4
2079	2	2391	29	2721	29	3131	1	3357	4
208	1	2392	18	2731	15	314	1	3361	23
2082	1	2393	4	2732	6	3143	1	3362	23
2084	1	2394	23	2741	31	3151	1	3369	12
2086	47	2395	4	2751	385	3161	3	339	1
2087	9	2396	5	2752	141	3171	5	3398	3
2091	4	2399	27	2753	9	3172	9	3399	13
2092	2	2411	17	2761	37	3199	15	341	1
2095	6	2421	43	2771	2	3211	7	3411	3
2097	30	2426	11	2782	6	3221	6	3412	1
2099	57	243	23	2789	13	3229	16	342	1
2211	3	2431	60	2791	31	3231	21	3421	1
2231	2	2434	3	2793	11	3241	6	3423	11
225	2	2439	3	2794	5	3251	19	3429	22
2251	1	2441	5	2795	4	3255	2	3431	2
2261	3	2448	2	281	14	3259	1	3432	3
2269	1	2449	6	2813	15	3262	1	3433	24
2271	6	2451	4	2819	22	3263	1	3441	115
2272	6	2452	1	2821	10	3264	1	3442	57
2279	4	2491	11	2822	1	3269	11	3443	120

TABLE 10-A—Continued

SIC	Total	SIC	Total	SIC	Total	SIC	Total	SIC	Total
3444	133	3533	137	3582	3	3671	1	3841	12
3446	59	3534	6	3585	25	3672	3	3842	16
3448	1	3535	10	3586	2	3673	1	3843	23
3449	70	3536	12	3589	21	3674	4	3851	24
3451	12	3537	14	359	1	3679	49	3861	10
3452	6	354	13	3599	303	3691	3	3873	4
346	27	3541	8	361	24	3693	1	3911	10
3462	2	3542	13	3612	6	3694	4	3914	9
3463	1	3544	20	3613	14	3699	13	3915	5
3466	2	3545	13	3621	8	371	1	3931	1
3469	6	3549	1	3622	16	3711	11	3944	5
3471	44	3551	12	3623	2	3713	30	3949	32
3479	40	3554	1	3629	7	3714	70	3951	2
3484	2	3555	8	3631	3	3715	40	3952	1
3489	3	3559	29	3634	2	372	55	3953	21
349	32	3561	51	3635	5	3721	12	3955	1
3493	7	3562	3	3639	1	3728	7	3961	6
3494	50	3564	8	364	15	3731	2	3962	3
3495	1	3565	17	3641	6	3732	17	3963	1
3496	8	3566	13	3643	4	3751	4	3964	1
3498	34	3567	7	3644	4	379	55	3991	9
3499	58	3569	35	3645	2	3792	10	3993	88
3511	3	3573	11	3648	1	3799	57	3995	13
3519	7	3576	3	3651	9	3811	26	3999	41
352	53	3579	4	3652	16	382	40		
3523	7	358	1	366	1	3822	4		
3531	40	3580	1	3661	7	3825	1		
3532	5	3581	3	3662	31	3832	13		

TABLE 10-B

SUMMARY OF THE TOTAL NUMBER OF INDUSTRIES BY SIC - MAJOR SIC ONLY

SIC	Total	SIC	Total	SIC	Total	SIC	Total	SIC	Total
1311	33	2272	6	2449	3	2795	1	3241	5
1321	23	2279	1	2451	0	281	8	3251	13
201	9	2281	1	2452	1	2813	14	3255	2
2011	112	2283	0	2491	9	2819	15	3259	1
2013	28	2291	1	2492	0	2821	6	3262	0
2021	2	2293	0	2499	44	2822	1	3263	0
2022	2	2294	1	2511	26	2823	0	3264	1
2023	1	2295	0	2512	61	2824	1	3269	10
2024	16	2299	2	2514	4	2831	3	327	1
2026	25	2311	2	2515	28	2833	1	3271	18
2032	0	2321	3	2517	1	2834	8	3272	64
2033	13	2322	2	2519	4	2841	4	3273	145
2034	6	2323	2	2521	2	2842	17	3274	1
2035	3	2327	14	2522	3	2843	2	3275	4
2037	9	2328	10	2531	3	2844	2	3281	33
2038	1	2329	8	2541	21	2851	17	3291	3
204	99	2331	0	2542	9	2861	2	3292	2
2041	6	2335	16	2591	15	2865	1	3293	13
2043	0	2337	1	2599	4	287	8	3295	36
2045	3	2339	10	2621	0	2873	0	3296	1
2046	1	2341	6	2631	1	2875	17	3297	2
2048	3	2342	2	2641	1	2879	6	3299	4
2051	88	2352	2	2642	2	2892	3	3312	8
2052	1	2361	4	2643	3	2893	2	3315	2
2062	2	2363	1	2645	1	2895	1	3316	0
2065	12	2369	2	2649	3	2899	28	3317	6
2066	0	2381	0	2651	4	2911	12	332	1
2076	3	2384	1	2652	1	2951	26	3321	14
2077	6	2386	0	2653	6	2952	4	3322	2
2079	1	2387	1	2654	0	2992	5	3332	1
208	1	2389	2	2655	4	2999	2	3333	2
2082	1	2391	24	2661	2	3011	9	3334	1
2084	1	2392	10	2711	242	3069	17	3339	1
2086	46	2393	3	2721	22	3079	88	3341	8
2087	5	2394	15	2731	9	3111	2	335	0
2091	4	2395	4	2732	4	3131	1	3351	1
2092	1	2396	4	2741	25	314	1	3356	1
2095	5	2399	15	2751	238	3143	0	3357	1
2097	27	2411	16	2752	59	3151	1	3361	11
2099	36	2421	33	2753	5	3161	3	3362	8
2211	3	2426	6	2761	21	3171	2	3369	3
2231	1	243	20	2771	1	3172	8	339	1
225	2	2431	47	2782	3	3199	13	3398	0
2251	1	2434	3	2789	6	3211	5	3399	6
2261	1	2439	3	2791	21	3221	5	341	0
2269	1	2441	2	2793	6	3229	13	3411	2
2271	5	2448	1	2794	1	3231	16	3412	0

TABLE 10-B—Continued

SIC	Total	SIC	Total	SIC	Total	SIC	Total	SIC	Total
342	0	3498	20	3573	10	3652	14	3825	1
3421	0	3499	28	3576	3	366	1	3832	8
3423	3	3511	2	3579	2	3661	6	3841	5
3429	15	3519	4	358	1	3662	24	3842	15
3431	2	352	38	3580	1	3671	1	3843	22
3432	2	3523	4	3581	1	3672	2	3851	22
3433	10	3531	28	3582	2	3673	0	3861	5
3441	73	3532	4	3585	19	3674	4	3873	3
3442	37	3533	89	3586	2	3679	32	3911	8
3443	80	3534	4	3589	15	3691	3	3914	4
3444	88	3535	3	359	1	3693	0	3915	4
3446	34	3536	8	3599	186	3694	3	3931	1
3448	1	3537	6	361	12	3699	7	3944	2
3449	40	354	5	3612	2	371	1	3949	26
3451	5	3541	1	3613	8	3711	9	3951	0
3452	2	3542	2	3621	6	3713	19	3952	1
346	9	3544	12	3622	12	3714	53	3953	10
3462	1	3545	10	3623	0	3715	27	3955	1
3463	0	3549	1	3629	4	372	37	3961	3
3466	2	3551	5	3631	0	3721	10	3962	3
3469	3	3554	0	3634	1	3728	6	3963	0
3471	35	3555	6	3635	1	3731	1	3964	1
3479	20	3559	14	3629	0	3732	19	3991	9
3484	2	3561	33	364	10	3751	3	3993	73
3489	2	3562	1	3641	5	371	47	3995	12
349	23	3564	6	3643	2	3792	6	3999	30
3493	4	3565	11	3644	2	3799	33		
3494	24	3566	7	3645	2	3811	12		
3495	1	3567	5	3648	1	382	18		
3496	1	3569	16	3651	4	3822	0		

Table 10-B is a summary of the total number of industries by the major SIC. Only a single SIC for each industry was counted and reported in the totals. The single SIC counted was the major SIC or the SIC which represented the major product(s) produced by an industry. There were five SIC code numbers that had over 100 industries listed. The same SIC's reported in table 10-A had the largest number of industries in table 10-B: SIC 2711 (newspaper publishing)-242 total industries; SIC 2751 (commercial printing)-238 total industries; SIC 3599 (machinery, except electrical, NEC)-186 total industries; SIC 3273 (ready-mixed concrete)-145 total industries; and SIC 2011 (meat packing plants)-112 total industries.

The total number of industries by counties are reported in table 11. The numbers represent the total number of industries minus the industries that went out of business, the duplicate records, and the support phases such as sales, retail, and wholesale distribution centers. The total number of industries that were surveyed were reported in tables 5 and 6 (chapter III). As can be seen in table 5, the total number of industries surveyed and returned (excluding Oklahoma and Tulsa counties) was 1864. This represented 82.8 percent of the 2251 surveys to be returned. There were six counties that did not return any surveys and six other counties that returned a small percentage of the total number of surveys for their county. If the surveys from these counties had been returned, the total number of industries in table 11 would be slightly less than the number reported because the industries that had gone out of business would have been deleted from the table. This would also apply to the two large metropolitan areas, Oklahoma and Tulsa counties, since the number of industries surveyed was a selected sample

TABLE 11.

TOTAL NUMBER OF SELECTED INDUSTRIES BY COUNTY

County Code No.	County Name	No. of Industries	County Code No.	County Name	No. of Industries
01	Adair	12	40	LeFlore	39
02	Alfalfa	8	41	Lincoln	30
03	Atoka	14	42	Logan	27
04	Beaver	4	43	Love	7
05	Beckham	25	44	McClain	13
06	Blaine	19	45	McCurtain	48
07	Bryan	46	46	McIntosh	14
08	Caddo	31	47	Major	10
09	Canadian	48	48	Marshall	18
10	Carter	62	49	Mayes	48
11	Cherokee	19	50	Murray	13
12	Choctaw	14	51	Muskogee	94
13	Cimarron	6	52	Noble	11
14	Cleveland	90	53	Nowata	18
15	Coal	4	54	Okfuskee	7
16	Comanche	60	55	Oklahoma	1,128
17	Cotton	8	56	Okmulgee	41
18	Craig	10	57	Osage	29
19	Creek	79	58	Ottawa	65
20	Custer	35	59	Pawnee	15
21	Delaware	18	60	Payne	38
22	Dewey	8	61	Pittsburg	31
23	Ellis	4	62	Pontotoc	48
24	Garfield	86	63	Pottawatomie	69
25	Garvin	37	64	Pushmataha	9
26	Grady	66	65	Roger Mills	3
27	Grant	13	66	Rogers	33
28	Greer	13	67	Seminole	45
29	Harmon	5	68	Sequoyah	29
30	Harper	9	69	Stephens	56
31	Haskell	9	70	Texas	23
32	Hughes	15	71	Tillman	20
33	Jackson	29	72	Tulsa	1,341
34	Jefferson	14	73	Wagoner	18
35	Johnston	11	74	Washington	59
36	Kay	96	75	Washita	20
37	Kingfisher	16	76	Woods	23
38	Kiowa	21	77	Woodward	22
39	Latimer	3			
				Total	4,632

of the total.

As stated previously, there were 5300 industries on the original list of industries to be surveyed and a total of 4632 actually surveyed on table 11. Therefore, approximately 13 percent of the industries went out of business or were deleted for other reasons. This 13 percent represents data returned from 63 counties (excluding Oklahoma and Tulsa counties). If 13 percent of the industries in Oklahoma and Tulsa counties were deleted from the totals shown in table 6, there would then be a total of 1000 and 1174 industries in these counties, respectively. Thus, the total number of industries reported in table 11 may be slightly larger than the actual number of industries in operation.

Table 12 shows a summary of industry size and total employment by major SIC. Approximately 41 percent of the total number of industries (2200) had twenty or less employees. The second category, designated by the letter "B", had the second largest number of industries (420) with an employment range of 21-50 employees. There were 1835 industries for which no employment data was available.

There were seven SIC code numbers that had over 4,000 total employment report in the state. The SIC code numbers 3533 (oil field machinery and equipment) and 3661 (telephone and telegraph apparatus) each had over 7,000 total employment. The next largest were SIC codes 243 (millwork, venier, plywood, and structural wood members) with a total employment of almost 6,300; 2911 (petroleum refining) with a total employment of almost 5,700; and 2711 (newspaper publishing) with a total employment of almost 4,900. The SIC codes 3441 (fabricated structural metal) and 3531 (construction machinery and equipment) each had a total employment of over 4,000. There were three other SIC's that had over 3,000 employees each:

TABLE 12

SUMMARY OF INDUSTRY SIZE (NUMBER OF EMPLOYEES) BY MAJOR SIC

No. of Employees									No. of Employees								
SIC	A	B	C	D	E	F	G	Total Employment	SIC	A	B	C	D	E	F	G	Total Employment
1311	0	0	0	0	0	0	33	33	2261	0	0	0	0	0	0	1	1
1321	0	1	0	0	0	0	22	70	2269	0	0	0	0	0	0	1	1
201	1	0	0	2	1	0	5	864	2271	0	1	1	2	0	0	1	429
2011	66	7	6	1	0	1	31	2935	2272	0	0	1	4	0	0	1	1011
2013	9	5	2	1	0	0	11	601	2279	0	0	0	0	0	0	1	1
2021	2	0	0	0	0	0	0	22	2281	0	0	0	1	0	0	0	115
2022	1	0	0	0	0	0	1	14	2283	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	1	1	2291	0	0	0	0	0	0	1	1
2024	8	1	1	2	0	0	4	542	2293	0	0	0	0	0	0	0	0
2026	3	2	5	2	0	0	13	678	2294	0	0	0	0	0	0	1	1
2032	0	0	0	0	0	0	0	0	2295	0	0	0	0	0	0	0	0
2033	2	0	4	1	0	0	6	817	2299	0	0	1	0	0	0	1	52
2034	1	0	0	0	0	0	5	23	2311	0	1	0	1	0	0	0	189
2035	1	0	1	0	0	0	1	109	2321	0	0	0	3	0	0	0	690
2037	4	2	0	1	0	0	2	328	2322	0	0	0	2	0	0	0	711
2038	1	0	0	0	0	0	0	3	2323	1	0	0	0	0	0	1	20
204	24	8	3	3	0	0	61	1291	2327	2	0	2	9	0	0	1	2853
2041	5	1	0	0	0	0	0	104	2328	0	0	1	5	0	0	4	1329
2043	0	0	0	0	0	0	0	0	2329	3	0	2	1	0	0	2	424
2045	0	0	1	1	0	0	1	258	2331	0	0	0	0	0	0	0	0
2046	1	0	0	0	0	0	0	15	2335	3	1	7	3	0	0	2	1068
2048	1	0	0	0	0	0	2	4	2337	0	0	1	0	0	0	0	87
2051	27	4	0	7	0	0	50	1734	2339	1	2	3	2	0	0	2	615
2052	0	0	0	1	0	0	0	323	2341	1	0	0	3	0	0	2	686
206	0	0	0	0	0	0	0	0	2342	0	0	0	0	0	0	2	2
2062	0	0	0	1	0	0	1	145	2352	0	1	0	0	0	0	1	27
2065	6	1	0	1	0	0	4	313	2361	1	1	1	0	0	0	1	87
2066	0	0	0	0	0	0	0	0	2363	0	0	1	0	0	0	0	96
2076	2	0	0	0	0	0	1	35	2369	2	0	0	0	0	0	0	9
2077	4	1	0	0	0	0	1	52	2381	0	0	0	0	0	0	0	0
2079	1	0	0	0	0	0	0	5	2384	0	0	1	0	0	0	0	99
208	0	0	0	0	0	0	1	1	2386	0	0	0	0	0	0	0	0
2082	1	0	0	0	0	0	0	1	2387	0	0	0	0	0	0	1	1
2084	0	0	0	0	0	0	1	1	2389	0	0	1	0	0	0	1	87
2086	22	9	3	6	0	0	6	2059	2391	11	0	0	1	0	0	12	225
2087	1	0	0	0	0	0	4	14	2392	1	1	0	4	0	0	4	666
209	0	0	0	0	0	0	0	0	2393	2	0	0	0	0	0	1	21
2091	0	1	1	0	0	0	2	125	2394	7	1	1	0	0	0	6	168
2092	1	0	0	0	0	0	0	17	2395	1	1	0	0	0	0	2	34
2095	1	0	0	1	0	0	3	164	2396	2	0	0	0	0	0	2	12
2097	13	1	0	0	0	0	13	98	2399	3	2	0	0	0	0	10	81
2099	10	5	2	0	0	0	19	407	2411	13	1	0	0	0	0	2	76
2211	0	0	1	1	0	0	1	227	2421	14	4	1	1	0	0	13	455
2231	0	0	0	0	0	0	1	1	2426	4	0	0	0	0	0	2	34
225	1	0	0	0	0	0	1	2	243	11	3	1	0	0	1	4	6300
2251	0	0	0	1	0	0	0	210	2431	10	1	1	0	0	0	35	202

A= 1-20 Employees
 B= 21-50 Employees
 C= 51-100 Employees

D= 101-500 Employees
 E= 500-1000 Employees

F= 1000 Employees
 G= No. of industries with no data

TABLE 12--Continued

No. of Employees								Total									Total
SIC	A	B	C	D	E	F	G	Employ- ment	SIC	A	B	C	D	E	F	G	Employ- ment
2434	1	0	1	0	0	0	1	83	2793	3	1	0	0	0	0	2	48
2439	3	0	0	0	0	0	0	48	2794	1	0	0	0	0	0	0	2
2441	0	1	0	0	0	0	1	33	2795	1	0	0	0	0	0	0	5
2448	0	1	0	0	0	0	0	21	281	3	0	0	0	0	0	5	25
2449	0	2	0	0	0	0	1	48	2813	5	1	0	0	0	0	8	77
2451	0	0	0	0	0	0	0	0	2819	7	0	2	3	0	0	3	878
2452	0	1	0	0	0	0	0	35	2821	2	0	1	0	0	0	3	87
2491	4	3	0	0	0	0	2	110	2822	1	0	0	0	0	0	0	4
2492	0	0	0	0	0	0	0	0	2823	0	0	0	0	0	0	0	0
2499	18	3	1	0	0	0	22	326	2824	0	0	0	0	1	0	0	150
2511	12	3	1	1	0	0	9	389	2831	3	0	0	0	0	0	0	18
2512	21	1	0	2	0	0	37	507	2833	1	0	0	0	0	0	0	6
2514	2	0	1	0	0	0	1	103	2834	6	0	0	0	0	0	2	21
2515	10	3	1	0	0	0	14	274	2841	0	0	0	0	0	0	4	4
2517	1	0	0	0	0	0	0	18	2842	12	1	0	0	0	0	4	87
2519	1	0	0	1	0	0	2	506	2843	0	0	0	0	0	0	2	2
2521	0	2	0	0	0	0	0	70	2844	0	0	0	0	0	0	2	2
2522	1	0	0	0	0	0	2	8	2851	12	2	1	0	1	0	1	1052
2531	1	1	0	0	0	0	1	42	2861	2	0	0	0	0	0	0	17
2541	5	0	1	2	0	0	13	397	2865	1	0	0	0	0	0	0	1
2542	1	0	0	1	0	0	7	116	287	2	0	0	2	0	0	4	499
2591	2	0	0	0	0	0	13	21	2873	0	0	0	0	0	0	0	0
2599	1	0	0	0	0	0	3	9	2875	3	0	0	0	0	0	14	59
2621	0	0	0	0	0	0	0	0	2879	1	0	0	0	0	0	5	8
2631	0	0	0	0	0	1	0	1327	2892	3	0	0	0	0	0	0	10
2641	1	0	0	0	0	0	0	3	2893	1	0	0	0	0	0	1	11
2642	1	0	1	0	0	0	0	58	2895	0	0	1	0	0	0	0	72
2643	3	0	0	0	0	0	0	29	2899	11	0	0	1	0	0	17	194
2645	0	1	0	0	0	0	0	24	2911	5	3	3	6	1	1	6	5688
2649	2	0	0	0	0	0	1	27	2951	8	2	0	1	0	0	15	280
2651	1	2	0	0	0	0	1	69	2952	0	1	0	2	0	0	1	350
2652	0	0	0	0	0	0	1	1	2992	0	1	0	1	0	0	3	220
2653	0	2	1	3	0	0	0	653	2999	0	0	0	0	0	0	2	2
2654	0	0	0	0	0	0	0	0	3011	0	0	0	2	0	2	5	3900
2655	2	0	1	0	0	0	1	78	3069	7	0	1	3	0	0	6	986
2661	0	0	1	0	0	0	1	85	3079	41	14	4	4	0	0	25	1772
2711	140	22	8	4	1	1	66	4847	3111	1	0	1	0	0	0	0	80
2721	13	1	0	2	0	0	6	459	3131	1	0	0	0	0	0	0	14
2731	5	0	0	1	0	0	3	138	314	1	0	0	0	0	0	0	7
2732	0	0	0	0	0	0	4	4	3143	0	0	0	0	0	0	0	0
2741	19	2	0	0	0	0	4	169	3151	0	0	0	1	0	0	0	227
2751	142	9	4	2	0	0	81	1807	3161	2	0	0	1	0	0	0	243
2752	30	6	1	1	0	0	21	675	3171	1	0	0	0	0	0	1	2
2753	3	0	0	0	0	0	2	37	3172	3	1	0	3	0	0	1	871
2761	9	1	1	3	0	0	7	727	3199	3	1	2	1	0	0	6	375
2771	1	0	0	0	0	0	0	3	3211	0	0	0	2	1	0	2	1005
2782	3	0	0	0	0	0	0	23	3221	0	0	0	3	1	0	1	1954
2789	4	1	0	0	0	0	1	63	3229	10	0	0	0	0	0	3	48
2791	14	1	0	0	0	0	6	99	3231	4	0	0	1	0	0	11	487

TABLE 12-Continued

SIC	No. of Employees							Total Employ- ment		SIC	No. of Employees							Total Employ- ment
	A	B	C	D	E	F	G				A	B	C	D	E	F	G	
3241	0	0	0	3	0	0	2	423		3423	2	0	0	0	0	0	1	7
3251	7	2	1	0	0	0	3	189		3429	8	3	0	1	0	0	3	268
3255	0	1	1	0	0	0	0	104		3431	1	0	0	0	0	0	1	6
3259	0	0	1	0	0	0	0	88		3432	1	1	0	0	0	0	0	56
3262	0	0	0	0	0	0	0	0		3433	4	2	0	1	1	0	2	720
3263	0	0	0	0	0	0	0	0		3441	23	15	5	9	2	0	19	4242
3264	0	0	1	0	0	0	0	70		3442	13	4	2	1	0	0	17	551
3269	3	0	0	1	0	0	6	141		3443	22	13	10	15	0	0	20	3732
327	0	0	0	0	0	0	1	1		3444	22	4	4	0	0	0	58	591
3271	11	3	0	2	0	0	2	530		3446	14	2	1	0	0	0	17	255
3272	29	3	3	0	0	0	29	499		3448	0	0	0	0	0	0	1	1
3273	65	8	2	1	0	0	69	1101		3449	17	7	2	1	2	0	11	1801
3274	1	0	0	0	0	0	0	19		3451	1	0	2	1	0	0	1	261
3275	0	1	0	3	0	0	0	695		3452	2	0	0	0	0	0	0	14
3281	6	1	0	0	0	0	26	126		346	1	3	1	1	0	0	3	344
3291	3	0	0	0	0	0	0	16		3462	1	0	0	0	0	0	0	3
3292	0	2	0	0	0	0	0	50		3463	0	0	0	0	0	0	0	0
3293	1	3	0	1	0	0	8	281		3466	1	0	1	0	0	0	0	84
3295	10	2	2	0	0	0	22	250		3469	1	1	0	0	0	0	1	39
3296	1	0	0	0	0	0	0	10		3471	24	4	2	0	0	0	5	409
3297	1	1	0	0	0	0	0	54		3479	8	1	1	2	0	0	8	395
3299	1	0	0	0	0	0	3	18		3484	1	0	0	0	0	0	1	9
3312	2	3	1	0	0	0	2	219		3489	0	0	0	0	0	0	2	2
3315	2	0	0	0	0	0	0	9		349	9	3	2	1	0	0	8	621
3316	0	0	0	0	0	0	0	0		3493	0	1	0	0	0	0	3	28
3317	0	2	0	1	0	0	3	174		3494	11	5	1	0	0	0	7	316
332	0	1	0	0	0	0	0	48		3495	1	0	0	0	0	0	0	15
3321	1	5	4	3	0	0	1	1031		3496	1	0	0	0	0	0	0	3
3322	0	0	0	0	1	0	1	524		3498	4	2	0	3	0	0	11	611
3332	0	0	0	0	0	0	1	1		3499	8	3	1	1	0	0	15	427
3333	0	0	0	2	0	0	0	689		3511	1	0	0	0	0	0	1	10
3334	1	0	0	0	0	0	0	12		3519	1	2	1	0	0	0	0	144
3339	0	0	0	1	0	0	0	129		352	14	2	2	5	0	0	15	1269
3341	3	2	0	1	0	0	2	217		3523	3	1	0	0	0	0	0	70
335	0	0	0	0	0	0	0	0		3531	10	3	1	4	4	0	6	4113
3351	1	0	0	0	0	0	0	11		3532	3	0	0	0	0	0	1	31
3356	0	0	1	0	0	0	0	69		3533	32	12	3	7	2	2	31	7471
3357	1	0	0	0	0	0	0	3		3534	1	1	0	0	0	0	2	48
3361	4	2	0	1	0	0	4	223		3535	1	0	1	0	0	0	1	80
3362	4	2	1	0	0	0	1	154		3536	3	0	1	1	0	0	3	442
3369	1	0	0	1	0	0	1	106		3537	2	2	0	0	0	0	2	75
339	0	0	0	0	0	0	1	1		354	1	0	0	1	0	0	3	159
3398	0	0	0	0	0	0	0	0		3541	0	1	0	0	0	0	0	34
3399	3	1	1	0	0	0	1	130		3542	1	0	0	0	0	0	1	3
341	0	0	0	0	0	0	0	0		3544	8	0	1	0	0	0	3	158
3411	1	0	0	1	0	0	0	154		3545	8	1	1	0	0	0	0	150
3412	0	0	0	0	0	0	0	0		3549	1	0	0	0	0	0	0	5
342	0	0	0	0	0	0	0	0		3551	2	0	1	0	0	0	2	62
3421	0	0	0	0	0	0	0	0		3554	0	0	0	0	0	0	0	0

TABLE 12-Continued

SIC	No. of Employees							Total Employ- ment		SIC	No. of Employees							Total Employ- ment
	A	B	C	D	E	F	G				A	B	C	D	E	F	G	
3555	3	0	1	0	0	0	2	108		3691	1	0	0	0	0	0	2	9
3559	6	0	0	0	0	0	8	45		3693	0	0	0	0	0	0	0	0
3561	12	4	0	6	1	0	10	1935		3694	1	1	0	0	0	0	1	57
3562	0	0	0	1	0	0	0	302		3699	1	2	0	0	0	0	4	75
3564	3	0	0	2	0	0	1	543		371	0	0	0	0	0	0	1	1
3565	11	0	0	0	0	0	0	57		3711	2	1	1	0	1	0	4	711
3566	2	1	0	0	0	0	4	57		3713	8	2	1	0	0	0	8	209
3567	1	1	0	0	0	0	3	54		3714	8	7	4	2	0	0	32	985
3569	8	3	0	2	0	0	3	640		3715	12	5	2	1	0	0	7	607
3573	2	2	0	0	2	0	4	1538		372	16	5	4	2	0	0	10	939
3576	0	2	0	0	0	0	1	48		3721	3	1	0	0	0	2	4	3270
3579	0	1	0	0	0	0	1	22		3728	5	0	0	0	0	0	1	51
358	0	0	0	0	0	0	1	1		3731	0	1	0	0	0	0	0	26
3580	0	0	0	0	0	0	1	1		3732	8	4	0	0	0	0	7	189
3581	0	0	0	0	0	0	1	1		3751	3	0	0	0	0	0	0	23
3582	1	0	0	0	0	0	1	9		379	19	8	2	5	0	0	13	1256
3585	3	2	1	2	0	0	11	469		3792	5	0	0	0	0	0	1	24
3586	0	1	0	0	0	0	1	34		3799	14	4	3	1	0	0	11	643
3589	7	2	1	0	0	0	5	242		3811	5	0	0	0	0	0	7	34
359	0	0	0	0	0	0	1	1		382	5	4	1	3	0	0	5	760
3599	137	13	3	2	0	0	31	1779		3822	0	0	0	0	0	0	0	0
361	3	2	1	1	0	0	5	483		3825	0	0	0	1	0	0	0	151
3612	1	0	0	1	0	0	0	216		3832	4	0	0	0	0	0	4	27
3613	3	0	0	1	0	0	4	170		3841	2	1	0	1	0	0	1	345
3621	2	0	0	2	0	0	2	486		3842	5	0	0	0	0	0	10	57
3622	5	1	0	2	1	0	3	947		3843	2	0	0	0	0	0	20	37
3623	0	0	0	0	0	0	0	0		3851	12	0	1	0	0	0	9	137
3629	1	0	1	0	0	1	1	1370		3861	1	0	0	0	0	0	4	16
3631	0	0	0	0	0	0	0	0		3873	1	0	0	1	0	0	1	107
3634	1	0	0	0	0	0	0	8		3911	6	1	0	0	0	0	1	42
3635	1	0	0	0	0	0	0	5		3914	2	0	0	0	0	0	2	17
3639	0	0	0	0	0	0	0	0		3915	1	0	0	0	0	0	3	4
364	7	1	0	0	0	0	2	66		3931	0	0	0	0	0	0	1	1
3641	3	0	0	0	0	0	2	17		3944	1	0	0	0	0	0	1	6
3643	1	0	0	1	0	0	0	213		3949	12	1	1	0	1	0	11	968
3644	1	1	0	0	0	0	0	40		3951	0	0	0	0	0	0	0	0
3645	2	0	0	0	0	0	0	6		3952	0	0	0	0	0	0	1	1
3648	0	0	0	0	0	0	1	1		3953	6	0	0	0	0	0	4	35
3651	2	1	0	1	0	0	0	334		3955	0	0	0	0	0	0	1	1
3652	4	5	0	1	0	0	4	315		3961	0	1	0	0	0	0	2	24
366	0	0	0	0	0	0	1	1		3962	1	0	0	0	0	0	2	19
3661	4	0	0	0	1	1	0	7127		3963	0	0	0	0	0	0	0	0
3662	9	3	1	4	0	0	7	1486		3964	0	0	0	0	0	0	1	1
3671	1	0	0	0	0	0	0	1		3991	2	2	0	0	0	0	5	86
3672	0	0	0	0	0	0	2	2		3993	29	3	0	1	0	0	40	435
3673	0	0	0	0	0	0	0	0		3995	6	2	0	0	0	0	4	124
3674	1	2	0	1	0	0	0	270		3999	13	0	1	0	0	0	16	178
3679	9	5	1	4	1	1	11	2402										

3011 (tires and inner tubes), 3443 (fabricated plate work and boiler shops), and 3721 (aircraft).

The age of the industries by major SIC is shown in table 13. The largest number of industries in the state were listed in category B (6-30 years) with a total number of approximately 1,900 industries. There were approximately 1,000 industries listed in category D (51 years or older). There were approximately 1,100 industries for which no age data was available.

Summary

The majority of the selected industries in Oklahoma have been characterized as newspapers or commercial publishers and manufacturers of electrical equipment or machinery. There were also over a hundred ready-mixed concrete and meat packing industries in the state. The geographic distribution indicates that almost one-half of the industries are located in the two metropolitan areas (Oklahoma City, Tulsa). Kay, Muskogee and Cleveland counties each have almost a hundred industries located within the county. The major portion of the industries have less than twenty employees and the largest industries by employment are manufactures of oil field machinery and equipment; and telephone and telegraph apparatus. Millwork, veneer, and plywood; petroleum refining; and newspaper publishing industries each have a labor force of over 4,000 employees. The largest number of industries have been in business in the state between 6-30 years. Of the largest industries in the State of Oklahoma, only the petroleum refining industry is considered a potential hazardous waste generator. The newspaper and commercial publishing industry is included on the list of secondary potential hazardous waste generators.

TABLE 13

SUMMARY OF INDUSTRY AGES BY MAJOR SIC

Industry Age						Industry Age						Industry Age					
SIC	A	B	C	D	E	SIC	A	B	C	D	E	SIC	A	B	C	D	E
1311	0	0	0	0	33	2099	1	13	5	8	9	2394	0	7	1	5	2
132	0	0	0	0	0	2211	0	1	1	0	1	2395	0	2	1	1	0
1321	0	18	4	1	0	2231	0	0	0	0	1	2396	0	2	0	1	1
201	0	6	3	0	0	225	0	1	0	0	1	2399	1	11	1	1	1
2011	9	47	17	19	20	2251	0	1	0	0	0	2411	0	3	0	6	7
2013	0	17	6	3	2	2261	0	1	0	0	0	2421	1	14	2	4	12
2021	0	0	1	1	0	2269	0	1	0	0	0	2426	2	3	0	0	1
2022	0	0	2	0	0	2271	0	4	0	1	0	243	2	4	0	6	8
2023	0	0	1	0	0	2272	1	4	0	1	0	2431	0	19	3	16	9
2024	0	3	4	4	5	2279	0	1	0	0	0	2434	2	1	0	0	0
2026	0	2	7	14	2	2281	0	1	0	0	0	2439	0	1	0	0	2
2032	0	0	0	0	0	2283	0	0	0	0	0	2441	0	1	1	0	0
2033	0	7	3	2	1	2291	0	0	0	1	0	2448	0	0	0	0	1
2034	0	5	0	1	0	2293	0	0	0	0	0	2449	0	1	0	1	1
2035	0	2	0	1	0	2294	0	0	0	1	0	2451	0	0	0	0	0
2037	0	8	0	1	0	2295	0	0	0	0	0	2452	1	0	0	0	0
2038	1	0	0	0	0	2299	0	2	0	0	0	2491	1	5	1	1	1
204	0	41	19	31	8	2311	1	0	0	0	1	2492	0	0	0	0	0
2041	0	1	0	1	4	2321	1	2	0	0	0	2499	5	18	4	9	8
2043	0	0	0	0	0	2322	1	1	0	0	0	2511	5	14	3	1	3
2045	1	1	0	1	0	2323	1	0	0	0	1	2512	5	36	6	7	7
2046	0	0	0	0	1	2327	-2	7	2	2	1	2514	2	1	1	0	0
2048	0	2	0	0	1	2328	2	4	0	4	0	2515	1	11	7	5	4
2051	1	25	19	22	21	2329	1	1	2	0	4	2517	1	0	0	0	0
2052	0	1	0	0	0	2331	0	0	0	0	0	2519	1	0	0	3	0
206	0	0	0	0	0	2335	2	9	0	1	4	2521	0	2	0	0	0
2062	0	1	0	1	0	2337	0	1	0	0	0	2522	0	1	0	0	2
2065	0	3	2	3	4	2339	3	3	0	3	1	2531	0	1	0	0	2
2066	0	0	0	0	0	2341	0	4	0	1	1	2541	0	15	1	1	4
2076	0	3	0	0	0	2342	2	0	0	0	0	2542	0	8	0	0	1
2077	0	3	0	1	2	2352	0	1	0	1	0	2591	0	5	6	3	1
2079	1	0	0	0	0	2361	0	1	1	1	1	2599	0	3	1	0	0
208	0	0	1	0	0	2363	0	1	0	0	0	2621	0	0	0	0	0
2082	0	0	0	0	1	2369	0	1	0	0	1	2631	1	0	0	0	0
2084	0	1	0	0	0	2381	0	0	0	0	0	2641	0	0	0	1	0
2086	0	11	11	16	8	2384	0	0	0	1	0	2642	0	0	0	1	1
2087	0	2	2	1	0	2386	0	0	0	0	0	2643	0	2	0	0	1
209	0	0	0	0	0	2387	0	0	1	0	0	2645	0	1	0	0	0
2091	0	0	1	3	0	2389	0	2	0	0	0	2649	0	1	0	1	1
2092	0	0	0	1	0	2391	0	10	1	7	6	2651	0	2	0	0	2
2095	0	0	1	3	1	2392	0	7	2	0	1	2652	0	0	0	1	0
2097	0	3	4	10	10	2393	0	1	1	0	1	2653	2	2	2	0	0

A = 1971-1975 (1-5 years)

B = 1945-1970 (6-30 years)

C = 1925-1944 (31-50 years)

D = Before 1925 or (51 years)

E = No data available

TABLE 13—Continued

Industry Age						Industry Age						Industry Age					
SIC	A	B	C	D	E	SIC	A	B	C	D	E	SIC	A	B	C	D	E
2654	0	0	0	0	0	3069	1	10	2	2	2	335	0	0	0	0	0
2655	0	2	0	0	2	3079	3	42	4	14	25	3351	1	0	0	0	0
2661	0	1	1	0	0	3111	0	0	0	0	2	3356	0	1	0	0	0
2711	3	27	22	136	54	3131	0	0	1	0	0	3357	0	0	0	0	1
2721	0	3	0	7	12	314	0	0	0	0	1	3361	0	3	1	2	5
2731	0	3	3	2	1	3143	0	0	0	0	0	3362	1	4	0	2	1
2732	0	1	0	3	0	3151	0	1	0	0	0	3369	0	0	0	1	2
2741	1	7	1	8	8	3161	1	1	0	0	1	339	0	1	0	0	0
2751	9	87	30	54	58	3171	1	1	0	0	0	3398	0	0	0	0	0
2752	1	31	8	7	12	3172	1	3	0	2	2	3399	0	4	0	0	2
2753	0	2	1	0	2	3199	1	6	2	2	2	341	0	0	0	0	0
2761	1	7	2	10	1	3211	0	3	0	1	1	3411	0	1	0	1	0
2771	0	0	0	1	0	3221	0	0	1	4	0	3412	0	0	0	0	0
2782	0	1	1	0	1	3229	2	5	1	1	4	342	0	0	0	0	0
2791	0	6	1	5	9	3231	1	7	2	5	1	3421	0	0	0	0	0
2793	1	0	2	1	2	3241	0	2	1	2	0	3423	0	2	0	0	1
2794	0	0	0	0	1	3251	0	1	0	8	4	3429	0	6	3	2	4
2795	0	0	0	0	1	3255	0	1	0	1	0	3431	0	0	0	0	2
281	0	4	1	0	3	3259	0	1	0	0	0	3432	0	0	0	1	1
2813	1	3	3	2	5	3262	0	0	0	0	0	3433	0	5	2	1	2
2819	0	6	1	3	5	3263	0	0	0	0	0	3441	6	24	8	13	22
2821	1	5	0	0	0	3264	0	0	0	0	1	3442	2	19	3	4	9
2822	0	0	0	0	1	3269	1	3	2	2	2	3443	2	37	6	13	22
2823	0	0	0	0	0	327	0	1	0	0	0	3444	5	44	11	18	10
2824	1	0	0	0	0	3271	1	12	0	0	3	3446	1	22	1	7	3
2831	0	0	1	1	1	3272	0	35	35	3	12	3448	0	1	0	0	0
2833	0	0	0	0	1	3273	3	71	5	41	25	3449	3	13	4	9	11
2834	0	0	3	1	4	3274	0	1	0	0	0	3451	0	4	0	0	1
2841	0	4	0	0	0	3275	0	3	0	1	0	3452	0	0	0	0	2
2842	0	5	2	3	7	3281	0	12	8	11	2	346	0	6	1	0	2
2843	0	1	0	1	0	3291	0	1	1	1	0	3462	0	1	0	0	0
2844	0	1	0	1	0	3292	0	1	0	0	1	3463	0	0	0	0	0
2851	0	6	1	3	7	3293	0	7	1	2	3	3466	1	1	0	0	0
2861	0	2	0	0	0	3295	0	16	3	7	10	3469	2	0	0	0	1
2865	0	0	0	0	0	3296	0	0	0	0	1	3471	1	17	2	2	13
287	1	4	0	2	1	3297	0	1	0	0	0	3479	2	11	2	3	2
2873	0	0	0	0	0	3299	0	2	0	0	2	3484	0	1	1	0	0
2875	0	9	2	4	2	3312	1	5	0	0	2	3489	0	0	2	0	0
2879	1	2	1	1	1	3315	1	0	0	0	1	349	0	10	2	3	8
2892	0	1	0	0	2	3316	0	0	0	0	0	3493	1	2	1	0	0
2893	0	2	0	0	0	3317	2	2	0	1	1	3494	0	14	1	1	8
2895	0	1	0	0	0	332	1	0	0	0	0	3495	0	0	0	0	1
2899	0	14	7	2	6	3321	1	3	3	3	4	3496	1	0	0	0	0
2911	0	16	5	7	5	3322	0	1	0	0	1	3498	1	10	0	3	6
2951	4	10	4	4	4	3332	0	1	0	0	0	3499	0	17	2	6	3
2952	0	2	1	0	1	3333	0	0	0	0	0	3511	0	0	1	1	0
2992	0	0	1	4	0	3334	0	1	0	1	0	3519	0	3	1	0	0
2999	0	0	2	1	2	3339	0	0	0	1	0	352	2	15	6	9	6
3011	1	5	0	1	0	3341	1	3	0	2	2	3523	2	0	1	0	1

TABLE 13--Continued

SIC	Industry Age					SIC	Industry Age					SIC	Industry Age				
	A	B	C	D	E		A	B	C	D	E		A	B	C	D	E
3531	0	18	2	6	2	3612	0	2	0	0	0	3728	1	0	0	0	5
3532	0	1	1	2	0	3613	0	3	2	1	2	3731	1	0	0	0	0
3533	1	35	17	16	20	3621	2	1	1	2	0	3732	2	13	0	1	3
3534	0	1	1	1	1	3622	0	7	1	1	2	3751	1	0	0	1	1
3535	0	1	0	1	1	3623	0	0	0	0	0	379	2	22	0	8	15
3536	2	2	1	2	1	3629	0	2	1	0	1	3792	3	0	0	0	3
3537	2	2	2	0	0	3631	0	0	0	0	0	3799	4	17	1	4	7
354	0	3	1	1	0	3634	0	0	0	0	1	3811	0	7	0	2	3
3541	0	0	0	0	1	3635	0	1	0	0	0	382	0	6	4	4	4
3542	0	1	1	0	0	3639	0	0	0	0	0	3822	0	0	0	0	0
3544	2	8	0	0	2	364	0	4	0	4	2	3825	0	1	0	0	0
3545	2	3	0	2	3	3641	0	1	0	0	4	3832	0	1	3	2	2
3549	0	1	0	0	0	3643	0	2	0	0	0	3841	1	2	0	1	1
3551	0	3	1	0	1	3644	0	1	0	0	1	3842	0	9	2	2	2
3554	0	0	0	0	0	3645	0	0	0	0	0	3843	0	10	6	5	1
3555	0	6	0	0	0	3648	1	0	0	0	0	3851	0	8	2	6	6
3559	1	10	1	0	2	3651	1	2	0	0	0	3861	1	3	1	0	0
3561	2	19	3	6	3	3652	0	3	0	2	9	3873	0	2	0	0	1
3562	0	0	1	0	0	366	0	0	0	0	1	3911	1	1	1	0	5
3564	0	5	1	0	0	3661	0	4	0	1	1	3914	0	4	0	0	0
3565	1	6	1	1	2	3662	0	15	0	1	8	3915	0	1	0	3	0
3566	0	4	1	1	1	3671	0	1	0	0	0	3931	0	1	0	0	0
3567	0	3	1	1	0	3672	0	2	0	0	0	3944	0	0	0	0	2
3569	2	2	3	4	5	3673	0	0	0	0	0	3949	0	15	4	2	5
3573	0	6	0	0	4	3674	0	2	0	1	1	3951	0	0	0	0	0
3576	0	2	0	0	1	3679	5	12	0	6	9	3952	0	0	0	0	1
3579	0	1	0	1	0	3691	0	2	0	0	0	3953	0	3	1	4	2
358	0	1	0	0	0	3693	0	0	0	0	0	3955	0	0	0	1	0
3580	0	1	0	0	0	3694	0	3	0	0	0	3961	0	1	0	1	1
3581	0	1	0	0	0	3699	0	7	0	0	0	3962	0	3	0	0	0
3582	0	2	0	0	0	371	0	0	0	1	0	3963	0	0	0	0	0
3585	1	7	4	3	4	3711	1	4	0	2	2	3964	0	1	0	0	0
3586	0	1	0	1	0	3713	1	9	3	1	5	3991	0	3	1	3	2
3589	1	8	0	1	5	3714	5	28	2	9	9	3993	1	34	11	11	16
359	0	1	0	0	0	3715	8	6	0	8	5	3995	0	3	4	2	3
3599	6	55	14	38	73	372	0	22	1	7	7	3999	5	10	3	4	8
361	0	8	0	0	4	3721	1	5	1	1	2						

Phase II - Waste Characterization

The volume of hazardous waste potentially generated in the state was estimated by several methods for the selected industries by SIC type. The SIC's industry types selected for phase II were the primary potential hazardous waste generators, secondary potential hazardous waste generators, and six other SIC's (201, 208, 2452, 3273, and 3531) known to typically produce or use hazardous substances in the manufacturing process.

Table 14 contains a summary of the total number of primary and secondary potential hazardous waste generators by county. The number of hazardous waste generators is parallel to the total number of industries in the counties. The largest number of industries that are considered hazardous waste generators are located in the two metropolitan areas, Oklahoma City and Tulsa.

Potentially Hazardous Waste - Sewered Portion

The volume of potential hazardous waste generated was estimated by several methods for the selected industries. Waste generation factors from tables 7, 8, and 9 were applied to either the production volumes, if available, or total employment. If the production volumes were not available for all SIC's of an industry type, the percentage of the total employment was determined for which production volume data were present. The percentage of known production data were used to determine the unknown production volume per employee. The hazardous waste generation factors that were applied to the total employment data were hazardous waste factors per employee per month (refer to table 9).

Table 15 contains a summary of the hazardous waste generation factors, the production volumes, and employment data utilized to

TABLE 14

SUMMARY OF THE SELECTED HAZARDOUS SIC's BY COUNTY *

County Code	County Name	Hazardous SIC's		County Code	County Name	Hazardous SIC's	
		No. of Listings	No. of Industries			No. of Listings	No. of Industries
01	Adair	7	5	29	Harmon	3	2
02	Alfalfa	7	5	30	Harper	5	3
03	Atoka	4	3	31	Haskell	7	6
04	Beaver	2	1	32	Hughes	9	8
05	Beckham	10	9	33	Jackson	8	7
06	Blaine	11	7	34	Jefferson	8	6
07	Bryan	13	10	35	Johnston	3	2
08	Caddo	17	12	36	Kay	47	37
09	Canadian	19	18	37	Kingfisher	11	7
10	Carter	27	21	38	Kiowa	11	9
11	Cherokee	7	7	39	Latimer	2	1
12	Choctaw	5	5	40	LeFlore	23	18
13	Cimarron	3	2	41	Lincoln	14	10
14	Cleveland	43	33	42	Logan	21	12
15	Coal	2	1	43	Love	2	2
16	Comanche	30	20	44	McClain	2	2
17	Cotton	5	3	45	McCurtain	20	15
18	Craig	6	4	46	McIntosh	5	4
19	Creek	42	32	47	Major	5	4
20	Custer	18	13	48	Marshall	4	2
21	Delaware	7	5	49	Mayes	32	22
22	Dewey	7	5	50	Murray	8	5
23	Ellis	8	4	51	Muskogee	62	41
24	Garfield	48	36	52	Noble	7	5
25	Garvin	17	13	53	Nowata	4	4
26	Grady	24	19	54	Okfuskee	5	4
27	Grant	10	7	55	Oklahoma	680	533
28	Greer	6	4	56	Okmulgee	22	17

*Does not include SIC's 201, 208, 2452, 3273, or 3531

TABLE 14 —Continued

County Code	County Name	Hazardous SIC's		County Code	County Name	Hazardous SIC's	
		No. of Listings	No. of Industries			No. of Listings	No. of Industries
57	Osage	12	9	68	Sequoyah	7	5
58	Ottawa	36	27	69	Stephens	21	16
59	Pawnee	7	6	70	Texas	12	9
60	Payne	24	19	71	Tillman	16	8
61	Pittsburg	17	13	72	Tulsa	963	679
62	Pontotoc	15	14	73	Wagoner	6	6
63	Pottawatomie	34	24	74	Washington	27	21
64	Pushmataha	2	2	75	Washita	10	8
65	Roger Mills	1	1	76	Woods	13	17
66	Rogers	18	14	77	Woodward	10	8
67	Seminole	22	17				

TABLE 15

SUMMARY OF WASTE QUANTIFICATION BY SIC

SIC Description	No. of Industries/ Major SIC	Total Employment	Production Volume	H.W. Generation Factor	Total Annual Vol./Tons	Waste Category
201 Meat Products	149	4,400		.46097	24,339.22	X
208 Beverages	54	2,076		.11982	2,984.96	R _c
2231 Wool Dyeing	1	1	300 blankets 1,500 lbs	70,000 gal /1,000 lbs	52.5- 57.76	X
226 Cotton Dyeing (1 Ind. - reweaver)	2	2	NA	NA		
243 Millwork, venier, plywood and structural wood members	73	6,633		.000816	649.50	X
2452 Prefabricated wood building & components	1	35		.670348	281.55	X
249 Misc. wood products	53	436		.0206	107.78	X
263- Pulp and paper mills except building mills	28	2,354		NA		X
271 Newspaper publishing	242	4,847		.43157	25,101.84	X
272- Commercial printing	422	4,259		.41273	21,093.80	X
279						
281 Ind. inorganic chemicals	37	980				
28132 Acetylene	3		12,100		No H.W.	
28133 CO ₂	3		68,200		No H.W.	
28134 Other industrial gases	7		5,500		No H.W.	
28193 Sulfuric acid	2		187,000			
28194 Inorganic acid	1					
28196 Aluminum compounds	1		11,000			
28197 Na&K compounds	1				3520	X
28199 Other inorganic chemicals, NEC	5		66,000		(880 Fl content)	
282 Plastic materials & synthetic resins, rubber & fibers	8	241				
283 Drugs-organic pharmaceuticals	12	45				
2911 Petroleum refining	12	5,688	483 M barrels/D		50,715	0
299 Lubricating oils & greases, reclaimers, residues	5	220		.296875	783.75	0

TABLE 15-Continued

SIC Description	No. of Industries/ Major SIC	Total Employ- ment	Production Volume	H.W. Generation Factor	Total Annual Vol./Tons	Waste Category
2999 Petroleum rerefining	2	NA	Waste oil	1 gal sludge		
	1	80%	3.6x10 ⁶ gal	/15 gal oil ^a	1,425	0
2841 Soaps, detergents & cleaning pre- parations, perfumes, cosmetics, etc.	4	NA <10			NA	
285 Paints, varnishes, lacquers, enamels & allied products	17	1052		.099956	1,261.84	F
286 Industrial organic chemicals	3	18	168,000 cds	.005435	1.17	X
287 Agricultural chemicals	31	566		.41337	2,807.61	P
289 Misc. chemical products	35	287		.847539	2,918.92	X
3011 Tires & inner tubes &	9	3,900		.09456	4,425.41	X
3069 Fabricated rubber products	17	986				
3111 Leather tanning (1 ind. - repair only)	2	80				
321- Glass products	39	3,494		.006412	268.84	
322- " "						
323 " "						
3273 Ready-mixed concrete	145	1,101		.0008408	.926	X
331 Blast Furnaces, steel works, rolling, & finishing mills	16	402				
332	17	1,603				
333 Primary smelting & refining of nonferrous metals	5	1,048		.0866357	1,089.53	X
3341 Secondary smelting & refining of nonferrous metals	8	217				X
3351 Rolling, drawing & extruding nonferrous metals -	1	11		.0924	12.20	X
3362 Copper base alloy foundries (castings)	8	154				
339 Misc. primary metal products	7	131		.4367999	686.65	X
347 Coating, engraving & allied services	55	804		.067598	652.19	

^a Assume a conversion factor of 1 gallon sludge = 9.5 lbs.

TABLE 15-Continued

SIC Description	No. of Industries/ Major SIC	Total Employ- ment	Production Volume	H.W. Generation Factor	Total Annual Vol./Tons	Waste Category
3531 Construction machinery & Equipment	28	4,113		.007	345.49	X
355 Special industrial machinery	25	215		.00611	15.76	X
357 Office computing & accounting machines	15	1,608		.008637	166.66	X
3585 Air conditioning & refrigeration equip.	19	469				
3612 Power, transformers, radio & TV equip. &	26	1,702		.00615	125.61	X
3662 Radio and TV Transmitting Equipment						
3671-Radio & TV tubes, cathode, ray tubes	39	2,675		.00437	140.28	X
3679 & printed circuits						
3691 Storage batteries - lead acid type	3	215	10,041.9		1.615 ^b	X
372 Aircraft & auxiliary equipment	16	4,260		.005	255.60	X
Total					146,233.54	

^bMedian value between 1972 & 1977 hazardous waste volume

determine total annual quantities of potentially hazardous waste generated in the State.

Due to the lack of production volumes, employment data had to be utilized for most SIC categories to estimate total volume of wastes generated. Several SIC categories were lacking both the waste generation factors and the total employment data. These categories lacking data do not represent a large number of industries or total employment. Only one SIC category lacking data was on the list of primary hazardous waste generators. The SIC 226 (cotton dyeing) had two industries listed with a total employment of two and one of the industries does only reweaving. It is doubtful that this SIC category would have a significant volume of hazardous waste from dyeing of cotton fabric, which is typical for that SIC.

The petroleum refining industry has the largest estimated total annual volume of over 50,000 tons of hazardous waste generated. Three other SIC categories that each produce over an estimated 20,000 tons of hazardous waste are: SIC 2711 (newspaper publishing), SIC 272 (commercial publishing), and 201 (meat products). Other SIC categories that generate an estimated 2,000 or more tons annually are: SIC 3011 (tires and inner tubes), 281 (industrial inorganic chemicals), 287 (agricultural chemicals), and 289 (miscellaneous chemical products).

Since the estimated volumes of hazardous waste generated was determined by SIC category rather than by each individual industrial plant, the total wastes described are mixed total process wastes and cannot be neatly categorized. In order to determine the exact volume for each general category described in chapter 3, a chemical analysis of each individual industrial plant effluent would be required. Even if the exact concentrations of each hazardous substance were known, the waste streams for

a given industrial plant are mixed together often times containing non-hazardous substances as well as hazardous substances. If an SIC industry category contained more than one type of waste from a general category, it was placed in the 'other' category as shown in table 15. Therefore, almost all of the SIC industry types except the petroleum industry had wastes from several general categories and were placed in the 'other' category and it was not possible to estimate volumes of hazardous waste generated for each waste category.

The organic/inorganic composition can be estimated from the volumes shown in table 15. There was an estimated total of 52,924 tons of hazardous waste from petroleum derivatives reported. This represents approximately 36 percent of the total estimated volume. This estimation is probably slightly lower than the actual amount of organic hazardous waste generated, since many of the SIC categories classified as having 'other' waste types would also have a certain amount of organic waste present in the waste stream.

As more production volumes become available and the EPA Group I and II research reports are published this waste quantification section could be updated with more reliable waste generation factors. More accurate waste generation data and specificity of SIC digits will provide more exact totals of potential hazardous waste generated. The methods used in the study to estimate the volume of potential hazardous waste generated provide the best estimates possible at the present time without a chemical analysis of each industrial plant.

Non-Sewered Hazardous Wastes

The non-sewered hazardous wastes that were considered in this study are of two types: (1) wastes disposed at the licensed hazardous

waste site and (2) waste disposed of at industrial injection wells. These are two legal means of disposing of hazardous wastes within the state. It should not be assumed, however, that all non-sewered hazardous wastes are disposed at these locations.

Table 16 contains a summary of the wastes, sources, description, and volumes of wastes disposed at the one licensed site located in McClain County near Washington, Oklahoma. During a twelve month period $2\frac{1}{2}$ million gallons of hazardous waste was disposed at this site from Oklahoma sources and over $3\frac{1}{2}$ million gallons from Texas sources. This would be equivalent to approximately 23.75×10^6 lbs. or 11,875 tons and 33.25×10^6 lbs. or 16,625 tons, respectively. A conversion factor of 9.5 lbs/gallon of sludge was utilized. Approximately 59 percent of the total volume of hazardous wastes disposed at the site is from Texas sources. There was a total of 6.2 million gallons or 29,450 tons of hazardous waste from all sources, manufacturing and non-manufacturing.

Since the recent amendment to the Appropriations Bill was passed in the state legislature, it is now illegal for Texas or any other state to deposit hazardous waste at a licensed hazardous waste site in Oklahoma. Thus, the volumes deposited at this site may change drastically in the next year. It could be expected that the total volume would decrease due to the legislation limiting out-of-state sources while the total volume of waste deposited by Oklahoma sources is likely to increase due to air and water pollution controls. Since the volumes are not reported by waste category, it is not possible to determine the total volume of each general waste category.

Double Eagle Refining Company has over 8,200+ sources of waste reported. They are the only company in the state that rerefines waste oil.

TABLE 16

SUMMARY OF WASTES DISPOSED AT THE LICENSED HAZARDOUS WASTE SITE BETWEEN MAY 1974 - APRIL 1975

Name	No. of Months Deposited	Maximum Number of Gallons	Minimum Number of Gallons	Average Gallons/Month	Total Annual Wastes-Gallons	Source			Type of Waste	
						Type	No.	Hauler	Description	Waste Category
Acme Fence	4	3,500	500	2,225	8,900	Mfg	1		Zinc skimmings	X _m
B&J Tank Truck Service ^a	3	12,660	5,360	8,247	24,740	Mfg,G	2	H	Oil, Paint sludge, metallic sludge	O,X _p ,X _m
Cato Oil	5	14,400	1,450	6,634	33,170	Mfg	1		Oil	O
Cimmaron Mfg.	3	1,100	450	817	2,450	Mfg	1		Paint sludge	X _p
Continental Oil	1	4,800	4,800	4,800	4,800	Mfg	1		Caustic	R _c
Double Eagle Refining Co.	12	96,800	61,600	74,308	891,700	Mfg,O	8,200 ^f		Acid	R _a
Eason, A.C. ^b	1	700	700	700	700	O	NA		Paint	X _p
Foster Septic Tank ^c	1	1,200	1,200	1,200	1,200	Mfg,G	3	H	Oil; animal grease; contaminated wheat	O,X
Industrial Disposal Serv Divn. Browning Ferris	11	15,205	1,350	7,150	78,655	Mfg,O	5 ^e	H	Hospital, metallic sludge, root beer	X,X _m ,X
J.C. Service Co. - Carl Jorski ^d	12	12,750	3,000	7,767	93,200	Mfg,O	4	H	Acid, caustic, rubber, metallic sludge	R _a ,R _c ,O,X _m
OG&E	3	8,600	605	5,468	16,405	O	1		PCB's askarel sludge	O
Powell Sanitation	12	108,100	24,700	49,334	592,004	Mfg,G	50	H	Coppertox ink, rubber, kerosene, naptha, toxaphene, metallic sludge, paint sludge, solvents	X,O,P,F,X _m ,X _p
Storm Plastics	1	350	350	350	350	Mfg	1		Plastic residues	O
Tinker AFB	2	57,600	48,000	52,800	105,600	G	1		Metallic sludge	X _m
Thompson-Hayward	1	1,350	1,350	1,350	1,350	O	1		Insecticides	F
Trans Western Transports ^a	3	1,680	1,100	1,487	4,460	G,O	NA		Paint sludge	X _p
U.S. Marshall-Tulsa	1	669	669	669	669	Mfg	1		Contaminated soup	X _p
U.S. Pollution Control, Inc	12	212,694	3,780	59,061	708,737	O	18	H	Sludge (aluminum, arsenic, chromic, ink, metallic, paint), NH ₃ with NaPO ₄ , NaCN ⁻ , filterwax with solvents, grease	X _m ,X _p ,R _c ,F,O,P
									iridite cellulose with salt. As,CN ⁻	
Total - Oklahoma Sources					2,569,090					
Totals - Texas Sources	12	565,600	208,650	305,657	3,667,887					
Total - All Sources					6,236,977					

^aPrimarily from one source: Tinker AFB^bIn recycle business of petroleum products; buys and sells to recyclers^cDo not haul or dispose of industrial wastes any longer; have disposed only once at the site^dChanged name to Oklahoma City Disposal Ink^eTwo sources are regular accounts

Type of Source:

Mfg= Manufacturing source(s)

G= Government Agency

O= Other

H= Hauler or waste contractor

Waste Category:

R_a= AcidR_c= Caustic

F = Flammable

O = Oil or petroleum derivative

P = Poison

X_p = PaintX_m = Metallic sludge

X = Other

The Oil Service Company (the collection and transport division of Double Eagle) has a network of five trucks operating in the state and collects waste from service stations, manufacturing industries, car dealers, trucking fleets, garages, and city, county, state, and Federal government agencies.

Table 17 contains a list of the names of owners of industrial injection wells in the state. There are thirteen injection wells permitted by OWRB (Nipak, Inc. has two wells, but only one permit was issued). Three other companies have permits to use any of the approved injection wells, but do not have their own wells. A complete list of the wastes injected into the well owned by American Airlines by compound name and the concentration in ppm appears in appendix L.

In table 18 can be found a summary of the wastes, sources, description, and volumes of waste disposed at the industrial injection wells during a six month period. All of the sources except three were each from a single source that was a manufacturing industry. The estimated annual total volume was based upon the sum of the daily volume injected during the months reported within the six month period. There was an estimated 387 million gallons or 1.838×10^6 tons of waste injected per year from Oklahoma sources of which approximately 1070 tons (dry weight basis) is hazardous. Over one million gallons or 4.75×10^3 tons of waste injected originates outside the state. An estimated total volume of 388.6 million gallons or 1.846×10^6 tons of waste injected from all sources. The 1070 tons estimated hazardous waste has been included by SIC in the estimated 146,000 tons in phase II. The 1070 tons was estimated from the . . .

TABLE 17

APPROVED INDUSTRIAL INJECTION WELL PERMITS

Name	County Location	Permit Number
<u>Industries that have industrial injection wells</u>		
American Airlines Maintenance & Engineering Center Tulsa, Oklahoma 74151	Tulsa	IW-69-034
Cherokee Nitrogen Company P.O. Box 429 Pryor, Oklahoma 74361	Mayes	IW-69-001
Halliburton Services Drawer 1431, Plant #2 Duncan, Oklahoma 73533	Stephens	IW-71-031
Kerr McGee Corporation ^a Cimarron Facility Kerr McGee Building Oklahoma City, Oklahoma 73102	Logan	IW-70-012
Kerr McGee Corporation ^a Sequoyah Facility Kerr McGee Building Oklahoma City, Oklahoma 73102	Sequoyah	IW-70-011
Lamberton, William J. 2904 Fourth National Building Tulsa, Oklahoma 74119	Tulsa	IW-73-035
Macklanburg-Duncan Company P.O. Box 25188 Oklahoma City, Oklahoma 73125	Oklahoma	IW-71-025
Nipak Incorporated P.O. Box 388 Pryor, Oklahoma 74361	Mayes	IW-69-026

SOURCE: Oklahoma Water Resource Board

^aWells have been drilled, but have not been used^bPermit approved, but well has not been drilled

TABLE 17-Continued

Name	County Location	Permit Number
Rockwell International P.O. Box 51308 Tulsa, Oklahoma 74151	Tulsa	IW-69-024
Ozark Mahoning Company ^b 1870 South Boulder Tulsa, Oklahoma 74119	Tulsa	IW-70-006
U.S. Pollution Control, Inc. 200 Classen Center, 200 South Oklahoma City, Oklahoma 73106	Kingfisher	IW-71-225
U.S. Pollution Control, Inc. 200 Classen Center, 200 South Oklahoma City, Oklahoma 73106	Tulsa	IW-71-088
<u>Industries that have permits to use any approved injection well, but do not have their own injection well</u>		
Flint Steel Corporation P.O. Box 1289 Tulsa, Oklahoma 74101		CW-71-201
Riverside Industries P.O. Box 2265 Tulsa, Oklahoma 74101		CW-71-095
Rogers Galvanizing Company P.O. Box 1902 Tulsa, Oklahoma 74101		CW-71-221

TABLE 18

SUMMARY OF WASTES DISPOSED AT INDUSTRIAL INJECTION WELLS BETWEEN NOVEMBER, 1974 - APRIL, 1975

Name of Well	No. of Mon. Vol. Reported	Days In Mon. Reported	Avg. Vol. /Day in gallons	Avg. Vol. /Mon. in gallons	Estimated Annual Volume	Source		Type of Waste	
						Type	No.	Description	Category
American Airlines	5	151	564,424	17,045,600	204,547,200	Mfg	1	Cleaners, solvents, acids, etc. (appendix K)	F, R _a
Cherokee Nitrogen	5	141 ^a	123,554	3,484,213	34,842,134	Mfg	1	NH ₃ , H ₂ NO ₃ , urea, ammonia nitrate plants	X, R _a
Halliburton	6	182	141	4,284	51,408	Mfg	1	Cement	X
Lamberton									
Rogers Galvanizing	3	90	3,241	97,220	166,644	Mfg	1	Spent pickle liquor	R
Flint Steel	6	182	2,098	63,644	763,728	Mfg	1	Zinx slab & zaclon; H ₂ SO ₄ ; alkaline cleaner	X _m , R _a
Riverside	2	61	2,109	64,335	772,020	Mfg	1	Spent pickle liquor	R
Macklanburg-Duncan	6	182	97,419	2,955,058	35,460,692	Mfg	1	Anodized zinc plating	X _m
Nipak, Inc.									
Well #1	6	182	63,993	1,941,120	23,293,440	Mfg	1	H ₂ OSO ₄ & CrO ₄ (25-30ppm) for blowdown cooling	X _m
Well #2	6	182	199,204	6,042,533	72,510,400	Mfg		H ₂ O & NH ₃ (1476ppm) + urea (960ppm) plant effluent	X
Rockwell Internat'l	4	120	33,592	1,007,750	12,093,000	Mfg	1	Alkaline-Acid sol. (pH=7.6+; Cr 0.1-0.4 mg/l)	R
U.S. Pollution Control									
#1	4	120	170	5,100	61,200	G	1	Waste oil	O
#18	6	182	5,450	165,317	1,983,804	Mfg, O	54, 4	See Table 19	All cat'g
Out of State Source ^b	12	NA		19,379	1,104,631	Mfg, O	12	CrO ₃ acid, solvent sludge, caustic, NaBr, CN ⁻	R _a , F, R _c , P
Mfg sources except U.S. Pollution Control					385,500,666				
Total									
In-State Sources					387,555,670				
In and Out of State Sources					388,660,301				

^a Meter was not in operation for 9 days in February^b All out-of-state sources are injected into U.S. Pollution Control, Inc. Well #18.

Type of Source:

Mfg = Manufacturing source(s)

G = Government Agency

O = Other

Waste Category:

R_a = AcidR_c = Caustic

F = Flammable

O = Oil or Petroleum derivative

P = Poison

X_p = PaintX_m = Metallic sludge

X = Other

TABLE 19

SUMMARY OF OKLAHOMA MANUFACTURING SOURCES USING THE U.S. POLLUTION CONTROL, INC.
WELL NO. 18 BETWEEN APRIL 1974 AND MAY 1975 FOR TWELVE MONTHS

Study I.D. No.	No. Months Injected	Total Volume Injected- Gallons	Average Volume/ Month Injected- Gallons	Major SIC	Type of Waste	
					Description	Waste Category
420	1	500	500	3231	CrO ₃	R _C
968	5	45,550	9,110	2631	Caustic/Water/Oil	R _C
1085	8	114,962	14,370	3211	Water/Oil	O
1113	10	66,669	6,666	3411	H ₂ SO ₄	R _a
1449	2	155	77	3821	Acid	R _a
1520	3	13,125	4,375	3679	Paint/Oil; Acid	X _p , R _a
1813	1	2,248	2,248	3721	Acid	R _a
1882	1	1,375	1,375	3612	Askarel	O
2352	7	40,683	5,811	3714	Oil	O
2460	2	5,000	2,500	3499	Acid	R _a
2474	3	12,375	4,125	2851	Paint Thinner	F
2477	1	800	800	3471	Acid	R _a
2511	1	500	500	3479	CrO ₃ /Water (Acid)	R _a
2514	6	17,179	2,863	2899	HCl/Water	R _a
2535	6	3,160	526	3533	Waste Oil; Acid/Water	O, R _a
2538	1	10	10	3821	H ₂ SO ₄	R _a
2604	4	3,200	800	3714	Cyanide; Acid	P, R _a
2650	2	1,200	600	3471	CrO ₃ /HNO ₂ (Acid)	R _a
2675	9	10,715	1,190	3498	Waste Oil	O
2694	2	2,100	1,050	3471	CrO ₃ (Acid)	R _a
2714	2	1,055	527	3662	FeCl ₃ (Acid)	R _a
2716 ^a	12	19,700	1,641	3533	CrO ₃	R _C
2716 ^b	12	108,878	9,073	3533	Acid	R _a
2717	3	7,335	2,445	2899	Caustic; Acid/Water; Guar Gum/ Inorganic Matter	R _C , R _a , X

a, b Two different locations of one industry

TABLE 19-Continued

Study I.D. No.	No. Months Injected	Total Volume Injected- Gallons	Average Volume/ Month Injected- Gallons	Major SIC	Type of Waste	
					Description	Waste Category
2772	1	6,800	6,800	3441	H ₂ SO ₄ / Water	R _a
2773	1	700	700	3498	Acid	R _a
2789	4	15,094	3,773	3441	H ₂ SO ₄ /Water; Waste Oil; Solvent	R _a , O, F
2828	1	8,000	8,000	3825	Acid	R _a
2832	6	8,400	1,400	3429	Waste Oil	O
2859	8	14,931	1,866	3471	CrO ₃	R _c
2905	4	11,606	2,901	2871	Paint Thinner	F ^c
2940	3	14,600	4,866	3471	Acid	R _a
2965	10	127,761	12,776	3721	Ammonia; HF; HNO ₃	R _a
3007	3	1,050	350	3471	CrO ₃	R _c
3201	1	400	400	2599	Acid	R _a
3227	12	590,284	49,190	3317	H ₂ SO ₄	R _a
3228	9	16,549	1,838	3471	CrO ₃	R _c
3229	3	4,800	1,600	3461	Waste Oil	O
3263	1	180	180	3573	Acid	R _a
3267	5	880	176	3622	Paint Solvent and Thinner	F
3271	6	95,053	15,842	2911	NaOH/Phenols	R _c , P
3299	1	3,055	3,055	3714	Acid	R _a
3349	4	3,500	875	3729	CrO ₃ /HCl/Cyanide/H ₂ SO ₄	R _a , P, R _a
3385	9	63,000	7,000	3443	Water/Oil; Caustic	O, R _c
3554	1	330	330	3679	Cyanide	P
4669	1	3,330	3,330	3714	Acid	R _a
6122	6	8,365	1,394	3443	Waste Oil/ Water/Oil/ Rust	O
7000	1	2,230	2,230	NA	H ₂ SO ₄	R _a
Total		1,479,372				

TABLE 20

SUMMARY OF OKLAHOMA MANUFACTURING SOURCES DISPOSING OF WASTES AT THE HAZARDOUS WASTE SITE
BY CONTRACT HAULERS

Study I.D. No.	No. Months Disposed	Total Volume Hauled- Gallons	Average Volume/ Hauled Monthly-- Gallons	Major SIC	Type of Waste	
					Description	Waste Category
<u>B&J Tank Truck Service, Inc.</u>						
N.A.			N.A.	2911	Waste Oils	0
<u>Industrial Disposal Service</u>						
1449 ^a				3821	Oil Emulsion	0
1986	6	167,392	11,232	3661	Metalic Sludge (Mud)	X _m
5271 ^a			3,300	3442	Caustic Soda	R _C
<u>J.C. Service Co.</u>						
1386	3	18,720	6,240	3011	Liquid Rubber	0
1590	3	9,360	3,120	3562	Cooling Sludge	X
1954	3	3,120	1,040	3714	Cooling Sludge	X
<u>Foster Septic Tank</u>						
1521	3	13,500	4,500	2011	Animal Grease	X
<u>Powell Sanitation Service</u>						
1386	8	87,000	12,429	3011	Waste Oil	0
1954	8	74,550	9,319	3714	Chemical; Acid	R _a
2514	8	15,000	3,000	2899	Chemical; Acid	X, R _C
2203	8	14,100	4,700	3011	Oil; Solvent	0, F
1435	8	15,000	2,143	3079	Oil Emulsion; Solvents	0, F
1590	8	35,500	5,071	3562	Oil Emulsion	0
1626	8	1,500	1,500	3714	Cleaning Solvents	F
1693	8	471	157	2851	Paint Sludge	X _p
1393	8	4,250	1,063	2851	Paint Sludge	X _p
1295	8	4,000	1,000	3491	Caustics	R
1313	8	7,500	1,500	3533	Oil and Cleaning Solvents	0, F
1727	8	23,826	3,971	2711	Ink	X

^a not a regular account

TABLE 20-Continued

Study I.D. No.	No. Months Disposed	Total Volume Hauled- Gallons	Average Volume/ Monthly- Gallons	Major SIC	Type of Waste	
					Description	Waste Category
1781	8	43,250	10,813	3691	Waste Acid	R _a
3535	8	7,200	3,600	3714	Waste Acid	R _a
1850	8	2,000	2,000	3479	Paint Stripper	F
0273	8	1,500	1,500	3481	Oil Emulsion	O
U.S. Pollution Control, Inc.						
N.A.	12	935	935		Acid Sludge; Oil Sludge	R _a , O
1813	12	7,174	2,391	3721	Oil/Solvent/Paint Thinner	O, F
2023	12	17,000	17,000	3211	Acid; Caustic Sludge	R _a , R _c
2352	12	37,000	37,000	3714	Oil Sludge; Oil/Solvent Sludge	O, F
2378	12	225	225	3533	Cyanide Sludge	P
2474	12	4,125	4,125	2851	Solvent Sludge	F
2717	12	13,708	6,854	2899	Chemical, Caustic Sludge; Solvent	X, R _c , F
2905	12	5,628	2,814	2871	Paint Sludge	X _p
2965	12	11,570	11,570	3721	NaPO ₄ ; Paint Sludge	R _c , X _p
3158	12	7,375	3,688	3729	Paint Sludge; Caustic	X _p , R _c
3227	12	3,355	3,355	3317	Caustic Sludge	R _c
4318	12	296,560	296,560	3333	Zinc Sludge	X _m
4669	12	2,310	2,310	3714	Waste	
5442	12	155	155	3679	Acid Sludge	R _a
7000	12	8,250	8,250		Acid Sludge	R _a

concentrations of the constituents injected by American Airlines
(refer to appendix L):

$$\leq \text{ppm} \times \frac{\text{annual volume}}{(\text{gallons})} \times 9.5\#/ \text{gallon} \div 2,000$$

Approximately 570 tons of the total volume of waste injected by American Airlines would be considered hazardous or 53 percent of the total volume of waste injected into all of the industrial injection wells.

In table 19 and 20 can be found a list of Oklahoma manufacturing sources disposing of hazardous waste. These lists were developed in order to identify the manufacturing sources that had been reported with non-manufacturing sources or as multiple sources and their volumes in tables 16 and 18. Only the U.S. Pollution Control, Inc., injection Well No. 18 had wastes from more than one source. Each source was identified by study I.D. number in table 19. Table 19 contains a list of the Oklahoma manufacturing sources, their major SIC's, description of wastes, and the volumes injected into Well No. 18 during a twelve month period. A total of 1.5 million gallons or 7.125×10^3 tons of waste injected was reported during the twelve month period by the U.S. Pollution Control, Inc. The difference in the volumes reported between the 1.983×10^6 gallons in table 18 and the 1.479×10^6 gallons in table 19 can be accounted for by four non-manufacturing sources.

Table 20 contains a summary of the Oklahoma manufacturing

TABLE 21

SUMMARY OF WASTE QUANTIFICATION

Source	Total Annual Volume (tons)
Sewered Wastes - Estimated Potential Hazardous Waste Generated from Manufacturing Sources	146,324
Non-sewered Wastes Disposed:	
Licensed Hazardous Waste Site	
Oklahoma Sources	11,875
Manufacturing Sources in Oklahoma	6,636
All Sources	29,450
Industrial Injection Wells	
Oklahoma Sources	1,840,899
Estimated Hazardous	1,070
Manufacturing Sources in Oklahoma	1,838,155
All Sources	1,846,136

sources disposing of hazardous waste at the hazardous waste site by the six contract haulers. Since the data were obtained from each contractor and reported over varying time periods, the volumes were not totaled. The total volume of waste hauled by each contractor can be found in table 16.

Summary

Table 21 contains a summary of the wastes quantified in phase II. The total volumes estimated for the sewered portion or the potential hazardous waste generated can be compared to the non-sewered wastes disposed of at the hazardous waste site and the industrial injection wells. The total volumes reported were all converted to tons. It should not be assumed that the total volumes of fluid injected into the industrial injection wells would qualify as hazardous, since most of the wastes are diluted and are not concentrated sludges as they are at the licensed hazardous waste site. There is a considerable difference between the estimated 146,200 tons of potential hazardous waste generated from manufacturing sources and the 6,636 tons deposited annually by manufacturing sources at the licensed hazardous waste site and the estimated 1070 tons of hazardous waste injected annually into the industrial injection wells.

Phase III - Treatment and Disposal Technologies

The volume of hazardous waste hauled by private contractors was determined for the non-sewered portion of hazardous wastes. In table 16 a total of 1.4 million gallons or 58 percent of the hazardous wastes from Oklahoma sources were hauled by private contractors to the hazardous waste site. The figure 1.4 million was obtained by adding the total annual volume of wastes identified by an "H" in the source category, which identified those companies that were private contract waste haulers in table 16. Data were not available to determine the exact percentage of the hazardous waste hauled by private contractors to injection wells, however, the best estimate would be approximately 10-25 percent. Only two companies, Beacon Well Service and U. S. Pollution Control, Inc., were reported as hauling wastes from other sources to industrial injection wells and their total combined volume was estimated at 10-25 percent.

In table 22 is a list of private waste haulers contracted to transport hazardous waste in the state. The service cost and type of waste hauled varies considerably as the cost of disposal and cost of transportation changes. Several of the waste contractors did not respond to the letter sent to them requesting information (refer to appendix M). Other contractors were not willing to reveal all of the information requested, particularly the name of the sources.

Due to the lack of available data reported on the industrial waste survey it was not possible to determine the prevalence of on-site vs off-site treatment and disposal practices of the selected industries in the study.

TABLE 22

SUMMARY OF PRIVATE CONTRACT WASTE HAULERS CONTRACTED TO TRANSPORT HAZARDOUS WASTE

Name and Address	Service Cost ^a	Type of Waste	Type of Disposal Facility
Arrow Tank Trucks, Inc. 2640 S. High, Oklahoma City	\$13-\$32/hr varies with size of truck	Oil field wastes only	Injection Wells
B&J Tank Truck Service 1013 S.E. 44th St., Oklahoma City	\$12.50/hr ^b with a 2 hr minimum	Industrial	H.W. Site
Beacon Well Services, Inc. ^c 1001 E. Reno, Oklahoma City	40 bar=\$15/hr; 70 bar=\$25/hr; 160 bar=\$35/hr	Industrial	H.W. Site
Consolidated Cleaning Service P.O. Box 6022, Tulsa	\$6-\$12.50/load	Mud & dirt/ carwash; solid waste/ construction sites	Salt H ₂ O Inj. Landfill at Compass Ind.
Foster Septic Tank Cleaning 2712 W. Sheridan, Oklahoma City	\$3/load; \$3/1,000 gallons	Sand & oil; animal grease	Municipal Landfill
Industrial Disposal Service Divn. of Browning-Ferris 2451 Exchange, Oklahoma City	NA	Industrial	Landfill
Oklahoma City Disposal Ink (previously J.C. Service Co.) 245 S.W. 15th St., Oklahoma City	\$30/hr ^b	Industrial	H.W. Site
Oil Service Co. ^d 301 N. Rhode Island, Oklahoma City	4-5¢/gallon avg.	Waste oil from service stations car	H.W. Site
Petro Limited Box "O", High Pt. Park, Enid	NA	Evaporation pit; oil	NA

^aPrices quoted on June 23, 1975^bDoes not include disposal cost of hazardous waste site which is approximately 4-6¢/gallon or \$6/55 gallon drum^cHauls waste for U.S. Pollution Control, Inc.^dSame company as Double Eagle; Double Eagle Refining Co. does the refining of waste oil hauled by Oil Serv. Co.

TABLE 22--Continued

Name and Address	Service Cost ^a	Type of Waste	Type of Disposal Facility
Powell Sanitation Service 2403 N.W. 1st Terrace, Oklahoma City	10¢/gal ^e	Industrial	H.W. Site
Siegman Mud Trap Service P.O. Box 443, Enid	NA	Mud & H ₂ O from service stations & carwashes	Dump
Trans Western Transports of Okla., Inc. 2705 S. Eastern, Oklahoma City	12¢/gal ^e	Industrial	H.W. Site
Tucker Mud & Sand Trap Service 1506 Linwood, Oklahoma City	NA	NA	NA
U.S. Pollution Control, Inc. 2000 Classen Center, Oklahoma City	50¢/mile \$24/hr ^f with a 2 hr minimum	Industrial	Two Injection Wells H.W. Site

^eIncludes cost of disposal at the hazardous waste disposal site

^fCost for hauling of wastes in Tulsa geographic area and disposal at the injection wells located near Tulsa

A recommendation for the number of disposal sites for hazardous waste was based upon the estimated volume of 146,000 tons generated annually determined in phase II. According to Battelle's conclusions, the best conceptual design for a small treatment and processing facility would be capable of treating 25,000 gallons per day or about 45,000 tons annually. A medium-sized facility would be capable of processing 122,000 gallons per day or approximately 217,000 tons annually. Assuming the estimated potential volume of 146,000 tons is accurate, it would require four small treatment/disposal facilities or one medium-sized facility. The facilities should be located near the point of generation of the majority of sources of hazardous waste, which is the two large metropolitan areas, Oklahoma City and Tulsa. At the present time the one licensed site and the one proposed site by U. S. Pollution Control, Inc. would provide the necessary capacity for the disposal/storage of hazardous wastes currently disposed. This recommendation assumes no adjustment in the volumes for treatment resource/recovery, or pollution controls. It will be several years before the estimated volumes are actually deposited in a hazardous waste site. The volumes of hazardous waste that are to be deposited in hazardous waste sites are dependent upon the implementation and enforcement of legislative restrictions upon industrial effluent point sources as well as many other variables.

In table 27 is a summary of the recommended treatment and/or disposal technologies for the Best Practicable Control Technology Currently Available (BPCTCA) and the Best Available Technology Economically Achievable (BATEA) by SIC. The numbers under the two headings BPCTCA and BATEA refer to the list of recommended technologies (refer to key on last page of the table). As new technologies are discovered

and refined other options will become feasible. Several SIC categories become candidates for a sanitary landfill, once the treatment technology is applied to reduce the hazardous substance to a non-hazardous form.

Phase IV - Management Guidelines

To determine current practices and the status of the development of management guidelines in other states the results of a state survey were analyzed. Table 23 shows a summary of the questions asked of state health departments and their responses. Thirty-three states responded to the first letter and questionnaire. All but three states (Nevada, Kentucky, and New York) responded to a second follow-up letter. The final results reported in the table represent a 98 percent response or data from 48 of the 49 states. The necessary information was obtained from Kentucky and New York by a personal request via the phone. Nevada was the only state from which data were not obtained. Only five states have passed hazardous waste legislation: California, Kentucky, Minnesota, New York, and Oregon. The responses to questions no. 1 and 2 were too ambiguous to adequately analyze. Seventeen states are developing management guidelines to control hazardous wastes and twenty states have begun to survey their hazardous wastes. The area of hazardous waste management has received a considerable amount of publicity recently and has attained greater emphasis from state legislative authorities, planning agencies, and health officials. It is a topic of considerable interest and activity at the state level.

Management guidelines were developed for the control of hazardous waste in the State of Oklahoma based upon the state survey results,

TABLE 23

SUMMARY OF STATE SURVEY

Question	No	Yes	Handled Case-by-Case	Legislation Pending/Proposed	Planning
1. Definition of hazardous wastes?	12	36 ^a	1	1 ^b	
List of hazardous substances?	37	7 ^c			
2. Control of disposal and/or storage of hazardous substances?	25	15	7	3 ^b	
3. Regulate handling and/or treatment of hazardous wastes?	32	14	2	2	
5. Developing management guidelines?	29	17 ^d			1 ^e
Hazardous waste legislation passed?	41	5 ^f		48	
6. Surveys within state?	20 ^h	20 ⁱ			10 ^j

a: Idaho and Illinois refers to solid hazardous waste

b: Wyoming - proposed regulations for Spills of Oil & Hazardous Materials into the Waters of State

c: California, Hawaii, Idaho, Minnesota, Oregon, Pennsylvania, Washington

d: California, Florida, Georgia, Hawaii, Illinois, Kansas, Massachusetts, Minnesota, Nebraska, New York, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Washington, Wisconsin

e: Colorado

f: California, Kentucky, Minnesota, New York, Oregon

g: Arizona, Iowa, Ohio, Tennessee

h: Idaho added a hazardous waste section to the Idaho Solid Waste Management Survey

i: Arizona, California, Florida, Georgia, Hawaii, Indiana, Kentucky, Maine, Maryland, Minnesota, Mississippi, Missouri, New York, North Carolina, Oregon, South Carolina, Tennessee, Texas, Washington

j: Colorado, Louisiana, Illinois, Indiana, Iowa, Kansas, Montana, New Hampshire, New York, North Dakota

other guidelines previously developed, and the results of phase I, II, and III. The guidelines were developed for four components of the waste management system: treatment, recycling and recovery, handling, and disposal/storage of hazardous waste. The recommendations for treatment and disposal technologies in appendix O, table 27 are proposed herein as tentative guidelines until official guidelines are published (scheduled to be released this year by EPA). The potential for recycling and recovery of hazardous waste by SIC are included in appendix O.

Conclusions

The following conclusions were based upon the results of the data as analyzed in this chapter from the four phases of the study:

1. The largest number of selected industries in Oklahoma were:
 - a) By number of establishments - newspaper or commercial publishers, manufacturers of electrical equipment of machinery, ready-mixed concrete, and meat packing plants.
 - b) By geographic location - Oklahoma and Tulsa counties each had over 1,000 industries
 - c) By employment - the largest category was industries that had less than 20 employees
 - d) By total employment and SIC - manufacturers of oil field machinery and equipment; telephone and telegraph apparatus; millwork, veneer, and plywood; petroleum refining; and newspaper publishing
 - e) By age - industries that had been in business between 6 and 30 years.
2. The volume of hazardous waste generated in the state was estimated for the sewered and non-sewered wastes:
 - a) The total volume of potential hazardous waste generated from manufacturing sources in Oklahoma was estimated to exceed 146,000 tons annually.
 - (1) Over one-third or an estimated 50,000 tons is generated by the SIC 2911 (petroleum refining).
 - (2) Three other SIC categories were estimated to produce each over 20,000 tons of hazardous waste: SIC 2711 (newspaper publishing), 272 (commercial publishing), and 201 (meat products).

- (3) Other SIC categories that generate over 2,000 tons annually are: SIC 3011 (tires and inner tubes, 218 (industrial inorganic chemicals, 287 (agricultural chemicals, and 289 (miscellaneous chemical products).
- b) The non-sewered sources of wastes disposed in Oklahoma were disposed at two types of facilities
 - (1) Over 11,000 tons of hazardous waste from Oklahoma sources were disposed annually; 6,500 tons were from manufacturing sources. Approximately 59 percent of the hazardous wastes disposed at the site were from Texas sources. Approximately 58 percent of the total wastes disposed at the licensed hazardous waste site are hauled by private contractors.
 - (2) An estimated 1.838 million tons of waste is injected into the industrial injection wells from manufacturing sources in Oklahoma annually; 1.840 million tons from manufacturing and non-manufacturing Oklahoma sources. Thirteen out-of-state sources deposit about 5,250 tons annually.
3. Four small (45,000 ton capacity/year) or one medium-sized treatment/disposal facility would be required to process the estimated 146,000 tons generated annually by manufacturing sources in the state. The disposal sites should be located close to the point of generation, which would be near the two large metropolitan areas, Oklahoma City and Tulsa.
4. Recommendations for treatment and/or disposal technologies as outlined in table 23 should be specific for an industry type by SIC and, if possible, by process type.
5. The potential does exist for resource recovery for most SIC categories, but further research is necessary prior to the development of guidelines. A list of potential recommendations is outlined in phase IV,

Recommendations For Further Study

The following recommendations for further study were made:

1. Expand this survey and include the four phases of this study for the SIC categories and topic areas: utilities, military installations, hospitals, pesticide containers, road oil, transportation.
2. Determine a correlation between the volumes of hazardous waste actually generated and the volumes estimated by the use of the waste generation factors; or determine other variables and combinations of variables that have predictive value in determining the volume of hazardous waste.

3. State and other governmental agencies conduct environmental monitoring programs and include an assessment of the effects of hazardous waste on the public health, welfare, and the environment.
4. The possibilities are practically limitless for studies dealing with resource recovery.
5. Conduct an in-depth survey via plant visits to the primary hazardous waste generators in the state; obtain production volume data, waste volume data, and effluent analysis by SIC and process type.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of the study was to survey the nonradioactive liquid hazardous wastes from manufacturing and selected mining industrial point sources in Oklahoma. The study was structured into four phases.

An industrial waste survey of the selected industries was conducted by the personnel of the Oklahoma State Department of Health. The total population was surveyed except Oklahoma and Tulsa counties. Approximately 82 percent of the surveys were returned. A selected sample of the total population was surveyed in Oklahoma and Tulsa counties.

Phase I, the industrial characterization identified the selected industries by four-digit SIC 's, employment, geographic location, age, and products. The largest number of industries were characterized as newspaper or commercial publishers and manufacturers of electrical equipment or machinery, each with over 180 establishments and ready-mix concrete and meat packing plants each had over 100 establishments. The largest category of the industries had over less than twenty employees; the largest industries by total employment were millwork, venier, and plywood, petroleum refining, and newspaper publishing each with over 4,000 employees.

Phase II characterized the volume of hazardous waste generated by industries in Oklahoma. Hazardous waste generation factors were applied to production volumes or total employment to estimate total volume of hazardous waste produced. An estimated 146,000 tons of potential hazardous waste is generated annually with over 50,000 tons being generated by the SIC 2911 (petroleum refining). At least 36 percent of the estimated potential volume is organic from petroleum derivatives. Of the non-sewered wastes disposed annually, 11,875 tons were deposited from Oklahoma sources of the 29,450 total tons at the licensed hazardous waste disposal site. About 59 percent of the total volume originates from Texas sources. Industrial injection wells accept a total of 1.8 million tons of waste annually, a portion of which are hazardous.

Phase III identified the percentage of non-sewered waste from Oklahoma sources hauled to the licensed hazardous waste site as 58 percent by private waste contract haulers. Recommendations were made for 33 different treatment and/or disposal technology alternatives for the BPCTCA and BATEA by SIC category. Four small (45,000 ton capacity/year) or one medium-sized (215,000 ton capacity/year) treatment/disposal facility would be required to process the estimated 146,000 tons generated annually.

Phase IV was developed to recommend management guidelines for the control of hazardous wastes in the State of Oklahoma. The treatment, handling, recovery, and disposal/storage components of the waste management system were considered.

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APPENDIX A

Proposed Bill

"Materials and Energy Recovery Act of 1975"

94TH CONGRESS
1ST SESSION

S. 1474

IN THE SENATE OF THE UNITED STATES

APRIL 18, 1975

Mr. DOMENICI (for himself and Mr. STAFFORD) introduced the following bill; which was read twice and referred, by unanimous consent, to the Committee on Public Works, and if and when reported therefrom, then to the Committee on Commerce

A BILL

To amend the Solid Waste Disposal Act to authorize State program and implementation grants, to encourage full recovery of energy and resources from solid waste, to reduce waste, to control the disposal of hazardous wastes, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*
3 That this Act may be cited as the "Materials and Energy
4 Recovery Act of 1975".

5 SEC. 2. Section 202 of the Solid Waste Disposal Act,
6 as amended by the Resource Recovery Act of 1970, is
7 amended to read as follows:

II

1 "FINDINGS AND PURPOSES

2 "SEC. 202. (a) The Congress finds that—

3 "(1) requirements for materials and energy are
4 national in scope and necessitate Federal leadership to
5 utilize to the fullest possible extent the energy resources
6 in materials that now are being discarded;

7 "(2) volume of waste of materials can be reduced
8 markedly and that the resultant reduced volume of
9 waste can then be disposed of in an economic and en-
10 vironmental manner consistent with the disposal regu-
11 lations of the States and localities;

12 "(3) energy supplies from such sources as petro-
13 leum products, natural gas, nuclear and hydroelectric
14 generation will be insufficient to meet increasing de-
15 mands and, therefore, the need exists to develop alter-
16 native energy sources for public and private consump-
17 tion;

18 "(4) increasing demand for products made from
19 mineral and nonmineral natural resources is causing
20 waste and depletion of these resources, while more
21 efficient use of such resources would extend the lifespan
22 of the world's existing reserves;

23 "(5) technology and economics to support in-
24 creased resource utilization through waste reduction,

1 source separation, recycling, and recovery of energy
2 from solid waste are improving;

3 “(6) available techniques for waste reduction,
4 source operations, and energy and resources recovery
5 are not being implemented widely; and

6 “(7) such traditional methods of waste disposal as
7 open dumps and open burning which contribute to un-
8 acceptable levels of air, water, and land pollution, con-
9 stitute unacceptable hazards to public health and welfare.

10 “(b) The purposes of this Act therefore are to—

11 “(1) encourage waste reduction and maximum
12 recovery of energy and materials from municipal, in-
13 dustrial, and other sources of solid waste, and encourage
14 the use of recycled materials by the Federal Govern-
15 ment to help preserve our natural resources;

16 “(2) assist States and localities in carrying out their
17 primary responsibilities for solid waste reduction, collec-
18 tion, handling, recycling, and disposal;

19 “(3) control carefully the treatment and disposal
20 of hazardous wastes to avoid adverse effects on health
21 and the environment; and

22 “(4) provide for the use of the best technological
23 practices to eliminate any adverse effect on air or water
24 quality when land disposal of hazardous and other wastes

1 is the only practicable alternative to the consideration
2 of alternative uses of the land.”.

3 SEC. 3. Section 207 of the Solid Waste Disposal Act,
4 as amended by the Resource Recovery Act of 1970 (84
5 Stat. 1230), is amended to read as follows:

6 “PROGRAM AND IMPLEMENTATION GRANTS

7 “SEC. 207. (a) STATE PROGRAM GRANTS.—(1) The
8 Administrator shall provide financial assistance to each
9 State to assist in developing a comprehensive State plan for
10 solid waste reduction, source separation, and energy and
11 resource recovery; assist such State in administering pro-
12 grams for implementing such plan, including programs to
13 provide technical assistance and management advice to mu-
14 nicipalities and regional agencies; and develop, implement,
15 operate, and enforce a State program for the control of
16 hazardous waste disposal.

17 “(2) (A) Financial assistance shall be provided to any
18 State under this subsection on condition that such State sub-
19 mit, within a reasonable time after the enactment of this sec-
20 tion and annually thereafter, a summary report of the status
21 of the State solid waste management plan and program, and
22 the proposed program of such State for solid waste manage-
23 ment and for the use of financial assistance under this sub-
24 section.

25 “(B) Any solid waste management plan or program

1 assisted under this subsection shall include adequate author-
2 ities and programs to (i) enforce the prohibition on open
3 dumping of solid wastes, establish a timetable or schedule of
4 compliance for each municipality, unit of local government,
5 and State agency which specifies a schedule of enforceable
6 actions to achieve, within a reasonable time, such prohibition
7 on open dumping of solid wastes; (ii) apply and insure com-
8 pliance with any applicable requirements of section 209 of
9 the Act through a system of permits, licenses, or the equiva-
10 lent which the Administrator finds is reliable and enforce-
11 able; (iii) provide technological and management advice
12 and assistance to units of local government within such State
13 to enable them to manage programs for waste reduction,
14 source separation, energy and resource recovery, and solid
15 waste disposal that enhance the environment; (iv) enforce
16 the requirements of the permit or equivalent system under
17 subparagraph (A) of this paragraph and such other regula-
18 tory programs as the State or region establishes to achieve
19 the purposes and carry out the provisions of this Act; (v)
20 inspect, monitor, enter, and require reports to at least the
21 extent required under section 211 of the Act; (vi) provide
22 advice and assistance to the general public regarding environ-
23 mentally sound solid waste management, waste reduction,
24 source separation, and recycling, (vii) provide, either within
25 the State agency responsible for the comprehensive solid

1 waste management and energy and resource recovery pro-
2 gram or in a separate entity, an organization capable of as-
3 sisting municipalities to obtain financing for energy and re-
4 source recovery projects through loans, grants, loan guaran-
5 tees, cooperative public and private ventures, or other means;
6 (viii) hire, train, and maintain in service an adequate staff
7 or professional and other personnel to carry out these func-
8 tions; and (ix) provide for development of financial self-
9 sufficiency for such programs no later than the beginning of
10 fiscal year 1980, either through an equitable system of fees
11 as a part of the permit or equivalent system required under
12 subparagraph (A) of this paragraph or through other means.

13 “(b) The Administrator shall grant to each State 80
14 per centum of the cost of a comprehensive solid waste man-
15 agement and energy and resource recovery program which
16 such State agrees to establish or continue in order to meet
17 the requirements of subsection (a) of this section, and, when
18 the Administrator determines that a regional entity com-
19 posed of two or more municipalities or other governmental
20 units that represent a significant geographical portion of a
21 State or States and that the Administrator finds is capable of
22 administering such a program within its jurisdiction, to each
23 such regional agency.

24 “(c) The Administrator shall provide (1) management
25 grant assistance of up to 10 per centum of the estimated cost

1 of implementation of any publicly financed energy or re-
2 sources recovery facility, and (2) a complete program of
3 management and technical assistance to any regional agency,
4 or municipality, to help it develop projects for—

5 “(A) improving source reduction, collection, sepa-
6 ration, and handling of solid waste;

7 “(B) implementing energy and resource recovery
8 or disposal systems which are technologically feasible
9 and cost-effective;

10 “(C) considering optimum ways to market energy
11 and secondary materials recovered from solid waste;

12 “(D) providing information to assist the applicant
13 in securing itself financially against unusual risks;

14 “(E) developing workable contract bid packages for
15 energy and resource recovery facilities;

16 “(F) securing sound financing for resource recovery
17 projects, whether through industrial revenue bonds,
18 loans, grants, or joint municipal-industrial cooperation.

19 “(d) There are hereby authorized to be appropriated
20 to carry out the purposes of subsection (a) of this Act not
21 to exceed \$50,000,000 for each of the fiscal years 1976,
22 1977, and 1978; and \$25,000,000 for each of such fiscal
23 years to carry out the purposes of subsection (c) of this
24 section.

1 “(e) No project funded under subsection (c) shall re-
2 ceive more than \$300,000.”.

3 SEC. 4. Section 209 of the Solid Waste Disposal Act,
4 as amended by the Resource Recovery Act of 1970 (84
5 Stat. 1230), is amended to read as follows:

6 “FEDERAL SOLID WASTE STANDARDS

7 “SEC. 209. (a) The Administrator shall, within one
8 year of the date of enactment of the Materials Energy Re-
9 covery Act of 1975 and after consultation with appropriate
10 officials and opportunity for public hearings, promulgate
11 standards for collection, handling, disposal, and recovery of
12 all hazardous and other solid wastes that may cause air or
13 water pollution or other environmental degradation.

14 “(b) Such standards shall—

15 “(1) identify hazardous and other wastes to be
16 regulated;

17 “(2) be specific in terms of allowable quantities,
18 concentration, and the physical, chemical, or biological
19 properties of such waste, taking into account likely dis-
20 posal sites and methods of disposal or recycling;

21 “(3) contribute to the achievement and mainte-
22 nance of Federal, State, and local emission or effluent
23 limitations, air quality implementation plans, and estab-
24 lished or proposed land use plans.”.

25 SEC. 5. Sections 211 through 216 of the Solid Waste

1 Disposal Act, as amended by the Resource Recovery Act
 2 of 1970 (84 Stat. 1230), are redesignated as sections 218
 3 through 223 and the following new sections are inserted
 4 after section 210:

5 "FEDERAL REGULATIONS

6 "SEC. 211. The Administrator, in carrying out the pro-
 7 visions of this Act, may require the operator of any disposal
 8 system for hazardous or other designated solid wastes to—

9 " (1) establish and maintain records which identify
 10 type and quantity of wastes identified in section 209;

11 " (2) make reports semiannually to the appropriate
 12 State agency to identify type and quantity of wastes
 13 identified in reports in paragraph (1) ;

14 " (3) install, use, and maintain monitoring equip-
 15 ment and provide methods designed to protect the en-
 16 vironment against unauthorized discharge of hazardous
 17 or other designated wastes; and

18 " (4) provide such other information as he may
 19 require.

20 " (b) The Administrator, his authorized representative,
 21 or a State representative of the State environmental agency,
 22 upon presentation of his credentials—

23 " (1) shall have a right to entry to, upon, or through
 24 any premises in which a hazardous or other designated

1 solid waste disposal site is located or in which any rec-
2 ords required to be maintained under subsection (a) of
3 this section are located, and

4 "(2) may have access to and copy any records, and
5 inspect any monitoring equipment or method required
6 under subsection (a) of this section.

7 "(c) The Administrator may make such rules and regu-
8 lations, after opportunity for hearing, as he considers neces-
9 sary to carry out the provisions of this Act.

10 "ENFORCEMENT

11 "SEC. 212. (a) (1) Whenever, on the basis of any infor-
12 mation available to him, the Administrator finds that any
13 person is in violation of any rule, regulation, standard, or
14 other requirement which implements section 209 or 211 of
15 this Act, the Administrator shall give notice to the violator
16 of his failure to comply with such requirement or he shall
17 request the Attorney General to commence a civil action in
18 the appropriate United States district court for appropriate
19 relief, including temporary or permanent injunctive relief.
20 If such violation extends beyond the thirtieth day after the
21 Administrator's notification, the Administrator shall issue an
22 order requiring compliance within a specified time period or
23 the Administrator shall request the Attorney General to
24 commence a civil action in the United States district court
25 in the district in which the violation occurred for appropriate

1 relief, including a temporary or permanent injunction:
2 *Provided, That,* in the case of a willful violation of any
3 requirement of section 209 or 211, the Administrator simul-
4 taneously shall give notice to the State in which such viola-
5 tion has occurred thirty days prior to issuing an order or
6 requesting the Attorney General to commence action. If such
7 violator fails to take corrective action within the time speci-
8 fied in the order, he shall on conviction be fined not more
9 than \$25,000 for each day of violation or imprisoned for not
10 more than one year or both.

11 “(2) Whenever on the basis of any information available
12 to him the Administrator finds that any person is in violation
13 of any provision of this Act or any rule, regulation, standard,
14 or condition thereof, or other requirements under this Act,
15 he shall issue an order requiring such person to comply
16 with such provision or requirement, or he shall bring a civil
17 action in accordance with paragraph (3) of this subsection.

18 “(3) Any regulation issued under this subsection shall
19 state with reasonable specificity the nature of the violation
20 and a time for compliance, not to exceed thirty days, which
21 the Administrator determines is reasonable, taking into
22 account the seriousness of the violation and any good faith
23 efforts to comply with applicable requirements.

24 “(4) Upon a request by the Administrator, the At-
25 torney General shall commence a civil action for appro-

1 piate relief, including a permanent stay of such violation,
2 for any violation for which the Administrator is authorized
3 to issue a compliance order under paragraph (1) of this
4 subsection. Any action under this subsection may be brought
5 in the district court of the United States for the district in
6 which the defendant is located or resides or is doing business,
7 and such court shall have jurisdiction to restrain such viola-
8 tion, require compliance, or impose such penalty.

9 “(b) (1) Each State may develop and submit to the
10 Administrator procedures under State law for enforcement
11 of the standards developed under section 209 of this Act,
12 and for inspection, monitoring, and entry and other require-
13 ments under section 211, with respect to hazardous and
14 other designated solid waste disposal systems located in
15 such State.

16 “(2) If the Administrator finds that the procedures
17 and the legal authority of any State relating to enforcement
18 of standards promulgated pursuant to section 209 of this
19 Act and to inspection, monitoring, entry, and other require-
20 ments of section 211 of this Act are substantially equivalent
21 to those required by sections 209 and 211, such State is
22 authorized to apply and enforce such procedures and legal
23 authority with respect to hazardous and nonhazardous waste
24 disposal systems located in the State.

1 "NATIONAL GUIDELINES FOR RESOURCE RECOVERY

2 "SEC. 213. (a) The Administrator, within one year
3 following enactment of this section and each year thereafter,
4 shall publish guidelines specifying the percentages of energy
5 and resources that can be recovered from solid waste by
6 use of the best recovery management practices and tech-
7 nology that are reasonably available. These guidelines shall
8 specify those materials which constitute a significant portion
9 of the solid waste stream, including but not limited to:

- 10 "aluminum;
- 11 "copper;
- 12 "glass;
- 13 "iron and steel;
- 14 "paper, lumber, and other wood products;
- 15 "petroleum and petroleum products;
- 16 "plastics and other synthetic materials;
- 17 "rubber; and
- 18 "zinc.

19 "(b) As a part of such guidelines, the Administrator
20 shall publish thorough descriptions of existing technology
21 and practices which can be implemented by agricultural
22 producers, industries, municipalities, consumers, and others
23 to achieve the percentages of energy or resource recovery

1 from each category of solid waste that the Administrator
2 finds reasonable.

3 "FEDERAL PACKAGING GUIDELINES

4 "SEC. 214. The Administrator shall, within one year
5 following enactment of this section—

6 "(a) make a complete assessment of the use of
7 energy and virgin and recycled materials in product
8 packaging and of the environmental, social, and economic
9 impact of such packaging;

10 "(b) establish guidelines for the packaging of prod-
11 ucts which will encourage efficient use of energy and
12 materials with a consequent reduction in solid waste
13 and improvement in environmental quality; and

14 "(c) publish model standards and regulations which,
15 if implemented by States and localities, will insure use
16 of types of packaging which best conserve energy and
17 materials while avoiding adverse economic, social, and
18 environmental impact.

19 "STUDY OF LAND ACQUISITION

20 "SEC. 215. The Administrator shall conduct a full in-
21 vestigation and study of the legal and institutional problems
22 associated with the acquisition of land for hazardous and
23 other solid waste disposal, and for the construction of energy
24 and resource recovery facilities, in consultation with appro-
25 priate Federal and State agencies, and shall report to the

1 Congress not later than nine months after enactment of this
2 section his findings, conclusions, and recommendations.

3 "REGIONAL RESOURCES RECOVERY INSTITUTES

4 "SEC. 216. (a) The Administrator shall make grants
5 to States to establish, equip, and maintain one regional en-
6 ergy and resources recovery research institute, center, or
7 equivalent agency (hereinafter referred to as 'institute')
8 at a college or university in each of the ten standard Fed-
9 eral regions in the United States. The recipient college or
10 university shall be one established in accordance with sec-
11 tions 301, 305, 307, and 308 of title 7 of the United States
12 Code or some other institution designated by Act of the
13 legislature of the State concerned. Such assistance shall be
14 a maximum of \$150,000 annually to each such institute;
15 two or more States may cooperate in the designation of a
16 single regional institute and the designated college or uni-
17 versity may arrange with other colleges and universities
18 within the region to participate in the work of the institute.

19 "(b) Such grants or contracts may include payment of
20 all or part of the cost of programs or projects to—

21 "(1) develop or expand training of State, municipi-
22 pal, and other government officials and other persons in
23 the design, financing, construction, management, opera-
24 tion, and maintenance of systems and facilities for en-
25 ergy and resources recovery from solid waste and for

1 all other aspects of solid waste management so as to
2 enhance the environment;

3 “(2) support research, development, and demon-
4 stration programs for the systems and facilities referred
5 to in paragraph (1) of this subsection; and

6 “(3) transfer and disseminate to interested govern-
7 ment officials and to the public technological and other
8 information related to the systems and facilities referred
9 to in paragraph (1) of this subsection.

10 “(c) Money appropriated pursuant to this section shall
11 also be available for printing and publishing the results there-
12 of and for administrative planning and direction.

13 “(d) There are hereby authorized to be appropriated
14 \$750,000 for the fiscal year which ends September 30, 1976,
15 and for each fiscal year thereafter.

16 “FEDERAL PROCUREMENT REGULATION

17 “SEC. 217. (a) The Administrator shall, following con-
18 sultation with the General Services Administration, the De-
19 partment of Defense, and other Federal agencies and, within
20 one year following enactment of this section, establish guide-
21 lines that encourage procurement and use of materials re-
22 covered from solid waste.

23 “(b) Each contractor supplying any such agency shall
24 give equal preference to the use of recovered resources and
25 to the reuse of used or reconditioned equipment; *Provided,*

1 That such equipment can be provided with a warranty cer-
2 tifying the guarantee to said agency of the equipment
3 purchased.

4 “(c) Within ninety days following publication on such
5 standards, the General Services Administration, Depart-
6 ment of Defense, and all other Federal agencies shall revise
7 their procurement regulations to comply with this section and
8 such guidelines.

9 “(d) Whenever any Federal agency determines, follow-
10 ing attempted solicitation of bids or other such procurement
11 action, that compliance with the guidelines established pur-
12 suant to this section is impossible due to unavailability of
13 products containing the specified quantity of secondary mate-
14 rials, such agency shall be exempt from the guidelines under
15 subsection (a) of this section, only if the Administrator of
16 such agency determines the product in question will not be
17 reasonably available during the period when it is required
18 and only for the period during which he determines the prod-
19 uct will be unavailable. Each agency will be expected to
20 comply with subsection (c) of this section whenever such
21 equipment can be obtained.”.

22 SEC. 6. Section 216 of the Solid Waste Disposal Act, as
23 amended, is redesignated as section 224 and amended to read
24 as follows:

1 "GENERAL AUTHORIZATIONS

2 "SEC. 224. There are authorized to be appropriated to
3 carry out the provisions of this Act, other than sections 207
4 and 217, \$40,000,000 for each of the fiscal years which end
5 September 30, 1976 and for each fiscal year thereafter."

6 SMALL BUSINESS LOANS

7 SEC. 7. (a) Section 7 of the Small Business Act is
8 amended by inserting at the end thereof a new subsection
9 as follows:

10 "(i) (1) The Administration also is authorized to make
11 loans (either directly or in cooperation with banks or other
12 lenders through agreements to participate on an immediate
13 or deferred basis) to assist any small business concern in
14 affecting additions to or alterations in the equipment, facili-
15 ties, or methods of operation of such concern to recover en-
16 ergy and resources from solid waste, if the Administrator
17 determines that such loans will help achieve the purposes of
18 the Solid Waste Disposal Act, as amended.

19 "(2) Any such loan—

20 "(A) shall be made in accordance with provisions
21 applicable to loans made pursuant to subsection (a) of
22 this section, except as otherwise provided in this sub-
23 section;

24 "(B) shall be made only if applicant furnishes the
25 Administration with a statement in writing from the En-

1 vironmental Protection Agency, or, if appropriate, the
2 State, that such additions or alterations will help achieve
3 the purposes of the Solid Waste Disposal Act, as
4 amended.

5 “(3) The Administrator of the Environmental Protec-
6 tion Agency shall, as soon as practicable after the date of
7 enactment of the Energy and Resources Recovery Act of
8 1975, but not later than one hundred and eighty days there-
9 after, promulgate regulations establishing uniform rules for
10 the issuance of statements for the purpose of paragraph (2)
11 (B) of this subsection.

12 “(4) There is authorized to be appropriated to the busi-
13 ness loan fund established pursuant to section 4 (c) of this
14 Act not to exceed \$300,000,000 solely for the purpose of
15 carrying out this subsection.”.

16 (b) Clause (B) of paragraphs (1) and (2) of section
17 4(c) and clause (A) of paragraph (4) of that section of
18 the Small Business Act are amended by inserting "7 (i)",
19 after "7 (h),".

20 ENVIRONMENTAL FINANCING

21 SEC. 8. (a) The Administrator is authorized, under
22 such terms and conditions as he determines necessary, to
23 approve municipal energy and resource recovery projects
24 for purposes of financing pursuant to the Environmental
25 Financing Act of 1972.

1 (b) The Environmental Financing Act of 1972, is
2 hereby amended:

3 (i) In subsection 12 (e) (1) to add the letter "(A)"
4 before the word "waste", change the period at the end
5 thereof to a comma and add the following language: "or
6 (B) energy and resource recovery facilities approved by
7 the Administrator of the Environmental Protection Agency
8 pursuant to the Solid Waste Disposal Act, as amended."

9 (ii) In subsection 12 (c) to add the phrase "or energy
10 and resource recovery facilities" after the words "treatment
11 works".

12 (iii) In subsection 12 (e) (2) to add the phrase "or
13 under the Solid Waste Disposal Act, as amended" after
14 "Federal Water Pollution Control Act".

15 (iv) In subsection 12 (f) to delete the figure "\$100,-
16 000,000" and insert in lieu thereof "\$500,000,000".

17 DEFINITIONS

18 SEC. 9. Section 203 of the Solid Waste Disposal Act as
19 amended by the Resource Recovery Act of 1970 (84 Stat.
20 1230), is amended by:

21 (a) amending paragraphs (4) and (5) to read
22 as follows:

23 "(4) The term 'solid waste' means any garbage, refuse,
24 and other discarded material, including solid, liquid, semi-
25 solid, or contained gaseous material, or used petroleum prod-

1 uct resulting from industrial, commercial, mining, and agri-
2 cultural operations, and from community activities, but does
3 not include solid or dissolved material in domestic sewage,
4 or dissolved materials in irrigation return flows or industrial
5 discharges which are point sources subject to the Federal
6 Water Pollution Control Act, as amended, or source, special
7 nuclear, or byproduct material as defined by the Atomic
8 Energy Act of 1954, as amended.

9 “(5) The term ‘solid waste management’ means waste
10 reduction and the systematic control of the collection, source
11 separation, storage, transport, treatment, recovery, recycling,
12 and disposal of solid waste.”.

13 (b) amending paragraph (7) to read as follows:

14 “(7) The term ‘municipality’ means (A) a city, town,
15 borough, county, parish, district, or other public body created
16 by or pursuant to State law, with responsibility for the plan-
17 ning or administration of solid waste management, or an
18 Indian tribe or authorized tribal organization or Alaska
19 Native village or organization, and (B) includes any rural
20 community or unincorporated town or village or any other
21 public entity for which an application for assistance is made
22 by a State or political subdivision thereof.”.

23 (c) adding the following new paragraphs:

24 “(11) The term ‘disposal’ means the discharge, deposit,
25 injection, dumping, spilling, leaking, or placing of any sub-

1 stance into or on any land or water so that such substance or
2 any constituent thereof may enter the environment or be
3 emitted into the air or discharged into any waters, including
4 ground waters.

5 “(12) The term ‘storage’ means the actual or intended
6 containment of solid waste, either on a temporary basis or for
7 a period of years, in such a manner as not to constitute dis-
8 posal of such solid waste.

9 “(13) The term ‘treatment’ means any method, tech-
10 nique, or process, including neutralization, designed to
11 change the physical, chemical, or biological character or com-
12 position of any solid waste, including any hazardous waste,
13 so as to neutralize such waste or so as to render such wastes
14 nonhazardous, safer for transport, amenable for recovery,
15 amenable for storage, or reduced in volume.

16 “(14) The term ‘solid waste management facility’ in-
17 cludes (A) any resource recovery system or component
18 thereof, (B) any system or project for waste reduction or
19 source separation, and (C) any facility for the treatment of
20 solid wastes, including hazardous wastes, whether such facil-
21 ity is associated with facilities generating such wastes or
22 otherwise.

23 “(15) The term ‘waste reduction’ means the prevention
24 of solid waste generation by changes in the design, composi-

1 tion, materials, patterns of use and distribution, and other
2 characteristics of products.

3 “(16) The term ‘source separation’ includes all measures
4 to facilitate recovery of energy and materials by first segre-
5 gating and classifying products or materials at the point
6 where they are discarded.

7 “(17) The term ‘hazardous waste’ means a waste or
8 combination of wastes of a solid, liquid, contained gaseous,
9 or semisolid form, excluding source, special nuclear, or by-
10 product material, as defined by the Atomic Energy Act of
11 1954, as amended, which in the judgment of the Adminis-
12 trator may cause, or contribute to, an increase in mortality
13 or an increase in serious irreversible, or incapacitating re-
14 versible, illness, taking into account the toxicity of such
15 was its persistence, and degradability in nature, and its
16 potential for accumulation or concentration in tissue, and
17 other factors that may otherwise cause or contribute to
18 adverse acute or chronic effects on the health of persons or
19 other organisms.

20 “(18) The term ‘person’ means an individual, cor-
21 poration, partnership, association, State, municipality, com-
22 mission, or political subdivision of a State, or any interstate
23 body.”.

94TH CONGRESS
1st Session

S. 1474

A BILL

To amend the Solid Waste Disposal Act to authorize State program and implementation grants, to encourage full recovery of energy and resources from solid waste, to reduce waste, to control the disposal of hazardous wastes, and for other purposes.

By Mr. DOMENICI and Mr. STAFFORD

APRIL 18, 1975

Read twice and referred, by unanimous consent, to the Committee on Public Works, and if and when reported therefrom, then to the Committee on Commerce

APPENDIX B

SIC Numbers for Selected Industries in Oklahoma

TABLE 24

SIC NUMBERS FOR SELECTED INDUSTRIES IN OKLAHOMA

SIC	Description
<u>Division B: Mining</u>	
1311	Crude Petroleum and Natural Gas
1321	Natural Gas Liquids
<u>Division D: Manufacturing</u>	
201	Meat Products
2011	Meat Packing Plants
2013	Sausages and Other Prepared Meat Products
2021	Creamery Butter
2022	Cheese, Natural and Processed
2023	Condensed and Evaporated Milk
2024	Ice Cream and Frozen Desserts
2026	Fluid Milk
2032	Canned Specialties
2033	Canned Fruits, Vegetables, Preserves, Jams and Jellies
2034	Dried and Dehydrated Fruits, Vegetables and Soup Mixes
2035	Pickled Fruits and Vegetables, Vegetable Sauces and Seasonings and Salad Dressings
2037	Frozen Fruits, Fruit Juices and Vegetables
2038	Frozen Specialties
204	Grain Mill Products
2041	Flour and Other Grain Mill Products
2043	Cereal Breakfast Foods
2045	Blended and Prepared Flour
2046	Wet Corn Milling
2048	Prepared Feed and Feed Ingredients for Animals and Fowls, not elsewhere classified
2051	Bread and Other Bakery Products, except Cookies and Crackers
2052	Cookies and Crackers
2062	Cane Sugar Refining
2065	Candy and Other Confectionary Products
2066	Chocolate and Cocoa Products
2076	Vegetable Oil Mills, except Corn, Cottonseed, and Soybean
2077	Animal and Marine Fats and Oils
2079	Shortening, Table Oils, Margarine, and Other Edible Fats and Oils, not elsewhere classified.
2082	Malt Beverages
2084	Wines, Brandy, and Brandy Spirits
2086	Bottled and Canned Soft Drinks and Carbonated Waters
2087	Flavoring Extracts and Flavoring Sirups, not elsewhere classified
2091	Canned and Cured Fish and Seafoods
2092	Fresh or Frozen Packaged Fish and Seafoods
2095	Roasted Coffee
2097	Manufactured Ice
2099	Food Preparations, not elsewhere classified
2211	Broad Woven Fabric Mills, Cotton
2231	Broad Woven Fabric Mills, Wool (including Dyeing and Finishing)
225	Knitting Mills
2251	Women's Full Length and Knee Length Hosiery
2261	Finishers of Broad Woven Fabrics of Cotton
2271	Woven Carpets and Rugs
2272	Tufted Carpets and Rugs
2279	Carpets and Rugs, not elsewhere classified
2281	Yarn Spinning Mills: Cotton, Man-Made Fibers and Silk
2283	Yarn Mills, Wool, including Carpet and Rug Yarn
2291	Felt Goods, except Woven Felts and Hats
2293	Paddings and Upholstery Filling
2295	Coated Fabrics, not rubberized
2299	Textile Goods, not elsewhere classified

TABLE 24-Continued

SIC	Description
2311	Men's, Youths', and Boys' Suits, Coats, and Overcoats
2321	Men's, Youths', and Boys' Shirts (except Work Shirts) and Nightwear
2323	Men's, Youths', and Boys' Underwear
2327	Men's, Youths', and Boys' Neckwear
2328	Men's, Youths', and Boys' Separate Trousers
2329	Men's, Youths', and Boys' Work Clothing
2331	Women's, Misses', and Juniors' Blouses, Waists, and Shirts
2335	Women's, Misses', and Juniors' Dresses
2337	Women's, Misses', and Juniors' Suits, Skirts, and Coats
2339	Women's, Misses', and Juniors' Outerwear, not elsewhere classified
2341	Women's, Misses', Children's, and Infants' Underwear and Nightwear
2342	Brassieres, Girdles, and Allied Garments
2352	Hats and Caps, except Millinery
2361	Girls', Children's, and Infants' Dresses, Blouses, Waists, and Shirts
2363	Girls', Children's, and Infants' Outerwear, not elsewhere classified
2381	Dress and Work Gloves, except Knit and All-leather
2384	Robes and Dressing Gowns
2386	Leather and Sheep lined Clothing
2389	Apparel and Accessories, not elsewhere classified
2391	Curtains and Draperies
2392	Housefurnishings, except Curtains and Draperies
2393	Textile Bags
2394	Canvas and Related Products
2395	Pleating, Decorative and Novelty Stitching, and Tucking for the Trade
2396	Automotive Trimmings, Apparel Findings, and Related Products
2399	Fabricated Textile Products, not elsewhere classified
2411	Logging Camps and Logging Contractors
2421	Sawmills and Planing Mills, General
2426	Hardwood Dimension and Flooring Mills
243	Millwork, Veneer, Plywood, and Structural Wood Members
2431	Millwork
2434	Wood Kitchen Cabinets
2439	Structural Wood Members, not elsewhere classified
2441	Nailed and Lock Corner Wood Boxes and Shook
2448	Wood Pallets and Skids
2449	Wood Containers, not elsewhere classified
2451	Mobile Homes
2452	Prefabricated Wood Buildings and Components
2491	Wood Preserving
2492	Particleboard
2499	Wood Products, not elsewhere classified
2511	Wood Household Furniture, except Upholstered
2512	Wood Household Furniture, Upholstered
2514	Metal Household Furniture
2515	Mattresses and Bedsprings
2517	Wood Television, Radio, Phonograph, and Sewing Machine Cabinets
2519	Household Furniture, not elsewhere classified
2521	Wood Office Furniture
2522	Metal Office Furniture
2531	Public Building and Related Furniture
2541	Wood Partitions, Shelving, Lockers, and Office and Store Fixtures
2542	Metal Partitions, Shelving, Lockers, and Office and Store Fixtures
2591	Drapery Hardware and Window Blinds and Shades
2599	Furniture and Fixtures, not elsewhere classified
2621	Paper Mills, except Building Paper Mills
2631	Paperboard Mills
2641	Paper Coating and Glazing
2642	Envelopes
2643	Bags, except Textile Bags

TABLE 24—Continued

SIC	Description
2645	Die-cut Paper and Paperboard and Cardboard
2649	Converted Paper and Paperboard Products, not elsewhere classified
2651	Folding Paperboard Boxes
2653	Corrugated and Solid Fiber Boxes
2654	Sanitary Food Containers
2655	Fiber Cans, Tubes, Drums, and Similar Products
2661	Building Paper and Building Board Mills
2711	Newspapers: Publishing, Publishing and Printing
2721	Periodicals: Publishing, Publishing and Printing
2731	Books: Publishing, Publishing and Printing
2732	Book Printing
2741	Miscellaneous Printing
2751	Commercial Printing, Letterpress and Screen
2752	Commercial Printing, Lithographic
2753	Engraving and Plate Printing
2761	Manifold Business Forms
2782	Blankbooks, Looseleaf Binders and Devices
2789	Bookbinding and Related Work
2791	Typesetting
2793	Photoengraving
2794	Electrotyping and Stereotyping
2795	Lithographic Platemaking and Related Services
281	Industrial Inorganic Chemicals
2819	Industrial Inorganic Chemicals, not elsewhere classified
2821	Plastics Materials, Synthetic Resins, and Nonvulcanizable Elastomers
2822	Synthetic Rubber (Vulcanizable Elastomers)
2823	Cellulosic Man-made Fibers
2824	Synthetic Organic Fibers, except Cellulosic
2831	Biological Products
2833	Medicinal Chemicals and Botanical Products
2834	Pharmaceutical Preparations
2841	Soap and Other Detergents, except Specialty Cleaners
2842	Specialty Cleaning, Polishing, and Sanitation Preparations
2851	Paints, Varnishes, Lacquers, Enamels, and Allied Products
2861	Gum and Wood Chemicals
2865	Cyclic (Coal Tar) Crudes, and Cyclic Intermediates, Dyes, and Organic Pigments (Lakes and Toners)
287	Agricultural Chemicals
2873	Nitrogenous Fertilizers
2875	Fertilizers, Mixing Only
2879	Pesticides, and Agricultural Chemicals, not elsewhere classified
2892	Explosives
2893	Printing Ink
2895	Carbon Black
2899	Chemicals and Chemical Preparations, not elsewhere classified
2911	Petroleum Refining
2951	Paving Mixtures and Blocks
2952	Asphalt Felts and Coatings
2992	Lubricating Oils and Greases
2999	Products of Petroleum and Coal, not elsewhere classified
3011	Tires and Inner Tubes
3069	Fabricated Rubber Products, not elsewhere classified
3079	Miscellaneous Plastics Products
3111	Leather Tanning and Finishing
314	Footwear, except Rubber
3151	Leather Gloves and Mittens
3171	Women's Handbags and Purses
3172	Personal Leather Goods, not elsewhere classified
3199	Leather Goods, not elsewhere classified
3211	Flat Glass
3221	Glass Containers

TABLE 24—Continued

SIC	Description
3229	Pressed and Blown Glass and Glassware, not elsewhere classified
3231	Glass Products, Made of Purchased Glass
3241	Cement, Hydraulic
3251	Brick and Structural Clay Tile
3255	Clay Refractories
3259	Structural Clay Products, not elsewhere classified
3262	Vitreous China Table and Kitchen Articles
3263	Fine Earthenware (Whiteware) Table and Kitchen Articles
3264	Porcelain Electrical Supplies
3269	Pottery Products, not elsewhere classified
3271	Concrete Block and Brick
3273	Ready-mixed Concrete
3274	Lime
3275	Gypsum Products
3281	Cut Stone and Stone Products
3291	Abrasive Products
3292	Asbestos Products
3293	Gaskets, Packing, and Sealing Devices
3295	Minerals and Earths, Grounds or otherwise treated
3296	Mineral Wool
3297	Nonclay Refractories
3299	Nonmetallic Mineral Products, not elsewhere classified
3312	Blast Furnaces (including Coke Ovens), Steel Works, and Rolling Mills
3315	Steel Wire Drawings and Steel Nail and Spikes
3316	Cold Rolled Steel Sheet, Strip, and Bars
3317	Steel Pipe and Tubes
332	Iron and Steel Foundries
3321	Gray Iron Foundries
3322	Malleable Iron Foundries
3333	Primary Smelting and Refining of Zinc
3334	Primary Production of Aluminum
3339	Primary Smelting and Refining of Nonferrous Metals
3341	Secondary Smelting and Refining of Nonferrous Metals
3351	Rolling, Drawing, and Extruding of Copper
3356	Rolling, Drawing, and Extruding of Nonferrous Metals, except Copper and Aluminum
3357	Drawing and Insulating of Nonferrous Wire
3361	Aluminum Foundries
3362	Brass, Bronze, Copper, Copper Base Alloy Foundries (Castings)
3369	Nonferrous Foundries (Castings) not elsewhere classified
3398	Metal Heat Treating
3399	Primary Metal Products, not elsewhere classified
341	Metal Cans and Shipping Containers
3411	Metal Cans
3412	Metal Shipping Barrels, Drums, Kegs, and Pails
3423	Hand and Edge Tools, except Machine Tools and Hand Saws
3429	Hardware, not elsewhere classified
3431	Enameled Iron and Metal Sanitary Ware
3432	Plumbing Fixture Fittings and Trim (Brass Goods)
3433	Heating Equipment, except Electric and Warm Air Furnaces
3441	Fabricated Plate Work (Boiler Shops)
3442	Metal Doors, Sash, Frames, Molding, and Trim
3443	Fabricated Plate Work (Boiler Shops)
3444	Sheet Metal Work
3446	Architectural and Ornamental Metal Work
3448	Prefabricated Metal Buildings and Components
3449	Miscellaneous Metal Work
3451	Screw Machine Products
3452	Bolts, Nuts, Screws, Rivets, and Washers
346	Metal Forgings and Stampings
3462	Iron and Steel Forgings
3463	Nonferrous Forgings
3466	Crowns and Closures

TABLE 24—Continued

SIC	Description
3469	Metal Stampings, not elsewhere classified
3471	Electroplating, Plating, Polishing, Anodizing, and Coloring
3479	Coating, Engraving, and Allied Services, not elsewhere classified
3484	Small Arms
3489	Ordnance Accessories, not elsewhere classified
3493	Steel Springs, except Wire
3494	Valves and Pipe Fittings, except Plumbers' Brass Goods
3495	Wire Springs
3496	Miscellaneous Fabricated Wire Products
3498	Fabricated Pipe and Fabricated Pipe Fittings
3499	Fabricated Metal Products, not elsewhere classified
3511	Steam, Gas, and Hydraulic Turbines, and Turbine Generator Set Units
3519	Internal Combustion Engines, not elsewhere classified
352	Farm and Garden Machinery and Equipment
3523	Farm Machinery and Equipment
3531	Construction Machinery and Equipment
3532	Mining Machinery and Equipment, except Oil Field Machinery and Equipment
3533	Oil Field Machinery and Equipment
3534	Elevators and Moving Stairways
3535	Conveyors and Conveying Equipment
3536	Hoists, Industrial Cranes, and Monorail Systems
3537	Industrial Trucks, Tractors, Trailers, and Stackers
3541	Machine Tools, Metal Cutting Types
3542	Machine Tools, Metal Forming Types
3545	Machine Tool Accessories and Measuring Devices
3549	Metalworking Machinery, not elsewhere classified
3551	Food Products Machinery
3554	Paper Industries Machinery
3555	Printing Trades Machinery and Equipment
3559	Special Industry Machinery, not elsewhere classified
3561	Pumps and Pumping Equipment
3562	Ball and Roller Bearings
3564	Blowers and Exhaust and Ventilation Fans
3565	Industrial Patterns
3566	Speed Changers, Industrial High Speed Drives, and Gears
3567	Industrial Process Furnaces and Ovens
3569	General Industrial Machinery and Equipment, not elsewhere classified
3573	Electronic Computing Equipment
3576	Scales and Balances, except Laboratory
3579	Office Machines, not elsewhere classified
358	Refrigeration and Service Industry Machinery
3581	Automatic Merchandising Machines
3582	Commercial Laundry, Dry Cleaning, and Pressing Machines
3585	Air Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment
3586	Measuring and Dispensing Pumps
3589	Service Industry Machines, not elsewhere classified
361	Electric Transmission and Distribution Equipment
3612	Power, Distribution, and Specialty Transformers
3613	Switchgear and Switchboard Apparatus
3622	Industrial Controls
3623	Welding Apparatus, Electric
3629	Electrical Industrial Apparatus, not elsewhere classified
3631	Household Cooking Equipment
3634	Electric Lighting and Wiring Equipment
3635	Household Vacuum Cleaners
3639	Household Appliances, not elsewhere classified
364	Electric Lighting and Wiring Equipment
3641	Electric Lamps
3643	Current-carrying Wiring Devices
3644	Noncurrent-carrying Wiring Devices
3645	Residential Electric Lighting Fixtures

TABLE 24—Continued

SIC	Description
3651	Radio and Television Receiving Sets, except Communication Types
3652	Phonograph Records and Prerecorded Magnetic Tape
3661	Telephone and Telegraph Apparatus
3662	Radio and Television Transmitting, Signaling, and Detection Equipment and Apparatus
3671	Radio and Television Receiving Type Electron Tubes, except Cathode Ray
3672	Cathode Ray Television Picture Tubes
3673	Transmitting, Industrial, and Special Purpose Electron Tubes
3674	Semiconductors and Related Devices
3679	Electronic Components, not elsewhere classified
3691	Storage Batteries
3693	Radiographic X-ray, Fluoroscopic X-ray, Therapeutic X-ray, and other X-ray Apparatus and Tubes; Electromedical and Electrotherapeutic Apparatus
3694	Electrical Equipment for Internal Combustion Engines
3699	Electrical Machinery, Equipment and Supplies, not elsewhere classified
371	Motor Vehicles and Motor Vehicle Equipment
3711	Motor Vehicles and Passenger Car Bodies
3713	Truck and Bus Bodies
3714	Motor Vehicle Parts and Accessories
3715	Truck Trailers
372	Aircraft and Parts
3721	Aircraft
3728	Aircraft parts and Auxiliary Equipment, not elsewhere classified
3731	Ship Building and Repairing
3732	Boat Building and Repairing
3751	Motorcycles, Bicycles, and Parts
379	Miscellaneous Transportation Equipment
3792	Travel Trailers and Campers
3799	Transportation Equipment, not elsewhere classified
3811	Engineering, Laboratory, Scientific, and Research Instruments, and Associated Equipment
382	Measuring and Controlling Instruments
3822	Automatic Controls for Regulating Residential and Commercial Environments and Appliances
3825	Instruments for Measuring and Testing of Electricity and Electrical Signals
3832	Optical Instruments and Lenses
3841	Surgical and Medical Instruments and Apparatus
3842	Orthopedic, Prosthetic, and Surgical Appliances and Supplies
3843	Dental Equipment and Supplies
3851	Ophthalmic Goods
3861	Photographic Equipment and Supplies
3873	Watches, Clocks, Clockwork Operated Devices, and Parts
3911	Jewelry, Precious Metal
3914	Silverware, Plated Ware, and Stainless Steel Ware
3915	Jeweler's Findings and Materials, and Lapidary Work
3931	Musical Instruments
3944	Games, Toys, and Children's Vehicles; except Dolls and Bicycles
3949	Sporting and Athletic Goods, not elsewhere classified
3951	Pens, Mechanical Pencils, and Parts
3953	marking Devices
3961	Costume Jewelry and Costume Novelties, except Precious Metal
3962	Feathers, Plumes, and Artificial Trees and Flowers
3991	Brooms and Brushes
3993	Signs and Advertising Displays
3995	Burial Caskets
3999	Manufacturing Industries, not elsewhere classified

APPENDIX C

Industries Under Study

Assessment of Industrial Hazardous Waste Practices

INDUSTRIES UNDER STUDY BY HAZARDOUS
WASTE MANAGEMENT DIVISION

Group I Studies

1. Industry: Metals Mining
SIC Codes: 1021; 1031; 1092; 1094; 1099
Contractor: Midwest Research Institute
Completion: September, 1975
HWMD Project Officer: Allen Pearce
2. Industry: Industrial Inorganic Chemicals
SIC Codes: 281
Contractor: Versar, Inc.
Completion: March, 1975
HWMD Project Officer: Sam Morekas
3. Industry: Pharmaceuticals
SIC Codes: 283
Contractor: Arthur D. Little, Inc.
Completion: September, 1975
HWMD Project Officer: Allen Pearce
4. Industry: Paint and Allied Products
SIC Codes: 285
Contractor: WAPORA, Inc.
Completion: September, 1975
HWMD Project Officer: Matthew Straus
5. Industry: Organic Chemicals, Pesticides, and Explosives
SIC Codes: 286; 2879; 2892
Contractor: TRW Systems Group
Completion: September 1975
HWMD Project Officer: Sam Morekas
6. Industry: Petroleum Refining
SIC Codes: 291
Contractor: Jacobs Engineering Company
Completion: August, 1975
HWMD Project Officer: Matthew Straus
7. Industry: Primary Metals
SIC Codes: 331; 3321; 3322; 3324; 333; 3341; 3399
Contractor: Calspan Corporation
Completion: November, 1975
HWMD Project Officer: Allen Pearce

8. Industry: Electroplating
SIC Codes: 3471
Contractor: Battelle Columbus Laboratories
Completion: September, 1975
HWMD Project Officer: Matthew Straus
9. Industry: Primary and Storage Batteries
SIC Codes: 3691; 3692
Contractor: Versar, Inc.
Completion: January, 1975
HWMD Project Officer: Sam Morekas

Group II Studies

10. Industry: Textile Mill Products
SIC Codes: 223; 226
Contractor: Versar, Inc.
Completion: 1st Quarter, FY-76
HWMD Project Officer: To be assigned
11. Industry: Rubber and Plastics Industry
SIC Codes: 282; 301; 302; 303; 304; 306
Contractor: Foster Snell, Inc.
Completion: 1st Quarter, FY-76
HWMD Project Officer: To be assigned
12. Industry: Leather Tanning and Finishing
SIC Codes: 311
Contractor: SCS Engineers, Inc.
Completion: 1st Quarter, FY-76
HWMD Project Officer: To be assigned
13. Industry: Machinery, except Electrical
SIC Codes: 355; 357
Contractor: WAPORA, Inc.
Completion: 1st Quarter, FY-76
HWMD Project Officer: To be assigned

APPENDIX D
Industry Data Form I

INDUSTRY DATA FORM I

		I.D. Code No.
1. _____	8. _____	9. _____
Name	Products Produced	SIC Code
2. _____	_____	_____
Address		
3. _____	_____	_____
City/Town		
4. _____	_____	_____
County Section		
5. _____	_____	_____
Size (Number of Employees)		
6. _____	7. _____	_____
Year Established Market Served		
10. _____		
Annual Production Volume		

APPENDIX E

Alphabetical List of Selected Industries in the Study

ALPHABETICAL LIST OF SELECTED INDUSTRIES IN THE STUDY

A & A Cabinet Shop	Adams Mfg. & Sales
A & A Company, Inc.	Adams W. E. Company
A & B Custom Fiberglass	Adams-Irick Truck Body Works
A & B Instrument Company, Inc.	Adams-Millis Corporation
A & E Frame Mfg. Company	Adamsco, Inc.
A & K Materials Company	Adart Printing Company
A & M Corporation	Additive Blend Control Corporation
A & M Upholstering	Admiral Statuary
A & R Enterprises	Adolph and Bud's Boiler and Welding Co.
A Ornamental Iron Works	Adrance Meat Company, Inc.
A. & S. Metals, Inc.	Adsit Lumber Co.
A. B. S. Screen Company, Inc.	Advance Interiors, Inc.
A. M. Grays Sawmill	Advance Meat Company
A. R. K. Foundry and Manufacturing Co.	Advance Printing
A-OK Air Filter Company	Advance Printing Co.
A-1 Bit & Tool	Advanced Printers
A-1 Storm Shelter Co., Inc.	Advertising & Printing Service of Tulsa
AAA Plastics	Advertising Services of Okla., Inc.
AAA Sign Service	Aerial Data Service
Aaron Manufacturing Co.	Aerial Photo Service
Aaron Preserving Co.	Aero Bilt Portable Builders
Abbott Controls, Inc.	Aero Bilt Portable Building, Inc.
Abbotts Processing Plant	Aero Commander Plant
ABC Upholstering Co.	Aero-Tech Services, Inc.
ABCO Tank & Manufacturing Co.	Aeroking Inc.
ABCO, Inc.	Aeroparts Company
Abrasive Equipment Systems, Inc.	Aeroparts Mfg. Co.
Academy Apparel, Inc.	Aerotron Tool and Manufacturing Co.
Accent Engraving & Metal Arts	Afton Machine Shop
Accra Manufacturing	Agee Products Corp.
Accro Machine, Inc.	Agland Inc.
Accurate Printing Company	Agnew Upholstering Co.
Ace Hi Signs	Agra Engineering Co.
Ace Jiffy Print	Agrico Chemical Co.
Ace Manufacturing Company	AH Metal Fabricators
Acker Industries, Inc.	Air Cargo Equipment Corporation
Acme Brick Company	Air Con. Inc.
Acme Engineering & Manufacturing Corp.	Air Cooled Exchangers Inc.
Acme Fence and Iron Co., Inc.	Air Flow After Burner and Incinerator
Acme Foundry & Machine Co., Inc.	Air Power Systems Company
Acme Machine Inc.	Air Products and Chemicals, Inc.
Acme Machine Shop	Air Refiner, Inc.
Acme Manufacturing Co., Inc.	Airco, Inc.
Acme Mattress Co.	Aircraft & Engine Enterprises
Acme Pollution Control Co.	Aircraft Engine Service Inc.
Acme Products Co.	Aire-Vent Mfg. Corp.
Acme Sheet Metal Works	Airico Manufacturing and Plating, Inc.
Acme Tool, Inc.	AK A-Kelly Monuments Inc.
Aco Inc.	Akin Distributors, Inc.
Acorn Printing Company	Akins & Fincannon Packing Co.
ACS Industries, Inc.	Aladd Pest Control Co., Inc.
Action Printing & Litho Company	Alamo Mexican Brand
Action Spring Company	Alchem Plastics, Inc.
Active Sign Co.	Alcor, Inc.
Ad Art Printers Incorporated	Aldor Manufacturing Corp.
Ad-Craft Sign Co.	Alfalfa County News
Ada Block Company	Alfalfa Dehydrating Plant
Ada By-Products Co.	Alko Industries, Inc.
Ada Candy Company	All American Mold Laboratories, Inc.
Ada Coca Cola Bottling Co., Inc.	All American Trophy
Ada Evening News	All Meat Co., Inc.
Ada Iron and Metal Co., Inc.	All Printing Co.
Ada Ready Mix Concrete Co.	All State Machine Shop
Adairs Mattress & Upholstering	All-Church Press, Inc.
Adams Alloy Rod Division	Allan Edwards Construction Company
Adams Feed Mill Inc.	Allen Brothers
Adams Hard-Facing Co.	Allen Camper Mfg. Co., Inc.

Allen Canning Co.
 Allen Company, Inc.
 Allen Enterprises
 Allen Farm and Ranch Supply
 Allen Lapidary Equipment Mfg. Co.
 Allen-Bradley Company
 Allens Ice Cream Co.
 Allens Litho Printing Co.
 Allergy Laboratories, Inc.
 Allied Aviation Supplies Company
 Allied Chain Link Fence Co., Inc.
 Allied Fence Co.
 Allied Fence Co. of Tulsa, Inc.
 Allied Graphic Arts Inc.
 Allied Limb & Brace Co.
 Allied Machine and Supply, Inc.
 Allied Marine Mfg. & Distr. Inc.
 Allied Materials Corporation
 Allied Metal Fabricators, Inc.
 Allied Printers
 Allied Stamp Corp.
 Allied Steel Construction Co.
 Allied Steel Products Corporation
 Allied Tower Company of Okla., Inc.
 Alloy Castings, Inc.
 Allstar Plastercraft Shop
 Alpha Products Co., Ltd.
 Alprod Corporation
 Alsip Concrete, Inc.
 Altec Corporation
 Alton Metal Products Co.
 Altus Printing Company
 Altus Time-Democrat
 Aluminum Hardcoat Co.
 Aluminum Mfg. Corp.
 Aluminum Products Co.
 Aluminum Window
 Alva Bakery Inc.
 Alva Coca-Cola Bottling Co., Inc.
 Alva Concrete Materials Co.
 Alva Newspapers, Inc.
 AM Reeves Locker Plant
 Am-Pro, Inc.
 Amateur Wrestling News, Inc.
 Amax Aluminum Mill Products, Inc.
 Amerace Corporation
 Amerand Inc.
 American Airlines
 American Awards & Trophies
 American Bakeries Co.
 American Body & Trailer, Inc.
 American Canvass Manufacturing Co.
 American Casting Company, Inc.
 American Chief Co.
 American Chief Publishing
 American Coating Supply Co.
 American Colloid Company
 American Color Press, Inc.
 American Cyanamid Company
 American Excelsior Co.
 American Hoist & Derrick Company
 American Hose & Reel Co.
 American Impacts Corporation
 American Industrial Supply Co.
 American Klockner-Moeller Corp.
 American Machine & Supply Company
 American Manufacturing Inc.
 American Mattress Co.
 American Millwork Co.
 American Optical Co.

American Optical Corporation
 American Optical Inc.
 American Plastics Corporation
 American Plating Co., Inc.
 American Precast Inc.
 American Printing Co.
 American Printing Company
 American Ready Mix
 American Rubber Co.
 American Sheet Metal Co.
 American Smelting & Refining Co.
 American Steel & Manufacturing
 American Steel & Pump Corporation
 American Tank & Construction CO.
 American Tea and Coffee Co.
 American Welding & Tool Work
 American-First Title and Trust Co.
 Ameron, Inc.
 AMF Tuboscope, Inc.
 Amoco Production Co.
 Amron Metals Company, Inc.
 Amsco, Corp.
 Amulco Asphalt Co.
 Amulco Concrete Company
 Anadarko Farm Center
 Anadarko Feed Lot
 Anadarko Printing & Office Supply Co.
 Anadarko Publishing Co.
 Anadarko Welding Service
 Anc-Co, Inc.
 Anchor Building Co.
 Anchor Concrete Co.
 Anchor Paint and Mfg. Co.
 Anchor Slaughtering Company, Inc.
 Anchor Stone Co.
 Ancorp Manufacturing Co.
 Anderson Machine & Body Works
 Anderson Sawmill
 Anderson, Clayton & Co.
 Andro Corporation
 Andy Anderson Metal Works
 Andy Card Leather Co.
 Andys Bakery
 Anixter Bros., Inc.
 Anken Chemical & Film Corp.
 Anns Bakery, Inc.
 Antlers Slaughter House
 Antrim Lumber Co.
 Anvil Manufacturing
 Apache Fabricating Co.
 Apco Oil Corporation
 Apex Machine and Manufacturing Co.
 Apollo Metal Specialties, Inc.
 Apollo Rubber Company
 Apple Apparel Corporation
 Applied Automation Inc.
 Aqua Play Equipment, Inc.
 Aquaria Manufacturing Corporation
 Aquarius Inc.
 Arbuckle Supply
 Archer Photo Copy Co., Inc.
 Archer Taylor Drug Company, Inc.
 Archer-Welch Nut Co.
 Arco Chemical Company
 Ardmore Coca Cola Bottling Co.
 Ardmore Homes, Inc.
 Ardmore Photocopy & Reproduction Co.
 Ardmore Venetian Blind & Awning Co.
 Arkhola Sand & Gravel Co.
 Arkhola Sand & Gravel Company

Armco Steel Corporation.
 Armour & company of Delaware
 Armstrong Metal Products
 Armstrong Optical Co.
 Armstrong-Kilpatrick Inc.
 Arnett Manufacturing, Inc.
 Arnold & Craddock Monument Co.
 Aroma Foods Corporation
 Arrow Bag Company
 Arrow Fence and Iron Co., Inc.
 Arrow Machinery Company
 Arrow Oil Tools, Inc.
 Arrow Plastics
 Arrow Polishing and Plating
 Arrow Sign Co., Inc.
 Arrow Specialty Company
 Arrowhead Asphalt Co.
 Arrowhead Rock and Lapidary Supplies
 Art-Fab. Incorporated
 Artcraft Printers, Inc.
 Artech, Incorporated
 Artiques
 Artistic Ornamental Iron
 Artistic Quotes, Inc.
 Artistic Upholstery Shop
 Artistic Weave Shop
 Arts Machine Shop, Inc.
 Asbury Bearing Company, Inc.
 Asg. Industries, Inc.
 Ashland Chemical Co.
 Associate Industries
 Associated Lithographing Co.
 Associated Milk Producers, Inc.
 Associated Spring Corporation
 Atco Termite & Chemical Co.
 Athena Products
 Athenian Marble Corp.
 Atkins & Merrill Training Devices, Inc.
 Atlantic Rich Field Company
 Atlas Concrete Inc.
 Atlas Fabricators, Inc.
 Atlas Instrument & Manufacturing Co.
 Atlas Iron Works, Inc.
 Atlas-Truck Concrete, Inc.
 Atoka Welding and Steel Co.
 Atomic Lamp Co.
 Attic Arts, Inc.
 Auburn-Cord-Duesenberg Company
 Audio Associates
 Ault Laboratories & Co., Inc.
 Austin Industries, Inc.
 Auto Battery & Electric
 Auto Crane Company
 Auto Parts & Machine Company of Okla.
 Auto-Man Service Center of Tulsa
 Automatic Controls
 Automatic Services Corporation
 Automation Equipment, Inc.
 Automation Industries, Inc.
 Automotive Division
 Automotive Household Products Corp.
 Automotive Lift Division
 Autopilots Central, Inc.
 AutoQuip Corporation
 Avco Corporation
 Avey Tool and Grinding Service
 Avionics, Inc.
 Award Design Medals, Inc.
 Azcon Corporation
 Aztec Steel Building Co.
 B & H Machine & Welding
 B & H Sheet Metal Shop
 B & J Welding and Manufacturing Co.
 B & K Glass
 B & L Electric Company
 B & L Fabricators, Inc.
 B & M Machine Shop
 B & P Sales Company
 B & R Machine Company
 B & R Woodworks
 B & T Mfg. Co.
 B & T Ready Mix Concrete Inc.
 B & W Manufacturing Co.
 B & W Muffler Manufacturing, Inc.
 B and B Tin Shop
 B and E Woodshop
 B and L Tin Shop
 B G Machine Service
 B H & W Industries, Inc.
 B S & B Safety Systems, Inc.
 B. & L. Plastics, Inc.
 B. & W. Processing Plant
 B. Chair Co.
 B. E. Sanders Company
 B. F. Machine Shop, Inc.
 B.C. Clark & Son Company
 B-Bar-A Trailers, Inc.
 B-J. Nutrients, Inc.
 Babcocks Mobile Home
 Baby Duds
 Bader Supply Co., Inc.
 Badger Meter, Inc.
 Badgett Steam Lubricator Corp.
 Baffle Manufacturing Company
 Bagby Harris Concrete, Co.
 Bags, Inc.
 Bagwell-General Steel Company
 Baird Manufacturing Company
 Bait Engineering Company
 Bake Rite Bakery
 Baker Bill Bait
 Baker Instrument Company
 Baker Sawmill
 Bakers Cabinet Manufacturing Co.
 Baldwin Redi Mix Concrete
 Bales L. F. Shop
 Ball Corporation
 Balon Corporation
 Bama Pie, Inc.
 Banfield, Charles Co., Inc
 Bank Note Printing & Stamp Co.
 Bankhead Print Shop
 Banknote Printing and Lithographing Corp.
 Bankoff Scrap & Metals Company
 Banner Book Bindery
 Banner Engineering Corporation
 Banner Sign and Display Co.
 Bantam Steam Company, Inc.
 Bar H. Horse Trailer Inc.
 Bar West, Inc.
 Barbers Glass and Mfg. Co., Inc.
 Barham Enterprises Inc.
 Barker Machine Shop
 Barnes & Son Ornamental Iron
 Barnes Aluminum Company
 Barnett Fence and Iron Co., Inc.
 Barnhart Brothers
 Barnhart Concrete, Inc.

Barnhill-Allen Sheet Metal Inc.
 Barrett Trailers, Inc.
 Bart Axtell Asphalt & Roofing Co., Inc.
 Bartlesville Examiner
 Bartlesville Ready Mix
 Bartlett-Collins Company
 Bash, Ted Machine Shop
 Bashaw Machine Company
 Bass Welding Shop
 Bates Brothers Manufacturing Company
 Bates Heat Treating, Inc.
 Bates-Reading Oil Corporation
 Bauer & Son
 Bauer & Son Packing Company
 Bauer Auto Top & Seat Cover Co.
 Baughman Lumber Co. The
 Bausch & Lomb, Inc.
 Bavarian Bakery
 Baxa Pattern Works
 Baxter Vault Company
 Bays Bakeries
 Bays Laboratory
 Beachwood Homes, Inc.
 Beacon Job Printing, Inc.
 Beacon Publishing Co.
 Beacon Stamp & Seal Company
 Bearcat Concrete Products, Inc.
 Beard Dental Laboratories
 Beard Manufacturing Company
 Beas Decorating & Specialty Shop
 Beatrice Foods Co.
 Beauty Craft Tile of the Southwest, Inc.
 Beauty Pleat Draperies
 Beaver Creek Fabricators, Inc.
 Beaver Handle Co.
 Beaver Handle Company
 Beaver Tool & Machine Co., Inc.
 Beckham County Democrat
 Bedford Tooling Co.
 Beeman Foundry
 Beenes Custom Butchering Service
 Beetle Plastics, Inc.
 Behar Sand and Gravel
 Behne Construction Co.
 Belcher Ray Sawmill
 Belshes Trailer Mfg.
 Belsky Manufacturing Co., Inc.
 Bemco of Oklahoma
 Bendco Pipe & Tube Bending
 Bender Direct Mail Service, Inc.
 Benson Sound Studio, Inc.
 Bentley-Gafford Company
 Berkshire Corp, The
 Berlin Barnes Tool Box Co.
 Bermuda King Co.
 Bermuda King Company
 Berry Drapery and Slipcover
 Bert Parkhurst Co.
 Berts Window Screen Co.
 Bestway Press Incorporated
 Betts L F Supply Company, Inc.
 Betty Jean Lamps, Inc.
 Beverage Products Corporation
 Bewleys Mfg. Co.
 Biddy Printing Company, Inc.
 Biffler C R
 Big Chief Roofing Company
 Big D Chemical Company
 Big E Industries, Inc.

Big Four Foundry Company, Inc.
 Big G Trailers
 Big Giant Bakery
 Big Three Ind Gas & Equipment Co.
 Big Yank Corporation
 Big-5-Manufacturing Inc.
 Biggers Fertilizer Service
 Bilbo Newman Co., Inc.
 Biles Concrete Products
 Bill Landreth & Son Meat Co.
 Billings Electric Co.
 Bills Wood Shop
 Billys Nectar and Candy Co.
 Bilt-Rite Furniture, Frame & Rocker Co.
 Bioscope Manufacturing Co.
 Bipo, Inc.
 Birchfield Wholesale Lumber Co.
 Bird Roofing Co.
 Bishop Machine Company & Gas Meter
 Bison Lumber & Supply
 Bitco Inc.
 Bits-N-Pieces
 Bixby Machine & Engineering Co.
 Bjorne Enterprises
 BK Electric Co., Inc.
 Black & Puryear
 Black Sivalls & Bryson, Inc.
 Blackmon, Ezra S., DBA
 Blackwell Concrete Co.
 Blackwell Printing & Stationery
 Blackwell Screen Co.
 Blackwell Steel Products, Inc.
 Blaine County Grailer Mfg. Co.
 Blaine Dairy Products Company
 Blake Manufacturing Company
 Blake Stone Co.
 Blands Upholstering
 Blissit Manufacturing Co., Inc.
 Blooms Wholesale Meats
 Blue & Gold Sausage Co.
 Blue Bell, Inc.
 Blue Chip Chemical Company
 Blue Jay Cards
 Blue Ribbon Cabinets
 Blue Star Ice Company
 Bluestem Foundry, Inc.
 Blumenthal Manufacturing Co., Inc.
 Blunck Studio, Inc.
 Blytheville Canning Co., Inc.
 BMW-Monarch Corp.
 Boatfloater Industries
 Boats By Hart
 Bob McMurtry Prefab
 Bobs Awning Company
 Bobs Meat Co.
 Bobs Seat Cover Shop
 Bodco Products Co., Inc.
 Bogle R H Co.
 Boise City News
 Bonanza Homes-Div. of Redman Mobile
 Home
 Bond Bakery - General Host Corp.
 Bond Sign Company
 Boney Slaughter House
 Boomer Packing Company
 Booster Bags, Inc.
 Booster Feed Mills, Inc.
 Boots Off, Inc.
 Borden, Inc.

Borders Custom Processing
 Borg Compressed Steel Corp.
 Borg-Warner Corporation
 Born Engineering Co.
 Born, Inc.
 Bos-Co Equipment Engineering & Mfg.
 Bosco Services
 Boswell Times
 Boswells of Vandever
 Bouncy Mfg. Co.
 Bowlarena Lane
 Bowlware, Inc.
 Bowman and Camp Cabinet Shop
 Bowman Orthopedic Service
 Bowman Printing Co.
 Boyds Auto Machine
 Boyle Engineering Company
 Boyles Galvanizing Co.
 Braden Industries, Inc.
 Braden Packing Co.
 Braden Steel Corp.
 Bradford Companies
 Brainerd Chemical Co., Inc.
 Brakesol Chemical Division
 Braley Manufacturing Corporation
 Brandt Equipment & Supply Co.
 Brantly Manufacturing Company
 Brantly Operators Inc.
 Braswell, F A Upholstery
 Braudrick Printery
 Brauns Brace and Orthopedic Co.
 Brewer Construction Co.
 Brewer Labs
 Brickell Ice Co.
 Briggs Printing
 Brimdon Plastics Corporation
 Bristow Mattress & Upholstering
 Brite Wae Blenders
 Brittain Industries, Inc.
 Britteco, Inc.
 Britton Upholstery Shop
 Brix, Inc.
 Braodway Bakery
 Brockway Glass Company, Inc.
 Brodie Steve Signs
 Brodies Cakes
 Broken Arrow Mobile Homes
 Broken Arrow Ledger
 Broken Arrow Productions, Inc.
 Bronzcraft Awards, Inc.
 Brooks Flame-Spray, Inc.
 Brooks Galleries
 Brooks Manufacturing Co./Shur-Winn
 Brooks Produce
 Brookwood Oil Company
 Broomtown Industries
 Brown & Hartman Engraving Co.
 Brown Fintube Co.
 Brown Manufacturing Company
 Brown Mill & Elevator
 Brown Printing Company Inc.
 Brown's Village Bakery
 Browns Feed Mill
 Bruest Industries, Inc.
 Bruner Ivory Handle Company
 Bruno's Corn Tortillas
 Brunswick Corporation
 Bryan County Limestone Co.
 Bryan Infants Wear Company

Bryan Machine & Supply
 Bryan, Mike, Office Products
 Bryant Incinerator Construction Inc.
 Bubs Locker Service
 Buckendorf Packing Co.
 Bucket Shop Inc, The
 Buckminster Gooseneck Trailer & Mfg.
 Bucks Meat Processing
 Buerger Brothers
 Buffalo Floral Mfg. Co.
 Buffington Associates, Inc.
 Builders Steel Co., Inc.
 Building Components Limited
 Building Products Company, Inc.
 Bumgarner Charles
 Bumper Service of Tulsa, Inc.
 Bunte Candies, Inc.
 Bur-Lane Marking Equipment Co., Inc.
 Burch Printing
 Burdine Mill & Elevator
 Burford Corp.
 Burford Distributing Corp.
 Burgess Mfg. of Okla., Inc.
 Burgess Printing Company Inc.
 Burk Home Improvement
 Burkey Creamery
 Burkharts Legal Forms, Inc.
 Burnett Fireworks Co., Inc.
 Burnett Lumber Company
 Burnham and Burnham
 Burns Draperies & Carpets
 Burns Mill, Inc.
 Burris Trailer Mfg. Company
 Burrow Shade and Linoleum Co.
 Burttek, Inc.
 Burtis Press & Office Supplies Co.
 Bush Manufacturing Company
 Business Builders, Inc.
 Business Controls Corp.
 Business Printing, Inc.
 Business Publication, Inc.
 Bussey Art Glass Co.
 Butcher Boy Enterprises
 Butcher Custom Meats
 Butchers Metal Shop
 Butler Shade Company, Inc.
 Butterfly, H. J., Inc.
 Butts Electric Supply Co.
 C & D Valve Manufacturing Company
 C & H Tool Company
 C & J Distributing Company
 C & J Distributing Co. of Ada
 C & J Printing Co.
 C & M Tire Co.
 C & P Printing & Stationary Co.
 C & S Printing
 C & W Lumber Co.
 C - H Products
 C and B Auto Pump Co.
 C and C Inc.
 C C E Service Company
 C F M, Inc.
 C Good Optical Co., Inc.
 C M F Mattress Company
 C M I Corp.
 C Ray For Signs
 C Tom Herring Co.
 C. & E. Machine Company
 C. & H. Lumber Co.

C. and L. Supply, Inc.
 C. H. Colpitt Drilling Co.
 C. J. Royer Company
 C. R. Asfahl Co.
 C-E Glass Inc.
 Cable Communication Corporation
 Cable Meat Center
 Cadco, Inc.
 Caddo Bag Co.
 Caddo Farm Supply
 Caddo Mfg, Inc.
 Cadet Manufacturing Co.
 Caine Steel Co.
 Cains Coffee Co.
 Cake Shop
 Calera Machine & Tool
 Calvin Chronicle
 Calvin Mill
 Cameron Corporation
 Cameron Enterprises
 Cameron Iron Works, Inc.
 Campbell Glass and Mirror Co.
 Campbell Specialty Company, Inc.
 Campion Plastics Company
 Campo Machining Company, Inc.
 Can Enterprises Inc.
 Canada Dry Bottling Co.
 Canadian Transit Mix, Inc.
 Canadian Valley Meat Company
 Canal Refining Company
 Candle-Glow Corp.
 Cannon Chemical Co.
 Canton Lake Industries
 Caparoon Glass Co.
 Capital Democrat
 Capitol Bag Co.
 Capitol Broom & Mop Co.
 Capitol City Printing Co.
 Capitol Glass and Mirror Co.
 Capitol Hill Ice Cream Co.
 Capitol Hill Mattress Co.
 Capitol Hill Sign Co.
 Capitol Hill Woodwork & Supply, Inc.
 Capitol Paint
 Capitol Plating Company
 Capitol Stage Equipment Co.
 Capitol Steel and Iron Company
 Capitol Trailer Corp.
 Capitol Tube Company
 Capitolas Draperies
 Captown Inc.
 Car Parts Machine Shop
 Cardinal Furniture Company
 Cardinal Instrument Corp.
 Carey Printing
 Cargill Inc.
 Carl-Built, Inc.
 Carlon Inc.
 Carlon Products Corp.
 Carls Machine Shop, Inc.
 Carlson Company
 Carmen Headlight
 Carnation Company
 Carnegie Co-op Mill & Elev
 Carol Lee Donuts
 Carpenter Mill, Lumber & Supply
 Carpenters Machine & Supply Company
 Carpentiers Bakery
 Carriage Line
 Carson Machine & Supply Co.
 Carter Components, Inc.
 Carter Printing Company
 Carvers Locker Plant
 Casebeer Printing Co.
 Cason Woodworks
 Casting Repair Service
 Castings Production & Leo Trailers
 Caston Door and Plywood Co.
 Cata-Sep Corporation
 Catalina Furniture Mfg. Inc.
 Cato Oil & Grease Company, Inc.
 Cattle Trailer Co.
 Catts Co.
 CBT Constructors Inc.
 CCI Marquardt Corporation
 CCMS Publishing Company
 Cecils Furniture Mfg. Co.
 Center Line, Inc.
 Centra Leathergoods of Okla., Inc.
 Central Caskets, Inc.
 Central Dairy Products Company
 Central Fixture Mfg. Co.
 Central Forest Products
 Central Glass Company
 Central Graphics Company
 Central Machine & Tool Co.
 Central Machine Shop
 Central Manufacturing & Supply Co.
 Central Mill & Fixture, Inc.
 Central Plastics Company
 Central Printing Company, Inc.
 Central Process & Sales Company, Inc.
 Central Residential Air Conditioning
 Div-Westinghouse Electric Corp.
 Central Sales Promotions, Inc.
 Central Specialties Manufacturing Co.
 Central States Printing Company
 Central Victorian Marble
 Centrifugal Casting Machine Co.
 Century Granite Co.
 Century Systems Corporation
 Cer-Mac Plastics, Inc.
 Challenger Publishing Company, Inc.
 Champion Rubber Company
 Champlin Firearms, Inc.
 Champlin Petroleum Company
 Chandler Bakery
 Chandler Engineering Company
 Chandler Expanded Metals Corp.
 Chandler Material Co.
 Chandler Meat Processing Plant
 Chandler Memorial Works Inc.
 Chaparral Manufacturing Co.
 Charles Bridges
 Charles E. Morrison Co., Inc.
 Charles Komer & Sons, Inc.
 Charles R. Walls Company
 Charles Wheatley Company, Inc.
 Charleys Chuckle Cards, Inc.
 Charlie's Upholstery
 Charlies Automotive Machine Shop
 Charlies Overhead Crane Service
 Charter House Reproductions
 Chata Arts & Crafts
 Cheairs Co.
 Checotah Ready Mix Concrete Co.
 Chelsea Custom Slaughtering
 Chelsea Mill

Chemco Products, Inc.
 Chemetron Corporation
 Chemical Equipment Corp.
 Chenille Mfg. Co., Inc.
 Cherokee Carbon Paper Co., Inc.
 Cherokee County Chronicle, Inc.
 Cherokee Electronics Co.
 Cherokee Forest Industries, Inc.
 Cherokee Homes, Inc.
 Cherokee Indian Weavers
 Cherokee Locker Plant
 Cherokee Mills
 Cherokee Nation Industries, Inc.
 Cherokee Nitrogen Company
 Cherokee Process Color, Inc.
 Cherokee Products, Inc.
 Cherokee-Shawnee Products, Inc.
 Chevron Chemical Company
 Cheyenne Industries, Inc.
 Cheyenne Mill & Elevator Inc.
 Cheyenne Star Inc.
 Chica Oil Property Management Co.
 Chickasha Cotton Oil Company
 Chickasha Daily Express
 Chickasha Iron Works & Supplies, Inc.
 Chickasha Manufacturing Co., Inc.
 Chickasha Mobile Homes, Inc.
 Chickasha Transit Mix, Inc.
 Chief Campers Manufacturing Co., Inc.
 Chief GMC & Equipment Co.
 Chief Industries Inc.
 Chiefs Trailer Manufacturing
 Childres Canvas Products, Inc.
 Chili Can Manufacturing, Inc.
 Chisholm Trail Concrete Inc.
 Chittom Equipment Company
 Choctaw Materials Inc.
 Chopper Mfg.
 Choska Alfalfa Mills, Inc.
 Christensen Diamond Products Company
 Chromalloy Div. of Oklahoma
 Chromatic Alloy
 Chromuim Plating Company of Okla.
 Churchill Logging Co.
 Cimarron Aircraft Corp.
 Cimarron Leather Works
 Cimarron Manufacturing Co.
 Cimarron Plant
 Cimarron Plastics Inc.
 Cimarron Transmission Inc.
 Cincinnati Blacksmith & Body Works
 Cindas Flower Shop
 Cinnamon Bend Publishers
 Circle H. Trailer, Co.
 Circle K Ready-Mix
 Circle K Welding
 Circuit Technology of Okla. Inc.
 Cities Service Gas Co.
 Cities Service Oil Co.
 City Bakery
 City Blue Print & Photo Copy Company
 City Concrete Of Altus Inc.
 City Glass Company
 City Ice Company
 City Map Service
 City Metal & Plastic Fabricators, Inc.
 City Packing Company
 City Springs Works, Inc.
 City Tent & Awning Co.
 Claggett Artificial Limb & Otho Brace
 Claremore Ice & Cold Storage Co.
 Claremore Machine Works
 Claremore Printing Company
 Clark Canvas Co.
 Clark Casket and Vault Company
 Clark Equipment and Construction, Inc.
 Clark Printing Co.
 Clark, B C, Jewelers
 Clark's Auto Trim
 Clarks Locker & Processing Co.
 Clarks Pastry Shop, Inc.
 Clarks Upholstering & Mfg. Co.
 Classen Furniture Upholstering
 Classen Plating Co., Inc.
 Classic Motors, Inc.
 Classic Trophy Company
 Claude Neon Federal Company of Tulsa
 Claude Neon Federal Company Southwest
 Clayton Flaming Ready Mix
 Clayton Plating Company
 Clean-Air-Ator Corporation
 Clearwater Inc.
 Clements Food Products Co.
 Clemishire Drilling Co.
 Clemishire, Clemishire, Barnes & Buttram
 Cleveland American
 Clifts Rubber Mat Co.
 Cline Industries, Inc.
 Cline Machine, Inc.
 Clint Williams Company
 Clinton Daily News Company
 Clinton Ice Company
 Clinton Packing Co.
 Cloar Tag and Printing Co.
 Close Products
 Close-Hutchison Mfg., Inc.
 Clover Printing Co.
 Clyde Cooperative Assn., Inc.
 Clyde Henslee Lumber Company
 CMI Corporation
 Co operative Publishing Co.
 Coalgate Record Register & Publishing
 Coating Laboratories
 Coburn Optical Industries, Inc.
 Coca Cola Bottling Co.
 Coca Cola Bottling Co. of Tulsa, Inc.
 Cochran Chemical Company, Inc.
 Cochran Lumber Co.
 Coeco, Inc.
 Coin Oper Equip & Mfg. Co.
 Cole Grain Company
 Coleman Instrument Company, Inc.
 Coleman Metal Treating Lab, Inc.
 Coleman Tulsa Company
 Colemans Picture Frames
 Coles Hardfacing and Welding
 Collegiate Cap & Gown Company
 Collin John M Constracting & Canvas
 Good
 Collins & Aikman Corp.
 Collins Litho Printing Co.
 Collins Sawmill
 Collinsville News
 Color Tech
 Colorado Magnetics, Inc.
 Colorcraft Poster Co.
 Colorprint Company, Inc.
 Colvert Dairy Products Co.

Colvert Dairy Products Company of
 Chickasha
 Colvert Dairy Products Company of Ada
 Coman Pattern Works
 Comanche Concrete Co.
 Comanche News & Duncan Eagle
 Comanche Seed and Grain Co.
 Combustion Engineering, Inc.
 Comet Feed Mills, Inc.
 Comfab, Inc.
 Comma Corporation
 Commanco Mfg. Corp.
 Commander Finishing Company
 Commerce Concrete Company, Inc.
 Commerce Mop Co.
 Commercial Awning Company
 Commercial Brick Corp.
 Commercial Printing Co.
 Commercial Publishers
 Commercial Sheet Metal Works
 Community Manufacturing Co.
 Compton Cakeshop
 Compton Machine Works, Inc.
 Computype, Inc.
 Con-Cure Co.
 Con-Form Corp.
 Concept Enterprises and Publishing Co.
 Concrete Inc. of Shawnee
 Concrete Incorporated
 Concrete Industries of Tulsa Corp.
 Concrete Products Company
 Concrete Service
 Congoleum Industries, Inc.
 Conley Corporation
 Conner Welding Shop
 Conoco Chemicals
 Consolidated Shade & Linoleum Co.
 Container Corporation of American
 Continental Baking Co.
 Continental Baking Co. Plant No. 156
 Continental Can Company, Inc.
 Continental Carbon Company
 Continental Industries, Inc.
 Continental Marble Company
 Continental Materials Company
 Continental Oil Co.
 Continental Plastics of Oklahoma
 Continental Printing Co., Inc.
 Continental Research Company, Inc.
 Continental Tank Company
 Contract Fiberglass Corporation
 Controls & Construction Inc.
 Controls Components, Ltd.
 Cook Gold & Porcelain Lab
 Cook Leon Memorial Co.
 Cook Machine Shop
 Cook Motor Machine & Supply
 Cook N Tools, Inc.
 Cooks Fence and Awning Co.
 Cooks Prompt Printers
 Cool-Temp Awning Company, Inc.
 Cooling Products Inc.
 Cooper Airmotive Inc.
 Cooper Farm Dairies
 Cooper Farms
 Coordinated Industries, Inc.
 Cordell Beacon Co.
 Cordell Farm & Garden Supply
 Cordell Manufacturing Company

Cordray Die Casting Co.
 Corken Pump Company
 Corn Locker Plant
 Cornelsen Company
 Cornett Packing Company
 Corning Glass Works
 Coronado Stone Company of Okla., Inc.
 Corral Sportswear Co.
 Corrosion Control Inc.
 Cosgrove Fire Protections, Inc.
 Cosmic Aircraft Corporation
 Costume Shop Inc. The
 Cottingham Dental Laboratory
 Country Club Publications
 Country Cookin Foods Inc.
 Coverite, Inc.
 Covey Corporation
 Covington Aircraft Engines
 Covington Record
 Cowan Printing & Litho
 Cowan V D Sawmill
 Cowden-Shawnee Company
 Coweta Times Star
 Crafts Leo Sign Co.
 Crager Sawmill
 Craig Floyd Co.
 Craig Neon, Inc.
 Crains Asphalt Co.
 Crane Carrier Co.
 Crawford Brothers Pulpwood Company
 Crawford Logging Contractors
 Crc-Crose International, Inc.
 Creative Designs, Inc.
 Creative Illumination Sign Company
 Creative Modular Homes, Inc.
 Creative Plaques
 Greeco Mill & Elevator Co.
 Creek Indian Foundry Inc.
 Creek Nation Crafts, Inc.
 Crescent Publishing Co.
 Crest, Incorporated
 Crestwood of Oklahoma, Inc.
 Criss-Cross Numerical Directory, Inc.
 Cromwells
 Cronkhite Automatic Products
 Crowell Boat & Manufacturing Co.
 Crowl Machine & Heat Treating Co.
 Crown Paint Company
 Crystal Craft Mfg. Co.
 Crystal Ice Co.
 Crystal Laboratory
 Cullison Mfg. Inc.
 Cumberland Operating Company
 Cummings Shade Co.
 Cummings, William G Co.
 Cummins & Wren Oil Company
 Cunningham Machine & Steel Co.
 Cunningham Sawmill
 Curtis Equipment Co., Inc.
 Curtiss-Wright Corporation
 Cushing Coca Cola Bottling Company
 Cushing Newspapers, Inc.
 Cushing Packing and Provision Co.
 Cushing Ready-Mix Co.
 Cust-O-Fab, Inc.
 Custom Audio Manufacturing, Inc.
 Custom Brick Company
 Custom Chrome Plating Co., Inc.
 Custom Counter Tops

Custom Die & Mfg. Co., Inc.
 Custom Engineering and Manufacturing Corp.
 Custom Engraving & Trophies
 Custom Machining Co.
 Custom Marine Manufacturing Co., Inc.
 Custom Molding Service, Inc.
 Custom Moulding & Millworks
 Custom Printing
 Custom-Production Co.
 Custom Rubber Stamp Company
 Custom Sign
 Custom Sizes, Inc.
 Custom Slaughtering Inc.
 Custom Wire Products, Inc.
 Customade Products, Inc.
 Cyril Publishing Co., Inc.
 D & D Printing
 D & D Redi Mix
 D & G Associates Inc.
 D & K Plating Co.
 D & K Trailer, Co.
 D & S Manufacturing Co., Inc.
 D - T Machine, Inc.
 D and H Equipment Welding Co.
 D and R Office Services Inc.
 D E Ziegler Art-Craft Supply
 D O T, Inc.
 D. C. Machine Shop
 D. D. Frederick Co.
 D. W. Hearn Machine Shop
 D-B Products, Inc.
 D-K Metal Form Co., Inc.
 Daack Packing Co.
 Caco Pattern Company
 Dad-Co Feeds Inc.
 Daily Ardmoreite Publishing Co.
 Daingerfield Manufacturing Co.
 Dainty Maid, Inc.
 Dalton Precision
 Damron Mfg. Co.
 Dan Peevy, Logging Contractors
 Dandee Donut Shop
 Daric Design, Inc.
 Darling-Delaware Company, Inc.
 Darr-Turner Industries, Inc.
 Dasee Plastic Inc.
 Data Documents of Oklahoma, Inc.
 Data Terminal Services of Oklahoma
 Dataq Incorp.
 David Bruce Desings, Inc.
 David Williams Machine Shop
 Davis Brothers Sawmill
 Davis International
 Davis J. Cabinet Shop
 Davis Mirror and Frame Gallery
 Davis Printing Co.
 Davis Sign Service
 Dawson Feed and Dog Food Co.
 Day Concrete Block Company, Inc.
 Daylight Donut Flour and Equip Co.
 Daylight Donut Shop
 Days Cabinet & Wood Products
 Dayton Tire & Rubber Co.
 Daz-E-Mae Lure Co.
 De Leon Peanut Co.
 Dead Shot Chemical Co.
 Deanos Jewelry Manufacturing
 Deans Draperies Inc.
 Dearinger Printing Co.
 Dears Custom Upholstering
 Deaton Medical Company
 Debbie Ann, Inc.
 Deckard Manufacturing Company
 Deckards Welding & Machine
 Decker Enterprises, Inc.
 Decker Foundry Company, Inc.
 Dees Custom Venetian Blind & Shade Co.
 Dees Manufacturing, Inc.
 Del City Wire Co., Inc.
 Del Paint Corporation
 Delaware County Democrat, (Formerly Jay
 Printing Co.)
 Delcon, Inc.
 Delta Industries
 Delta Mining Corporation
 Deluxe Check Printers, Incorporated
 Demanco, Inc.
 Demco Inc.
 Demco Printing, Inc.
 Democrat Printing Co.
 Dennis Cordell Lavarack
 Dennis Donut Co. of Midwest City
 Dennis Donuts
 Dennis Publishing Co., Inc.
 Denton Frame Co.
 Denton's
 Denver Reese-Waller Typesetting Co.
 Design Stamping Corporation
 Detergen Company
 Detergent Engineering Corporation
 Dewey Alfalfa Dehydrating Co.
 Dewey County News
 Dewey News-Record
 Dexter Publishing Company
 Diamond Crystal Salt Company
 Dick Stout & Co.
 Dick Wills Machine Shop
 Dickson Goodman Lumber Co. Cmpts.
 Diener-Chandler Mills, Inc.
 Diesterweg Sign Co.
 Dietzgen Corp.
 Dillman Awning Co.
 Dimension Plastics
 Direct Mail Printing Service Inc.
 Disan Engineering Corporation
 Diversified Products Incorporated
 Dixie Belting and Supply Co.
 Dixon Farm Supply
 Dixon Pipe Industries, Inc.
 Dixon Welding Shop
 Dixons Printing & Stationery
 DLM, Inc.
 Dobson Exterminating & Dobson Mfg. Co.
 Dolese Brothers
 Dolese Brothers Ardmore
 Dolese Brothers Co. - Rayford Plant
 Dolese Concrete Co., The
 Dolese Plant
 Dollies Ceramics and Porcelain
 Don Eckel Typesetting Co.
 Don Hume Leathergoods, Inc.
 Don R. Hinderliter, Inc.
 Dona Dress Company
 Donald Hines Garment Bag Co.
 Donaldson Company, Inc.
 Donrey Electrical Signs
 Dons Market
 Dorate Inc.

Dorchester Gas Producing Company
 Dorsett Educational Systems, Inc.
 Dorsett Electronics
 Doss Mfg. Co.
 Dottle Ds Ceramics
 Dotts Industries, Inc.
 Double Eagle Refining Co.
 Double T Co., Inc.
 Double-Z, Inc.
 Dover Corporation
 Dowell
 Dowling, Pete, Master Printers
 Downing Manufacturing Co.
 DP Manufacturing, Incorporated
 Dr. Pepper Bottling Co.
 Dr. Pepper Love Bottling Co.
 Dresser Plumbing and Heating Co.
 Drillers Engine and Supply
 Drilling Equipment
 Drive thru Gate Co.
 Drum Service, Inc.
 Drumco, Inc.
 Drumgoole W B Broom Works
 Drumright Concrete Inc.
 Dub Ross Company, Inc.
 Dugger Mfg. Co.
 Duke Mfg. Inc.
 Duke Times
 Dulaney Fiberglass Shop
 Dumas Mfg. Co.
 Duncan Banner Inc. The
 Duncan Manufacturing Company
 Duncan Mattress
 Duncan Oxygen Therapy Co.
 Duncan Pallett Company
 Duncans Bindery Service
 Dunkin Donuts
 Dunkin Donuts of America, Inc.
 Dunkin, Inc.
 Dunlap Manufacturing Company
 Dunn, H C, Printing and Dist Co.
 Dura-Stilt Company
 Durant Box Factory, Inc.
 Durant Coca-Cola Bottling Company
 Durant Concrete Block Company, Inc.
 Durant Dress Company, Inc.
 Durant Electronics, Inc.
 Durant Marble and Granite Works
 Durant Publishing and Broadcasting Corp.
 Durant Sheet Metal
 Durant Sign Service
 Dutron Corporation
 Duty Meat Co.
 Duvalls Transmission Service
 Dwane Interior Products, Inc.
 Dymond Sign Company
 Dyanplex Corp.
 Dynmac Corporation
 E & E Mobile Homes, Inc.
 E and B Lamp Co.
 E. E. Enyart Construction Company
 E. I. Du Pont De Nemours and Company
 E-Con Placer
 Eagle Canvas Company
 Eagle Industries
 Eagle Picher Industries Inc.
 Eagle Press
 Eagle-Picher Industries, Inc.
 Earl's Upholstering Co.

Earls Party and Carnival Supplies
 Eason Oil Co.
 Eastern Materials, Inc.
 Eastern Oklahoma Messenger
 Eastern Sheet Metal Co.
 Eastland Ready Mix Concrete Co., Inc.
 Eastside Machine Works
 Eastulsa Office Supply Co.
 Easy Car Wash Systems, Inc.
 Eaton Quade Co., The
 Eaton Store Fixture Company
 Eaton Wholesale
 Ebka Industries, Inc.
 Ebsco Spring Co.
 Eby Mining Co.
 Eckroat Seed Co.
 Ecodyne Corporation
 Econo-Therm Corp.
 Economy Auto Top Company
 Economy Guttering Co.
 Ed Crimmins, Fairmont Distributor
 Ed Wright Construction Co.
 Ed-Be Inc.
 Edco Chemicals Co.
 Eddies Woodworks
 Edmond Printing Company
 Edmond Publishing Co., Inc.
 Edmonson Machine Works, Inc.
 Educational Development Corp.
 Educational Electronics Inc.
 Edward Industries
 Edwards Manufacturing Company
 Eejack Printing Company
 Effects Unlimited Inc.
 Eico Manufacturing, Inc.
 Eileen's Draperies
 El Reno American Commercial Print Shop
 El Reno B-1 Products Inc.
 El Reno Daily Tribune
 El Reno Dental Lab
 El Reno Equipment
 El Reno Mattress Co.
 El Reno Monument Co.
 El Reno Terminal Grain
 El Sombrero Baking Co., Inc.
 Eldon B. Davis
 Eldorado Courier
 Electric Specialties Inc.
 Electrical Displays Co.
 Electro Chemical Laboratories Corp.
 Electro Foam Packaging Co., Corp.
 Electro Platers
 Electro Tech, Inc.
 Electronic Counter Corp.
 Electronic Systems Engineering Co.
 Elf Motor Coach Conversion Co.
 Elgin Street Auto Trim Shop
 Elitas Go Candles
 Elizabeth Burial Garment Co.
 Elk City Manufacturing Company, Inc.
 Elk City Sheet Metal
 Elkins Dental Lab
 Elliott Mobile Homes Mfg. Co.
 Ellis Construction Specialties, Ltd.
 Ellis County Building and Supply Inc.
 Ellis County Capital
 Ellis Marvin Manufacturing Co.
 Ellis Mfg. Co., Inc.
 Ellsworth Bottling Company, Inc.

Els Roll Shop
 Elsing Manufacturing Company
 Eltra Corporation
 Ember Box Fireplaces
 Emerald Mfg. Corp.
 Empire Asphalt Co., Inc.
 Empire Construction, Inc.
 Empire Foundry Company
 Empire Optical Company
 Empire Roofing and Insulation Co.
 Empire Sheet Metal Co.
 Empire Supply, Incorp.
 Empire Valve & Equipment Co.
 Engineered Coatings, Inc.
 Engineering for Industry, Inc.
 Enid Concrete Co., Inc.
 Enid Ice & Fuel Co.
 Enid Packing Company
 Enid Printing & Supply Co.
 Enid Publishing Co.
 Entek Corporation
 Enterprise Foundry, Inc.
 Enterprise Ice, Inc.
 Enterprise Manufacturing and Supply Co.
 Enterprise Truss
 Environmental Control Corp.
 Equal Manufacturing Company
 Erma J. Lee, Draperies
 Ernest Wiemann Iron Works
 Ernst Valves & Fittings
 Erwins Printers-Stationers
 Escoa Corporation
 Eskew Jim Saddle Shop
 Essary Donut Shop
 Essex, Inc.
 Estey Mill Works and Supply
 Ethan Allen, Inc.
 Eufaula Manufacturing Co.
 Eureka Ozarka Water Co.
 Evans & Throop Construction
 Evans Box Manufacturing Corporation
 Evans Dental Lab
 Evans Pipeline Equipment Company
 Evans Plating Works, Inc.
 Evans Ready-Mix Concrete Company
 Evans Tool Company
 Evergreen Mills, Inc.
 Everyday Foods, Corp.
 Ewbank Mfg. Div., Inc.
 Ewing Manufacturing Company
 Excel Wood Products
 Excelllo Mfg. Co.
 Executive Publishing Co.
 Executive Type Inc.
 Express Motor Rebuilders
 Expressway Sign Co.
 Eze Mfg. Co.
 F & J Industries, Inc.
 F & L Pattern Works
 F & K Plating Co.
 F and S Auto Parts Inc.
 F. C. Ziegler Co.
 F. P. Menager
 F-K Company
 Fabers Machine & Welding
 Fabricating Service Company
 Fabrication Specialties
 Fabricators, Inc.
 Fabricut Manufacturing Company

Fabsco
 Fabwell Corporation
 Fagan Engineering
 Fairfax Chief Publishing Co.
 Fairfax Granite Inc.
 Fairfax Packing Company
 Fairmont Foods Company
 Fairview Packing Co.
 Fairview Republican
 Fairway King Manufacturing Inc.
 Faith Garment Co., Inc.
 Faith Publishing House
 Famcor, Inc.
 Family Homes Associates, Inc.
 Famous Chili Company
 Fansteel, Inc.
 Fantasy Lamps
 Farm Enterprises Inc.
 Farm Ranch Cooperative
 Farmer-Stockman, The
 Farmers Co op Association
 Farmers Co op Elevator & Supply Co.
 Farmers Co-op Elevator Co.
 Farmers Co-operative Exchange
 Farmers Cooperative
 Farmers Cooperative Association
 Farmers Cooperative Trading Co.
 Farmers Corner
 Farmers Elevator Inc.
 Farmers Grain Co.
 Farmers Grain Company
 Farmland Industries, Inc.
 Farnams Machine Shop
 Farr Better Feeds
 Fastprint, Inc.
 Fastway Copy Company
 Federal Memorial Mfg. Co.
 Federal Printing & Office Supply Co.
 Feeders Milling Co., Inc.
 Fenimore Manufacturing, Inc.
 Fergus Cart & Wheel Company, Inc.
 Fiber Glass Manufacturing Co.
 Fibercast Co.
 Fiberfab Corporation
 Fiberglass Fabricators
 Fibre Reduction, Inc.
 Fibre-Mold Corp.
 Fields Manufacturing Co.
 Fields Inc.
 Fields, J E. Cabinet Shop
 Fife Corporation
 Filter-Sorb Co.
 Fin-Tube Manufacturing Company
 Fincher Flavor Products Co.
 Fine Arts Engraving Company, Inc.
 Fine Arts Music Press, Inc.
 Fine Candy Co.
 Fish-Master Manufacturing Company
 Fisher Products, Inc.
 Five Fifty Five Insecticide Co.
 Five Star Engineering Inc.
 Five Star Industries, Inc.
 Five States Battery Manufacturing Co.
 Fizz-O Water Co., Inc.
 Flangco Corporation
 Flasher Company of Oklahoma, Inc.
 Flasher Supply Co.
 Fle Fly Mfg., Inc.
 Fleener, George E. Printing Co.

Fleet-Air Corporation
 Fletcher Herald
 Fletcher Industries, Inc.
 Fletcher Locker & Ice Co.
 Flex-Rite Valve & Mfg. Inc.
 Flight Systems, Inc.
 Flint Steel Corporation
 Flo-Bend, Inc.
 Florelei Hand Braided Rug Co.
 Florence's Draperies
 Flour Mills Of America, Inc.
 Flow Measurement Co. The
 Floyd's Cabinet Shop
 Flying -O- Enterprises, Inc.
 Flying H Trailers
 Fo-Mac Enterprises, Inc.
 Food Pak Inc.
 Foods By Livingston Inc.
 Football Enterprises, Inc.
 Ford Motor Co-Tulsa Glass Plant
 Ford R A & Son Roller Mill
 Foreman Printing Co.
 Foresee Ready-Mix Concrete Inc.
 Forguson Welding
 Forrester Welding Co.
 Fort Cobb Locker Plant
 Fort Cobb News The
 Forum Press, The
 Four States Motor Parts, Inc.
 Fowler, Sims Printer
 Fox-Stanley Photo Products Inc.
 Francis A. Caldwell
 Frank W. Murphy Manufacturer, Inc.
 Frank's Redi-Mix Inc.
 Franklin Mrs. D. G. Porcelain & Glass
 Franklin Properties, Inc.
 Frankoma Pottery, Inc.
 Franscon, Inc.
 Fred E. Cooper, Inc.
 Fred Jones Manufacturing Company
 Frederick Meat Company
 Frederick Press
 Free Shopper
 Freedom Call
 Freeman Decorating Co.
 Fremont Industries, Inc.
 Fresher Candy Company
 Frigiquip Corporation
 Frisco Packing Co.
 Frito-Lay Co.
 Frizzell Coach and Wheel Works
 Frohock Planing Mill
 Frontier Printers, Inc.
 Frontier Steel Corporation
 Fry Forest Products, Lumber Division
 Fry Manufacturing Company
 Fry Optical Co., Inc.
 Frybrant Inc.
 Fugate Lumber Mills and Creosoting
 Fuller Sign Co.
 Fullers Engraving Co.
 Funsten Nut Division
 FWI, Inc. Valve Division
 FWI, Inc.
 G & D Bit Service, Inc.
 G & G Manufacturing Co.
 G & H Decoys, Inc.
 G & W Body Works
 G & W Industries

G H R Mfg. Co., Inc.
 G Wiz Fertilizer Inc.
 G. R. C. Fiberglass, Inc.
 G. T. Bynum Co.
 G. A. Cotten Company
 G-W Mfg. & Supply Co., Inc.
 Gabes Office Supply
 Gaddis Petroleum Corporation
 Gage Record
 Gaido-Lingle Co., Inc.
 Gaines Brothers Gladys I Gaines, Trustee
 Galazie Sign Co.
 Garber Free Press
 Gardner Pre-Cast Concrete
 Gardner Spring Co.
 Gardner-Denver Co.
 Garner Electric
 Garnett Corporation
 Gas Burner Systems -GBS-, Inc.
 Gas Engineering and Construction Co.
 Gaso Pumps, Inc.
 Gasser Construction Co.
 Gateway Luggage
 Gault Tool Company, Inc.
 Gayle Towry Co.
 Gear Products, Inc.
 Geary Star
 Gemco, Incorporated
 Gemini Lacquers Inc.
 Gene Dunbar
 General Corrosion Services Corporation
 General Host Corporation
 General Manufacturing Company
 General Mill and Fixture
 General Mills, Inc.
 General Cil Tool Company
 General Printing Co.
 General Sash and Door Co.
 General Sheet Metal Co.
 General Steel Fabricating, Inc.
 General Tire & Rubber Co.
 General Wire & Supply Company
 Genes Machine Shop
 Genesco, Inc.
 Gentry Job Shop
 Gentry Body & Trailer Co.
 Geo. A. Hormel & Co.
 Geolograph Co, The
 Geophysical Research Corporation
 George E. Harris & Co., Inc.
 Georges Bakery
 Georgia-Pacific Corporation
 Giacomo Sign Company
 Giant Services, Inc.
 Gibbs L T Company
 Gibson Meat Co.
 Gibson Pre-Fab Concrete Products
 Gibsons Glenn Honey Co.
 Gilbert Sawmill
 Gilberts Machine Shop
 Giles Printing Company
 Gilmore Pattern Shop
 Gilt Edge Farms, Inc.
 Glass Coach, Inc.
 Glass Kraft Manufacturing Company
 Glass-Tex Co.
 Glassmare Inc.
 Glassmaster Plastics Company
 Glen Bowers Lumber Co., Inc.

Glen Oaks Industries, Incorporated
 Glenciff Dairies, Inc.
 Glenn Berry Mfrs., Inc.
 Glenn R. Briggs, Consulting Engineer
 Glenn Tool & Die Company
 Globe Color Press, Inc.
 Globrite Corporation
 Glow-Lite Corporation
 Goddards Ready-Mix Concrete, Inc.
 Gold Kist Inc.
 Gold Kist Peanut
 Gold Spot Dairy
 Golden Crust Bakery
 Goldenstern & Stolper Inc.
 Goodbary Engineering
 Goodman's Upholstery Shop
 Goodyear Tire and Rubber Co.
 Gordon Cartons, Inc.
 Gordon Machine & Electric Co.
 Gordon, Samuel, and Co.
 Gorrell's Big G Co.
 Gosney Printing Co., Inc.
 Gotebo Record-Times
 Gougler Sawmill
 Gould, Inc.
 Gourley Archery Mfg. Co.
 Governair Corporation
 Gra-Iron Foundry Corporation
 Grade Sports, Inc.
 Grady Feed Mills, Inc.
 Graham-Tull & Associates, Inc.
 Grand Lake Concrete Company
 Grandfield Publishing Company
 Granite Enterprise
 Grant Manufacturing & Equipment Company
 Graphic Electronics Inc.
 Graphic Plate & Supply Company
 Graphic Publishers Inc. The
 Graphics International, Inc.
 Graphics Universal, Inc.
 Grav A Name
 Graves Manufacturing Co.
 Great Lakes Aircraft Company
 Great Lakes Carbon Corporation
 Great Land Products, Inc.
 Great Plains Mfg. Co.
 Grecian Marble of Tulsa, Inc.
 Greco Products-Hobby Lobby
 Green Country Castings Corp.
 Green Country Concrete, Inc.
 Green Country Smoke House
 Green Country Trailer Manufacturing
 Green Frozen Food Center
 Green Manufacturing Co.
 Green Metal Fabricators Company
 Greenleaf Bakery
 Greens Broom Co.
 Greer County Cold Storage
 Greers, Inc.
 Griffin Mfg.
 Griffin Producing Company
 Griffy Sign Co.
 Griggs Exhibits
 Grimes Gasoline Co.
 Grissom Manufacturing Co.
 Gross Concrete and Plumbing Service
 Group III
 Grove Ready Mix Cement
 Growers A G Service Inc.

Gruner and Company, Inc.
 Guffeys Executive Journal of Tulsa, Inc.
 Gulfco Industries, Inc.
 Guthrie Cotton Oil Co.
 Guthrie Meat Co.
 Guthrie Monument Company
 Guthrie Welding & Construction Co., Inc.
 Guy H. James Industries, Inc.
 Guy's Foods, Inc.
 Guyette-Atkins Printing, Inc.
 Guymon Chemical & Engineering Co., Inc.
 Guymon Coca-Cola Bottling Co.
 Guymon Daily Herald
 Guymon Ready-Mix
 Guymon Sheet Metal
 Guyton Manufacturing Co., Inc.
 H & B Litho, Inc.
 H & C Equipment Company, Inc.
 H & H Manufacturers
 H & H Manufacturing Company
 H & L Machine Works
 H & M Machine & Tool Co., Inc.
 H & M Pipe Beveling Machine Company
 H and H Mfg. Co.
 H and R Meat Co.
 H B Corporation
 H S H, Inc.
 H Stark Woodard
 H. C. Rustin Corporation
 H. E. Anderson Company
 H. K. & S. Iron Co.
 H. K. Porter Company, Inc.
 H. S. Boyd Company, Inc.
 H. W. Guderian Produce
 H. C. Becker & G. C. Stout
 H-I-S Manufacturing Co.
 Haas Manufacturing Co.
 Hackney Iron & Steel Co.
 Haenchen & Co.
 Haggard Slacks - Duncan Mfg. Co.
 Hale Manufacturing Company, Inc.
 Hall Jimmie Welding Co.
 Halliburton Company
 Hallman Printing Company
 Hamilton Industries
 Hamlin Canvas Goods Co.
 Hammco
 Hammett House of Foods, Inc.
 Hammond Concrete Co.
 Hammond Mills, Inc.
 Hammonds Horse Trailers
 Hampton Research & Engineering, Inc.
 Handi Sak, Inc.
 Handy Andy Broom Company
 Hanger, J. E. Inc. of Okla.
 Hanna Lumber Co.
 Haralson Construction Co.
 Harback Printing & Lithographing Co.
 Hardwall Fabricators
 Hargrove Casket Company
 Harley Industries
 Harley, Ok and Co.
 Harlow Publishing Corporation
 Harmans Bakery
 Harmony-Woodruff, Inc.
 Harndens Candles
 Harold Printing Co.
 Harolds Concrete Supplies
 Harper County Journal

Harper Industries, Inc.
 Harper's Electric
 Harps Green Valley Farms
 Harrall Meats
 Harrell-Morris Candy Company
 Harris Neon Co.
 Harris Packing Company
 Harris, M. A. Cabinet and Fixture Shop
 Harrison Bolt & Nut Company
 Harrison Gypsum Co.
 Harrison Manufacturing Company
 Harrymans Custom Meat Processing
 Harshman Machine & Welding
 Hart Cotton Machine Company
 Hart Machine & Engineering Co.
 Hart Mfg., Inc.
 Hart Plating Company
 Harter Marblecrete Stone Co.
 Hartshorne Sun Publishing Co.
 Harve Porton, Sawmill
 Hasco Mfg. Co.
 Haskell Foods, Co.
 Haskell Lemon Const Co.
 Hathaway Industries, Inc.
 Hatter Farms Inc.
 Hausners Concrete Septic Tanks
 Hauths Processing
 Haynes Manufacturing Company, Inc.
 HCT Products Inc.
 Hearn, D W Machine Works
 Hearon Steel
 Heat Fluid Engineering Corporation
 Heavener Charcoal, Inc.
 Heavener Furniture Mfg. Co.
 Heavener Ledger
 Heavener Ready Mix, Inc.
 Heck Leather Goods, Inc.
 Hedgers Heating & Air Conditioning
 Hefners Concrete Block Plant
 Heldebrand Steel Buildings
 Heldenbrand & Son Mfg. Co.
 Heldies Machine Works
 Helmer Printing Co.
 Hendershot Tool Company
 Henderson Coffee Co.
 Henderson Manufacturing, Inc.
 Hendersons Clover Printing Co.
 Henley Halter Company
 Hennessey Clipper
 Henry Manufacturing Co.
 Henry Mfg. Co. of Okla.
 Henryetta Asphalt Company
 Henryetta Baking Company
 Henryetta Daily Freelance
 Henrys Septic Tank
 Hensel Optical Co. of Okla City
 Henthorn Printing Co.
 Herald Democrat
 Herald Printing Company
 Herald Publishing Co.
 Herb Welding and Radiator Co., Inc.
 Hercules Co.
 Hercules Galion Products, Inc.
 Hercules Industries, Inc.
 Heritage Art Glass, Inc.
 HeritageGraphics Corp.
 Heritage Manufacturing & Supply Company
 Heritage Press
 Hermetic Switch, Inc.

Herndon Map Service
 Herrin & Brown Printing
 Herron Lumber, Inc.
 Herschberger Printery
 Heslars Bakery
 Hessmer Co.
 Hesston Corporation
 Hestand Machine Shop
 Hexagon Homes
 Hi Performance Marine Inc.
 Hi-Vi Dog Food Company
 Hickman Millwork & Supply Inc.
 Hickory King Trailors Inc.
 Hicks Welding & Machine Shop
 Higginbotham, D K, Grapic Prod
 Higgins Upholstering
 Higgins-Acme Neon, Inc.
 High Pressure Engineering Co., Inc.
 Highland Supply Corporation
 Hill-Looney, Inc.
 Hillcrest Memorial-Vault Company, Inc.
 Hillsdale Homes, Inc.
 Hillson Steel Products Inc.
 Hinkels Book Shop
 Hinkle Printing Company & Office Supply
 Hinman Machine Works
 Hinman Manufacturing Corporation
 Hipsleys Printing Co.
 Hiway 81 Dairy
 Hoaglin, John, Auto Trim
 Hobart Democrat-Chief
 Hobart Redi-Mix Concrete Co.
 Hobart Seed Co.
 Hobbs Trailers
 Hobbs, John, and Co.
 Hock Printing Co.
 Hodges Materials Inc.
 Hodgson Engineering and Mfg. Co.
 Hoedebeck Brothers
 Hoerner Waldorf Corporation
 Hoffman Fixtures Co.
 Hoffman-Speed Printing Co.
 Hogan Investment Company
 Holbrook Printing and Lithographing Co.
 Holden Trailer Mfg. Co., Inc.
 Holdenville Daily News
 Holdenville Mill & Elevator
 Holder's Locker Plant
 Holders Locker Plant
 Holiday Ornamental Iron Co.
 Holley Carburetor
 Hollis ConcreteCo.
 Hollis Weekly News
 Holloway Lumber Company
 Holly Creek Fryers, Inc.
 Hollywood Bakery
 Holmes Cabinet Shop and Constr Co.
 Holsum Baking Co. of Oklahoma Inc.
 Holt Packing Co.
 Holton Mills, Inc.
 Home Builders & Associated Products
 Home Furnace Co.
 Hominy Welding & Machine Works
 Honeywell Information Systems, Inc.
 Honor Bilt Feed Mills, Inc.
 Hooker Advance
 Hooper Printing Company, Inc.
 Hop Mfg. and Equipment
 Hopkins J C Baking Co.

Horinek Window & Door Factory
 Hormel Fine Foods
 Hornet Antenna Products Co. Inc.
 Hoster Steel
 House of Clay, The
 House of Craftsmen
 House of Envelopes & Forms, Inc.
 House of George, Inc.
 House of Heirlooms
 House of Monogram
 House of Thompson
 Howard Furniture Manufacturing Co., Inc.
 Howard Packing Plant
 Howard Press
 Howard Welding and Engineering Co.
 Howards Auto Top and Body Shop
 Howry Boat Company
 Hucks Printing Limited
 Hudgins Supply
 Hudson Foods, Inc.
 Huffines Cabinet Shop
 Huffman Lumber Co.
 Huffman Wood Preserving, Inc.
 Huggart Industries
 Hughes County Publishing Company, Inc.
 Hughes Upholstery
 Hughes-Anderson Engineering Corporation
 Hugo Dress Company
 Hugo Ice Company, Inc.
 Hugo Milling Co. - Plant No. 2
 Hugo Publishing Company
 Humco of Oklahoma, Inc.
 Hunt Sheet Metal Works
 Hunter Bros. Trailers
 Hunter Printing Company
 Hunters Horn Inc.
 Hunts Wholesale Meats
 Huntsinger & Son
 Hurricane Sales Inc.
 Hurst Stone and Bldg. Supply Co.
 Husband Brother Packing Co.
 Huston Laboratories, Inc.
 Hutchins Sawmill
 Hutchinson Products Company
 Buttons Printing
 Hy Test Remanufacturers, Inc.
 Hy-Vi Battery Rebuilders
 Hyatt Ready Mix Concrete
 Hyco Corp.
 Hyde Park Canning Corp.
 Hydra-Hoist Inc.
 Hydraulics of Tulsa Inc.
 Hydro Conduit Corporation
 Hydro Review
 Hydronics Mfg. Inc.
 Hyroop Manufacturing Co., Inc.
 Ice Service of Tulsa
 Ici America Inc.
 Idabel Stone Co.
 Ideal Basic Industries, Inc.
 Ideal Brick & Brikcrete Mfg. Co., Inc.
 Ideal Machine & Welding Co.
 Ideal Mattress Factory
 Ideal Specialty Company
 Ifr Products, Inc.
 Ikes Chili House
 Imco Services
 Imperial Cabinet & Fixture Company, Inc.
 Imperial Chair Co., Inc.

Imperial Stone Cutters, Inc.
 Imperial Trailer Company
 Impress Color Press
 Impress, Inc.
 In En Corporation
 Indel Inc.
 Independent Ice Co.
 Independent Screen Company, Inc.
 Independent Tank and Mfg. Co.
 Independent Tank Company
 Indian Capitol Plastic, Corporation
 Indian Head Inc.
 Indian Journal Printing Company, Inc.
 Indian Mound Glass Plant
 Indian Nation Asphalt Co.
 Indain Records, Inc.
 Induction Processing Co.
 Industrial Electrical Controls, Inc.
 Industrial Electrical Manufacturing.
 Industrial Engine
 Industrial Fabricating Co.
 Industrial Gasket & Packing Co., Inc.
 Industrial Hard Chrome Co.
 Industrial Iron and Machine Company
 Industrial Iron Works, Inc.
 Industrial Machine Company
 Industrial Photography Co.
 Industrial Plastics Company
 Industrial Rubber, Inc.
 Industrial Service Co., Inc.
 Industrial Splicing Co.
 Industrial Vehicles, Inc.
 Ingram Machinery Co.
 Inland Laminates
 Inland Machine & Welding Company
 Inola Machine & Fabricating Company, Inc.
 Insta-Box & Supply Co., Inc.
 Insta-Wood Co.
 Instant Glass
 Instant Ice Tea
 Instrument Products, Inc.
 Insul-Bead Corporation
 Insulation Services Inc.
 Inerceptor Corporation
 Intergraphics Press, Inc.
 International Air Conditioning Corp.
 International Chain Link Co., Inc.
 International Bank Equipment & Service
 International Biological, Inc.
 International Crystal Manufacturing Co.
 International Environmental Corp.
 International Marina Systems Inc.
 International Metal Co. Inc.
 International Multifoods Corporation
 International Paper Co.
 International Wood Products, Inc.
 Interplastic Corp. Commercial Resins
 Div. Plant
 Interstate Electric Company, Inc.
 Interstate Tool and Manufacturing Co.
 Iowa Beef Processors, Inc.
 Irenes Bake Shop
 Irish Pipe Coating Company, Inc.
 Iron Masters
 Ironcraft
 Irwin J L Sand and Gravel Company
 Irwin Packing Co.
 Isador -Izzy- S. Renco, Litho
 Itt Continental Baking Company

Iwi Division, Essex International, Inc.
 J & D Machine Shop
 J & D Ornamental Iron
 J & J Mfg. Co.
 J & J Sheet Metal
 J & J Sheet Metal Works
 J & M Food & Packing Co.
 J & R Speedprint
 J. & E, Manufacturing Company
 J. & J. Co.
 J. A. Runge Company
 J. B. Battle Uniform Company, Inc.
 J. C. Potter Sausage Company
 J. D. Fine Candy Co.
 J. E. Shaffer Co.
 J. Foreman Moore-Lease Account
 J. L. Garrett
 J. L. Reynolds, Inc.
 J. Lewis Small Co.
 J. P. Burroughs & Son, Inc.
 J. P. Machine & Tool Company
 J. W. Gaston, Logging
 J. L. Parker
 J. M. Hewgley, Jr.
 J-F Thermal Products Inc.
 Jack Anthony Machine Works, Inc.
 Jack Pratt Screen Ad. Co.
 Jacks Machine Shop
 Jacks Potato House
 Jackson Co.
 Jackson Locker Service
 Jackson Machine Co. and Timmy Bright Sale
 Jackson Manufacturing, Inc.
 Jackson Tool Co.
 Jackson Wire Mfg. Inc.
 Jacksons Upholstering
 Jacksons Welding and Machine
 Jacobson L A Inc.
 Jacobson Materials, Inc.
 Jakes Foundry, Inc.
 Jamco Inc.
 James E. Sullivan
 James H. Ginn
 James M. Bird, Proprietor
 James Sausage Company
 James Walter Lumber Co.
 Jansco Thrifty Printing, Inc.
 Jay Redi-Mix
 Jeffersonian Publishing Co., Inc.
 Jeffery Bob Co.
 Jelly & Son Hasty Taters
 Jem Mfg., Inc.
 Jenkins Sawmill
 Jennings & Jennings Logging Contractor
 Jensen International, Inc.
 Jermain Trailers
 Jero Manufacturing Co.
 Jerome Upholstery
 Jerry Dale Gordon Enterprises
 Jersey Products
 Jersey Products Company
 Jess & Lowell Well Casing Company
 Jet Printing Company
 Jet Stamp & Paper Co.
 Jet Visitor, The
 Jetflo Manufacturing Corporation
 Jetty-Fagg Inc.
 Jeweler's Service Co.
 Jewell Drainboard Co.
 Jiffy Mfg. Co.
 Jiggs Smoked Turkey Inc.
 Jim Did It, Inc.
 Jim Meehan Co.
 Jimmie McGaheys Welding Shop
 Jimmies Oven Fresh Pastries
 Jims Welding Service
 Jody's Letter Service, Inc.
 Joe Brown Company, Inc.
 Joe Lewis Welding & Construction
 Joe S. Brown & Sons Packing Company
 Joe S. Peerson & Devine
 Joe S. Wylie Company
 Joe Smith Sawmill
 Joe's Potato House and Wholesale Meat
 Joel W. Crain Displays
 Joes Frame Shop
 Joes Red-I-Mix
 Joes Upholstery and Repair Shop
 John D. Saddlery
 John Hudson Woodcraft
 John N. Martin, Manufacturer
 John Pickle Company
 John Roberts Manufacturing Company
 John W. McDougall Co., Inc.
 John Zink Company
 Johndrow Pest Control & Home Improv.
 Johns Bakery
 Johns E-Z Spuds
 Johnson Mattress Co., Inc.
 Johnson Printing & Office Supply
 Johnson Service Company
 Johnson Welding Company, Inc.
 Johnsons Bakery
 Johnsons Milk & Ice Cream Co.
 Johnston County Capital-Democrat
 Johnston County Peanut Company
 Johnston W B Grain Co., Inc.
 Jole Manufacturing Co., Inc.
 Jonco Septic Tank Mfg. Co.
 Jones Aluminum Corporation
 Jones and Laughlin Supply Div.
 Jones Billy Signs and Displays
 Jones Concrete Products Co.
 Jones Fertilizer Co.
 Jones Meat Service
 Jones Packing Company, Inc.
 Jones, Jimmie, Co.
 Jones, R. D., Upholstering Co.
 Jonny on the Spot, Inc.
 Joplin & Son Feed Mill
 Jordan Sheet Metal Shop
 Jorski Mill & Elevator Co., Inc.
 Joseph Manufacturing Co., Inc.
 Journal-Record Publishing Company
 Joy Oil Tools, Hillman
 Julia Pauline Snow
 Juno Promotions
 K & F Machine and Mfg. Co.
 K & L Frame Company, Inc.
 K Enterprises
 K. B. Reed
 K. C. Enterprises, Inc.
 K. C. Welding & Machine Company
 K-M Oil Company
 K-P Construction Company, Inc.
 K-V Charcoal, Inc.
 K-W Manufacturing Co., Inc.
 Kae-Jac Precision Manufacturing, Inc.

Kaiser Aluminum & Chemical Corporation
 Kaiser Outdoor Advertising Company, Inc.
 Kaiser Tool & Die
 Kaisers Ice Cream Co.
 Kajac Manufacturing Co.
 Kajun Industries, Inc.
 Kamac Manufacturing Company
 Kamp Brothers, Inc.
 Kamp, Frank Interiors
 Kams, Inc.
 Kansas-Nebraska Natural Gas Co., Inc.
 Kar Glo Manfg. Co.
 Karlin Company
 Katz Auto Supply Co.
 Kaw Industries, Inc.
 Kaw Lake Cement Co.
 Kay Engineering and Sheet Metal, Inc.
 Kay Memorial Co.
 Kay Packing Co.
 Kay's Furniture & Upholstery
 Keck Steel Corporation
 Keco Incorporated
 Keefeton Slaughter House
 Keepsake Candles
 Keirn Dairy
 Kelleher Equipment Company
 Keller Williams Furniture Mfg. Co.
 Keller Williams Upholstery Division
 Keller's Furniture Refinishing & Uphols
 Kellwood Company
 Kelly Creamery or Kelly Farms
 Kelly Dental Studio Inc.
 Kelly Enterprises
 Kelly Office Supply
 Kelly Venetian Blind Co.
 Kelly-Moore Paint Company, Inc.
 Kelly, W R & Son
 Kelly's Home & Office Decorating Ctr.
 Kellyville Fabricators, Inc.
 Kelsey-Hayes Company
 Keltner, J D. Co.
 Keltronics Corporation
 Kems Inc.
 Kenco Engineering Company
 Kenco Portable Buildings, Inc.
 Kendall Charles Motor Machine Works
 Kenneth D. Pate - Logging
 Kenneth E. Wilson, Jr. Enterprises
 Kenneth R. Taylor Machine and Mfg. Co.
 Kennys Ice Cream
 Kens Bakery
 Kens Cabinet & Trim
 Kens Machine Shop, Inc.
 Kent Western Corp.
 Kentube Company
 Keota Mill & Elev Co., Inc.
 Kerr Glass Manufacturing Corp.
 Kerr Machine Co.
 Kerr McGee Corp Plant Number 9
 Kerr McGee Nuclear Corp.
 Kerr McGee, Corp.
 Kerr-McGee Chemical Corp.
 Kerr-McGee Farm Center
 Keyes Helium Plant
 Keyes Publishing Co.
 Keystone Pipe & Supply Company
 Keystone Publishing Company
 Keystone Steel Fabrication, Inc.
 Keystone Tape and Label

Kilpatrick Brothers Inc.
 Kilproducts, Inc.
 Kimball Chemical Co.
 Kimball Ready Mix - Farm and Ranch
 Kimberling Bakery No. 2
 Kimco Sales Corporation
 Kimray, Inc.
 Kimwar Memorials Inc.
 Kinder Manufacturing Company, Inc.
 King Communications, Inc.
 King Law Brief Printing Co.
 King, Don, Corporation
 King, Paul, Company
 Kingfisher Cooperative Elevator Assn.
 Kingfisher Times and Free Press, Inc.
 Kingly Business Forms, Inc.
 Kingsberry Homes
 Kinzie Industries, Inc.
 Kiowa County Democrat
 Kiowa County Star Review
 Kipps-Roberts
 Kirchner, A. L. Furniture Refinishing
 Kirks Feed & Garden Supply
 Kirkwood Tank Co., Inc.
 Kitchen Clinic
 Kitty Clover Potato Chip Company
 Kleen Products Inc.
 Klein Meats
 Klingensmith Sheet Metal & Welding
 Klingsick Machine Shop
 Knapp Printing and Gifts
 Knepper Mfg. Co.
 Knight Electronic
 Knight Industries, Inc.
 Knox Refining Co.
 Kobe, Inc.
 Koehring Company
 Kolb, Herman
 Kolbs Type Service
 Kompco Inc.
 Konawa Leader Publishing Co.
 Kool-Fuel Racing Products, Inc.
 Korte Company
 Kraft Foods Division of Kraftco Corp.
 Krause Plastics
 Krauss Screen Process, Inc.
 Kress Manufacturing Co.
 Kwik Kopy # 76
 L & L Ornamental Iron & Supply
 L & L Paving
 L & M Furniture Mfg. Co.
 L & M Pattern & Mfg. Co.
 L & M Steel
 L & S Specialty Co.
 L & S Tool Company
 L and E Resleeving
 L and M Mfg., Inc.
 L. & S. Bearing Mfg. Co.
 L. A. Jacobson, Inc.
 L. A. King Corp.
 L. W. Barrett
 La Maison
 La Sill Milk Co.
 La Velle Laboratories Inc.
 Labarge Inc.
 Labarge Tubular Division
 Ladish Co.
 Lahmeyer Pattern Shop
 Laingor Monument Co.

Lair and Sons Concrete Co., Inc.
 Laird Typesetting Service
 Lake Commodities Inc.
 Lake Country Beverage, Inc.
 Lake Eufaula World
 Lake Mfg. Company
 Lakey Printing
 Lamont Valley News
 Lampe Industries, Inc.
 Lance Leathergoods
 Landis Steel Company, Inc.
 Landreth Products
 Landshire Sandwich Co.
 Landshire Sandwiches of Tulsa
 Lane Trailers, Inc.
 Lane, Ralph Interiors
 Lanman Machine Co.
 Larco Industries, Inc.
 Larrance Tank Corporation
 Larrys Fence and Iron
 Larsco, Incorporated
 Larson, A. D., Supply Co.
 Lasiter Printing Company
 Latimer County News-Tribune
 Latimer's Inc.
 Laundry Enterprises
 Lawrence Machine and Trailer Co., Inc.
 Lawrence Monument Co.
 Lawrenz Mfg.
 Lawson Brothers Iron Works
 Lawton Brace & Limb Co., Inc.
 Lawton Coca-Cola Bottling Company
 Lawton Fence Co., Inc.
 Lawton Machine Shop, Inc.
 Lawton Manufacturing Company
 Lawton Mfg. Co.
 Lawton Plating Co.
 Lawton Publishing Co., Inc.
 Lawton Seven Up Bottling Co.
 Lawton Specialty Co.
 Lawton Transit Mix, Inc.
 Lawton Venetian Blind & Screen Company
 Lawton Woodworking Co.
 Lawyer Graphic Screen Process
 Lazy L Bar Ranch Ornamental Glass
 Lazy S Trailers
 Lazy Suzan Catering Service
 Le Crone Rhythm Record Sales Company
 Leach Cabinet Shop
 Leader Press Inc.
 Leader Publications, Inc.
 Leader Tribune
 Lear Siegler, Inc.
 Leco Enterprises
 Leco Materials, Inc.
 Lee & Hodges, Inc.
 Lee Boss Saddlery
 Lee C. Moore Corporation
 Lee Company The
 Lee Fac, Inc.
 Lee Gift Desings
 Lee Laboratory
 Lee Ready-Mix Company, Inc.
 Leco Machine Co.
 Lees Country Cured Meats
 Lees Gift & Hobby Shop
 Lefco Mfg. & Welding
 Leger Mill Co., Inc.
 Leggett & Platt

Leggett & Platt Incorporated
 Lehmer Manufacturing Corporation
 Leisure Activities Products Corp.
 Leland Equipment Company
 Lemike Signs Co.
 Lennier Manufacturing Company
 Leon's Inc.
 Leonard Printing Company
 Leonards Cake Shoppe & Catering
 Lewis Camper Mfg. & Sales
 Lewis Dog Boot Shop
 Lewis Instrument
 Lewis Manufacturing Company
 Lewis Printing Company
 Lewis Trailers Mfg.
 Lewmar, Inc.
 Lews Auto Trim Shop
 Lexington Sun
 Liberty Candy Company
 Liberty Glass Co.
 Liebmann Ice Co.
 Lillian Russell Originals, Inc.
 Limestone Products Co.
 Lin Manufacturing Co. of Oklahoma, Inc.
 Lin-Co Mfg. Co.
 Linam Machine Shop
 Lincoln County News
 Lincoln Industries Incorporated
 Lincoln Riley Country Homes
 Linda Dress Manufacturing Co., Inc.
 Lindamood Sawmill
 Linde Divn
 Linden Upholstering
 Linderer Printing Company
 Lindsay Manufacturing Co., Inc.
 Linville, Inc.
 Linwood Pattern Co.
 Lip So Aluminum Awning Company
 Liquid Carbonic Corp.
 Litho Negative and Plate Co.
 Litho Negative Service, Inc.
 Little Giant Pumpco Corp.
 Little Revel Tree Injection Co.
 Littles Northside Printing Co., Inc.
 Littles Printing & Stationery Co.
 Lloyd A. Fry Roofing Co.
 Lobaris Copper Company
 Lockards Upholstery
 Lockheed Aircraft Corporation
 Locust Grove Truck & Equipment
 Lofland Steel Mill Inc.
 Lofton Planning Mill
 Logan Dental Laboratory
 Logan Publishing Co.
 Lone Star Brewing Company
 Lone Star Gas Co. - Katie Plant
 Lone Wolf News
 Long Bell Lumber
 Long-Bell Ready Mixed Concrete Plant
 Loomis Battery
 Loomis Co.
 Looney Edna Products
 Looper Leather Goods Co.
 Louises Drapery & Quilting
 Louisiana Land & Exp Co.
 Love Air Conditioning Co.
 Loveco, Inc.
 Lowell Morpheu Sawmill
 Lowrance Electronic Mfg. Corp.

Lucas Control Company, Inc.
 Lukken Steel Construction Co.
 Lumbermens Millwork & Supply Co.
 Lustwork Mfg. of Tulsa
 Luther Silver Inc.
 Luthers Custom Slaughter
 Luxury Manufacturing and Supply Company
 Lynns Bakery
 Lyntone Belts Co. The
 M & D Manufacturing
 M & E Services
 M & M Machine Shop
 M & M Sporting Goods Mfg. Co.
 M & O Welding Co.
 M and D Ornamental Iron Co.
 M D & S Products
 M. E. Stewart & Sons Rock Products
 M. W. Bevins Co.
 M. W. K. Machine Works
 M.I.C.R. Check Printing Co.
 M-C-M Machine Works, Inc.
 M-R Data Service, Inc.
 M-T Publications
 Maassen Tool & Supply Co.
 Mabar, Inc.
 Mac Brothers
 Mac Signs, Inc.
 Mac Supply Co.
 Macanudo Oil Corporation
 Macfarlane, Inc.
 Machine Engineering Inc.
 Machine Products Co.
 Machine Shop
 Machine Tool Specialities, Inc.
 Machinery & Electrical Products Co.
 Mackeys Slaughterhouse, Inc.
 Macklanburg
 Macklanburg-Duncan, Co.
 Macs Mobile Homes & Camper Repair Inc.
 Macs Plating Works
 Mactum Lighting Co.
 Madden Utility Houses
 Maddox Asphalt Co.
 Madewell and Madewell
 Madill Manufacturing Company, Inc.
 Madison Furniture Industries
 Madison Machinery Company, Inc.
 Madison, Inc.
 Magic Air Inc.
 Magic Bait Company
 Magna Company The
 Magnetic Switches, Inc.
 Magnetic Tapes Inc.
 Magnitron, Inc.
 Mainus Mfg. Co.
 Majestic Lubricating Company
 Major Atlas, Inc.
 Major Engineering Co.
 Major Laboratories
 Makins Concrete Compant
 Mallory Co. The
 Malone Metal Fabricators, Inc.
 Malone Products, Inc.
 Maloney-Crawford Tank Corporation
 Malt-A-Plenty, Inc.
 Manchester Motor Company
 Maneke-Kinzie Printing Company
 Maness Type Company, Inc.
 Mangum Brick Company

Mangum Concrete, Inc.
 Mangum Newspapers, Inc.
 Mangum Publishing Company
 Manly Office Supply Co., Inc.
 Mannford Ready-Mix
 Manning Screen Printing Service Co.
 Mantle Upholstery
 Manufacturers, Incorporated
 Manufacturing Innovations
 Manus L. Smith Company, Inc.
 Mapco Inc-Production Division
 Marblecraft, Inc.
 Marco Products, Inc.
 Marcus Manufacturing Co.
 Maremont Corp-Shock Absorber Divn.
 Marietta Feed Mill
 Marietta Monitor
 Marietta Sportswear Mfg. Co.
 Marley Printery
 Marlow Concrete Company
 Marlow Review
 Marrs Publications
 Marshall Plastics Company
 Marshall Poster and Design
 Marshall Strozier
 Marston Mill & Elevator Inc.
 Mart Trophy Co.
 Martin Doughnut Shop & Coffe Bar
 Martin Lee Concrete Co.
 Martin Monument Co.
 Martin Wholesale Co., Inc.
 Martin-Marietta Corporation
 Marvin Catron Co.
 Marvin Printing Co.
 Mary Faulkner Frame Shop
 Mary's Pie Shop
 Maschino Meat Processing
 Masonic Home Print Shop
 Masonry Systems Inc. of Oklahoma
 Massey's Trim Shop
 Massman Enterprises, Inc.
 Master Kraft Tooling Corporation
 Master Motor Rebuilders, Inc.
 Materials Handling Inc.
 Math-U-Matic Inc.
 Mathey Manufacturing Company
 Max Vax
 Maxetron Industries, Inc.
 Maysville News The
 Maywood Baking Company, Inc.
 Mazie Frame Co., Inc.
 McAlester Coca-Cola Bottling Company
 McAlester Democrat
 McAlester Oil Mill Company
 McAlester Publishing Company
 McAlester Ready-Mix
 McClure Pattern Shop
 McConnell Bottling Company
 McCormick Sign Company
 McCoy Marking Co.
 McCulloch Airmotive, Inc.
 McCurtain Gazette Company
 McCurtain Printing Company
 McDonnell Douglas Corporation
 McElroy Manufacturing Inc.
 McGraw-Hill, Inc.
 McKissick Products Company
 McLendon Manufacturing Company
 McMichael Asphalt Sales Co.

McMichael Concrete Co.
 McWilliams Publications, Inc.
 McAdams Pipe & Supply Co.
 Mcalester Monument Company
 McBride D C Slaughtering & Processing
 Mccaslin Recapping Co.
 McClain Mfg. Co. & Engineering Service
 Mcconaghine, V C. Co.
 McCoy, Bill, Concrete Pipe Co.
 McDonald Sheet Metal Specialties
 McGinnis, D W. Optical Dispensary
 McIntosh County Democrat
 MCM Hospital Supplies Inc.
 McMichael Concrete Co. Sand Plant
 McNabb Engraving & Trophy Company
 McNutt Brothers
 McNutt Industries
 Mead Foods, Inc.
 Meadow Gold Dairies
 Meadow Gold Mild Co. - Beatrice Foods
 Mecca Coffee Company
 Med Electronics
 Medco Products Mfg. Corp.
 Medford Printing Company
 Medford Redi Mix
 Medlin-Daley Dental Lab
 Meeco Marinas, Inc.
 Meeker Manufacturing Co., Inc.
 Meeks Lithographing
 Mel-O-Dee Ice Cream Co.
 Mels Donut Shop
 Melvin Tyler Manufacturer-Distributor
 Memco Inc.
 Memheth Ltd.
 Mercer Tackle Co.
 Merchants Sign and Paint Co.
 Mercury Press
 Mercury Tool, Inc.
 Merrick Printing Co.
 Merryman Machine Works
 Mertz Iron & Machine Works, Inc.
 Mervs Litho Service
 Metal Fabricating Inc.
 Metal Goods Manufacturing Company
 Metal Processing Co., Inc.
 Metal Products Inc.
 Metal-Fab Trophy Co.
 Metalcraft Manufacturing Co., Inc.
 Metalines, Inc.
 Metals & Tubes Division
 Metalspand, Inc.
 Metem of Oklahoma
 Metric Inc.
 Metro Press, Inc.
 Metro Printing, Inc.
 Metrodata Systems, Inc.
 Metropolitan Paving Company, Inc.
 Meyer Meat Service
 Miami Armature Works
 Miami Co Operative Assn, The
 Miami Coca Cola Bottling Co., Inc.
 Miami Newspapers, Inc.
 Miami Products, Inc.
 Miami Ready Mixed Concrete
 Miami Stone, Inc.
 Miami Tin Shop
 Michael Casuals, Incorporated
 Michelin Renovex Corp.
 Mickey's Sign Co.
 Micro Finishing Co. Of Oklahoma
 Micro-Vision Contact Lens Co.
 Microfoto Industries
 Mid Continent Glass Sand Company
 Mid-America Chemical, Inc.
 Mid-America Machining, Inc.
 Mid-America Steel Co. Inc.
 Mid-America Yarn Mills, Inc.
 Mid-Continent Concrete Company
 Mid-Continent Fabricating Corporation
 Mid-Continent Paper Grading Company
 Mid-Continent Torpedo Company
 Mid-Del Newspapers, Inc.
 Mid-States Aircraft Engines, Inc.
 Mid-States Camper Manufacturing Inc.
 Mid-States Publishing Company
 Mid-Stream Travel Industries, Inc.
 Mid-West Creamery Co.
 Mid-West Mill & Supply Co.
 Mid-West Printing & Publishing Company
 Midco Advertising Inc.
 Midcon Fabricators, Inc.
 Midcontinent Map Company
 Midland Casting Co.
 Midland Cooperatives, Inc.
 Midland Hol-O-Met, Inc.
 Midland Industries, Inc.
 Midway Publishing Co.
 Midway Tack Mfg., Inc.
 Midwest Autopilots, Inc.
 Midwest Bakers Supply
 Midwest Carbide Corporation
 Midwest Decals, Inc.
 Midwest Door and Window
 Midwest Jewelry Co.
 Midwest Machine Co.
 Midwest Machinery Co.
 Midwest Marble Co.
 Midwest Oil Register, Inc.
 Midwest Products Corp. of Oklahoma
 Midwest Sheet Metal Co.
 Midwest Steel & Supply Co.
 Midwest Textiles, Inc.
 Midwest Upholstery & Carpets
 Midwest, Inc.
 Midwestern Industries, Inc.
 Midwestern Manufacturing Company
 Midwestern-Industries, Inc.
 Mightons Machine Shop
 Mike and Dale Bates
 Mike Kelly Manufacturing Co.
 Milam Produce
 Mill Creek Manufacturing Co.
 Millcon Corporation
 Miller Aircraft Engines-A Div-Airprt In
 Miller Concrete Co.
 Miller Enterprises
 Miller Equipment & Mfg. Co.
 Miller Manufacturing Co.
 Miller Packing Company
 Miller Printing Co.
 Miller Sheet Metal Shop
 Millers Printing & Office Supply
 Million Machine & Mfg. Co.
 Mills Castings
 Mills Concrete Company
 Mills Machine Co.
 Millwork Supply, Incorporated
 Minit Print

Minneapolis Artificial Limb Co. of Okla.
 Minnesota Mining and Manufacturing Co.
 Mitchell Ice Co.
 Mixon Brothers Post Co.
 Mobil Oil Corp Chitwood Gas Plant
 Mobil International Company, Inc.
 Mock Brothers Saddlery
 Model Printing Company
 Model Stone
 Modern Bearing & Supply Co.
 Modern Bindery, Inc.
 Modern Carpet Industries, Inc.
 Modern Fireworks, Inc.
 Modern Machine & Mfg. Co.
 Modern Manufacturing Co.
 Modern Metals, Inc.
 Modern Pipe, Inc.
 Modern Plating Company, Inc.
 Modern Sheet Metal Company, Inc.
 Modern Stamp & Seal Co.
 Modular Concepts Inc.
 Mohawk Industries, Inc.
 Mohawk Ornamental Iron
 Mohawk Rock & Sand Company
 Mohawk Steel Company, Inc.
 Mohawk Valve Company
 Moinette Pottery
 Mold Tech
 Monahan Ready Mix
 Monarch Asphalt Paving, Inc.
 Monarch Pipe Company
 Monarch Refineries, Inc.
 Monico Manufacturing & Supply Co., Inc.
 Monitron Corporation
 Monogram & Linen Cottage, The
 Monroe Trailer Inc.
 Monsanto Agricultural Center
 Montello Inc.
 Mony-X Inc.
 Moody's Jewelry
 Moore Buck Signs
 Moore Business Forms, Inc.
 Moore City Plating
 Moore Furniture Hospital
 Moore Hat Co., Inc.
 Moore Publishing Co., Inc.
 Moore Roming Industries, Inc.
 Mooreland Leader
 Moores Cabinet and Refinishing
 Moores Processing
 Moran Furnace & Sheet Metal Co.
 More Sandwich Co.
 Moreland & Hulse Dental Lab
 Morgan & Sons Monument Co.
 Morgan Engraving Co.
 Morgan Manufacturing & Supply, Inc.
 Morgan Publishing Company, Inc.
 Morgan-Bishop & Associates
 Morris & Sons Trailers
 Morris Fixture Co.
 Morris Monument Works
 Morris News The
 Morris Pastry Shop
 Morris Printing & Office Supply
 Morris Sign Company
 Morris Welding and Blacksmith
 Morrison H F Welding Shop
 Morrison Industries, Inc.
 Morrow Service Co.
 Morse Dental Laboratory, Inc.
 Morton Foods, Inc.
 Moss Seat Covers, Inc.
 Motivation, Inc.
 Mott, Benny Roofing & Sheet Metal Co.
 Motter Bookbinding Company
 Mountain View Grain Co. Sub Kimbell
 Milling Co.
 Mountain View News
 Moutrey & Associates, Inc.
 Mr. Kent Ties
 Mt. Scott Foods, Inc.
 Mud Engineering Supplies
 Muirs Quick Meal Products
 Mulkey Manufacturing
 Multi-Color Company
 Multi-List of Oklahoma, Inc.
 Multifab Manufacturing Corporation
 Mungles Guernsey Farms
 Municipal Cabinet & Trailer Repair
 Munsingwear Inc.
 Murdock Production Equipment, Ltd.
 Murdock Tank & Mfg. Co.
 Murphey Machine & Supply
 Murphy & Perkins Ready-Mixed Concrete
 Murphy, L N, Upholstering Co.
 Murray County Publishing Co.
 Musgrave Sawmill
 Muskogee Bottling Company, Inc.
 Muskogee Broom Company
 Muskogee Dairy Products Company
 Muskogee Iron Works
 Muskogee Materials Company
 Muskogee Mill & Elevator Co.
 Muskogee Neon Co.
 Muskogee Packing Company, Incorporated
 Muskogee Rubber Stamp & Seal Co.
 Muskogee Sheet Metal Fabricators, Inc.
 Mutual Printing Co.
 Muzny Sheet Metal Works
 Myers Hard Surfacing Co.
 Myrtle I. Gordon
 N.E.O.C. Manufacturing Company
 Naco Plastics, Incorporated
 Nagy Printing Co.
 Name Plates, Inc.
 Nance Screen and Builders Supply, Inc.
 Nancy Anne Roll Bakery
 Napier Industries
 Nash Aluminum Products, Inc.
 Nashwa Advertising Company
 National Casket Co.
 National Distillers and Chemical Corp.
 National Gypsum Company
 National Homes Corp.
 National Hydro-Hoist Company
 National Machine Works Inc.
 National Manufacturing & Supply Co., Inc
 National Mfg. & Supply Corp.
 National Office & Bank Supply
 National Packaging
 National Wood Products, Inc.
 National Zinc Company, Inc.
 Natkin & Co.
 Natural Plant Food Co.
 Naturizer Co.
 NBC Modular Homes
 Ne-Way Crating
 Neece Steel Corporation

Neel Canning Company
 Neerman, Claude F. Co.
 Nehi Royal Crown Bottling
 Nehi-Dr. Pepper Bottling Company
 Nehi-Royal Crown Bottling Co.
 Neil Sawmill
 Neill Commercial Printing Co.
 Neilson Steel Company
 Nelco Manufacturing Corp.
 Nelson Foundry
 Nelson R. Crow Publishing Inc.
 Nelson Sheet Metal and Roofing Co.
 Nemco Castings Company
 New Art Printers
 New Deal Specialty Co., Inc.
 New Orleans Furniture Manufacturing Co.
 New State Dental Laboratories
 New State Furniture
 New Style Homes, Inc.
 New West Construction Co.
 Neway Crating & Boxing Co., Inc.
 Newberry Sheet Metal
 Newell Coach Corp.
 Newkirk Publishing Company, Inc.
 Newman Industries, Inc.
 Newman Machine
 News Capital Co.
 News Publishing and Printing Co.
 News Publishing Co.
 News-Graphic
 Newspaper Printing Corporation
 Nicholson Plating & Grinding Co., Inc.
 Nickles Machine Corporation
 Nipak, Inc.
 Nips Auto Trim
 Nixco Mfg. Co., Inc.
 Nixon Manufacturing & Service
 Nobel News
 Nomad Travel Trailers
 Nome Inc.
 Norbest (Formerly O-Kay Turkeys Inc.)
 Norco Manufacturing Corporation
 Nordix Division
 Norflex Mfg. Co.
 Norgan Lighting Corporation
 Norick Brothers, Inc.
 Norman Asphalt Company
 Norman Bookbindery
 Norman Builders Supply (Formerly Barbour Development Co.)
 Norman Contact Lab
 Norman Feed & Seed
 Norman Jay Processing
 Norman Laboratories, Inc.
 Norman Truss Plant
 Norris-O'Bannon Divn, Dover Corp.
 North American Rockwell Corp.
 North Texas Wilbert Vault Corporation
 Northeast Equipment Company
 Northeast Oklahoma Coca-Cola Bottling Co.
 Northrop Worldwide Aircraft
 Northside Times
 Northwest Oklahoman-News
 Northwest Pub. Co.
 Norton Candy Company
 Nourse Precision Machining Co.
 Novel Ideas, Incorporated
 Nowata Machine Works, Inc.
 Nowata Publishing Company
 Nth Stone Inc.
 Nu Grape Bottling Co.
 Nu Way Emulsions Inc.
 Nu-Line, Inc.
 Nu-Metals, Inc.
 Nu-Par Manufacturing Company, Inc.
 Nu-Pro Inc.
 Nuchrome Plating Co.
 Nugget Ring Co., Inc.
 Nutri Co.
 Nutter Engineering Co.
 Nutters Sawmill
 O C Novelty Co.
 O K Crowns, Inc.
 O. K. Feed Mills, Inc.
 O. K. Products of Tulsa, Inc.
 O. K. Ready-Mix Company, Inc.
 O. K. Stamp & Seal Company
 O. K. Trailer
 O-K Machine & Mfg. Co.
 O-Matic Tool & Mfg. Co.
 O'Brien Meat Company
 O'Reilly Marine Inc.
 Obrien Poultry Company
 Occidental Chemical Company of Texas
 Oconnors Insect Control
 Offset House
 Ohlfest & Son
 Ohse Meat Products, Inc.
 Oil & Gas Distributors, Inc.
 Oil Capital Neon Company
 Oil Capital Sheet Metal Works
 Oil Capital Valve Company
 Oil Capitol Machine and Tool Company
 Oil Capitol Printing Company, Inc.
 Oil Dynamics, Inc.
 Oil Fields Mfg. Company
 Oil Operations Inc.
 Oil Originals By Lu Celia Inc.
 Oil-Law Records Corporation
 Oilfield Specialty Distributors, Inc.
 Oiline Division of FMC Corp.
 Ok Mattress Co.
 Ok Wreath Co.
 Ok. Products, Inc.
 Okarche Chieftain
 Okc Refining Co., Inc.
 Okeene Milling Co. (Formerly Shawnee Milling Co.)
 Okfuskee County Journal
 Okfuskee Publications, Inc.
 Okie Konkrete, Inc.
 Okie Manufacturing Co.
 Okie Mfg. Co.
 Okie Plastics
 Oklahoma Acetylene Corporation
 Oklahoma Aerotronics, Inc.
 Oklahoma Beverage Co.
 Oklahoma Boiler Company
 Oklahoma Brick Corporation
 Oklahoma Broom Manufacturers
 Oklahoma Business News Company
 Oklahoma Cement Company
 Oklahoma City Casket Company
 Oklahoma City Lamp Mfg. Co.
 Oklahoma City Machine Works, Inc.
 Oklahoma City Mattress and Felt Company
 Oklahoma City Pallet Company
 Oklahoma City Poster and Sign Service

Oklahoma City Pottery Company, Inc.
 Oklahoma City Scenic Company
 Oklahoma City Star All Church Press
 Oklahoma City Structure Inc.
 Oklahoma City This Week Inc.
 Oklahoma Coca Cola Bottling Company
 Oklahoma Concrete Products Corp.
 Oklahoma Daily
 Oklahoma Dental Laboratory
 Oklahoma Eagle Publishing Co.
 Oklahoma Fiberglas & Marine
 Oklahoma Fixture Company
 Oklahoma Floor Sweep Mfg. Co.
 Oklahoma Gasoline Plant
 Oklahoma Gear Works, Inc.
 Oklahoma Goodwill Industries, Inc.
 Oklahoma Graphics
 Oklahoma Industrial Finishing Co.
 Oklahoma Industries and Engineering, Inc.
 Oklahoma Industry Finishing Co.
 Oklahoma Journal Publishing Company
 Oklahoma League For the Blind
 Oklahoma Lithographing Co.
 Oklahoma Machine Works, Inc.
 Oklahoma Marine and Dock Mfg.
 Oklahoma Mat & Plate Company
 Oklahoma Mattress and Furniture Co.
 Oklahoma Metal Fabricators
 Oklahoma Mfg. Co.
 Oklahoma Modular Designs Incorporated
 Oklahoma Neon Company, Inc.
 Oklahoma Oil Maps
 Oklahoma Optical Supply Company
 Oklahoma Paper Company
 Oklahoma Pecan Shellers, Inc.
 Oklahoma Press Publishing Company
 Oklahoma Printing Company
 Oklahoma Printing Company of Guthrie,
 Oklahoma, Inc.
 Oklahoma Refractory & Concrete Co., Inc.
 Oklahoma Rendering Co.
 Oklahoma Rig and Supply Company
 Oklahoma Rural News
 Oklahoma Shade Factory
 Oklahoma Sign Service, Inc.
 Oklahoma Statehouse Reporter
 Oklahoma Statesman
 Oklahoma Telephone Directories
 Oklahoma Type & Service Co.
 Oklahoma Vegetable Oil Co.
 Oklahoma Vending Company
 Oklahoma Vermiculite Co.
 Oklahoma Waste and Wiping Rag Co., Inc.
 Oklahoma Wilbert Vaults
 Oklahoma Wire & Iron Works
 Okmulgee County News, Inc.
 Okmulgee Mills, Inc.
 Okmulgee Packing Co.
 Okmulgee Ready Mix Co., Inc.
 Oktronics Data, Inc.
 Oktronics, Inc.
 Old Village Draperies
 Old Village Products
 Old-Hickory Glass
 Olive Machine Works
 Oliver Machine Shop
 Oliver, George R. Mfg. Co.
 Ollies George Lumber Co., Inc.
 Olmstead Machine Company
 Olvey Sign & Electric, Inc.
 Omeco, Inc.
 Omega Press, Ltd.
 Only Aluminum
 Opal Art Studio
 Optronics, Inc.
 Oral Health Products, Inc.
 Orbit Finer Foods, Inc.
 Orbit Valve Company
 Order-Matic Electronics Corporation
 Ore Reclamation Co., Inc.
 Orig-Equip Mfg. Co., Inc.
 Ornamental Iron Works
 Ortner Cabinet Shop
 Orville Enis Feed Store
 Orville Keeney
 Osage Lumber Co., Inc.
 Osborn Inc.
 Oscars Oven
 Ostertag Optical Service, Inc.
 Otis Phillips Printing, Inc.
 Outdoors Products, Inc.
 Overhead Door Co. of Tulsa, Inc.
 Overmyer-Perram Glass Co.
 Overton Aircraft
 Owasso Reporter, The-Sub Retherford Pub
 Owen Tool & Cutter Grinding
 Owens-Illinois, Inc.
 Ozark Flue Damper Co.
 Ozark Industries, Inc.
 Ozark Trailer Company
 Ozark Mahoning Company
 P & D Enterprises, Inc.
 P & M Group Mfg. Div.
 P & S Engineering Co.
 P. E. D., Inc.
 P. J. Reed Company
 P-F Business Forms, Co.
 P-W Manufacturing Company
 Pacesetter Products, Inc.
 Pacific Gem Cutters
 Padgett Machine Shop
 Page Industries of Oklahoma, Inc.
 Paia Electronics, Inc.
 Paksan Concrete & Hovaka Hotel
 Palecek Mills
 Palmer Enterprises
 Palu Bedding Co., Inc.
 Par-Buster
 Par-Ex Machine Co.
 Par-Lay Industries, Inc.
 Para-Lac Chemical Co.
 Paramore Neon Company
 Parawax Co.
 Parish Cabinet Shop & Mfg. Co.
 Parker Brothers, Inc.
 Parker Drilling Co.
 Parker Glass Mfg.
 Parker Printing Company, Inc.
 Parker-Hannifin Corporation
 Parks Concrete Co.
 Parrish & Clark, Inc.
 Parsons Monument Company
 Parts Rebuilders, Inc.
 Pastry Maid
 Pat Badger
 Pats Food Co.
 Patterson Funeral Supply
 Patterson M F Dental Co.

Patterson Yacht Mfg. Corp.
 Patty Precision Products Company
 Paul Manufacturing Company
 Paul Mayer & Sons Co.
 Paul R. Sheline & Associates
 Paul Summers
 Pauls Sausage Products Co.
 Pauls Welding Service, Inc.
 Pawhuska Bakery
 Pawhuska Journal-Capital
 Pawhuska Manufacturing Co.
 Pawhuska Ready-Mix Concrete Company
 Pawnee Chief Div. of American Chief Co.
 Pawnee Grain & Supply Inc.
 Pawnee Marble & Granite Works
 Paxtons Fashions
 PDQ Lapidary Equip. Mfg. Co.
 Pearce, Hal, Enterprises, Inc.
 Pearson Signs
 Pecan Plant and Paint Store The
 Peddlers II of Oklahoma, Inc.
 Pedrick Laboratories
 Peerless Ice Cream Company
 Peerless International Corporation
 Peerless Press
 Peerless Printing Company
 Peerless Products, Inc.
 Peerson Dental Arts
 Pelton Company, Inc.
 Pendergraph, Morse and Creed, Inc.
 Penn Industries
 Pennant Inc.
 Fenner Plumbing
 Pennington Mfg. Co.
 Pennsylvania Glass
 Penny Pincher Press, Inc.
 Penny Record Co.
 People's Baking Company
 Peoples Ice Company
 Pepper Mattress Co.
 Pepsi Cola Bottling
 Pepsi Cola Bottling of Ardmore
 Pepsi Cola Bottling of McAlester
 Pepsi-Cola Bottling Co. of Okla. City
 Perdue Housing Industries
 Perdue Industries
 Perdue Industries, Inc.
 Perkins Fence Co.
 Perkins Glass & Millwork Co.
 Perkins Publishing Company
 Perlich Rapid Print
 Permachrome
 Perry Daily Journal
 Perry Printing & Office Supply
 Perryman Floyd Inc.
 Perryman Floyd L. Inc.
 Pet, Incorporated
 Pete Dowlings Master Printers
 Petro Tech. Inc.
 Petroleum Information Corporation
 Petroleum Marketers Equipment Co., Inc.
 Petroleum Records Company
 Petroleum Specialty Company
 Petrolite Corp. - Bareco
 Petrolite Corp. - Tret-O-Lite
 Petrolite Corporation
 Pettett Manufacturing Company, Inc.
 Pharmaseal Laboratories
 Phil-Good Products Inc.

Phillips Industries, Inc.
 Phillips Petroleum Co.
 Phillips Petroleum Co. Bradley Plant
 Phillips Petroleum Co. Edmond Plant
 Phillips Products Co., Inc.
 Phillips Trailers Inc.
 Philis Ice & Storage
 Platt Bros Dental Laboratory
 Pictorial Mail Newspaper
 Pictorial Press, The
 Pillow Villa
 Pinion Mfg. & Supply Co.
 Pinkerton Air Conditioning Company
 Pioneer Chemical, Inc.
 Pioneer Fence Co.
 Pioneer Furniture Mfg. Co. #28
 Pioneer Furniture Mfg. Company
 Pioneer Gas Products Company
 Pioneer Pesticide Systems Inc.
 Piping Engineering Co., Inc.
 Pittenger Sintered Products, Inc.
 Pixley Coating, Inc.
 Pixley Tube Corp.
 Plainview Electronics
 Plaque Party Plan
 Plas-Tech Manufacturing, Inc.
 Plastic Engineering Company of Tulsa
 Plastic Molding Co., Inc.
 Plastic Products Inc.
 Plastic Sign Company
 Plaza Press
 Plenty Products Div-Malt A Plenty, Inc.
 Flexi-Lite Plastics Inc.
 Plunkett of Oklahoma
 Plunketts Mrs. Doll Shop
 PMI, Inc.
 Poage Sand Co.
 Pogue Display, Inc.
 Pogue Machine Co.
 Poindexter Upholstering Co.
 Polley Shade Factory
 Poly-Version, Inc.
 Polyguard Pipeline Products, Inc.
 Polyneering Enterprises, Inc.
 Pomco, Inc.
 Ponca Cabinet and Tile Company
 Ponca City Mattress Company
 Ponca City Publishing Company
 Ponca Fabricators Inc.
 Ponca Iron and Metal Co.
 Ponca Tank Company
 Pond Creek Herald
 Pools Machine Shop
 Portable Gasoline Plants, Inc.
 Portable Products, Inc.
 Porter Mattress Co.
 Porter Mill & Elevator
 Post Glass Plant
 Postal Instant Press
 Postal Instant Press #185
 Posters, Incorporated
 Poteau Publishing Company
 Potter Rendering Co.
 Potters Sausage
 Pottery Division of Indian City USA
 Potts Optics & Mfg., Inc.
 Pow Meat Processing
 Powell Concrete Products
 Powell Dental Laboratory

Power Electronics Mfg., Inc-Sub Apache C
 Power Equipment & Manufacturing Co., In C
 Power Spike Mfg. Co.
 Powers Mfg. Co.
 PFG Industries, Inc.
 Practical Products Corp.
 Prague Bakery The
 Prague Locker Plant
 Prague News Record
 Prague Ready-Mix Concrete Company
 Prater Sawmill
 Praysons Candies Corporation
 Precise Tool and Die
 Precision Fixtures
 Precision Hone & Mfg.
 Precision Machine and Manufacturing Co.
 Precision Machine Company
 Precision Machine Shop
 Precision Plating, Inc.
 Precision Products Inc.
 Precision Rubber and Plastic, Inc.
 Precision Tool & Die Co.
 Precision Welding Co.
 Preddy Venetian Blinds
 Premier Metal Fabricators, Inc.
 Premier Trailer Co.
 Prescor, Inc.
 Prestige Printing Co.
 Prestige Products Co.
 Prestolite
 Price H C Co.
 Price Machine Shop
 Prices Quality Printing
 Priddys Quality Foods, Inc.
 Prides Meat Processing
 Prince Valve, Inc.
 Printed Products, Inc.
 Printers Bindery Service
 Printing Design
 Printing Inc.
 Pritchett Machine Co.
 Privett Packing Co., Inc.
 Pro-Finer Chemical Corporation
 Process Engineering Inc.
 Process Foods, Inc.
 Processing Unlimited, Inc.
 Producers Cooperative Oil Mill
 Product Mfg. & Tooling
 Product Research Inc.
 Production and Experimental Engineering
 Production Manufacturing Company
 Professional Jewelry Services, Inc.
 Professional Research Contact Lens, Inc.
 Profit Maker Enterprises, Inc.
 Progonasyl Co., Inc. The
 Progressive Brass Mfg. Co.
 Protective Coating & Sandblasting Compa
 N
 Protecto Plastic Coating Company
 Prototype, Inc.
 Pruitt Co.
 Pruitt H A Produce Co.
 Pruitt Realty Company
 Pryamid Manufacturing
 Pryer Machine and Tool Company
 Pryor Automatic Tool Company
 Pryor Ice Dock
 Pryor Jeffersonian The
 Pryor Publishing Company
 Pryse Monument Co.
 Public Letter Shop
 Public Supply Company
 Publications, Inc.
 Publishing Industries, Inc.
 Pucketts Stock Farm
 Purcell Ready Mix, Inc.
 Purchasing Management Association
 Putnam Industries
 Q Line Corporation, The
 Q. O. Stevens Company
 Quadall Co.
 Quadrant Corporation
 Qual-Pet of El Reno, Inc.
 Qual-Pet, Inc. - Woodward Drive
 Quality Bakery
 Quality Bindery
 Quality Cabinet Shop
 Quality Concrete Products, Inc.
 Quality Fabrication & Sales
 Quality Industries, Inc.
 Quality Machine & Mfg. Co.
 Quality Machine Works Div.
 Quality Manufacturing Company
 Quality Meat Co.
 Quality Metal Finishing Company
 Quality Plating
 Quality Portable Bldg. Co.
 Quality Printing
 Quality Steel Fabricators, Inc.
 Quality Wood Products
 Quapaw Canoe Co.
 Quapaw Red-E-Mix Concrete
 Quick Charge Corporation
 Quick Print
 Quick Print, Inc.
 Quick Spuds
 Quickway Industries Inc.
 Quik Print
 Quintella Printing Co.
 R & D Pattern & Foundry Company, Inc.
 R & J Metal Products, Inc.
 R & L Manufacturing Service
 R & M Sales
 R & R Engineering Co., Inc.
 R & R Radiator Service
 R & S Leather Manufacturing, Inc.
 R & S Packing
 R and J Aluminum Products Co.
 R. F. Rodgers Lithographing Co., Inc.
 R. H. Ferguson, Inc.
 R. H. Siegfried, Inc. Nordam Div.
 R. Jack Christy & Son Publishing Co.
 R. L. Polk and Co.
 R. M. Hollingshead Corporation
 R. W. Coburn Oil Account
 R.A. Powers Printing
 R.E. Owens Podiatrist
 R.G. Anderson
 R.G. Berry Company
 Ra-Nav Laboratories
 Radford-Shelton Dental Lab
 Rainbo Baking Company of Okla. City
 Rainbo Baking Company of Tulsa
 Rainbow Color Press, Inc.
 Rainbow Pennant Manufacturing Company
 Ralph and Gary Machine Shop, Inc.
 Ralph Peters
 Ralphs Packing Company, Inc.

Ralston Purina Company
 Ram Machine
 Ram Metal Works, Inc.
 Rambo, Jay, Co.
 Ramirez Enterprises
 Ramos Plating Company
 Ramparts, Inc.
 Ramsey Winch Co.
 Ranck Fabricating Company
 Randco Tool & Mold Company
 Randys Frozen Meats, Inc.
 Raney & Black Manufacturing Co., Inc.
 Ranger Electronics Corporation
 Ransbottom, Fred, Cast Laboratories
 Rapides Homes, Inc.
 Rascoe Machine Shop Inc.
 Rath Foods, Inc. (Formerly Katy-K Foods)
 Ray Belcher Saw Mill
 Rayson Paul Awning & Upholstery Co.
 Razien Metals Company Inc.
 Rea Mfg. Co.
 Ready-Mix Concrete Co. of Tulsa
 Ready-Mix Concrete Co., Inc.
 Real Estate Pictorial Publish
 Recreation Products Inc.
 Red Arrow-Sub W D Moore Co., Inc.
 Red Cloud Oil Company
 Red Devil, Inc.
 Red T Concrete Products
 Red-Ridge Co.
 Redman Mobile Homes, Inc.
 Reds Tent and Awning Co.
 Ree-Born Industries, Inc.
 Reeds World For Girls, Inc.
 Reeds, A C Cabinet Shop
 Reels Mfg. Co., Inc.
 Reese Tie Co.
 Refinery Supply Div-Central Scientific C
 Regal Concrete Co.
 Regent For Men
 Register Publishing Co.
 Reibert Steel Company
 Reid Manufacturing
 Reimers Machine Shop
 Reints Sash and Door Co.
 Reliable Manufacturing Corporation
 Remco Mfg. Co., Inc.
 Remington Arms Company, Inc.
 Remote Monitoring Systems Inc.
 Remwood Chemicals Inc.
 Renfro Ready Mix Concrete
 Reporter Publishing Co.
 Republic Block & Supply Co.
 Republic Glass Co., Inc.
 Republic Gypsum Company
 Research and Development Limited
 Research and Manufacturing Corporation
 Research Controls
 Research Flour Service Products Co., Inc.
 Research Instrument Company
 Resthaven-Sunset Memorial
 Retherford Publications, Inc.
 Rex Display Co.
 Rex Laboratories, Inc.
 Rex Sales Co., Inc.
 Reyckerts Statuary
 Reyco, Inc.
 Reynolds-French & Co.
 Reynolds-Wilson Lumber Company
 Rheem Manufacturing Company
 Rhodes Grain Co.
 Rice Auto Machine Shop
 Rich Mar Corp.
 Richardson Upholstery Shop
 Richey Mattress Company
 Ricks Manufacturing & Supply
 Riddles Stock Trailer Co.
 Ridge Tool Company
 Ridgway, L L Enterprises, Inc.
 Ridley Packing Co.
 Riesinger's Jewelers, Inc.
 Riggs Floor and Drainboard
 Riggs Manufacturing Company
 Riggs, Claude Upholstery Co.
 Riggs, William L., Co.
 Riley Southwest Corp.
 Ringling Eagle The
 Rinse-A-Matic Systems
 Rite Brush Co.
 River Rest Inc.
 Riverside Concrete Products
 Riverside Industries, Inc.
 Riverside Sand Co.
 Roark Lumber & Hardware Co.
 Robberson Steel Company
 Robert Boling
 Robert D. Kerr Manufacturing Jewelers
 Robert F. Taylor
 Robert M. Ellis
 Robert M. Neumann
 Robert Stauter Lumber Company, Inc.
 Roberts Manufacturing Co.
 Roberts Printing Company
 Roberts Trailer Manufacturing
 Roberts, Oral, Evangelistic Assn. Inc.
 Robertsons Country Hams Inc.
 Robinson Neon Company
 Robinson Printing
 Robinsons Printing
 Robison Canning Company
 Rochell Manufacturing
 Rock Art Originals Inc.
 Rocket Optical Laboratory
 Rockwell International (GAD)
 Rodeo News, Inc.
 Rodman Mfg. Co.
 Roger M. Wheeler
 Rogers Auto Upholsteries
 Rogers Brothers Mattress Co.
 Rogers Galvanizing Company
 Rogers Machine Co.
 Roisman Drug Sundries, Inc.
 Roland Furniture Mfg. Company
 Rolf Lawrence Welding Contractor
 Rollett Mfg. Inc.
 Rollings Manufacturing, Inc.
 Roma Industries Inc.
 Roman Enterprises
 Ron Co. Engineering, Inc.
 Roos Mfg. Co.
 Roosevelt Granite Co., Inc.
 Roosevelt Quarries
 Rosco Industries Inc.
 Rose Equipment Co.
 Rose Hill Mill Lumber & Supply
 Ross Foundry
 Ross-Martin Company
 Rosson Lumber and Ready Mix Company

Rotary Manufacturing Co.
 Rotec, Incorporated
 Roth Manufacturing Company
 Roto Hammer Company
 Roto Hammer Foundry Co.
 Roto-Swing Door Co., Inc.
 Roush Machine Co.
 Roy Massey Ready Mix
 Roy Wilson Mfg. Co.
 Royal Casket Company, Inc.
 Royal Coach Manufacturing Company
 Royal Crown Bottling Co. of Shawnee
 Royal Crown Cola Bottling Co. of Okla.
 City
 Royal Furniture Co.
 Royal Glass Apparatus Co.
 Royal Industries, Inc.
 Royal Manufacturing Company
 Royal Printing Co.
 Royal Sign and Display Co.
 Royal Tube Mfg. Co.
 Royal Vista Plastics, Inc.
 Royal Vista Precision Coatings, Inc.
 Royal Vista Tooling, Inc.
 Roys Trailer Works
 Rst-Service Manufacturing, Inc.
 Rubys Mfg. & Sales Co.
 Rus-Tique Brik of Oklahoma City
 Rush Enterprises
 Rush Metals, Inc.
 Rush Springs Gazette
 Rush Springs Manufacturing Company, Inc.
 Russell, Burdsall & Ward Bolt and Nut Co.
 Russells Axle Co.
 Ryan Leader
 Ryans Packing
 Rywin Inc.
 S & E Frame Shop
 S & H Printing
 S & H Shade Co., Inc.
 S & S Feed & Seed Co.
 S & S Foundry
 S & S Plating Company
 S & S Saw Service
 S & S Valve & Machine Co.
 S & T Welding & Fabrication
 S & W Engine Service
 S & W Industries, Inc.
 S K Steel Products
 S. & H. Trailer Manufacturing Co.
 S. E. B. Paint & Varnish Mfg. Co., Inc.
 S. L. Cowley & Sons Mfg. Co., Inc.
 Safe-T-Bath, Inc.
 Safeway Stores, Incorporated
 Sailboat Grain Company
 Salas Little Mexico, Inc.
 Sallisaw Rus-Tique Brik
 Salt Fork Industries
 Sam Bennett Sawmill
 Sam S. Joiner - Independent Logging Con
 Sams Donuts
 San Bois Concrete Co.
 San Juan Pools of Oklahoma, Inc.
 San-O-Let Service of Oklahoma, Inc.
 Sand Springs Bakery
 Sand Springs Industries, Inc.
 Sand Springs Newspapers, Inc.
 Sand Springs Sand Company
 Sand Springs Sheet Metal, Inc.
 Sandefer Printing Company
 Sanders Feed Mills
 Sanders Laboratories, Inc.
 Sanders Machine Shop
 Sanders Material Company
 Sanders Repair Service
 Sanders-Garland Mfg. Co.
 Sandifer & Edwards Steel Corp.
 Sanguin Machine Shop - Cearley Machine
 Shop
 Santa Fe Packing Company, Inc.
 Sapulpa Brick & Tile Corporation
 Sapulpa Herald Company
 Sapulpa Legal News
 Sapulpa Machine and Tool Co.
 Sare & Co.
 Sare C W & Company
 Sartin Septic Tank Co.
 Sav-A-Snap, Inc. Owned By Southwest
 Stationary
 Sawyer Manufacturing Company
 Sayre Daily Headlight-Journal
 Sayre Grain & Farm Supply
 Scarves By Barbara
 Schoonmaker Publishers
 Schroeder Grain Co.
 Schuler and Son Packing Co.
 Schultz Roof Trust, Inc.
 Schwab & Co.
 Schwartz Meat Company
 Schwarz & Schwarz
 Schwarz Peter J. Winery
 Schwarz Ready-Mix
 Scientific Research Corporation
 Scoggins Floor Sweep Company
 Scott and Hill Steel Corp.
 Scott Depot Glass Co.
 Scott Manufacturing Company, Inc.
 Scott Mini Stop
 Scott Rich Homes
 Scott Type Co.
 Scott-Rice Co.
 Scott, Lon, Company
 Scotts Seat Cover Center
 Scotttype, Inc.
 Scottys Donuts
 Screen Fab
 Seaba Mfg. Co., Inc.
 Sealed-In Plastic Co.
 Seamprufe Incorporated
 Security Devices Inc.
 Security Industries
 Security Mfg.
 Security Tie-Down & Mfg. Inc.
 Sedco-Smf, Inc.
 Sedco, Inc.
 Seiberling Latex Products Division
 Seicor Division
 Seiling News Record
 Sel-Mor Garment Co., Inc.
 Select Plaster Products, Inc.
 Self Printing & Office Supply
 Self, Ed, Cabinet Shop
 Sells Custom Butchering
 Selgo Pumps, Inc.
 Sellers Mfg., Inc.
 Semco Color Press
 Seminole Baking Co.
 Seminole Bottlers, Inc.
 Seminole Mobile Home Anchor Company
 Sendee Sales Co.

Senter Plating Company
 Sentinel Leader
 Sentinel Locker & Ice Company
 Sentinel Manufacturing Company
 Sentry Manufacturing Company
 Sentry-Lite Corporation
 Sequoyah Concrete Co.
 Sequoyah County Times
 Sequoyah Lithoprinting Company
 Sequoyah Mattress Mfg. Co.
 Sequoyah Mills, Inc.
 Sequoyah Spinning Mills, Inc. or
 Sequoyah Industries, Inc.
 Seright Neon Sign Company
 Sermetel Southwest Incorporated
 Serro Travel Trailer Co., Inc.
 Serta Mattress Co.
 Service Container Corp.
 Service Paint Co.
 Service Printing Company
 Service Welding Co.
 Seven Up Bottling Company
 Seven-Up Bottling Company of Ada
 Seven-Up Bottling Company of Okla. City
 Seven-Up Fort Worth Bottling Co., Inc.
 Sowards Welding & Iron Works
 Sewell Products Company
 Shade-Little Logging Co.
 Shalloup Packing Co., Inc.
 Shamrock Manufacturing & Sales Co.
 Shannon Agricultural Lab
 Shannon Lithograph
 Sharum Cabinet Shop
 Shawnee Apparel Mfg. Corp.
 Shawnee Bottling Company
 Shawnee Garment
 Shawnee Ice Co.
 Shawnee Milling
 Shawnee News Co.
 Shawnee Paving Co.
 Shawnee Planing Mill, Inc.
 Shawnee Printing Co.
 Shawnee Ready-Mix Concrete Co.
 Shawnee Sheet Metal Works
 Shawnee Steel Company
 Shawnee Trophy Co.
 Shaws Parts & Machine Shop
 Sheetmetal Fabricators, Inc.
 Shelby Trailer & Mfg. Co.
 Shell and Tube, Inc.
 Shell Gasoline Plant
 Shelter Recording Co., Inc.
 Sheriff Manufacturing and Supply Co.,
 Inc.
 Sherman Machine & Iron Works
 Sherri Classics, Inc.
 Sherwood Machine Company
 Shi Maid Mfg. Co.
 Shibley Machine Shop
 Shidler Review
 Shield Manufacturing Corporation
 Shir-Lee Originals
 Shoemaker, Forrest, Air-C
 Sholem Alechem Gasoling Plant
 Shults Packing Co.
 Shultz, Walt, Equipment & Mfg. Co.
 Shuman Machine Co.
 Shur Plug Company, Inc.
 Shurden Casket Co.
 Sies Machine Co.
 Sif-Tee, Inc.
 Sigler Sales & Service
 Signal Oil & Gas Company
 Signet Controls, Inc.
 Sikes Corporation
 Silk Screen Specialty
 Sill Farm Supply Inc.
 Silver Seal Food Products
 Simanks Frozen Food Center
 Simpson Printing Co.
 Simpsons Metal Sales
 Sims Upholstery
 Singer Steel, Incorporated
 Sir Speedy Instant Printing Center
 Skaklee Machine Shop
 Skandie Tile of Shawnee, Inc.
 Skelly Oil Co.
 Skelly Oil Co. Velma Plant
 Skeltons Welding and Repair Shop
 Skill Textile Re-Weavers
 Skinner & Son Printing Co.
 Skinner & Son, Printers
 Skinner Bros. Company, Inc.
 Sky Witch Industries, Inc.
 Skyhill Publishing Company Inc.
 Slagle Manufacturing Corporation
 Slaughter Co. Inc.
 Sleep-Aire-Mattress Co. of Okla., Inc.
 Slim Haney, Inc.
 Slosky, E H, Interiors
 Slover Box Corporation
 Slyman's Lebanese Foods
 Smart Meat Processing Co.
 Smico, Inc.
 Smith Byron Printing Co.
 Smith Culvert Company, Inc.
 Smith Industries International, Inc.
 Smith Mat Co.
 Smith Publishing Co.
 Smith Sheet Metal Co.
 Smith Tank & Equipment Co., Inc.
 Smithco Engineering, Inc.
 Smithfair Design & Engineering
 Smokey Joes Industries
 Snap-Wrap, Inc.
 Snyder Artificial Limb & Brace Co.
 So-Shur Products Co.
 Sober Brothers
 Society of Exploration Geophysicists
 Sohio Petroleum Co. Elmore Plant
 Sola Basic Industries, Inc.
 Solo Cup Company
 Solvent Manufacturing Company, Inc.
 Sommer, W L, Co. of Oklahoma, Inc.
 Sommers Sign System
 Sontheimer Ice Cream
 Sooner Bindery Company
 Sooner Boat Co.
 Sooner Box Company
 Sooner Camper Kaps, Inc.
 Sooner Cooperative Inc.
 Sooner Die and Manufacturing Company
 Sooner Door Systems, Inc.
 Sooner Drainboard Co.
 Sooner Fence Co.
 Sooner Glass Company
 Sooner Lariats, Inc.
 Sooner Leather Industries

Sooner Locker Service
 Sooner Manufacturing Co.
 Sooner Meat Co.
 Sooner Millwork & Cabinet Company
 Sooner Motor Home Corporation
 Sooner Rock and Sand
 Sooner Sign Co.
 Sooner Signs, Inc.
 Sooner Spuds
 Sooner State Construction Co., Inc.
 Sooner State Tool & Mfg. Co.
 Sooner, Fiberglass Co., Inc.
 Sound Enterprises, Inc.
 Sound Values Marketing Corp.
 South West Packaging, Inc.
 Southeast Instrument Company
 Southeastern Packing Company
 Southern Air Filter, Inc.
 Southern Builders Supply Co.
 Southern Burner Company
 Southern Coffee & Restaurant Sup. Co.
 Southern Ice & Cold Co.
 Southern Ice & Cold Storage Co.
 Southern Ice Co.
 Southern Machine Works, Inc.
 Southern Maid Donut of Tulsa, Okla., Inc.
 Southern Millwork Co.
 Southern Printing Company, Inc.
 Southern Publishers, Inc.
 Southern Rubber Stamp Company
 Southern Service and Manufacturing Co., Inc.
 Southern Sheet Metal Works
 Southern Specialties Corporation
 Southern Supply and Valve Co., Inc.
 Southgate Home Building Center
 Southland Foam Corporation
 Southland Furniture, Inc.
 Southside Publishers, Inc.
 Southward Welding Service
 Southwest Bedding Company
 Southwest Burial Vault Company
 Southwest Construction News Service
 Southwest Corset Corp.
 Southwest Electric Co., Inc.
 Southwest Electric Company
 Southwest Filter Company
 Southwest Furniture and Mattress Co.
 Southwest Jewish Chronicle
 Southwest Manufacturing Company
 Southwest Modulers, Incorporated
 Southwest Novelty Co.
 Southwest Pecan Co.
 Southwest Plastics
 Southwest Radiator Co.
 Southwest Recyclers, Inc.
 Southwest Rock & Chat Company, Inc.
 Southwest Terrazzo, Inc.
 Southwest Tooling and Mfg.
 Southwest Tube Manufacturing Co.
 Southwest United Industries, Inc.
 Southwest Wheel and Mfg. Co.
 Southwest Wire Cloth Mfg. Co.
 Southwestern Apparel Inc.
 Southwestern Directory Company
 Southwestern Gage & Sales Inc.
 Southwestern Glass and Mirror Co.
 Southwestern Lures
 Southwestern Micr, Inc.

Southwestern Paint Co.
 Southwestern Process Supply
 Southwestern Refrigeration
 Southwestern Stationery & Bank Supply
 Southwestern Steel & Fabrication
 Southwestern Supply and Machine Works, Inc.
 Southwestern Wood Preserving Company
 Space Age Trailers
 Space Tek Mfg. Co.
 Spann Millwork and Cabinets
 Sparks Fence Company
 Spartan Aviation Inc-Sub Automation Ind.
 Spavinaw Saddle Shop
 Speaks Sheet Metal Co.
 Speas Company
 Spec-Trol Company
 Special Service Systems, Inc.
 Specialty Candy Company
 Specialty Chemicals Manufacturing Co.
 Specialty Materials Corporation
 Spectra, Inc.
 Speed Fab-Crete of Oklahoma
 Speed Fab-Crete Western Okla., Inc.
 Speed King Mfg. Co.
 Speedprint
 Speedprint Systems, Inc.
 Spencer Machine Works
 Sperry Machine & Mfg. Co.
 Sperry Rand Corporation
 Spin Craft
 Spiro Graphic
 Spiva Dental Laboratory, Inc.
 Spohn Welding Shop
 Sponco Mfg., Inc.
 Sprekelmeyer Printing Co.
 Spring Air Bedding, Inc.
 Springdale Food Co.
 Springer Electric Co.
 Spudnut Co.
 Spudnut Shop
 St. Clair Lime Co.
 St. Regis Paper Company
 Sta-Bec Company
 Sta-Wax Products Co., Inc.
 Staff Recording Co.
 Stafford-Lowdon Company
 Stalcup and Kiser Co.
 Stallion Trailer Kits, Inc.
 Stamps Brothers Upholstery Co.
 Stan Ramsey Company
 Standard Engraving Company
 Standard Ind Inc. Aggregate Divn.
 Standard Motor Supply
 Standard Paint Works, Inc.
 Standard Parts Co.
 Standard Roofing and Material Co.
 Standard Steel Co.
 Standard Welding Service Inc.
 Stanfield Printing Co.
 Stanley Trailer Mfg.
 Star Engineering Corporation
 Star Engraving Co.
 Star Forms, Incorporated
 Star Manufacturing Company
 Star Paper Tube Co.
 Star Publishing Company
 Star Wood Products
 Stark Weatherproofing Co.

Starr Furniture Mfg. Co.
 Starr Services Inc.
 Statuary Desings, Inc.
 Stauffer Publications, Incorporated
 Stead Manufacturing Co., Inc.
 Steel Fab, Inc.
 Steelcraft Inc.
 Steele Canning Co.
 Steele Canning Company, Inc.
 Steele Canning, Inc.
 Steinmetz Auto Top Shop
 Stel Pride Products, Inc.
 Stephens Manufacturing Co., Inc.
 Sterrs Foods Inc. Bakery and Delicatessen
 Steve's Leather Shop
 Steven Sweatt, Inc.
 Stevens Asbestos Products Company, Inc.
 Stevens Bindery Company
 Stevenson Farm Supply & Feed Mill
 Steves Iron Shop
 Stewart Feed Mill
 Stewart Furnace and Sheet Metal Co.
 Stewart Sheet Metal Company
 Stewarts Produce Co.
 Stidham Horse Trailers, Inc.
 Stigler Boat and Trailer Manufacturers, Inc.
 Stigler Ice and Cold Storage
 Stigler News-Sentinel
 Stik-Strip Laminating Inc.
 Stillwater Milling Company
 Stillwater Photoengraving Service
 Stillwater Publishing Co.
 Stillwell Foods Co.
 Stilwell Democrat-Journal, Inc.
 Stiverson Furniture and Upholstery
 Stockyards Saddlery
 Stokes Transit Mix, Inc.
 Stolzer Display Advertising
 Stone-Kuske
 Stop & Shop Bakery
 Storch Aluminum Products Co.
 Store Supply Co. Inc.
 Storm Plastics, Inc.
 Strange Bill Bit Service
 Strescon, Inc.
 Stringtown Material and Asphalt Co.
 Stripprinter, Inc.
 Stromberg-Carlson Corporation
 Strongcraft Mfg. Co.
 Stroud American
 Stroud Roofing Manufacturing Company
 Studebaker Cabinet Shop
 Student Press Association, Inc.
 Studers Incorporated
 Stylemaster Kitchens
 Suburban Cabinet Shop
 Suburban Newspapers, Inc.
 Sullivan (Gene) Recording Studio
 Sulphur Bakery
 Sun Chemical Corporation
 Sun Motor Supply Company
 Sun Oil Company
 Sunbank Electronics, Inc.
 Sunco Manufacturing Company, Inc.
 Sundstrand Service Corporation
 Sunnyside Donuts, Inc.
 Sunray DX Co - Duncan Refinery
 Sunray DX Oil Co Criner Gas Products
 Sunset Sign Co.
 Sunward Enterprises, Inc.
 Superior Body Works
 Superior Clay Products, Inc.
 Superior Hardsurfacing Company
 Superior Insulation & Supply Co.
 Superior Mattress Company, Inc.
 Superior Neon Company, Inc.
 Superior Tank
 Superior Trophies
 Superior Welding, Inc.
 Sur-Kil Chemical Co.
 Surface Active Energy Corp.
 Swanda Brothers
 Sweet Home Stone Co.
 Swift and Company
 Swigart Woodcraft
 Swindler Oil Corporation
 Switzer Sign Co.
 Sybron Corporation
 Syfo Water and Beverage Co.
 Sylvan Printing & Stationery Co.
 Sylvania Electric Products, Inc.
 Systems Engineering
 Systems Printing Co.
 T & J Marble & Tile Co., Inc.
 T & P Manufacturing Co.
 T and T Milling Co., Inc.
 T W Manufacturing Co.
 T. & L. Brass & Aluminum Foundry
 T. & D. Williamson, Inc.
 T. G. Sanders
 T-P Metal Stampings & Mfg. Co., Inc.
 Tag Along Corp.
 Tahlequah Chair Factory
 Tahlequah Mill and Elevator Company
 Tahlequah Printing
 Tahlequah Ready Mix and Material Co.
 Talihina American
 Talihina Charcoal, Inc.
 Talley-Frac Corporation
 Tallmans Fine Pastries
 Taloga Times - Advocate
 Tamac Pottery
 Tan-Co., Inc.
 Tandy Industries, Incorporated
 Tar Baby Asphalt of Okla., Inc.
 Tasty Donut Shop
 Tate Bros, Custom Processing Plant
 Tate Bros, Mfg. Co.
 Taton Bros Planing Mill
 Taurus Enterprises
 Taylor Oil Tools, Inc.
 Taylor Precision Mfg.
 Taylor Tools
 Taylor Window Co.
 Taylor-Mate Products, Inc.
 Taylors Good Pies
 TC Bit Mfg., Inc.
 Tear-Eaze Co., The
 Tech-Fab, Inc.
 Technacron, Corp.
 Technical Metals, Inc.
 Technical Systems Incorporated
 Tee-Pak, Inc.
 Tee-Pee Engraving Company
 Tefco Lithographers, Inc.
 Tel Gard Industries
 Telephone Communications Co.

Telux Computer Products, Inc.
 Temco, Inc.
 Tempco Corp.
 Temple Custom Products Inc.
 Temple Manufacturing Company
 Temple Products, Inc.
 Temple Publishing Company, Inc.
 Temples Camper Door Mfg., Inc.
 Temtex Leisure Products of Okla., Inc.
 Temtrol Inc.
 Tenderette Steak Co., Inc.
 Tenneco Oil Company
 Terac Controls, Inc.
 Terra Resources, Inc-Sub Farmland Ind.
 Terrahome Stone Company
 Terrell, E D Sign Co.
 Terris Draperies, Inc.
 Teruko Mfg. Co.
 Tesco, Inc.
 Tex-O-Con Optics of Oklahoma, Inc.
 Texas Pipe Bending Co.
 Texhoma Times
 Texoma Meat, Inc.
 Texoma Sash and Door Company
 Textile Rubber and Chemical Company, Inc.
 Textron Inc.
 The Afton American
 The Aico Corporation
 The Allen Advocate
 The Allen Co. of Okla., Inc.
 The Antlers American, Inc.
 The Atoka County Times, Inc.
 The Atoka Press
 The B. F. Goodrich Co.
 The Barnsdall Times
 The Bendix Corporation - Bendix Heavy
 Vehicle Systems Group
 The Black Dispatch Publishing Company
 The Blackwell Zinc Company
 The Blair Enterprise
 The Blanchard News
 The Boardman Co.
 The Boeing Company
 The Bryan County Star
 The Bryant Polishing Company
 The Carver Corporation, Inc.
 The Centrifugal Casting Machine Co.
 The Charles Machine Works, Inc.
 The Coca-Cola Bottling Co. of Guthrie
 The Coca-Cola Company
 The Commercial Press, Inc.
 The County News
 The Davis News
 The Dodson Mfg. Co., Inc.
 The Dolese Co.
 The Dolese Co. - Midwest City Plant
 The Economy Company
 The Elk City Daily News, Inc.
 The Equipment Exchange Co., Inc.
 The Eureka Tool Company
 The F And G Concrete and Construction Co.
 The Fields Company, Inc.
 The Foster Manufacturing Company
 The Foster Company
 The Frederick Leader Company
 The Friendly Laboratories, Inc.
 The G. C. Broach Company
 The Gene Green Company
 The General Printing Company
 The Good Printing Company, Inc.
 The Grenco Corp.
 The Grove Sun Newspaper Company, Inc.
 The H. W. Gossard Co.
 The Hale Company
 The Harrah News
 The Haskell News
 The Haymaker Press, Inc.
 The Healdton Herald
 The Hunters Horn, Inc.
 The J. H. Holland Company
 The Logan County News
 The Madill Record
 The Magnalectric Corporation
 The Marley Company
 The Maro Corporation
 The Metalcraft Corporation
 The Milton Co., Inc.
 The Minco Publishing Co.
 The News Company
 The OBrien Corporation
 The Okeene Record
 The Oklahoma Publishing Company
 The Original Chili Bowl, Inc.
 The Osage Metal Company, Inc.
 The Page Milk Company
 The Petroleum Publishing Company
 The Pewther-Willett Mfg. Co.
 The Pillsbury Company
 The Press Room, Inc.
 The Printery
 The Printing Place
 The Printing Press, Inc.
 The Progress Printing Company
 The Rainey Corporation
 The Robertson Factories
 The Scott & Fetzer Company
 The Seminole Producer, Inc.
 The Skiatook News
 The Smith Septic Tank Corporation
 The Southwestern Stationery and Bank
 Supply, Inc.
 The Stratford Star
 The Telex Corporation
 The Thermax Company
 The Times Democrat Company, Inc.
 The Tipton Tribune
 The Transcript Company, Inc.
 The Transcript Press, Inc.
 The Tribune-Review
 The Tulsalite, Inc.
 The Unlaub Company, Inc.
 The Watonga Republican, Inc.
 The Weatherford News, Inc.
 The Westville Reporter
 Theatre Calendar Service
 Thedford Mfg. Co.
 Therma Technology, Inc.
 Thermal Design Corporation
 Thermo-Chem Corporation
 Thermodynamics Corporation
 Thomas B. Sanders Sawmill
 Thomas Concrete Products Co.
 Thomas E. Burleson, D.P.M.
 Thomas Enterprises Inc.
 Thomas Extruded Plastics Co.
 Thomas Meat Service Inc.
 Thomas R B Co.
 Thomas Tribune

Thomason Lumber Company
 Thomasson Sawmill
 Thompson Machine & Equipment Inc.
 Thompson Mill & Elevator Co.
 Thompson Pump Company
 Thor Steel, Inc.
 Thornton Tooling and Production
 Thorpe Sheet Metal Works
 Threlkelo Brothers Pickle Company
 Thunder-Brown Enterprises, Inc.
 Thurman Bridge & Block Inc.
 Thurmans Sausage Co.
 Tiara Furniture, Inc.
 Times Printing Division
 Times Publishing Company
 Times-Journal Publishing Company
 Timmons Sheet Metal Works
 Tindel Concrete Co.
 Tindel Material Company
 Tindel Ready Mix
 Titus Mfg. Corp.
 Tol-Spec Inc.
 Tom Bennett Mfg. Co.
 Tom Browns Optical Service, Inc.
 Tom's Upholstery Co.
 Tompkins Printing Co.
 Tonkawa Foundry, Inc.
 Tonkawa Refining Co.
 Tonkawa Sports Supply
 Toolco, Inc.
 Topaz Industries
 Topog-E Gasket Co.
 Torbett Printing Company
 Torpedo Shell Tin Co.
 Torrance Monuments
 Tots Artistic Fun Toys, Incorporated
 Tower Printing Co.
 Town & Country Ice Mfg. Co.
 Town & Country Mobile Homes, Inc.
 Townleys Dairy Company
 Townsend, John, Graphics Unlimited
 Traction Manufacturing Co., Inc.
 Tracy Wood Shop
 Trader Mills
 Traffic Supplies, Inc.
 Trailer Service Co.
 Trainor Products Co.
 Tram Corporation
 Trans-American Chemical Corp.
 Trans-World Steel Co., Inc.
 Transo-Oklahoma Envelope Mfg. Co.
 Tranter Manufacturing Inc.
 Trappe, Carl R. Venetian Blinds Service
 Trasor Corp.
 Treat-Rite Water Laboratories, Inc.
 Tregos Westwear, Inc.
 Trellis L. Clouse
 Trem Inc.
 Trend Signs, Inc.
 Tresco Inc.
 Tretolite Division Petrolite Corp.
 Tri Country Farm Center Inc.
 Tri State Tribune
 Tri-City Company
 Tri-State Foam Co.
 Tri-State Stone Company
 Triangle A and E Inc.
 Triangle Blue Print and Supply Co.
 Triangle Transformer Service Corporation

Trimco, Incorporated
 Trinity Steel Co., Inc.
 Triple AAA Company
 Triple Ring of Oklahoma, Inc.
 Triple-Clean, Inc.
 Troco Oil Co.
 Trojan Livestock Equipment Company
 Troy Enterprises Co.
 Tru-Air Inc.
 Tru-Trail Trailers, Inc.
 True-Flow Corp.
 Trumbull Asphalt Company of Delaware
 Trussler Street Metal
 TEW, Inc.
 Tryon Manufacturing Co.
 Tube Fab, Inc.
 Tube Honing Service, Inc.
 Tuffy Trailer Manufacturing Company
 Tullys Bakery
 Tulsa Air-Seal Vault, Inc.
 Tulsa Artificial Lime & Brace Co.
 Tulsa Auto Spring Company
 Tulsa Beef & Provision Company Inc.
 Tulsa Beverage Packers, Inc.
 Tulsa Body Works, Inc.
 Tulsa Bottling Co.
 Tulsa Bronze Works, Inc.
 Tulsa Building Supply, Inc.
 Tulsa Cabinet Shop
 Tulsa Chrome Plating Co.
 Tulsa Concrete Company
 Tulsa County News-Sub Retherford Pub In
 Tulsa Crating Co.
 Tulsa Emergency & Safety Equipment Co.
 Tulsa Fabricators & Distributors
 Tulsa Fittings Corporation
 Tulsa Forge, Inc.
 Tulsa Gasket Manufacturing Company
 Tulsa Generator Supply and Mfg. Co.
 Tulsa Graphics Press, Inc.
 Tulsa Iron Works Co.
 Tulsa Jewish Review-Div Tulsa Sect Natl
 Tulsa Litho Company
 Tulsa Machine Works, Inc.
 Tulsa Matchplate Company
 Tulsa Matrix Co.
 Tulsa Mattress Co.
 Tulsa Measurement & Gage Lab-Div Wm Rig
 Tulsa Ornamental Iron & Screen Company
 Tulsa Paper Company
 Tulsa Pattern & Manufacturing Co.
 Tulsa Pipe Coating, Inc.
 Tulsa Pizza Company
 Tulsa Plastics Company
 Tulsa Power Products, Inc.
 Tulsa Precision Castings Inc.
 Tulsa Precision Mfg. Co.
 Tulsa Pro-Quip, Inc.
 Tulsa Rendering Company
 Tulsa Rock Co-Sub McMichael Construct
 Tulsa Rotary Broom Co.
 Tulsa Rubber Co.
 Tulsa Sand Co.
 Tulsa Screw Products, Inc.
 Tulsa Shade and Drapery Co.
 Tulsa Sheet Metal Works, Inc.
 Tulsa Star
 Tulsa Stationery Co-Sub Dwms Rando
 Tulsa Steel Mfg. Company, Inc.

Tulsa Tallow & Feed Company, Inc.
 Tulsa Tribune Company
 Tulsa Truck Manufacturing Company, Inc.
 Tulsa Truck Rebuilders Co.
 Tulsa Tube Bending Co., Inc.
 Tulsa Typesetting Company
 Tulsa Welding & Tool Works
 Tulsa Wilbert Vaults-Div N Texas Wilbt
 Tulsa-Jetco, Inc.
 Turnbow Trailers, Inc.
 Turner Brothers
 Turnkey Industries, Inc.
 Turveys Inc.
 Tv Time Table & Duncan Publishing Co.
 Twilites Manufacturing Co.
 Two Worlds Interior Design Furnishings
 Ty Tailor Fiberglass Co.
 Tyler Feed Store
 Tyner & Son Mfg.
 Type Composition Service
 Type Service Company
 Typo Photo Graphics Inc.
 Typographic Service, Inc.
 U.S. Carbon Co.
 U.S. Industries, Inc.
 U.S. Magnetics, Inc.
 U.S. Metal Container Co.
 U.S. Tower Co.
 U-Change Lock Industries, Inc.
 U-S Enameling Sign Corp.
 U-Save Auto Parts Machine Shop
 Unarco Industries, Inc.
 Unifab, Inc.
 Unified Products
 Union Carbide Corporation
 Uniroyal Tire Co.
 Unistrut Oklahoma, Inc.
 Unit Parts
 Unit Rig & Equipment Co.
 Unit Step and Septic Tank Co.
 United Clay Pipe Co.
 United Divers
 United Foam Corp.
 United Graphics, Inc.
 United Manufacturing, Inc.
 United Metal Products
 United Neon Company
 United Outdoor Advertising
 United Plastic Screening Co.
 United Plating Works, Inc.
 United Railway Machine Shop, Inc.
 United Rendering Company
 United States Chemical Corporation
 United States Envelope Company
 United States Gypsum Company
 Universal Dynamics Scientific Eng.
 Universal Joint Specialists Inc.
 Universal Manufacturing Co.
 Universal Oil Products Co.
 Universal Press, Inc.
 Universal Pure Air Inc.
 Universal Truck Body Works.
 Universal Welding & Fabricating Co.
 University of Oklahoma Press
 University Optical Inc.
 University Sounds
 Unraus Locker & Processing
 Upton Manufacturing Company
 US Gypsum Inc.

US Naval Ammunition Depot
 Utility Equip Co. International, Inc.
 Utility Steel Company
 Utility Tower Co.
 Utterback Typesetting Company
 V & J Stamp Co.
 Vacu-Maid, Inc.
 Vada of Oklahoma, Inc.
 Vails Ready Mix, Inc.
 Val-Qua Manufacturing Co.
 Valhoma Industries, Inc.
 Value Engineering, Inc.
 Van Donge's Inc.
 Van's Interiors, Inc.
 Vanity & Marble, Inc.
 Vans Donut
 Vari-Color Duplicator Corp.
 Vassar Manufacturing Company
 Vaughn Industries, Ltd.
 Veach Saddlery & Western Wear
 Veale Bros. Concrete Products Co.
 Velmas Bakery
 Vemco Plating Inc.
 Venable, Tom H Co.
 Venetian International of Oklahoma, Inc.
 Venetian Marble Co.
 Venaire Corporation
 Venus Electronics Corporation
 Veped Traffic Controls, Inc.
 Veras Purse Shop
 Versatile Helicopters, Inc.
 Vian's Radiator Shop
 Vic Shipp Typography, Inc.
 Vice Sheet Metal Company
 Vickers Petroleum Corp. Bell Oil & Gas
 Victory Glass Co., Inc.
 Viking Industries
 Vincent Radiator Company
 Vincil Co.
 Vindale Corporation
 Vinita Flag & Apron Co.
 Vinita Hay & Grain Co., Inc.
 Vinita Printing Company, Inc.
 Vinsonite Sales Company
 Vip Laboratories
 Virgil Greene Co., Inc.
 Virginia B Packing Co.
 Vista Vision, Inc.
 Vox Printing & Photocopy
 Voyager Corporation
 Vulcan Manufacturing, Inc.
 Vulcan Tank Corporation
 W & W Steel Company
 W & W Steel Company Mfg. Div.
 W D Mfg. Co.
 W P Bill Atkinson Industries, Inc.
 W T W Mfg.
 W. C. -Bill- Thweatt Concrete
 W. E. Reeves Packing Co.
 W. H. Stewart Co.
 W. K. Kerr Manufacturing Company
 W. L. Oakes Manufacturing Company
 W. M. Heitgras Company
 W. P. Atkinson Industries, Inc.
 W. R. Meat Co.
 W.W. McClure
 W-P Milling Company, Inc.
 W-W Trailer Manufacturers, Inc.
 Wadie Riggs Furniture Mfg. Co.

Wagner Electric Corporation
 Wagon Hill Glass
 Wagon Mate Industries, Inc.
 Wagoner Fiberglas Products
 Wagoner Newspapers, Incorporated
 Wait Manufacturing Co. and Marine Sales
 Wakita Herald
 Wako, Inc.
 Walco-Lorain, Inc.
 Walden Chemical Mixer
 Waldens Machine Shop
 Waldo Alfalfa Mill
 Waldon Inc.
 Walker Manufacturing Corp.
 Walker Stamp and Seal Co.
 Walker, M A, Mfg. Co.
 Wall & Wall Packing Company
 Wall Colmondy Corporation
 Wallace Business Forms, Inc.
 Wallace Construction
 Wallace Printing Co.
 Wallas Printing
 Waller Typesetting Company
 Walter Johnson Cookie Company
 Walton Gypsum Company
 Walton Manufacturing
 Wampler Fence and Iron Co.
 Wanda Mfg. Co., Inc.
 Wandabar Mfg. Co.
 Waner Corporation
 Wantland Oil Reclaiming Co.
 Wantland Products Co.
 Ward Industries Incorporated
 Ward Tool & Manufacturing Company, Inc.
 Wards Concrete Co.
 Wards Cooler Filter Mfg. Co.
 Warehouse Service, Inc.
 Warner Furniture Mfg. Co.
 Warren G. Harvell
 Warren J E Machine Shop
 Warren Monument Co.
 Warren Petro Corp Maysville Plant
 Warren Petroleum Corp Knox Plant
 Warren Petroleum Corp-Plant No. 159
 Warren Supply Co.
 Washita Construction Co.
 Washita County Enterprise
 Waste-Treat, Inc.
 Water and Gas Plastic Products Corp.
 Waurika Manufacturing Co.
 Waurika News-Democrat
 Way Side Press, Inc.
 Wayne Burt Machine Shop
 Wayne Electronic Products Company
 Wayne Manufacturing Inc.
 Wayne Minks Glass Plant
 Waynoka Cooperative Elevator Assn
 Waynoka Publishing Company
 Weather Whipper Awning Co.
 Weatherford Press
 Weatherford Processing Plant
 Webb Mfg. Co.
 Webcraft Inc.
 Webco Tank Incorporated
 Weddle Sign Co.
 Weilmuenster F W Company
 Weimer Oil Company
 Weiss Marking Co., Inc-Sub Lowen Co. Inc.
 Welch Locker Service

Weldco, Inc.
 Wells Lamont Corporation
 Wentworth Printing Company, Inc.
 Wesco Electronics, Inc.
 Wesco Plaques and Awards
 Westemeir & Sons Printers
 Western Avionics Inc.
 Western Bank & Office Supply, Inc.
 Western Electric Company, Inc.
 Western Extract & Mfg. Co.
 Western Flare Co.
 Western Furniture Industries, Inc.
 Western Leather Company
 Western Lumber Company
 Western Outdoor Advertising Co.
 Western Plains Construction Corp.
 Western Publishing Company
 Western Salt
 Western State Sheet Metal
 Western Supply Company
 Westoak Industries, Inc.
 Westwood Executive Furniture, Inc.
 Wetmore, Inc.
 Wewoka Brick & Tile Co.
 Wewoka Times Co., Inc.
 Weyerhaeuser Company
 Weyerhaeuser Dierks Division
 Wheat Western Store
 Wheeler Brothers Grain Co., Inc.
 Wheeler Industries Inc.
 Whisco Steel Fabricators, Inc.
 Whitaker Printing Service
 Whitcomb Manufacturing Company
 White Eagle Bedding Co.
 White Products Co., Inc.
 White Stag Mfg. Co.
 White Truss Co.
 White Way Construction Co.
 Whitehorn Marine Service
 Whitlock Sawmill
 Wholesale Hatters
 Wichita Granite Co., Inc.
 Wickham Packing Co., Inc.
 Wickham Packing Company of Ada
 Widicks
 Wietelman Broom & Mop Company
 Wilbert Vault Corp.
 Wilhelm Honey Farm
 Wilkinson Industries Corporation
 Williams Chemical Co.
 Williams Cline Company
 Williams Lumber Co.
 Williams Machine & Mfg. Co.
 Williams Mfg. Co.
 Williams Neon Sign Co.
 Williams Planning Mill
 Williams Woodworks Inc.
 Williamson-Mason Manufacturing Company
 Willis Bros. Lumber & Tie Co.
 Willis Don Concrete Co., Inc.
 Willis Fellow Bros Granite Monument Co.
 Wills Ready-Mixed Concrete, Inc.
 Willyard Mobil Feed Service
 Wilsey-Bennett of Oklahoma, Inc.
 Wilshire Productions, Inc.
 Wilson & Co., Inc.
 Wilson Trophies, Inc.
 Winart Pottery
 Winter R H Co.

Winters Dairy & Locker Service
 Wire Engineering Company
 Wiser Aeration Company Inc.
 Wofferman, Fred, Inc.
 Wolf Ready-Mix, Inc.
 Wolfs Manufacturing Company
 Wonder Snack Foods
 Wood Concrete
 Wood Specialties Corporation
 Wood-Lam Structures, Inc.
 Woodfiber Div.
 Woodward Coca-Cola Bottling Company
 Woodward County Journal
 Woodward Daily Press, Inc.
 Woodward Manufacturing Company, Inc.
 Woody Candy Co.
 Word Industries Pipe Fabricating, Inc.
 World Publishing Company
 Worsham-Miller, Inc.
 Worstell Oil & Gas Company
 Worthington Vertical Pump Corporation
 Wright Printing Service
 Wright Welding Service
 Wrights Donuts
 Wrights Metal Shop
 Wudlite, Inc.
 Wyco, Inc.
 Wylie Manufacturing Company
 Wynnewood Block Co.
 Wynnewood Gazette
 Wynns Trailer Works
 Yaffe Iron & Metal Co., Inc.
 Yale Concrete Products
 Yeaman Cabinet Shop
 York Metal Fabricators, Inc.
 Young, Bob, Cabinet Shop
 Young, Gerald M., Machine Co.
 Young, J D, Company, Inc.
 Youngblood Machine & Welding Shop
 Youngbloods Custom Houseboats Docks
 Youngstown Sheet and Tube Company
 Your Community Manufacturing Corp.
 Yuba Heat Transfer Corporation
 Yukon Mill & Grain
 Yukon Printing, Inc.
 Yukon Review and Mustang Mirror
 Yukon Steel Corporation
 Zander Concrete Co.
 Zanes Ready Mix
 Zapata Industries, Inc.
 Zeligson Company, The
 Zephyr Metal Craft, Inc.
 Zerby Cabinet Industries, Inc.
 Zero Instruments
 Zero Packing Company
 Ziegler, D. E., Artcraft Supply
 Ziese Manufacturing Company
 Zimmer-Hoffman Associates, Inc.
 Zip Print
 Zipco, Inc.
 Zone Packer Manufacturing Co.
 Zorns
 Zuber Mfg. Co.
 Zurn Industries, Inc.
 20th Century Mfg. & Supply Co.
 5K Products, Inc.
 68 Feed Mill
 7-Up Bottling Co.

APPENDIX F

Combined List of Hazardous Substances

KEY - LIST OF HAZARDOUS SUBSTANCES

Source: A = Report to Congress-Disposal of Hazardous Waste, 1974,
pp. 47-8.
B = Federal Register, "Designation and Determination of
Removability of Hazardous Substances from Water," vol.
39, no. 164, 22 August 1974, pp. 30467-71.
C = U.S. Environmental Protection Agency, "Action Guide for
State Hazardous Waste Survey," 1974. (Mimeographed.)
Appendix C - Potentially Hazardous Waste Constituents
and Industrial Sources.

Category TRW - Hazardous Waste Decision Model

I = Extremely hazardous wastes that are candidates for fed-
erally regulated National Disposal Sites because of
their very hazardous nature. They are difficult to
handle safely, have a Threshold Limit Value less than 1
part per million, are highly explosive or flammable or
are currently regulated or are considered for regula-
tion by EPA.

II = Hazardous wastes which cannot be safely handled by
waste treatment and disposal techniques commonly used
by municipalities without pretreatment. Pretreatment
included incineration with proper scrubbing, encapsula-
tion in a specially designed land disposal area, or
special chemical, physical, or biological treatment
process.

Description: F = Flammables C = Corrosive
E = Explosives I = Irritant
P = Poison O = Oxidizer
R = Reactive

Significant Producer - EPA:

Description	SIC
1. Metals Mining	1021, 1031, 1092, 1094, 1099
2. Textiles	223, 226
3. Inorganic Chemicals	281
4. Plastics	282
5. Rubber	301, 302, 303, 304, 306
6. Drugs - Pharmaceuticals	283
7. Paint & Allied Products	285
8. Organic Chemicals	286
9. Pesticides	2879
10. Explosives	2892
11. Petroleum Refining	291
12. Leather Tanning	311
13. Primary Metals	331, 3321, 3322, 3324, 333, 3341, 3399
14. Electroplating	3471
15. Machinery	355, 357
16. Primary & Storage Batteries	3691, 3692

TABLE 25

COMBINED LISTS OF HAZARDOUS SUBSTANCES

No.	Hazardous Constituent Common Name	Source	Classi- fication		Booz-Allen Study	Significant Producer EPA - Action Guide (Appendix C)																Significant User Booz-Allen Study		
			Cate- gory	Descrip- tion																				
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
1	Abate	C													x									
2	Acetaldehyde	BC	II	F																				
3	Acetic acid	B	II	C																				
4	Acetic anhydride	B	II	P	2818																	20,26,2818,282,36		
5	Acetone cyanhydrin	B	II	P	2818																	28		
6	Acetonitrile	C	II	F	2818																	28		
7	Acetyl bromide	B	II	C																				
8	Acetyl chloride	B	II	C	2818																	20,28		
9	Acrolein	ABC	I	F	291,2818																	19,28		
10	Acrylonitrile	BC	II	F																				
11	Adiponitrile	BC	II	P																				
12	Aldehydes	C																						
13	Aldrin	ABC	I	P	291,2818																	28		
14	Aliphatic mercury compounds	C																						
15	Alkylleads	A																						
16	Allyl alcohol	BC	II	I																				
17	Allyl chloride	BC	II	F	2818																	28		
18	Aluminum chloride	C																						
19	Aluminum salts	C																						
20	Aluminum sulfate	BC	II	I	14,10,2819																	20,22,26,31,49		
21	Aminophenol	C																						
22	Ammonia	B																						
23	Ammonium acetate	B	II	C																				
24	Ammonium benzoate	B																						
25	Ammonium bicarbonate	B																						
26	Ammonium bifluoride	C	II	P																				
27	Ammonium bisulfite	B																						
28	Ammonium bromide	B																						
29	Ammonium carbamate	B																						
30	Ammonium carbonate	B	II	C																				
31	Ammonium chloride	B	II	C	2819																	20,28,3692		
32	Ammonium chromate	AC	I	O	2819																	22,38		
33	Ammonium citrate dibasic	B																						
34	Ammonium dichromate	AC	I	F	2819																	27,28,32,38		
35	Ammonium ferrocyanide	B																						
36	Ammonium fluoborate	B																						
37	Ammonium fluoride	C	II	C	2819																	20,22,24,28,32		
38	Ammonium formate	B																						
39	Ammonium gluconate	B																						
40	Ammonium hydroxide	B	II	I																				
41	Ammonium hypophosphite	B																						
42	Ammonium iodide	B																						
43	Ammonium molybdate	B																						
44	Ammonium nitrate	B	II	O																				
45	Ammonium oxalate	B																						
46	Ammonium pentaborate	B																						
47	Ammonium persulfate	B	II	O	2819																	20,28,34,38		
48	Ammonium picrate	C			2819																	28		
49	Ammonium silicofluoride	BC																						
50	Ammonium sulfamate	B																						
51	Ammonium sulfate	B	II	C																				
52	Ammonium sulfide	BC	II	C																				
53	Ammonium sulfite	B																						
54	Ammonium tartrate	B																						
55	Ammonium thiocyanate	B	II	P																				
56	Ammonium thiosulfate	B																						
57	Amyl acetate	BC	II	F	2818																	20,22,28,39		
58	Amyl Alcohol	C	II	P																				
59	Aniline	BC	II	P	2815																	2815,2818,30,38		
60	Antimony	C	II	P	3339																	22,28,30,32,33		
61	Antimony chloride	C																						
62	Antimony Compounds	C																						
63	Antimony pentachloride	B	II	C	2819																	28		
64	Antimony pentafluoride	ABC	I	C	2819																	28		
65	Antimony pentoxide	C																						
66	Antimony potassium tartrate	B	II	P	2819																	28		
67	Antimony tribromide	B																						
68	Antimony trichloride	B	II	C	2819																	28,32		
69	Antimony trifluoride	ABC			2819																	28,32		
70	Antimony triiodide	B																						
71	Antimony trioxide	BC	II	P	2819																	28		
72	Antimony trisulfide	C	II	P																				

TABLE 25—Continued

No.	Hazardous Constituent	Source	Classification		Significant Producer																Significant User	
			Category	Description	Booz-Allen Study	EPA - Action Guide (Appendix C)														Booz-Allen Study		
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
73	Aromatic mercury compound	C																				
74	Aromatic solvents	C																				
75	Arsenates	C																				
76	Arsenic	C	II	P	3339	x																
77	Arsenic acid	C	II	P																		
78	Arsenic compounds	C																				
79	Arsenic disulfide	B																				
80	Arsenic pentaoxide	B	II	P																		
81	Arsenic sulfide	C	II	P																		
82	Arsenic tribromide	B																				
83	Arsenic trichloride	ABC	I	P	2819																	
84	Arsenic trifluoride	B																				
85	Arsenic triiodide	B																				
86	Arsenic trioxide	ABC	I	P	2819	x																
87	Arsenic triselenide	C																				
88	Arsenic trisulfide	BC																				
89	Arsenic cacodylic acid	B																				
90	Arsenic calcium arsenate	B																				
91	Arsenic calcium arsenite	B																				
92	Arsenic potassium arsenate	B																				
93	Arsenic potassium arsenite	B																				
94	Arsenic sodium arsenate	B																				
95	Arsenic sodium arsenite	B																				
96	Arsenic sodium cacodylate	B																				
97	Arsenyl acid	C																				
98	Asbestos	C																				
99	Barium carbonate	C	II	P	2819																	
100	Barium chloride	C	II	P	2819																	
101	Barium chromate	C																				
102	Barium compounds	C																				
103	Barium cyanide	C	II	P	2819																	
104	Barium hydrosulfide	C																				
105	Barium nitrate	C	II	O	2819																	
106	Barium sulfide	C	II	P	2819																	
107	Benzene	BC	II	F																		
108	Benzene hexachloride	C	I	P	2815																	
109	Benzo-trifluoride	C																				
110	Benzoic acid	B	II	C	2815																	
111	Benzonitrile	B																				
112	Benzoylchloride	B																				
113	Benzylchloride	BC	II	C	2815																	
114	Beryllium	C				x																
115	Beryllium carbonate	C	II	P	2819																	
116	Beryllium chloride	BC	II	P	2819																	
117	Beryllium fluoride	B																				
118	Beryllium Hydroxide	BC	II	P	2819																	
119	Beryllium nitrate	BC	II	O																		
120	Beryllium oxide	C	II	P	2819																	
121	Beryllium phosphate	B																				
122	Beryllium selenate	C	II	P	2819																	
123	Beryllium sulfate	B	II	P																		
124	Boric acid	B	II	C																		
125	Bromine pentafluoride	AC	I	C	2819																	
126	Brucine	BC	II	P																		
127	Butadiene	C																				
128	Butanol	C																				
129	Butyl acetate	BC	II	F	2818																	
130	Butyl aldehyde	C																				
131	Butylamine	B	II	P	2818																	
132	Butyric acid	B	II	C																		
133	Bux ten	C																				
134	Cacodylic acid	C	I	P	2818																	
135	Cadmium (alloys)	AC	I	P	3339	x																
136	Cadmium acetate	B																				
137	Cadmium bromide	B																				
138	Cadmium carbonate hydroxide	C																				
139	Cadmium chloride	ABC	I	P																		
140	Cadmium chromate	C																				
141	Cadmium cyanide	AC	I	P																		
142	Cadmium fluoborate	B																				
143	Cadmium nitrate	ABC	I	P	2819																	
144	Cadmium oxide	AC	I	P	2819																	
145	Cadmium phosphate	AC	I	P	2819																	
146	Cadmium potassium cyanide	AC	I	P	2819																	
147	Cadmium (powdered)	A	I	P																		

TABLE 25 — Continued

Hazardous Constituent		Source	Classification		Significant Producer																Significant User		
No.	Common Name		Category	Description	Booz-Allen Study	EPA - Action Guide (Appendix C)														Booz-Allen Study			
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
148	Cadmium sulfate	ABC	I	P	2819								x	x							x	28,36	
149	Cadmium sulfide	C						x					x									28	
150	Calcium arsenate	AC	II	P	2819								x										
151	Calcium arsenite	AC	II	P									x										
152	Calcium carbide	B	II	F	2819									x								22,28	
153	Calcium cyanides	A	II	P	2819																	28	
154	Calcium hydroxide	B	II	C																			
155	Calcium hypochlorite	BC	II	O				x															
156	Calcium oxide	BC						x															
157	Captan	B																					
158	Carbaryl	BC																					
159	Carbofuran	C													x								
160	Carbon disulfide	B	II	F	2818																	2823	
161	Carbon tetrachloride	C	II	P																			
162	Carbon tetrafluoride	C						x															
163	Carcinogens	A																					
164	Catechol	B																					
165	Chlordane	ABC	I	P											x								
166	Chlorinated aromatics	A																					
167	Chlorinated hydrocarbons	C						x	x				x										
168	Chlorinated solvents	C																					
169	Chlorine	B	I	O																			
170	Chlorine pentafluoride	C						x															
171	Chlorine trifluoride	C	I	C	2812			x														28	
172	Chlorobenzene	BC	II	P																			
173	Chlorobenzoic acid	C												x									
174	Chlorobenzylchloride	C												x									
175	Chlorobenzyltrichloride	C												x									
176	Chloroform	BC	II	P										x									
177	Chloropicrin	AC	II	P										x									
178	Chlorosulfonic acid	BC	II	O	2818																	28	
179	Chlorourea	C																					
180	Chromates	C						x															
181	Chrome oxide	C																					
182	Chromium compounds	B																					
183	Ammonium bichromate	B																					
184	Ammonium chromate	B																					
185	Calcium chromate	B																					
186	Chromic acetate	B																					
187	Chromic acid	ABC	I	O				x						x									
188	Chromic hydroxide	C						x						x									
189	Chromic sulfate	BC	II	P										x									
190	Chromium	C	II	P										x									
191	Chromous carbonate	B																					
192	Chromous chloride	B																					
193	Chromous oxalate	B																					
194	Chromyl chloride	B																					
195	Chromic acid,Lithium bichromate	B																					
196	Chromic acid,Lithium chromate	B																					
197	Chromium compounds																						
197	Potassium bichromate	B																					
198	Potassium chromate	B																					
199	Sodium bichromate	B																					
200	Sodium chromate	B																					
201	Strontium chromate	B																					
202	Zinc bichromate	B																					
203	Cobalt	C																					
204	Cobaltous acetate	B																					
205	Cobaltous bromide	B																					
206	Cobaltous chloride	B	II	P																			
207	Cobaltous citrate	B																					
208	Cobaltous fluoride	B																					
209	Cobaltous formate	B																					
210	Cobaltous iodide	B																					
211	Cobaltous nitrate	B	II	O	2819																	28,32	
212	Cobaltous perchlorate	B																					
213	Cobaltous succinate	B																					
214	Cobaltous sulfamate	B																					
215	Cobaltous sulfate	B																					
216	Copper	C						x						x									
217	Copper acetate	BC																					
218	Copper acetoarsenite	ABC	I	P	2819																	24,28	
219	Copper acetylacetonate	B																					
220	Copper acetylhydride	AC	I	E																			
221	Copper ammonium carbonate	C						x															

TABLE 25--Continued

No.	Hazardous Constituent Common Name	Source	Classi- fication		Significant Producer																Significant User
			Cate- gory	Descrip- tion	Booz-Allen Study	EPA - Action Guide (Appendix C)														Booz-Allen Study	
						1	2	3	4	5	6	7	8	9	10	11	12	13	14		
222	Copper ammonium fluoride	C					x														
223	Copper arsenate	AC	I	P																	
224	Copper bromide	B																			
225	Copper chloride	B	II	P																	
226	Copper chlorotetrazole	AC	I	P																	
227	Copper cyanide	AC	I	P																	
228	Copper formate	B																			
229	Copper gluconate	B																			
230	Copper glycinate	B																			
231	Copper hydroxide	C																			
232	Copper lactate	B																			
233	Copper nitrate	BC	II	O																	
234	Copper oxalate	B																			
235	Copper oxide	C																			
236	Copper pyrophosphate	C																			
237	Copper salts	C																			
238	Copper subacetate	B																			
239	Copper sulfate	BC	II	P																	
240	Copper sulfate, ammoniated	B																			
241	Copper tartrate	B																			
242	Cuprous bromide	B																			
243	Cuprous iodide	B																			
244	Copper, 2-blue waters	C																			
245	Cumaphos	B																			
246	Cresol	B	II	F	2821															20,28,33	
247	Cumene	C	II	O	2818															28	
248	Cuprous chloride	C																			
249	Cuprous oxide	C																			
250	Cyanide	AC	I	P																	
251	Cyanide (barium)	B																			
252	Cyanide (calcium)	B																			
253	Cyanide (hydrogen)	B																			
254	Cyanide (potassium)	B																			
255	Cyanide (sodium)	B																			
256	Cyanide (zinc)	B																			
257	Cyanuric triazide	AC																			
258	Cyclohexane	B	II	F	2815															28	
259	Cyclohexanone	C	II	P	2818															28	
260	2, 4-D (acid)	AB	I	P																	
261	2, 4-D (esters)	B																			
262	2, 6-D	C																			
263	Dalaphan	BC																			
264	DDD	AC	I	P	2842,2879															28	
265	DDT	ABC	I	P	2842,2879															28	
266	Decaborane	AC																			
267	Demeton	AC	I	P	2818															28	
268	Diazinon	BC																			
269	Diazodinitrophenol (DDNP)	AC																			
270	Diborane	AC			2819															28	
271	12-Dibromo-3-chloropropane(DBOP)	C																			
272	Dicamba	B																			
273	Dichlobenil	B																			
274	Dichlone	B																			
275	Dichlorinated hydrocarbons	C																			
276	Dichlorobenzene	C	II	I	2818															28	
277	Dichloroethylidinitro talidene	C																			
278	Dichloronitro benzene	C																			
279	2,4-Dichlorophenoxyacetic acid	C			2842,2879															28	
280	Dichloropropyl ether	C																			
281	Dichlorotoluene	C																			
282	Dichloruox	B																			
283	Dieldrin	ABC	I	P	2818															28	
284	Diethylamine	B	II	F	2818															28,29,30	
285	Dimethyl arsenic acid	C																			
286	Dimethyl formamide	C	II	I																	
287	Dimethyl sulfate	AC	I	F	2818															2626,29	
288	Dimethylamine	B			2818															28	
289	Dimethylformamide	C																			
290	Dinitrobenzene	ABC																			
291	Dinitro cresols	AC	I	P																	
292	46-Dinitro-o-cresol (DNOC)	C																			
293	Dinitrophenol	ABC	II	F	2818															28,34	
294	2,4 Dinitrotoluene	AC	I	E	2818															28	
295	Dipentaerythritol hexanitrate	AC																			

TABLE 25—Continued

Hazardous Constituent		Source	Classification		Significant Producer																Significant User		
No.	Common Name		Category	Description	Booz-Allen Study	EPA - Action Guide (Appendix C)																Booz-Allen Study	
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
296	Diphenyl	C																					
297	Diphenyl oxide	C																					
298	Diphenylamine	C	II	P	2815																		28
299	Diquat	B																					
300	Disulfonic acid	C																					
301	Disulfoton	B																					
302	Diuron	BC																					
303	Dodecylbenzenesulfonic acid	B																					
304	Dodecylbenzenesulfonic acid (Calcium salt)	B																					
305	Dodecylbenzenesulfonic acid (isopropanolamine salt)	B																					
306	Dodecylbenzenesulfonic acid (sodium salt)	B																					
307	Dodecylbenzenesulfonic acid (triethanolamine salt)	B																					
308	Dursban	B																					
309	Electrolyte waste	C																					
310	Endosulfan	B																					
311	Endrin	ABC	I	P	2818																		28
312	Epichlorohydrin	C			2818																		20, 28
313	Ethanol	C	II	P																			
314	Ethion	B																					
315	Ethyl acetate	C	II	F	2818																		28
316	Ethyl cellosolve	C																					
317	Ethyl mercaptans	C	II	F																			
318	Ethylamine	C	II	F	2818																		20, 28
319	Ethylbenzene	B	II	F																			
320	Ethylene bromide	AC	II	P	2818																		28, 29
321	Ethylenediamine	B	II	I	2818																		28
322	Ethylenediamine-tetraacetic acid	B	II	C																			
323	Ethylene dichloride	C	II	F																			
324	Ferrocyanides	C																					
325	Fluoroacetic acid	C																					
326	Fluorobenzoic acid	C																					
327	Fluorides	AC			2819		x																28
328	Fluorine	AC	I	F	2819																		28
329	Fluorine-Aluminum fluoride	B																					
330	Fluorine-Ammonium bifluoride	B																					
331	Fluorine-Ammonium fluoride	B																					
332	Fluorine-Hydrofluoric acid	B																					
333	Fluorine-Lithium fluoride	B																					
334	Fluorine-Phosphorus pentafluoride	B																					
335	Fluorine-Sodium bifluoride	B																					
336	Fluorine-Sodium fluoride	B																					
337	Fluorine-Stannous fluoride	B																					
338	Formaldehyde	BC	II	I																			
339	Formic acid	B	II	C																			
340	Fumaric acid	B	II	C																			
341	Furfural	BC	II	I	2818																		28
342	GB(propoxy(2)methylphosphoryl fluoride)	A																					
343	Gasoline	C																					
344	Gelatinized nitrocellulose(PNC)	AC																					
345	Glycol dinitrate	AC	I	P																			
346	Gold fulminate	AC	I	E																			
347	Guthion	BC	I	P	2818																		28
348	Halogenated hydrocarbons	C																					
349	Heptachlor	ABC	I	P	2818																		28
350	Herbicides, benzoic	C																					
351	Herbicides, carbonate	C																					

TABLE 25 — Continued

Hazardous Constituent		Source	Classi- fication		Significant Producer																Significant User		
No.	Common Name		Cate- gory	Descrip- tion	Booz-Allen Study	EPA - Action Guide (Appendix C)																Booz-Allen Study	
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
362	Hydrazine azide	A	II	C	2819															28,33,34			
363	Hydrochloric acid	B																					
364	Hydrocyanic acid	C																					
365	Hydrogen bromide	C																					
366	Hydrogen cyanide	C																					
367	Hydrogen fluoride	C	II	P	2815															28,34			
368	Hydrogen sulfide	C																					
369	Hydroquinone	BC																					
370	Hydroxylamine	B																					
371	Immiscible solvents	C																					
372	Insecticides, organic	C																					
373	Insecticides, organophosphorous	C																					
374	Insecticides, polychlorinated hydrocarbons	C																					
375	Iron Ferric ammonium citrate	B																					
376	Iron Ferric ammonium oxalate	B																					
377	Iron Ferric chloride	B																					
378	Iron Ferric fluoride	B																					
379	Iron ferric glycerophosphate	B																					
380	Iron ferric nitrate	B																					
381	Iron ferric phosphate	B																					
382	Iron ferric sulfate	B																					
383	Iron ferrous ammonium sulfate	B																					
384	Iron ferrous chloride	B																					
385	Iron ferrous oxalate	B																					
386	Iron ferrous sulfate	B																					
387	Isobutyl alcohol	C																					
388	Isobutyl ketone	C																					
389	Isophthalonitrile	C																					
390	Isoprene	B																					
391	Isopropyl alcohol	C				II	F	2822															28,30
392	Kelthane	B	II	P	2819																		
393	Lead	C																					
394	Lead acetate	BC																					28
395	Lead arsenate	ABC				I	P	2819															2879
396	Lead arsenite	AC	II	P	2819																		
397	Lead azide	AC				I	E																28
398	Lead bromide	B																					
399	Lead carbonate	C																					28
400	Lead chloride	B																					
401	Lead chromate	C																					
402	Lead cyanide	AC				I	P																
403	Lead 2,4-dinitroresorcinate	AC				I	E																
404	Lead dioxide	C																					
405	Lead fluoborate	B																					
406	Lead fluoride	B																					
407	Lead iodide	B																					
408	Lead nitrate	BC	II	O	2819																		
409	Lead oxide	C																					
410	Lead salts	C																					2816,30,32
411	Lead stearate	B																					
412	Lead styphnate	AC	II	P																			
413	Lead sulfate	BC																					
414	Lead sulfide	BC																					
415	Lead tetraacetate	B																					
416	Lead thiocyanate	B																					
417	Lead thiosulfate	B																					
418	Lead tungstate	B																					
419	Lewisite (2-chloroethenyl dichloroarsine)	A				I	P																
420	Lindane	ABC	I	P	2819																		
421	Linuron	C																					
422	Magnesium arsenite	AC																					28
423	Malathion	BC																					
424	Maleic acid	BC	II	I																			
425	Maleic anhydride	BC																					
426	Manganese arsenate	AC																					
427	Manganese salts	C																					
428	Manganese thiocarbonate	C	I	E																			
429	Mannitol hexanitrate	AC																					
430	Mercaptans	C																					
431	Mercuric acetate	B																					
432	Mercuric ammonium chloride	B																					

TABLE 25 — Continued

Hazardous Constituent		Source	Classification		Significant Producer																Significant User		
No.	Common Name		Category	Description	Booz-Allen Study	EPA - Action Guide (Appendix C)														Booz-Allen Study			
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
433	Mercuric bromide	B	II	P																			
434	Mercuric chloride	ABC	I	P	2819			x	x		x	x		x						x		28,38	
435	Mercuric cyanide	ABC	I	P	2819			x			x	x		x					x		x	28	
436	Mercuric Diammonium chloride	AC	I	P				x			x	x		x									
437	Mercuric iodide	B	II	P																			
438	Mercuric nitrate	ABC	I	P	2819			x		x	x			x							x	28	
439	Mercuric oxide	B																					
440	Mercuric sulfate	ABC	I	P	2819			x		x	x			x						x		28,33,36	
441	Mercuric sulfide	C						x															
442	Mercuric thiocyanate	B																					
443	Mercurous chloride	B																					
444	Mercurous iodide	B																					
445	Mercurous nitrate	B	II	P																			
446	Mercury	AC	I	P				x	x	x	x		x	x	x			x			x		
447	Mercury compounds (organic)	A	I	P																			
448	Mercury fulminate	C	I	E																			
449	Mercury fungicides	C													x								
450	Mercury mercaptans	C														x							
451	Mercury salts	C														x							
452	Meta-Nitrochlorobenzene	C												x									
453	Methanol	C									x					x							
454	Methoxymyl	C													x								
455	Methoxychlor	BC													x								
456	Methyl bromide	AC	II	F	2818										x							28	
457	Methyl chloride	AC	II	F	2818										x							28,30	
458	Methyl ethyl ketone	C	II	F							x		x										
459	Methyl mercaptans	BC														x							
460	Methyl mercuric chloride	C									x			x									
461	Methyl methacrylate	BC	II	F	2818						x			x								28,29	
462	Methyl parathion	ABC	I	F	2818										x							28	
463	Methyl sulfate	C														x							
464	Methylene chloride	C													x								
465	Methylene dichloride	C																					
466	Mevinphos	B																					
467	Molybdate chrome	C											x										
468	Molybdenum disulfide	C							x														
469	Molybdictrioxide	B	II	P																			
470	Monochlorophenoxy acetic acid	C														x							
471	Monochlorotoluene	C													x								
472	Monoethylamine	B																					
473	Monomethylamine	B																					
474	Mononitroresorsinate	C														x							
475	Monuron	C														x							
476	Naled	B																					
477	Naphtha	C			2911																	2815	
478	Naphthalene	B	II	F	2815																	28,31,34	
479	Naphthenic acid	B																					
480	Nickel	C			3339		x											x	x	x	x	28,33,34	
481	Nickelacetate	B																					
482	Nickel ammonium sulfate	B	II	P	2819																	28,34	
483	Nickel bromide	B																					
484	Nickel carbonate	C																					
485	Nickel carbonyl	AC	I	F	2819				x										x			28	
486	Nickel chloride	BC	II	P																x			
487	Nickel cyanide	AC	I	P																x			
488	Nickel fluoride	B																					
489	Nickel formate	B																					
490	Nickel hydroxide	B																					
491	Nickel iodide	B																					
492	Nickel nitrate	B	II	P	2819																	28,32,34	
493	Nickel perchlorate	B																					
494	Nickel sulfate	BC	II	P															x	x			
495	Nickel titanate	C																					
496	Nickelic oxide	C																					
497	Nickelous oxide	C																					
498	Nicotin	C																					
499	Nitric acid	B	II	C																			
500	Nitroaniline	AC	II	P	2815																	28	
501	Nitrobenzene	BC	II	P	2815																	28	
502	Nitrobenzyl bromide	C																					
503	Nitrocellulose	AC	I	E																			
504	Nitrocellulose acetates	C																					
505	Nitrocellulose alcohols	C																					
506	Nitrogen dioxide	B																					
507	Nitrogen mustard (2,2', 2" - trichlorotriethylanine)	A																					

TABLE 25 —Continued

No.	Hazardous Constituent Common Name	Source	Classi- fication		Significant Producer																Significant User Booz-Allen Study
					Booz-Allen Study	EPA - Action Guide (Appendix C)															
			Cate- gory	Descrip- tion		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
508	Nitroglycerin	AC	I	E	2897										x						19,28
509	Nitrophenol	B	II	P	2815																2818,34
510	Nitrotoluene	C											x		x						
511	Organic acids	C																			
512	Organic arsenites	C									x									x	
513	Organic chlorides	C											x								
514	Organic fungicides	C												x							
515	Organic solvents	C												x							
516	Oxalic acid	C	II	PC	2818																
517	Paraformaldehyde	B	II	I	2818																22,28,31
518	Para-nitrochlorobenzene	C											x								28
519	Parathion	ABC	I	P	2818									x							2879
520	Pathogenic bacteria	C									x										
521	Penicillin	C									x										
522	Pentaborane-9	AC	I	P			x														
523	Pentaborane-11	A																			
524	Pentachlorophenol	ABC	I	P	2818							x	x								22,24,26,28
525	Pentaerythritol tetranitrate (PETN)	C	I	E	2818										x						19,28
526	Perchloric acid (to 72%)	AC	I	C	2819		x														28
527	Perchloryl fluoride	AC	I	O	2818																
528	Phenol	BC	II	P				x		x		x			x		x		x		
529	Phenol-formaldehyde resin	C									x										
530	Phenylenediamine	C										x									
531	Phenylisocyanate	C										x									
532	Phenylisocyanate	C										x									
533	Phosgene (carbonyl chloride)	ABC						x		x		x	x								
534	Phosphoric acid	B	II	C																	
535	Phosphorothioates	C																			
536	Phosphorus	B	II	F	2819									x							22,28
537	Phosphorus oxychloride	B			2819																28,29
538	Phosphorus pentasulfide	BC	II	F	2819									x							28,29
539	Phosphorus trichloride	B	II	I	2819																28,33
540	Picloram	C												x							
541	Picric acid	AC	I	E	2818										x						19,28
542	Platinum	C				x															
543	Polychlorinated biphenyls (PCB)	ABC	I	P					x	x			x								
544	Potassium arsenite	AC	I	P	2819					x				x							28,32
545	Potassium bifluoride	C							x												
546	Potassium chromate	AC	I	P	2819					x											28
547	Potassium cyanide	AC	I	P	2819				x												10,28,33,34
548	Potassium dichromate	AC	I	O	2819				x												22,26,27,28,29,31
549	Potassium dinitrobenzofurokan (KDNBF)	AC	I	E																	
550	Potassium fluoride	C	II	I	2819			x							x						20,28,32
551	Potassium hydroxide	BC	II	C	2819																28
552	Potassium perchlorate	C													x						
553	Potassium permanganate	BC	II	O	2819																22,28,31,38
554	Propanil	C												x							
555	Propionic acid	B			2818																28
556	Propionic anhydride	B																			28
557	Propyl alcohol	B	II	P	2818																
558	Pyrethrins	BC																			
559	Pyridine	C	II	F	2815,2818						x										2822,30
560	Pyrogalllic acid	B																			
561	Quaternary ammonium compounds	C											x								
562	Quinoline	BC	II	P									x								
563	Radioactive wastes	C							x												
564	Radox	C																			
565	Rare-earth	C					x														
566	RDX	C																			
567	Red lead	C																			
568	Resins	C																			
569	Resorcinol	B	II	I																	
570	Rotenone	C																			
571	Selenic acid	B																			
572	Selenium	AC	I	P		x			x												
573	Selenium compounds	C																			
574	Selenium diethyldithiocarbamate	C																			
575	Selenium oxide	B																			
576	Selenium oxychloride	B																			
577	Siduron	C																			
578	Silicon tetrafluoride	C																			
579	Silver	C																			
580	Silver acetylde	A	I	E																	

TABLE 25 —Continued

Hazardous Constituent		Source	Classification		Significant Producer																Significant User	
No.	Common Name		Category	Description	Booz-Allen Study	EPA - Action Guide (Appendix C)																Booz-Allen Study
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
581	Silver azide	A	I	E																		
582	Silver chloride	C																				
583	Silver cyanide	AC	I	P																		
584	Silver oxide	C																				
585	Silver salts	C																				
586	Silver styphnate	C	I	E																		
587	Silver tetrazene	AC																				
588	Silvex	C																				
589	Sodium	B	II	P	3339																28,33	
590	Sodium arsenate	AC	I	P	2819																22,28	
591	Sodium arsenite	AC	I	P	2819																2879	
592	Sodium azide	C	I	P	2819																19,28	
593	Sodium bichromate	AC	I	C																		
594	Sodium bifluoride	C	II	P																		
595	Sodium bisulfite	B	II	P	2819																20,26,28	
596	Sodium borate	B	II	P	2819																28,32,33	
597	Sodium chloride	C																				
598	Sodium chromate	AC	I	C																		
599	Sodium cyanate	C	II	P																		
600	Sodium cyanide	AC	I	P																		
601	Sodium dichromate	C	II	O																		
602	Sodium ferricyanide	C	II	P																		
603	Sodium ferrocyanide	C	II	P																		
604	Sodium fluoride	C	II	P																		
605	Sodium fluoroacetate	C																				
606	Sodium hydrosulfide	B																				
607	Sodium hydroxide	B	II	I																		
608	Sodium hypochlorite	BC																				
609	Sodium methylate	B																				
610	Sodium methyl dithiocarbamate	C																				
611	Sodium monofluoroacetate	A																				
612	Sodium nitrate	BC	II	O																		
613	Sodium phenol sulfonate	C																				
614	Sodium phosphate (dibasic)	BC																				
615	Sodium phosphate (monobasic)	BC																				
616	Sodium phosphate (tribasic)	BC																				
617	Sodium pyrophosphate	C																				
618	Sodium selenite	B	II	P																		
619	Sodium silicate	B	II	P																		
620	Sodium sulfate	C																				
621	Sodium sulfide	BC	II	P																		
622	Sodium sulfite	C	II	P																		
623	Stannic oxide	C																				
624	Strychnine	BC																				
625	Styrene	B	II	I																		
626	Sulfuric acid	B	II	C																		
627	Sulfur monochloride	B																				
628	2,4,5 - T(acid)	BC																				
629	2,4,5 - T(esters)	BC																				
630	2,3,6 - TBA	C																				
631	Tannic acid	B	II	C																		
632	TDE	B																				
633	TDX	C																				
634	Tear gas (CN Xchloroaceto-phenone)	A	I	I	2819																19	
635	Tear gas (CS) (2-chlorobenzylidene malononitrile)	A																				
636	Temik	C																				
637	TEPP	C																				
638	Tetraborane	A																				
639	Tetrachloro-ethane	C	II	I	2618																28	
640	Tetraethyl lead	BC	II	P	2818																29	
641	Tetraethyl pyrophosphate	BC	II	P																		
642	Tetramethyl lead	C	II	P	2818																29	
643	Tetranitromethane	C	II	O	2818																19	
644	Tetrazene	AC																				
645	TETRYL	C																				
646	Thallium compounds	AC	I	P	3339																28,33,34	
647	Thallium sulfate	C																				
648	Thallium sulfide	C																				
649	Thiocyanate	C																				
650	Thiosulfate	C																				
651	Tin	C																				
652	Titanium	C																				
653	Titanium dioxide	C																				

TABLE 25 --Continued

Hazardous Constituent		Source	Classification		Significant Producer																Significant User		
No.	Common Name		Category	Description	Booz-Allen Study	EPA - Action Guide (Appendix C)																Booz-Allen Study	
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
654	Toluene	BC	II	F																			
655	Toluene diisocyanate	C	II	I																			
656	Trichloron	B																					
657	Trichloroacetic acid	C																					
658	Trichlorobenzene	C	II	P																			
659	Trichlorobenzyl chloride	C																					
660	Trichloroethylene	C	II	P	2818																	22,28,34	
661	Trichlorophenol	B	II	P																			
662	Trichlorophenoxy acetic acid	C																					
663	Triethylamine	B			2818																	28	
664	Trimethylamine	B			2818																	28	
665	Trinitrotoluene (TNT)	C	I	E																			
666	Tungsten	C																					
667	Uranium	C																					
668	Uranium peroxide	B																					
669	Uranyl acetate	B																					
670	Uranyl nitrate	B																					
671	Uranyl sulfate	B																					
672	Vanadium	C																					
673	Vanadium oxytrichloride	B																					
674	Vanadium pentoxide	B			2819																	22,28,32,38	
675	Vanadium salts	C																					
676	Vanadyl sulfate	B	II	I																			
677	Vinyl acetate	B	II	F																			
678	Vinylidene chloride	C	II	F																			
679	Viruses	C																					
680	VX(ethoxymethylphosphoryl-N,N-dipropoxy-(2,2)-thiocholine)	A																					
681	Warfarin	C																					
682	Xylene	B	II	F	2815																	28	
683	Xylenol	B	II	P	2815																	28	
684	Zectran	B																					
685	Zinc	C																					
686	Zinc acetate	B																					
687	Zinc ammonium chloride	B																					
688	Zinc ammonium sulfate	B																					
689	Zinc arsenate	AC	I	P	2819																	28	
690	Zinc arsenite	AC	I	P	2819																	28	
691	Zinc borate	B																					
692	Zinc bromide	B																					
693	Zinc carbonate	BC																					
694	Zinc chloride	BC	II	O																			
695	Zinc chromate	C																					
696	Zinc cyanide	AC	I	P																			
697	Zinc fluoride	B																					
698	Zinc formate	B																					
699	Zinc hydrosulfite	B																					
700	Zinc nitrate	B	II	O	2819																	22,28	
701	Zinc oxide	C			2816,2819																	x	
702	Zinc permanganate	B	II	O	2819																	20,22,28,30,32,34	
703	Zinc phenolsulfomate	B																					
704	Zinc phosphide	B																					
705	Zinc potassium chromate	B																					
706	Zinc propionate	B																					
707	Zinc salts	C																					
708	Zinc silicofluoride	B																					
709	Zinc sulfate	B	II	P																			
710	Zinc sulfate monohydrate	B																					
711	Zinc sulfide	C	II	P																			
712	Zirconium	C																					
713	Zirconium acetate	B																					
714	Zirconium ammonium fluoride	B																					
715	Zirconium potassium fluoride	B																					
716	Zirconium nitrate	B																					
717	Zirconium oxychloride	B																					
718	Zirconium sulfate	B	II	P																			
719	Zirconium tetrachloride	B																					
*	Cacodylates	C																					
**	Nekal																						

APPENDIX G

Survey Forms for the County Health Departments and the District Sanitarians

- G-1 Memorandum No. EH-74-32
- G-2 Industrial Waste Survey Instructions
- G-3 Blank Form - List of Industries Within a County
- G-4 Industry Data Form II
- G-5 Follow-up Letter

State Board of Health

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Commissioner

R. LEROY CARPENTER, M.D., M.P.H.

Oklahoma

State Department of Health

Northeast 10th Street & Stonewall
Post Office Box 53551
Oklahoma City, Oklahoma 73105

December 2, 1974

MEMORANDUM NO. EH-74-32

TO: County Health Departments
Attention: Sanitararians

FROM: Loyd F. Pummill
Deputy Commissioner for
Environmental Health Services

SUBJECT: Industrial Waste Survey

In an effort to update our information on industrial wastes, we are conducting a comprehensive survey of all the manufacturing industries and a few selected mining industries which discharge wastes into navigable streams and municipalities. The purpose of this survey is to provide background information for the evaluation of facilities plans of wastewater treatment facilities now required as a regular part of the construction grants program.

Mr. Forrest Nelson, Director of the Oklahoma Water Resources Board (OWRB), was informed of this survey effort. Any information obtained from manufacturing and mining industries under the jurisdiction of the OWRB will be forwarded directly to that agency after receipt and review by this office.

We are enclosing a list of the selected industries for the survey within the county. Please fill out the enclosed "Data Form II" forms (one for each industry). The name of the industry and the corresponding SIC code number(s) have been supplied on the survey forms. Please advise Ms. Shelly Williamson, Water Quality Service, of any additions or deletions to the list of selected industries in your county.

LFP/SW/dw
Enclosure
cc: District Sanitararians

Table 1 - Units of Measurement by SIC Code (Industry)

SIC Code(s)	Code	Units of measurement	Industry
201; 2077	A-1	Pound live weight killed (meatpacking in slaughterhouse or packing-house; poultry processing).	Meat products.
	A-2	Pound product (slaughtering & rendering; processing).	
	A-3	Pound raw material (rendering in offsite plant).	
202; 5143	B-1	1,000 lb milk equivalent	Dairy products.
2033; 2034; 2037; 2038	C-1	Ton raw material	Canned and preserved fruits and vegetables.
204	D-1	1,000 bu processed	Grain mill products.
2061	E-1	Ton sugar cane processed	Raw cane sugar.
2062	E-2	Ton raw sugar processed	Cane sugar refining.
2063	E-3	Ton beets sliced	Beet sugar.
2077		See SIC 201	
2084	F-1	Ton grapes pressed	Wines, brandy, and brandy spirits.
	F-2	1,000 gal wine (table wine, for process season only).	
2085	F-3	1,000 bu grain processed	Distilled liquor, except brandy.
2086	F-4	1,000 standard cases	Bottled and canned soft drinks.
2091; 2092	G-1	Ton raw material	Seafoods.
22	H-1	1,000 lb raw material	Textile mill products.
	H-2	or 1,000 lb product	
2421	I-1	1,000 ft ³	Sawmills and planing mills.
2435; 2436	I-2	1,000 ft ² on three-eighths inch basis	Veneer and plywood.
2491	I-3	1,000 ft ³ treated	Wood preserving.
2492	I-4	1,000 ft ² on a three-fourths inch basis	Particle board.
26	J-1	Ton product	Paper and allied products.
2812; 2816; 2819	K-1	Ton product	Inorganic chemicals.
2821; 2823; 2824; 2891; 3079	L-1	1,000 lb product	Plastic materials and synthetics industry.
2822	M-1	1,000 lb rubber produced	Synthetic rubber (vulcanizable elastomers).
283	N-1	1,000 lb raw material	Drugs and pharmaceuticals.
2841	O-1	1,000 lb product	Soap and detergents.
	O-2	or 1,000 gal product	
2865; 2869	P-1	1,000 lb product	Organic chemicals.
2873; 2874; 2875	Q-1	1,000 ton product	Fertilizer industry.
2879	R-1	1,000 lb product	Agricultural chemicals and pesticides.
2891		See SIC 2821	
2911	S-1	1,000 bbl crude or partially refined feed stock (stream day).	Petroleum refining.
3011; 3021; 3031; 3041; 3069	T-1	1,000 lb raw material	Rubber products.
3111	U-1	1,000 lb green salted hides or pickled skins.	Leather tanning and finishing.
3211; 3231	V-1	1,000 ton product	Flat glass and glass products made from purchased glass.
	V-2	or 1,000 ft ² mirrored surface (for mirrored glass only).	
3241	V-3	1,000 bbl product	Hydraulic cement.
327	V-4	1,000 ton product	Concrete, gypsum, and plaster products.
3292	V-5	1,000 ton asbestos used	Asbestos products.
331	W-1	Ton dry coal	Coke making.
	W-2	Ton hot metal	Blast furnaces.
	W-3	Ton liquid steel	Steelworks.
	W-4	Ton hot formed steel	Hot forming.
	W-5	Ton processed steel	Rolling and finishing mills.
332	W-6	Ton metal cast	Iron and steel foundries.
333	X-1	1,000 lb metal product	Primary smelting and refining of nonferrous metals.
334	X-2	1,000 lb metal product	Secondary smelting and refining of nonferrous metals.
335	X-3	1,000 lb metal processed	Rolling, drawing, and extruding of nonferrous metals.
336	X-4	1,000 lb metal cast	Nonferrous foundries.
3465; 3711; 3714	Y-1	Unit production	Automobile manufacturing.
	Y-2	or square feet	
4911; 4931	Z-1	1,000 MWd generated	Electric power services.
4961	Z-2	1 million lb steam produced	Steam supply.

OKLAHOMA STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL HEALTH SERVICES
WATER QUALITY SERVICE

INDUSTRIAL WASTE SURVEY

Instructions:

We are interested in determining the volume of liquid wastes from manufacturing industrial sources. The term "waste" as applied in this survey refers to liquid wastes and will include semiliquids, sludges, and slurries. Do not include information relating to solid wastes.

Please complete the enclosed survey forms as completely as possible. In filling out the form actual data should be provided, if it is available. For any answers which are estimations (rather than actual data recorded, such as city water records obtained from meters) place within parentheses. Do not guess or round-off figures.

You may wish to request the assistance of the industries in obtaining the data and completion of the survey forms. An official within the industry knowledgeable of the company's waste disposal quantities and techniques should be consulted. If you receive assistance from the industries, please supervise the collection, handling, mailing, and returning of the survey forms to the State Health Department.

One blank "Data Form II" form is enclosed for each industry plus several extra copies. The name of the industry and the corresponding SIC code number(s) have been supplied on the survey forms. If an industry on your list has moved or gone out of business, please indicate that it is no longer in operation on the survey form.

Question No. 1 can be answered by consulting city or town water records. All other questions can be answered by consulting the industries. Question No.'s 4 through 9 and 15 are omitted for programming purposes, because the information is being obtained from other sources.

The units to be used in giving quantities of products are as listed in Table I (Units of Measurement by SIC Code (Industry)). Other SIC categories should use the units of measure normally used by that industry.

Please remember that our object is to make a reasonable and accurate determination of the industrial waste in your area. The information obtained from this survey will be used for evaluation purposes for facility plans and not for regulatory purposes. As further protection to the industries, the data will be combined and coded so that individual entities cannot be identified. Your assistance and cooperation in filling out and returning the enclosed forms will be of great assistance to the Department.

Return survey forms by _____ to Ms. Shelly Williamson, Water Quality Service, Oklahoma State Department of Health.

OKLAHOMA STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL HEALTH SERVICES
WATER QUALITY SERVICE
INDUSTRIAL WASTE SURVEY

COUNTY: _____

<u>NAME OF INDUSTRY</u>	<u>LOCATION</u>	<u>ADDRESS</u>	<u>TOWN</u>
-------------------------	-----------------	----------------	-------------

**INDUSTRIAL WASTE SURVEY
DATA FORM II**

Confidential (No individual identification of data - all data will be coded)

<u>Name of Industry</u>	<u>Code No.</u>
-------------------------	-----------------

1. a. Volume of municipal water supply (gallons): (Please state the units of measurement used, such as gallons or thousands or tens of thousands of gallons.)

<u>Nov 1973</u>	<u>Mar 1974</u>	<u>Jul 1974</u>
<u>Dec 1973</u>	<u>Apr 1974</u>	<u>Aug 1974</u>
<u>Jan 1974</u>	<u>May 1974</u>	<u>Sept 1974</u>
<u>Feb 1974</u>	<u>Jun 1974</u>	<u>Oct 1974</u>

b. Unit measurement _____

2. Are additional sources of water supply used? ☐ Yes ☐ No
If yes, complete following. (Please state the units of measurement used, such as gallons or thousands or tens of thousands of gallons.)

	<u>Check if Used</u>	<u>Average Daily Volume</u>	<u>Average Monthly Volume</u>	<u>% of Total Water Supply</u>
a. Private Supply	_____	_____	_____	_____
b. Stream	_____	_____	_____	_____
c. Other (specify) _____	_____	_____	_____	_____
d. Unit of measurement _____				

3. What is the most recent annual production volume or number of units manufactured of products. (indicate unit, i.e. barrels, tons, etc.)? (Refer to Table I.)

<u>SIC Code</u>	<u>Product A</u>	<u>Quantity & Unit of A</u>	<u>Product B</u>	<u>Quantity & Unit of B</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

10. a. What is the total volume of effluent discharged? _____
Average Daily Average Monthly

b. Type of effluent (check one or more):
☐ Sanitary Sewer ☐ Industrial Waste ☐ Cooling

c. Volume of water used for cooling: _____
Average Daily

11. Plant effluent being recirculated? ☐ Yes ☐ No If yes: _____
Volume gals/day

12. Flow characteristics of effluent (check one): ☐ Continuous ☐ Intermittent ☐ Batch

13. Pre-treatment of wastes? ☐ Yes ☐ No If yes, answer following:

a. Type of pre-treatment (check one or more): ☐ Physical ☐ Chemical
☐ Biological ☐ Advanced

b.

<u>Volume treated (gallons)</u>	<u>% of total effluent</u>	<u>Volume discharged after treatment</u>
---------------------------------	----------------------------	--

c. Type of Treatment _____

14. Method of Disposal:

a. On-Site Disposal - other than sanitary sewers: ☐ Yes ☐ No

(1) No. of Sites _____

(2) Volume (list separately for each site): _____

b. Off-Site Disposal: ☐ Yes ☐ No

(1) No. of Sites _____

(2) Locations: _____

(3) Volume (list separately for each site): _____

c. Facilities utilized for disposal of liquid waste only (check, if utilized):

	<u>On-Site</u>	<u>Off-Site</u>
(1) Sanitary Sewers	_____	_____
(2) Stream	_____	_____
(3) Municipal Landfill	_____	_____
(4) Burial (deep or surface-other than municipal landfill)	_____	_____
(5) Licensed hazardous waste site at Washington	_____	_____
(6) Private Contractor	_____	_____
(7) Private Landfill	_____	_____
(8) Dump	_____	_____
(9) Deepwell industrial injection	_____	_____
(10) Mine Disposal	_____	_____
(11) Open Burning	_____	_____
(12) Incineration	_____	_____
(13) Lagoon (ultimate disposal)	_____	_____
(14) Recycle	_____	_____
(15) Other (specify) _____	_____	_____

16. Other Methods of Disposal of Collected Wastes:

	<u>Check if used</u>	<u>Location of Disposal</u>	<u>Volume</u>
(1) Plastic/concrete encapsulation	_____	_____	_____
(2) Steel Drums	_____	_____	_____
(3) Leachate Collection & Treatment	_____	_____	_____
(4) Industrial Chemical Containers	_____	_____	_____
(5) Other (specify) _____	_____	_____	_____

17. Estimated average number of employees during 1974? _____

18. Has the industry been in business in the county at the same location (refer to list of industries) for more than one year? ☐ Yes ☐ No Year established? _____

REPORT PREPARED BY _____ (Name) _____ (Title)

Date Form Completed _____

State Board of Health

BOB E. BUTENICK, D.S., President
ROBERT E. WICKLOW, D.O., Vice President
THOMAS BORICA, M.D., Secretary
CLAU L. BARNES, M.D.
WALLACE SPYER, M.D.
ARNOLD MELBY
BURTON A. GIBBS, M.D.
W.A. "TAM" TAYLOR
WALDO A. TONE



Oklahoma
State Department of Health

Northeast 10th Street & Stonewall
Post Office Box 43551
Oklahoma City, Oklahoma 73103

Commissioner

R. LEROY CARPENTER, M.D., M.P.H.

March 10, 1975

TO: County/District Sanitarians

FROM: Shelly J. Williamson *SJW*
Water Quality Service

RE: Memorandum No. EH-74-32
Industrial Waste Survey

According to our records you were mailed _____ number of survey forms on _____, 197_. We requested that all the survey forms be returned by _____, 1975. We realize this was a short time period to complete a sizeable task.

Would you please let us know when we can expect the completed forms? If you have any particular problems, I would be happy to answer any questions. If you need some assistance in completing the surveys, possibly I can provide some help. It is extremely important that all surveys be returned as soon as possible in order to meet our deadlines for the writing of the report and analysis of the data.

Thank you for your cooperation.

SJW/dw

APPENDIX H

City of Tulsa - Industrial Survey Forms

- H-1 Cover Letter to Industries Within the City of Tulsa
- H-2 Cover Letter to Industries Within the Tulsa Metropolitan Area
- H-3 Instructions for Completing Industrial Influent Source Information Form (TUL-1676)
- H-4 Industrial Influent Source Information (TUL-1676)
- H-5 Sample of a Follow-up Letter to Industries Within the City of Tulsa
- H-6 Sample of a Follow-up Letter to Industries Within the Regional Metropolitan Area

WATER AND SEWER
DEPARTMENT



NOV 1 1974

2317 SOUTH JACKSON • TULSA, OKLAHOMA • 74107

August 19, 1974

TO: ALL INDUSTRIES WITHIN THE
TULSA METROPOLITAN AREA

RE: Wastewater Discharges

Gentlemen:

The City of Tulsa is currently receiving National Pollutant Discharge Elimination System (NPDES) Permits from the U. S. Environmental Protection Agency (EPA) for the wastewater treatment plants which are operated by the Water and Sewer Department. The NPDES Permit requires that we furnish the EPA certain information about the industries which are discharging wastewater into the sanitary sewer system or into area waters. In order for this Department to comply with the deadlines which have been placed upon the City, we must have the enclosed forms completed and returned no later than Friday, September 27, 1974. Please comply by that date.

The information contained within this form will be used to evaluate the present sewage treatment and future treatment needs. The form will also be used to identify "Major" contributing industries and to locate possible sources of incompatible pollutants entering the system.

In completing the forms please consult the enclosed instructions. If further information is required please contact:

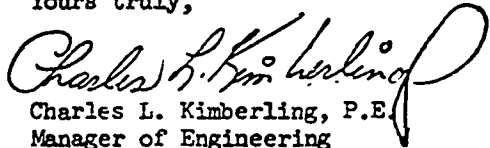
Charles L. Kimberling, P.E.
2317 South Jackson Avenue
Tulsa, Oklahoma 74107
PHONE: 581-5189

OR

Monte Hannon, PHONE: 581-5592

Your immediate attention to this would be appreciated.

Yours truly,


Charles L. Kimberling, P.E.
Manager of Engineering

CLK:jw
Attachments

REGIONAL METROPOLITAN UTILITY AUTHORITY

2317 SOUTH JACKSON

TULSA, OKLAHOMA 74107
918-581-5580

August 21, 1974

TO: ALL INDUSTRIES WITHIN THE
TULSA METROPOLITAN AREA

RE: Wastewater Discharges

The City you are located in has accepted Beneficial Interest in the Regional Metropolitan Utility Authority. The Regional Authority is currently preparing a facilities plan and study for the region under a Step I grant from the U. S. Environmental Protection Agency (EPA).

In order to fulfill the requirements for the grant, we need to obtain information about each of the industries located in the Tulsa Metropolitan Area, whether they are discharging their liquid waste into a municipal sanitary sewer or not. Also, the City will receive a National Pollutant Discharge Elimination System (NPDES) Permit from the EPA. This permit requires that the City provide EPA with certain information about industrial wastewater.

Deadlines have been placed upon both the City and the Regional Authority, thus we need the enclosed form completed and returned by Friday, September 27, 1974. Please comply by that date.

The information contained within this form will be used to evaluate the present sewage treatment and future treatment needs. The form will also be used to identify "Major" contributing industries and to locate possible sources of incompatible pollutants entering the sanitary sewer system.

In completing the forms please consult the enclosed instructions. If further information is required from the Authority please contact:

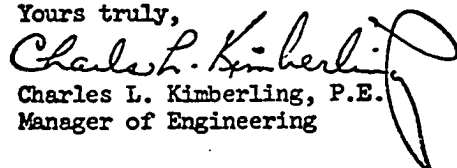
Charles L. Kimberling, P.E.
Manager of Engineering
2317 South Jackson Avenue
Tulsa, OK 74107
PHONE: 581-5580

OR

Monte Hannon, PHONE: 581-5592

Your immediate attention to this would be appreciated.

Yours truly,


Charles L. Kimberling, P.E.
Manager of Engineering

CLK:jw

INSTRUCTIONS FOR COMPLETING INDUSTRIAL EFFLUENT
SOURCE INFORMATION FORM (TUL-1676)

In filling out the form actual data should be provided if it is available. If actual data is not available, a best estimate should be provided. This should be marked "interim" with a statement indicating when the actual information will be available. If an item does not apply, it should be marked "NA".

The blocks marked "I.D. Number," "Permit Number," and "Stream System" (Stream System) are for Water and Sewer Department use, DO NOT FILL THESE BLOCKS IN.

The industry name block is self explanatory, it requires the mailing address and the location of the industry.

The Facilities Operations section requires information about the operation of your facility. If the facility operates on an irregular basis (i.e. Seasonal) this should be noted in the process description. The units to be used in giving quantities of products and raw materials are as listed in Table I (Units of Measurement by SIC Code (Industry)). Other SIC categories should use the units of measure normally used by that industry.

The section titled Domestic Wastewater requires information about the number of persons employed at the facility. The amount of wastewater produced in the sanitary facilities and kitchens located within the facility in gallons per day (GPD), and how this waste is disposed of.

The Solid Waste section requires information about the types of solid wastes produced, i.e. Office Waste, Scrap Steel, Wood Scraps, etc. The amounts produced and the methods of disposal.

The Industrial Wastewater Characteristics section requires information about the quantity of water produced including how often the various types of waste are discharged and how much is discharged in millions of gallons per day (MGD). Also required is the location of the discharge and to what and where the discharge is made, (i.e. Sanitary Sewer, Storm Sewer, Stream, etc.)

In the section titled Industrial Wastewater Composition requires a description of what the water was used for in your processes. Also, if the wastewater has been tested, how the samples were collected, by whom the tests were run, and when. The rest of this section requires the results of these tests as to the concentrations of various substances the wastewater contains (1) as Industry Effluent (after the processes it is used in, prior to any in-plant pretreatment); (2) as Industry Pretreatment Effluent (after in-plant treatment, if any); and (3) as Municipal System Influent (whatever is discharged into the municipal sewer system, in some cases this will be the same as the Industry Effluent or the Pretreatment Effluent). We have found two printing errors in this section. 1) Item 10. PH should be pH, and 2) Item 28. Radio Active Materials should be Radioactive Materials.

The Industrial Wastewater Treatment Facilities section requires a description of the in-plant treatment given to your wastewater before it is discharged to the municipal sanitary sewer, storm sewer or stream.

The Untreated Wastewater Disposal section requires information about the disposal of the industrial wastewater if there are no in-plant pretreatment facilities.

The form is then to be signed by an official within the company knowledgeable of waste disposal techniques used.

After the form is completed, place the original and one carbon copy in the enclosed envelope. (The remaining carbon copy is for your records). Attach a stamp and mail the envelope.

Table 1 - Units of Measurement by SIC Code (Industry)

SIC Code(s)	Code	Units of measurement	Industry
201; 2077	A-1	Pound live weight killed (meatpacking in slaughterhouse or packinghouse; poultry processing).	Meat products.
	A-2	Pound product (slaughtering & rendering; processing).	
	A-3	Pound raw material (rendering in offsite plant).	
202; 5143	B-1	1,000 lb milk equivalent	Dairy products.
2033; 2034; 2037; 2038	C-1	Ton raw material	Canned and preserved fruits and vegetables.
204	D-1	1,000 bu processed	Grain mill products.
2061	E-1	Ton sugar cane processed	Raw cane sugar.
2062	E-2	Ton raw sugar processed	Cane sugar refining.
2063	E-3	Ton beets sliced	Beet sugar.
2077		See SIC 201	
2084	F-1	Ton grapes pressed	Wines, brandy, and brandy spirits.
	F-2	1,000 gal wine (table wine, for process season only).	
2085	F-3	1,000 bu grain processed	Distilled liquor, except brandy.
2086	F-4	1,000 standard cases	Bottled and canned soft drinks.
2091; 2092	G-1	Ton raw material	Seafoods.
22	H-1	1,000 lb raw material	Textile mill products.
	H-2	or 1,000 lb product	
2421	I-1	1,000 fbm	Sawmills and planing mills.
2435; 2436	I-2	1,000 ft ² on three-eighths inch basis	Veneer and plywood.
2491	I-3	1,000 ft ³ treated	Wood preserving.
2492	I-4	1,000 ft ² on a three-fourths inch basis	Particle board.
26	J-1	Ton product	Paper and allied products.
2812; 2816; 2819	K-1	Ton product	Inorganic chemicals.
2821; 2823; 2824; 2891; 3079	L-1	1,000 lb product	Plastic materials and synthetics industry.
2822	M-1	1,000 lb rubber produced	Synthetic rubber (vulcanizable elastomers).
283	N-1	1,000 lb raw material	Drugs and pharmaceuticals.
2841	O-1	1,000 lb product	Soap and detergents.
	O-2	or 1,000 gal product	
2845; 2849	P-1	1,000 lb product	Organic chemicals.
2873; 2874; 2875	Q-1	1,000 ton product	Fertilizer industry.
2879	R-1	1,000 lb product	Agricultural chemicals and pesticides.
2891		See SIC 2821	
2911	S-1	1,000 bbl crude or partially refined feed stock (stream day).	Petroleum refining.
3011; 3021; 3031; 3041; 3069	T-1	1,000 lb raw material	Rubber products.
3111	U-1	1,000 lb green salted hides or pickled skins.	Leather tanning and finishing.
3211; 3231	V-1	1,000 ton product	Flat glass and glass products
	V-2	or 1,000 ft ² mirrored surface (for mirrored glass only).	made from purchased glass.
3241	V-3	1,000 bbl product	Hydraulic cement.
327	V-4	1,000 ton product	Concrete, gypsum, and plaster products.
3292	V-5	1,000 ton asbestos used	Asbestos products.
331	W-1	Ton dry coal	Coke making.
	W-2	Ton hot metal	Blast furnaces.
	W-3	Ton liquid steel	Steelworks.
	W-4	Ton hot formed steel	Hot forming.
	W-5	Ton processed steel	Rolling and finishing mills.
332	W-6	Ton metal cast	Iron and steel foundries.
333	X-1	1,000 lb metal product	Primary smelting and refining of nonferrous metals.
334	X-2	1,000 lb metal product	Secondary smelting and refining of nonferrous metals.
335	X-3	1,000 lb metal processed	Rolling, drawing, and extruding of nonferrous metals.
336	X-4	1,000 lb metal cast	Nonferrous foundries.
3465; 3711; 3714	Y-1	Unit production	Automobile manufacturing.
	Y-2	or square feet	
4911; 4931	Z-1	1,000 MWh generated	Electric power services.
4961	Z-2	1 million lb steam produced	Steam supply.

INDUSTRIAL INFLUENT SOURCE INFORMATION

TUL-1076

NAME OF INDUSTRY		STANDARD INDUSTRY CLASSIFICATION (SIC) CODE		DATE	
MAILING ADDRESS	CITY	COUNTY	STATE	ZIP CODE	PHONE
FACILITY ADDRESS	CITY	COUNTY	STATE	ZIP CODE	PHONE

FACILITY OPERATIONS

FACILITY NORMALLY OPERATES		PRODUCTS MANUFACTURED AND QUANTITY	
DAYS PER WEEK:	HOURS PER DAY:	PRODUCTS:	QUANTITY:

BRIEF DESCRIPTION OF FACILITY PROCESSES:

PRINCIPAL PRODUCTS	QUANTITY	UNITS	RAW MATERIALS	QUANTITY	UNITS

DOMESTIC WASTEWATER

NUMBER OF PERSONS SERVED	VOLUME G.P.D.	METHOD OF DISPOSAL
--------------------------	---------------	--------------------

REMARKS

SOLID WASTE

TYPE OF SOLID WASTES
VOLUME OF SOLID WASTES (TONS PER DAY)
METHOD OF DISPOSAL

INDUSTRIAL WASTEWATER CHARACTERISTICS

QUANTITY		FREQUENCY OF DISCHARGE			FLOW (MGD)		
		CONTINUOUS	PERIODIC BATCH	INTERMITTENT BATCH	MINIMUM	AVERAGE	MAXIMUM
DOMESTIC	Existing						
	Design						
INDUSTRIAL	Existing						
	Design						

LOCATION OF DISCHARGE TO SANITARY SEWER, STORM SEWER, STREAM

INDUSTRIAL WASTEWATER COMPOSITION

INDUSTRIAL WASTEWATER COMPOSITION							
TYPE OF WASTEWATER		METHOD OF SAMPLE COLLECTION AND ANALYSIS					
TYPE		ANALYSIS BY		SAMPLE DATE AND TIME			
☐ Grab Sample		☐ In Plant		1.			
☐ Average Grab Sample		☐ Independent Testing Lab.		2.			
☐ Composite Sample		☐ Government Agency		3.			
☐ Continuous		NAME OF AGENCY		4.			

AVERAGE QUALITY	INDUSTRY EFFLUENT (mg/l)	INDUSTRY PRE-TREATMENT EFFLUENT (mg/l)	MUNICIPAL SYSTEM INFLUENT (mg/l)	AVERAGE QUALITY	INDUSTRY EFFLUENT (mg/l)	INDUSTRY PRE-TREATMENT EFFLUENT (mg/l)	MUNICIPAL SYSTEM INFLUENT (mg/l)
1. Total Solids				16. Oil and Grease			
2. Total Settleable Solids				17. Cr			
3. Total Suspended Solids				18. Cu			
4. Total Dissolved Solids				19. Fe			
5. B.O.D. ₅				20. Cd			
6. C.O.D.				21. Pb			
7. Fecal Coliform Bacteria NO/100ML				22. Mn			
8. D.O.				23. Zn			
9. Temperature				24. F			
10. PH				25. As			
11. Phosphorus Total (asP)				26. Ag			
12. NH ₃ (asN)				27. Alkyl Benzene Sulfonate			
13. NO ₃ (asN)				28. Radio Active Materials			
14. NO ₂ (asN)				29. Others (Specify)			
15. Chlorine Demand				30. Others (Specify)			

INDUSTRIAL WASTEWATER TREATMENT FACILITIES

PHYSICAL PRETREATMENT
CHEMICAL PRETREATMENT
BIOLOGICAL TREATMENT
SLUDGE HANDLING AND DISPOSAL
TERMINAL SECONDARY TREATMENT
ADVANCED TREATMENT
REMARKS

UNTREATED WASTEWATER DISPOSAL

METHOD AND LOCATION
REMARKS

THIS IS TO VERIFY THAT THE INFORMATION PRESENTED ABOVE IS A TRUE AND ACCURATE REPRESENTATION OF ALL THE INDUSTRIAL WASTES HAVING A SOURCE WITHIN THE INDUSTRY NAMED.

SIGNATURE	TITLE	DATE

DATE

NAME
ADDRESS

Dear Mr. _____:

This letter is in reference to the Industrial Influent Source Information Form (TUL-1676) which Mr. J. D. Smith, Plant Operations, returned dated September 12, 1974 (Enclosed).

Because the City of Tulsa is severely limited by a deficiency of funds, manpower, equipment, and outfall access, we cannot operate a monitoring program which would cover all industries within the City, much less the wide variety of pollutants which are contributed by these industries.

Consequently, we must insist that you have an independent or an in plant testing laboratory run a series of tests upon the wastewater effluent from your plant. The tests as listed on the Industrial Influent Source Information Form which you should have run include: (1) Total Solids; (2) Total Settleable Solids; (3) Total Suspended Solids; (4) Total Dissolved Solids; (5) BOD₅; (6) COD; (7) Fecal Coliform Bacteria; (9) Temperature; (10) pH; (11) Phosphorus Total; (12) NH₃; (13) NO₃; (14) NO₂; (15) Chlorine Demand; (16) Oil and Grease and (27) Alkyl Benzene Sulfonate. Also tests should be run for any material used in your processes or cleaning operations which might reach the sewer.

A composite sample of the effluent should be taken over an entire operating day and the tests run on this sample. A copy of the lab report should then be sent to our office in the envelope enclosed. There are a number of labs in Tulsa which have the capacity to run these tests. Any of these labs would be acceptable to our Department.

The City of Tulsa is being required to place these requirements upon industries in order to comply with the permits we have received from the U. S. Environmental Protection Agency. Thus, we hope that you will voluntarily comply with our request.

If we can be of further assistance to you in this matter, please feel free to contact wither Monte Hannon (Phone 581-5592) or myself.

Very truly yours,

Charles L. Kimberling, P. E.
Assistant Superintendent

CLK:MTH:rc
Enclosure
CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Re: Industrial Wastewater
Information Form

Dear _____:

The Regional Metropolitan Utility Authority has initiated studies to determine the most efficient method of treating the wastewater produced in this area. This is being done so that all cities in the region can comply with wastewater treatment requirements which have been established by the United States Environmental Protection Agency (EPA). (Your City name) has utilized the Regional Authority to have this study prepared in order to conserve as much local money as possible. Not only is the study being prepared on a regional basis, but regional wastewater treatment is also being considered.

The EPA requires that "major" industries which may use the wastewater treatment facilities be identified, not only by the volume of the water they use, but also by the content of the wastewater produced. (A "major" industry is defined as one which: (1) Has a flow of 50,000 gallons or more per average work day; (2) has a flow greater than 5 per cent of the total flow carried by the municipal system receiving the waste; (3) Has a toxic material in its discharge; or (4) Has significant impact on the treatment works or the quality of its effluent.)

The Regional Authority sent a questionnaire to each industry in the area. Many of these questionnaires have not yet been returned. In order for the Engineers to complete this study they must obtain the information requested on the form. Also, the City must obtain this information in order to comply with the Discharge Permit we have obtained from the EPA.

Thus, I urge you to complete the enclosed forms. It is requested that even though you may not be a "major" industry that you fill out the portions which may apply and return the forms.

If you would like more information, please contact Charles L. Kimberling, Manager of Engineering, The Regional Metropolitan Utility Authority, 2317 South Jackson Avenue, Tulsa, Oklahoma 74107 (Phone 581-5580), or Monte Hannon (Phone 581-5592).

Thank you for taking care of this matter.

Sincerely,

(Mayor, City Manager, etc.)

APPENDIX I

City of Oklahoma City - Industrial Survey Forms

- I-1 Cover Letter
- I-2 Instructions for Completing Industrial Influent Source Information Form
- I-3 Blank Survey Form - Industrial Influent Source Information

CITY of OKLAHOMA CITY

OKLAHOMA CITY, 73102

MUNICIPAL BUILDING

200 NORTH WALKER

February 17, 1975



Mayer

PATIENCE LATTING

TO: ALL INDUSTRIES WITHIN THE
OKLAHOMA CITY METROPOLITAN AREA

RE: Wastewater
Discharges

Gentlemen:

Councilman
F. ANTHONY ZAHN
ERIC GROVES
NEAL A. BALKAN
BILL H. BISHOP
JOHN M. SMITH
KEN BOYER
REV. GOREE L. JAMES
STEWART E. MEYERS, SR.

City Manager
M. D. McMAHAN

The City of Oklahoma City is currently receiving National Pollutant Discharge Elimination System (NPDES) Permits from the U.S. Environmental Protection Agency (EPA) for the wastewater treatment plants which are operated by the Water Pollution Control Division, Oklahoma City Public Works Department. The NPDES Permit requires that we furnish the EPA certain information about the industries which are discharging wastewater into the sanitary sewer system or into area waters. In order for this Department to comply with the deadlines which have been placed upon the City, we must have the enclosed forms completed and returned no later than Friday March 17, 1975. Please comply by that date.

The information contained within this form will be used to evaluate the present sewage treatment and future treatment needs. The form will also be used to identify "Major" contributing industries and to locate possible sources of incompatible pollutants entering the system.

In completing the forms please consult the enclosed instructions. TECHRAD will be processing the information. If further information is required, please contact:

TECHRAD
4619 North Santa Fe
Oklahoma City, Oklahoma 73118
Telephone 528-7016

Your immediate attention to this would be appreciated.

Yours truly,

Thomas J. Carpenter, Superintendent
Water Pollution Control Division

"PEOPLE Are Our Business"

TJC/lp

**INSTRUCTIONS FOR COMPLETING INDUSTRIAL EFFLUENT
SOURCE INFORMATION FORM**

In filling out the form actual data should be provided, if it is available. If actual data is not available, a best estimate should be provided. This should be marked "interim" with a statement indicating when the actual information will be available. Do not guess or round-off figures. If an item does not apply, it should be marked "NA".

- I. The industry name block is self explanatory, it requires the mailing address and the location of the industry. SIC codes should be given in order of importance (code for the principal product listed first, code for the second most important product listed second, etc). Leave the space blank if SIC codes are not known.
- II. The Facilities Operations section requires information about the operation of your facility. If the facility operates on an irregular basis (i.e. Seasonal) this should be noted in the process description. The units to be used in giving quantities of products and raw materials are as listed in Table I (Units of Measurement by SIC Code (Industry)). Do not be alarmed if your particular SIC code(s) does not appear in Table I.
- III. The Industrial Wastewater Characteristics section requires information about the quantity of water produced including how often the various types of waste are discharged and how much is discharged in millions of gallons per day (MGD). Also required is the total volume discharged.
- IV. The Solid Waste section requires information about the types of solid wastes produced, i.e. Office Waste, Scrap Steel, Wood Scraps, etc. and the amounts produced.
- V. The section titled Industrial Wastewater Composition requires a description of what the water was used for in your processes. Also, if the wastewater has been tested, information is required concerning how the samples were collected, by whom the tests were run, and when. Three or more samples must be taken if an average grab sample is reported. Also, the flow at the different times of sampling must be taken into account. The rest of this section requires the results of these tests as to the concentrations of various substances the wastewater contains (1) as Industry Effluent (after the processes it is used in, prior to any in-plant pretreatment); (2) as Industry Pretreatment Effluent (after in-plant treatment, if any); and (3) as Municipal System Influent (whatever is discharged into the municipal sewer system, in some cases this will be the same as the Industry Effluent or the Pretreatment Effluent). If any of the 40 items are used in a process but not analyzed in the effluent, please indicate with a check mark.
- VI. The Industrial Wastewater Treatment/Disposal Facilities section requires a description of the in-plant pretreatment given to your wastewater before it is discharged to the municipal sanitary sewer, storm sewer or stream and the location and method of disposal of the waste.

The form is then to be signed by an official within the company knowledgeable of waste disposal techniques used. After the form is completed, place it in the enclosed envelope. Attach a stamp and mail the envelope.

Table 1 - Units of Measurement by SIC Code (Industry)

SIC Code(s)	Code	Units of measurement	Industry
201; 2077	A-1	Pound live weight killed (meatpacking in slaughterhouse or packing-house; poultry processing).	Meat products.
	A-2	Pound product (slaughtering & rendering; processing).	
	A-3	Pound raw material (rendering in offsite plant).	
202; 5143	B-1	1,000 lb milk equivalent	Dairy products.
2033; 2034; 2037; 2038	C-1	Ton raw material	Canned and preserved (fruits and vegetables).
204	D-1	1,000 bu processed	Grain mill products.
2061	E-1	Ton sugar cane processed	Raw cane sugar.
2062	E-2	Ton raw sugar processed	Cane sugar refining.
2063	E-3	Ton beets sliced	Beet sugar.
2077		See SIC 201	
2084	F-1	Ton grapes pressed	Wines, brandy, and brandy spirits.
	F-2	1,000 gal wine (table wine, for process season only).	
2085	F-3	1,000 bu grain processed	Distilled liquor, except brandy.
2086	F-4	1,000 standard cases	Bottled and canned soft drinks.
2091; 2092	G-1	Ton raw material	Seafoods.
22	H-1	1,000 lb raw material	Textile mill products.
	H-2	or 1,000 lb product	
2421	I-1	1,000 fbm	Sawmills and planing mills.
2435; 2436	I-2	1,000 ft ² on three-eighths inch basis	Veneer and plywood.
2491	I-3	1,000 ft ³ treated	Wood preserving.
2492	I-4	1,000 ft ² on a three-fourths inch basis	Particle board.
26	J-1	Ton product	Paper and allied products.
2812; 2816; 2819	K-1	Ton product	Inorganic chemicals.
2821; 2823; 2824; 2891; 3079	L-1	1,000 lb product	Plastic materials and synthetics industry.
2822	M-1	1,000 lb rubber produced	Synthetic rubber (vulcanizable elastomers).
283	N-1	1,000 lb raw material	Drugs and pharmaceuticals.
2841	O-1	1,000 lb product	Soap and detergents.
	O-2	or 1,000 gal product	
2865; 2869	P-1	1,000 lb product	Organic chemicals.
2873; 2874; 2875	Q-1	1,000 ton product	Fertilizer industry.
2879	R-1	1,000 lb product	Agricultural chemicals and pesticides.
2891		See SIC 2821	
2911	S-1	1,000 bbl crude or partially refined feed stock (stream day).	Petroleum refining.
3011; 3021; 3031; 3041; 3069	T-1	1,000 lb raw material	Rubber products.
3111	U-1	1,000 lb green salted hides or pickled skins	Leather tanning and finishing.
3211; 3231	V-1	1,000 ton product	Flat glass and glass products made from purchased glass.
	V-2	or 1,000 ft ² mirrored surface (for mirrored glass only).	
3241	V-3	1,000 bbl product	Hydraulic cement.
327	V-4	1,000 ton product	Concrete, gypsum, and plaster products.
3292	V-5	1,000 ton asbestos used	Asbestos products.
331	W-1	Ton dry coal	Coke making.
	W-2	Ton hot metal	Blast furnaces.
	W-3	Ton liquid steel	Steelworks.
	W-4	Ton hot formed steel	Hot forming.
	W-5	Ton processed steel	Rolling and finishing mills.
332	W-6	Ton metal cast	Iron and steel foundries.
333	X-1	1,000 lb metal product	Primary smelting and refining of nonferrous metals.
334	X-2	1,000 lb metal product	Secondary smelting and refining of nonferrous metals.
335	X-3	1,000 lb metal processed	Rolling, drawing, and extruding of nonferrous metals.
336	X-4	1,000 lb metal cast	Nonferrous foundries.
3465; 3711; 3714	Y-1	Unit production or square feet	Automobile manufacturing.
	Y-2		
4911; 4931	Z-1	1,000 MWd generated	Electric power services.
4961	Z-2	1 million lb steam produced	Steam supply.

INDUSTRIAL INFLUENT SOURCE INFORMATION

I.D. Number

Permit Number

Steam System

Do Not Write Above Double Line

I GENERAL

Name of Industry	Date	Standard Industry Classification (SIC) Codes			
Mailing Address	City	County	State	Zip Code	Phone
Facility Address	City	County	State	Zip Code	Phone

II FACILITY OPERATIONS

Facility Normally Operates

Days Per Week	Hours Per Day	Shifts Per Day	Average Employees- Typical Week
Year Established	Length of Time in Business Under Present Name	Previous Name if Applicable	

Brief Description of Facility Processes

RAW MATERIALS	Leave Blank	PRINCIPAL PRODUCTS	Annual Quantity	Units (Refer to Table I)

III INDUSTRIAL WASTEWATER CHARACTERISTICS

	FREQUENCY OF DISCHARGE			FLOW (MGD)		
	Contin- uous	Inter- mittent	Batch	Minimum	Average	Maximum
1. Domestic						
2. Industrial						
3. Cooling						

Total Volume Discharged

IV SOLID WASTE

Type of Solid Wastes (Describe)	Volume of Solid Wastes (Tons Per Day)
---------------------------------	--

V INDUSTRIAL WASTEWATER COMPOSITION

METHOD OF SAMPLE COLLECTION AND ANALYSIS

TYPE	ANALYSIS BY	SAMPLE DATE AND TIME
☐ Grab Sample	Name	1.
☐ Average Grab Sample	☐ Independent Testing Lab	2.
☐ Composite Sample	☐ In Plant	3.
☐ Continuous	☐ Government Agency	4.

AVERAGE QUALITY	Industry Effluent (mg/l)	Industry Pre-Treatment (mg/l)	Municipal System Influent (mg/l)	AVERAGE QUALITY	Industry Effluent (mg/l)	Industry Pre-Treatment (mg/l)	Municipal System Influent (mg/l)
1. Total Solids				20. Al			
2. Total Settleable Solids				21. Cu			
3. Total Suspended Solids				22. Fe			
4. Total Dissolved Solids				23. Cd			
5. B.O.D. 5 day				24. Pb			
6. C.O.D.				25. Mn			
7. Fecal Coliform Bacteria No/100 ml				26. Zn			
8. D.O.				27. F			
9. Temperature				28. As			
10. pH				29. Ag			
11. Phosphorus Total (asP)				30. Ni			
12. NH ₃ (asN)				31. Alkyl Benzene Sulfonate			
13. NO ₃ (asN)				32. Cyanides			
14. NO ₂ (asN)				33. Phenols			
15. Chlorides				34. Asbestos			
16. Sulfides				35. Hydrocarbons - Total			
17. Oil and Grease				36. Halogenated hydrocarbons			
18. Cr - Total				37. Pesticides			
19. Cr + 6				38. Radioactive Materials			
				39. Beryllium			
				40. Others (Specify)			

VI INDUSTRIAL WASTEWATER TREATMENT/DISPOSAL FACILITIES

PRETREATMENT

Effluent recirculated?	Volume (gals/day)	
Yes ☐ No ☐		
Pretreatment of wastes?	Type of Pretreatment	
Yes ☐ No ☐	☐ Physical ☐ Biological ☐ Chemical ☐ Advanced	
Volume treated (gals)	% total effluent	Pretreated volume discharged
Describe type of pretreatment		

DISPOSAL					
On-Site (not sanitary sewer)		No. Sites		Volume for Each Site	
Yes ☐	No ☐				
Off-Site		No. Sites		Volume for Each Site	Locations
Yes ☐	No ☐				
DISPOSAL FACILITIES (Check if Used)					
Disposal Facility	Liquid		Solid		
	On-Site	Off-Site	On-Site	Off-Site	
1. Sanitary sewer					
2. Storm sewer					
3. Stream					
4. Municipal landfill					
5. Burial (deep or surface) (not municipal landfill)					
6. Licensed hazardous waste site					
7. Private contractor					
8. Private landfill					
9. Dump					
10. Deepwell industrial injection					
11. Mine disposal					
12. Open burning					
13. Incineration					
14. Lagoon (ultimate disposal)					
15. Recycle					
16. Other (specify)					
OTHER METHODS OF DISPOSAL OF COLLECTED WASTES					
Method	Check if Used		Location	Volume	
	Liquid	Solid		Liquid	Solid
1. Plastic/concrete encapsulation					
2. Steel drums					
3. Leachate collection and treatment					
4. Industrial chemical containers					
5. Other (specify)					
THIS IS TO VERIFY THAT THE INFORMATION PRESENTED ABOVE IS TRUE AND ACCURATE REPRESENTATION OF ALL THE INDUSTRIAL WASTES HAVING A SOURCE WITHIN THE INDUSTRY NAMED.					
Signature		Title		Date	

APPENDIX J

State Survey Forms

- J-1 Letter of Introduction and Explanation
- J-2 Blank State Questionnaire
- J-3 Follow-up Letter

State Board of Health

OTHO R. BENTENCK, D.D.S., President
ROBERT D. MACCULLOUGH, D.D., Vice President
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OLEN L. BERKEMULE, M.D.
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ARNOLD HELVEY
EUGENE A. ORRIS, M.D.
R. A. "TATE" TAYLOR
HAROLD A. TOAZ



Commissioner

R. LEROY CARPENTER, M.D., M.P.H.

Oklahoma
State Department of Health

Northeast 10th Street & Stonewall
Post Office Box 53551
Oklahoma City, Oklahoma 73105

DATE

NAME
ADDRESS

Dear Sir:

I am engaged in research of hazardous wastes in Oklahoma and we are attempting to make a comprehensive survey of nonradioactive, liquid hazardous wastes from industrial sources.

Has your agency developed guidelines or regulations for the management of hazardous wastes? More specifically, are there state statutes or regulations that: (1) define a hazardous waste, (2) regulate the method of disposal of hazardous wastes, or (3) regulate the handling and/or treatment of hazardous wastes? Are there any surveys within your state of hazardous wastes from industrial sources? I would appreciate any information you have regarding the above areas. Would you please fill out the enclosed questionnaire and return?

If you have become involved in the management of hazardous wastes, your experience in handling the difficult problems of obtaining data of this type would be of considerable help. If another department or division within your agency (such as Water or Air Quality) has become involved in the development of management guidelines of hazardous wastes, would you please forward this information to the appropriate individual? Your assistance would be greatly appreciated. Thank you for consideration of this request. I will be anxiously awaiting your reply.

Sincerely,

Shelly J. Williamson
Water Quality Service

SJW/ms

OKLAHOMA STATE DEPARTMENT OF HEALTH
ENVIRONMENTAL HEALTH SERVICES
WATER QUALITY SERVICE

State Questionnaire

1. Has your State defined "hazardous wastes" or developed a list of hazardous substances? _____

2. Does your State control the disposal and/or storage of hazardous substances? If so, which type of substances? Please indicate any state statutes or regulations which apply. _____

3. Does your State regulate the handling and/or treatment of hazardous wastes? Please indicate any state statutes or regulations which apply. _____

4. Which State agency(ies) has responsibility for hazardous waste pre-treatment, disposal, or storage? _____

5. Does your State currently have or is anyone developing management guidelines for hazardous wastes? If so, please indicate a reference. _____

6. Are you aware of any surveys of hazardous wastes conducted within your State? If so, please indicate a reference or include a copy and answer the following questions: _____

 - a. Method used to calculate volume of hazardous waste? _____

 - b. Were waste generation factors or waste generation coefficients used? _____
If so, would you indicate a reference or include a copy? _____

State Board of Health

OTHO R. SMITHWICK, D.D.S., President
ROBERT D. MCULLOUGH, D.D., Vice President
THOMAS DONICA, M.D., Secretary
GLEN L. BERNHARDT, M.D.
WILLACE BYRNE, M.D.
ARNOLD MELVEY
RUSSELL A. CHASE, M.D.
W.A. "TATE" TAYLOR
HAROLD A. POZ



Commissioner

R. LEROY CARPENTER, M.D., M.P.H.

Oklahoma
State Department of Health

Northeast 10th Street & Stonewall
Post Office Box 53551
Oklahoma City, Oklahoma 73105

DATE

NAME
ADDRESS

Dear Sir:

This is a second follow-up letter sent to other states as part of a state survey. The first letter was sent September 20, 1974. We did not receive a response from your state. It is extremely important that we are up-to-date and cooperate with other states in their effort toward hazardous waste management. Would you please take a few minutes of your time to fill out the enclosed questionnaire and return?

I am engaged in research of hazardous wastes in Oklahoma and we are attempting to make a comprehensive survey of nonradioactive, liquid hazardous wastes from industrial sources.

Has your agency developed guidelines or regulations for the management of hazardous wastes? More specifically, are there state statutes or regulations that: (1) define a hazardous waste, (2) regulate the method of disposal of hazardous wastes, or (3) regulate the handling and/or treatment of hazardous wastes? Are there any surveys within your state of hazardous wastes from industrial sources? I would appreciate any information you have regarding the above areas.

If you have become involved in the management of hazardous wastes, your experience in handling the difficult problems of obtaining data of this type would be of considerable help. If another department or division within your agency (such as Water or Air Quality) has become involved in the development of management guidelines of hazardous wastes, would you please forward this information to the appropriate individual? Your assistance would be greatly appreciated. I will be anxiously awaiting your reply.

Sincerely,

Shelly J. Williamson
Water Quality Service

SJW/ms

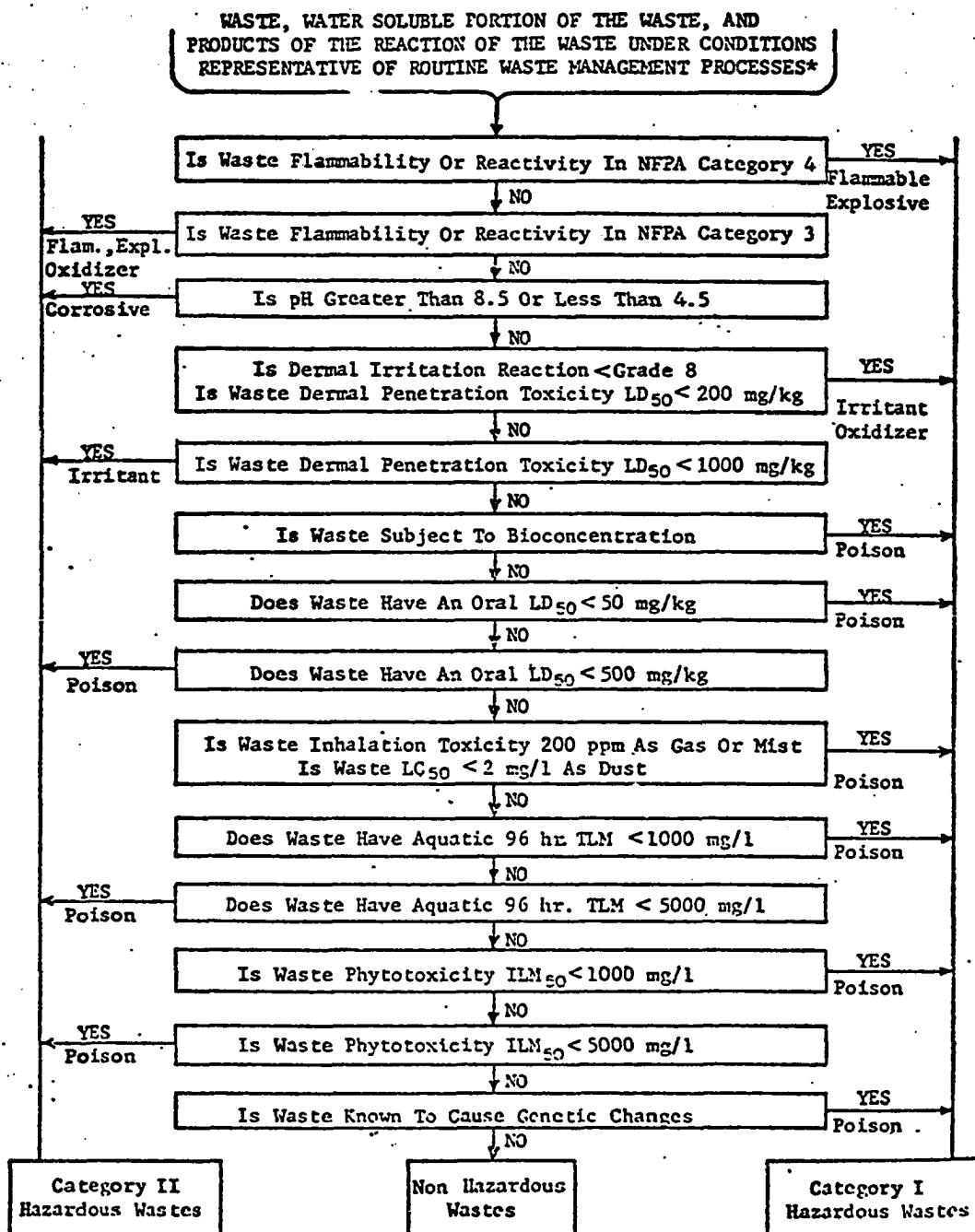
APPENDIX K

Hazardous Waste Decision Model

K-1 Decision Model for Identifying Hazardous Waste

K-2 Selection Criteria for the Decision Model

DECISION MODEL FOR IDENTIFYING HAZARDOUS WASTE



* $4.5 \leq \text{pH} \leq 8.5$; $\text{temp} \leq 150^\circ\text{F} (65^\circ\text{C})$; Ammonium (NH_4^+) and Sulfates ($\text{SO}_4^{=}$) - Sanitary Landfilling
 Oxidizing conditions, $\text{Temp} \leq 1300^\circ\text{F}$, No treatment of emission gases - Incineration
 $-30^\circ\text{F} \leq \text{temp.} \leq 110^\circ\text{F}$; atmospheric pressure; - Handling

SELECTION CRITERIA OF THE HAZARDOUS WASTE DECISION MODEL

1. Bioconcentration - The process by which elements or compounds can be concentrated above levels in the surrounding environment by living organisms. A limited amount of information relative to the bioconcentration properties of some chemicals is available in the publication "Dangerous Properties of Industrial Materials" (Sax, 1968).
2. NFPA - National Fire Protection Association - data on the flammability and reactivity of a large number of chemicals used and shipped commercially is contained in NFPA Publication 49 - "Hazardous Chemical Data 1972" (National Fire Protection Association, 1972).
3. Category 4 Flammable Materials - Very flammable gases, very volatile flammable liquids, and materials that in the form of dusts or mists readily form explosive mixtures when dispersed in air.
4. Category 3 Flammable Materials - Liquids which can be ignited under normal temperature conditions. Solids which create flash fires and burn rapidly usually because they contain their own oxygen. This category also includes any material that ignites spontaneously at normal temperature in air.
5. Category 4 Reactive Materials - Materials which in themselves are readily capable of detonation or of explosive decomposition or reaction at normal temperature and pressures.
6. Category 3 Reactive Materials - Materials which in themselves are capable of detonation or of explosive decomposition or reaction but which require a strong initiating source or which must be heated under confinement before detonation.
7. pH - The symbol pH is used to designate the logarithm (base 10) of the reciprocal of the hydrogen ion concentration. Low pH represents acidic conditions and high pH represents alkaline conditions. Under normal conditions the pH of landfill leachate varies between 4.5 and 8.5. Due to the importance of pH in the solubility of many metal compounds, material with a pH outside the range normally found in a sanitary landfill should not be disposed of in a sanitary landfill.
8. LD₅₀ - Lethal Dose Fifty - A dose of a chemical substance which is expected to kill 50 percent of a population of experimental animals exposed through a route other than respiration. Dose concentration is expressed in terms of milligrams of chemical per kilogram of body weight. A LD₅₀ of 50 mg/kg was used as the threshold limit for Category I Waste (Report to Congress - Disposal of Hazardous Wastes, 1974) and a LD₅₀ of 500 mg/kg was used as the threshold limit for Category II Waste (45). A LD₅₀ less than 500 mg/kg includes the Class A and Class B poisons as classified by

the Department of Transportation. Lethal dose data is included in the Toxic Substances List-1972 published by the U. S. Department of Health, Education, and Welfare (U. S. Department of Health, Education and Welfare, 1972 Edition, 1972).

9. LC₅₀ - Lethal Concentration Fifty - A concentration of a chemical substance which, when administered by the respiratory route, will kill 50 percent of a population of experimental animals during an exposure of 4 hours. Concentration is expressed in terms of milligrams per liter. A LC₅₀ of 2 mg/l was used as the threshold limit of Category I Hazardous Wastes. Lethal Concentration data is included in the Toxic Substances List - 1972 published by the U. S. Department of Health, Education and Welfare (Ibid.).
10. Grade 8 Dermal Irritation Reaction - An indication that dead tissue has resulted from skin irritation caused by the application of 1 percent chemical solution.
11. Dermal Penetration Toxicity LD₅₀ - A dose of chemical which, through skin penetration, is expected to kill 50 percent of a population. A dermal penetration LD₅₀ of 200 mg/kg was used as the threshold limit of Category I Hazardous Waste (Report to Congress - Disposal of Hazardous Wastes, 1974) and a dermal penetration LD₅₀ of 1000 mg/kg was used as the threshold limit of Category II Hazardous Waste.
12. Aquatic 96 Hr. TLM - Aquatic Median Threshold Limit - The concentration of a substance which is lethal to 50 percent of the test population over a 96 hour exposure period. Threshold limit concentration is expressed in milligrams per liter. An aquatic 96 hr. TLM of 1000 mg/l was used as the threshold limit for Category I Wastes (Ibid.) and an aquatic 96 hr. TLM of 5000 mg/l was used as the threshold limit of Category II Wastes. The most up-to-date information regarding aquatic 96 hr. TLM is available from the "Report of the Committee on Water Quality" published by the Environmental Protection Agency. (Report of the Committee on Water Quality Criteria, 1968 and 1973 Edition). Information on Aquatic 96 hr. TLM is also available from the publication "Water Quality Criteria" (McKee and Wolf, 1963).
13. Phytotoxicity - Phytotoxicity is the ability of a chemical to be toxic or poisonous to plants.
14. ILM₅₀ - Median Inhibitory Limit - The concentration at which a 50 percent reduction occurs in the biomass, cell count, or photosynthetic activity of a test culture when compared to a control culture over a 14-day period. A literature search indicated that a very limited amount of phytotoxicity ILM₅₀ data is available. An ILM₅₀ of 1000 mg/l was used as the threshold limit of Category I Waste (Report to Congress - Disposal of Hazardous Wastes, 1974). An ILM of 5000 mg/l was selected for the threshold limit of Category II Waste in order to provide the same relative degree of protection as provided by the 96 hr. aquatic TLM.

15. Genetic Changes - Genetic changes are defined as "molecular alterations of the deoxyribonucleic or ribonucleic acids of mitotic or meiotic cells occurring from chemicals" (Ibid.).

APPENDIX L

Sample Listing of Wastes from American Airlines Injected
into the Injection Well for March and April, 1975

TABLE 26

SAMPLE LISTING OF WASTES FROM AMERICAN AIRLINES INJECTED
INTO THE INJECTION WELL FOR MARCH AND APRIL, 1975

Description	Average PPM	Waste Category
Hydrofluoric acid, 48% tech.	.8	R _a
Muriatic acid, 20 deg. baume	19.5	R _a
Sulphuric acid, 66 deg. baume	2.6	R _a
Chromic acid, 99.5%	12.5	R _a
Nitric acid, 42 deg. baume	3.5	R _a
Boric acid, tech. grade	.7	R _a
Hydrochloric acid, C/P Reagent grade	3.5	R _a
Sulfamic nickel acid	.1	R _a
Ammonia	2.3	X
Ammonia nitrate, tech. grade	.9	X
Inhibitor - Kelite, proprietary item	1.4	X
Rocheltex, (KN C ₄ H ₄ O ₆ -4H ₂ O)	.5	X
Sodium sulfamate, nickel sol., mildly acidic	15.6	R _a
Sodium hypophosphite	.5	R _c
Stripper - metex #2, proprietary item	6.7	F
Stripper - metex, sodium cyanide & caustic soda, proprietary item	4.7	R _c
Cleaner - anodex NP2 strong alkali, proprietary item	3.4	R _c
Cleaner - Turco #4181, highly alkaline, proprietary item	50.0	R _c
Compound - Kenvert 11PC, sodium chromate and nitric acid, proprietary item	.2	R _a
Compound - Etco Buff, organic salt, proprietary item	.9	X
Compound - Alodine powder #1200, chromate	.1	X _c
Compound - Sol-U-Salt, pot. silver cyanide, 53.5% min. silver metal in 500 avor oz.	.1	P
Trisodium phosphate	.2	R _c
Nickel sulphate, pure	.8	X
Nickel Chloride, 99%	4.5	X
Pot. cyanide, koppers 35-40% K1N solution	1.1	P
Pot. cu. cyanide, DuPont double salt	1.0	P
Potash - caustic mercury cell with max. 2% chloride	.4	R
Soda bicarbonate	.4	R _c
Sodium cyanide - 0.96% cyanide, 4% sodium carbonate & cyanite	11.3	P
Sodium hydroxide, 98%	.5	R
Phosphoric acid - Parko Lubrite #2	.9	R _a
Cleaner - Turco Jet Mulso #2, proprietary item	1.0	X
Cleaner - Turco Jet Cleaner "C", proprietary item	2.9	X
Cleaner - Cee Bee, Alko proprietary item	3.9	X
Cleaner - Turco T-900 proprietary item	31.9	X
Stripper - B&B #1717 AMX proprietary item	5.7	F
Cleaner - B&B #713 proprietary item	143.1	X

TABLE 26-Continued

Description	Average PPM	Waste Category
Cleaner - Turco #2976 proprietary item	3.9	X
Remover - High acidic, Cee Bee #B-4 proprietary item	24.3	R _a
Compound - Phosphoric acid, Turco #WO-1 proprietary item	.6	R _a
Paint stripper - Turco #5555B, proprietary item	4.3	F
Cleaner - Turco #3133, proprietary item	3.6	X
Trichlorethylene	173.5	F
Coolant - precision machining, Cymlite #7, proprietary item	2.5	X
Coolant - precision machining, blue chip, proprietary item	9.0	X
Coolant - precision machining, Lusol, proprietary item	11.8	X
Solvent - Soltrol #170, odorless	7.5	F
Penetrant - Zyglo ZL-2	.4	X
Penetrant - Zyglo ZL-1B	1.4	X
Penetrant - Zyglo ZL-22	1.4	X
Developer - Zyglo ZP-4	.1	X
Developer - Zyglo ZP-5	.2	X
Emulsifier - Zyglo ZE-2	.6	X
Emulsifier - Zyglo ZE-3	.5	X

APPENDIX M

Letter of Inquiry to Private Contract Industrial Waste Haulers

State Board of Health

OTWIS R. WHITEHEAD, D.O.S., President
ROBERT B. MACCULLOUGH, D.O., Vice President
THOMAS DOMICA, M.D., Secretary
OLEN L. BRIDGEMAN, M.D.
WALLACE BYRD, M.D.
ARNOLD MELVET
BURNS A. OWENS, M.D.
W. A. "TATE" TAYLOR
HAROLD A. YOE



Commissioner

R. LEROY CARPENTER, M.D., M.P.H.

Oklahoma
State Department of Health

Northeast 10th Street & Stonewall
Post Office Box 53551
Oklahoma City, Oklahoma 73105

June 30, 1975

NAME
ADDRESS

GENTLEMEN:

I am writing you to request information regarding the source of waste which your company handles. We are interested in the information in order to determine total volumes of liquids, industrial sludges, oil wastes, chemical wastes, or hazardous materials within the State, sources, and characteristic types of the waste. We are not requesting data regarding garbage, salt water, or municipal solid wastes. The information will be held confidential and will not be published without your consent.

Would you please send the following information:

- (1) Name and location of industries located in Oklahoma for which you handle, treat, and/or dispose of their waste.
- (2) Average volume of wastes handled per month in #1.
- (3) Type of waste.
- (4) Type and location of disposal.
- (5) Cost per unit or volume for disposal.
- (6) Average total number of industries and individuals located outside of Oklahoma for which you handle, treat, and/or dispose of their wastes.

Your prompt consideration of this request will be appreciated and if I can be of further service to you, please do not hesitate to call. Thank you.

Sincerely,

Shelly J. Williamson
Water Quality Service

SJW:ped

APPENDIX N

Summary of Recommended Treatment and/or Disposal Technologies by SIC

TABLE 27

SUMMARY OF RECOMMENDED TREATMENT AND/OR DISPOSAL TECHNOLOGIES BY SIC

SIC	Description	Typical Composition	Treatment and/or Disposal		Reference Source
			BPCTCA	BATEA	
22	Textile Mill Products	Some sludges contain small quantities of heavy metal residues	12, 28, 1 *		EPA 1974
28	Chemicals & Allied Products	Sodium Dichromate	30		Stone 1974
281	Industrial Inorganic Chemicals	CaCO ₃ , Mg(CH) ₂ , Na ₂ SO ₄ , 100 ppm Hg, Chlorinated Hydrocarbons, 0.1% lead, 1.5% CaF ₂ , Fe ₂ O ₃ , 1.3% Cr, inerts. Zn, Pb, Fluorine and Hg.	1, 3, 12, 19, 16, 17		Sarton et al 1974, EPA 1974
282	Plastic Material and Synthetic Resins, Synthetic Rubber, Synthetic and Other Man-made Fibers, except Glass	Organic contaminants; some wastes contain zinc, mercury, antimony, chromium and titanium pigments.	16, 17, 9, 12, 19, 24	20, 24 *	Franklin 1973, Marynowski 1970, Blanco et al 1970, Saheki 1972
283	Drugs	Chemical dusts.	8, 12, 19, 16, 27, 29		Braez 1972, Phillips & Wells 1974, Huffman 1971, Env. Sci. Tech. 1968
284	Soaps, Detergents, & Cleaning Preparations, Perfumes, Cosmetics, & Other Toilet Preparations		12, 9		Bayer 1973, EPA 1973, Water Pollution Control 1969

*Refer to key at the end of the table

TABLE 27 —Continued

SIC	Description	Typical Composition	Treatment and/or Disposal		Reference Source
			BPCTCA	BATEA	
285	Paints, Varnishes, Lacquers, Enamels, and Allied Products	Inorganic pigment, TiO_2 , extenders, binders, 0-700ppm Hg, CrO_4 - green phenyl, Hg compounds, Lead, Cd, Se, CN^-	12, 19, 16, 28, 24, 33		Ottinger 1973, Hilton, Morse, Black 1972
286	Industrial Organic Chemicals	PCB's, chromates (58ppm), sulfides, nitrobenzine, nitroaniline, phosgene, dimethyl sulfate, organic chlorides, chromic hydroxide, dinitrotoluene, iron oxides, sodium chloride	19, 12, 9		Ottinger 1973
287	Agricultural	Chlorinated hydrocarbons, organo phosphates, carbamates, urea, ammonia, sodium chromate, fluorine	9, 12, 19, 16	24, 19, 20	Ottinger 1973, Federal Register 1974, Ground Disposal 1970, Journal Air Pollution Control 1965, Chemical Week 1969, Swank
289	Misc. Chemical Products	Leadizide, mannitol, hexanitrate, sulfuric acid, nitric acid, nitro-glycerin, RDX, HMX, TNT, acetic acid, organic and inorganic salts, smokeless powder, phosphorus, tungsten, barium carbonate	19, 22		Ottinger 1973
291	Petroleum Refining	Oil, volatile solids, tetraethyl, lead, lead oxide, lead and mercury salts		23	American Petroleum Institute 1963
30	Rubber and Misc. Plastic Products	Rubber compound, metals and cords for tires	9, 19 12	24	Koenig & Barker, Huffman 1971, Pettigrew 1970

TABLE 27--Continued

SIC	Description	Typical Composition	Treatment and/or Disposal		Reference Source
			BPCTCA	BATEA	
31	Leather and Leather Products	Chromium, dyes, organic matter, brines, fats, acid, Cr^{3+}	1, 9, 10, 12, 19, 28	24	Booz-Allen 1973
323	Glass Products made of Purchased Glass	Disolved heavy metals including Cr, Fe	9, 12, 19		Koenig & Barker, Tyrell & Feld 1971
331	Blast Furnaces, Steel Works and Rolling & Finishing Mills	Hydrofluoric acid, sulfuric acid, iron chromium, nickel, nitric acid, sodium, cyanide, phenols, fluorides, ammonia, zinc chloride, hydrochloric acid, thiocyanate, Cd, beryllium, Zn	1, 24, 16, 17		Seyler et al 1974, Berkowitz et al 1974, PED Co. 1974, Stoner 1972, Aarons & Taylor 1967
332	Iron and Steel Foundries	As, Ba, Be, Cu, Pb, Mn, Ni, V, Zn	14, 24, 19	24	Gouwens & Ale-shin 1972, Morgan 1972
333	Primary Selting & Refining of Nonferrous Metals	Arsenic trioxide, Se, H_2SO_4 , HCl, Cu, Pb, Hg, Sb, As, Cd, F, Zn, chromium	1, 9, 12, 16, 17		Booz-Allen 1973, PED Co. 1974, Bayer 1973, Orlandine et al 1970
34	Frabricated Metal Products, except Machinery & Transportation Equipment	Chromates, Fe_2O_2 , CuO, chromic sulfate, chromic hydroxide, Cu, Zn, Fe, Ni, CaSO_4 , NaCN salts, cyanide	1, 12, 27	28, 24	Tripler et al 1973, Products Finishing 1973, Landreth & Rogers 1974, Pinner 1973, Tuznik & Kiesz-kowski 1972, George & Cochran 1970

TABLE 27 --Continued

SIC	Description	Typical Composition	Treatment and/or Disposal		Reference Source
			BPCTCA	BATEA	
35	Machinery, except Electrical	Selenium, NaOH, Arsenic, Fluorides, chromates, aluminium, heavy metals, acid	N.A.	N.A.	Versar Inc. 1974
36	Electrical & Electronic Machinery, Equipment & Supplies	Lead, lead sulfate, lead hydroxide, calcium sulfate, cadmium hydroxide, nickel hydroxide, Hg, zinc, Cr ³⁺ , copper chloride, ethylene dichloride, calcium phosphate	19, 12	13, 23, 24	
37	Transportation Equipment	Chromium, Zinc	9, 12, 19, 28	24	
					Combustion Engineering Inc. 1969, Brink 1964, Vernia 1973

Treatment and/or Disposal Technologies:

- | | | |
|-------------------------------------|--------------------------|--|
| 1. Ponding/Lagooning | 15. Deep mine disposal | 29. Chemical coagulation/polyelectrolytes |
| 2. Backfill | 16. Deep well disposal | 30. Evaporation |
| 3. Surface piles | 17. Ocean dumping | 31. Freezing-thawing; electrophoresis |
| 4. Spoil banks | 18. Open burning | 32. Treat with specific organisms for greater fuel use |
| 5. Dam construction | 19. Incineration | 33. Process modification - designed to decrease waste production |
| 6. Land reclamation | 20. Pyrolysis | |
| 7. Lake or river disposal | 21. Gasification | |
| 8. Land burial | 22. Detonation | |
| 9. Open dumping | 23. Chemical fixation | |
| 10. Land spraying; spray irrigation | 24. Reclamation | |
| 11. Compost | 25. Fly larvae reduction | |
| 12. Sanitary landfill | 26. Re-use as feed | |
| 13. Secure landfill | 27. Centrifuging | |
| 14. Soil additive, conditioner | 28. Filtration | |

APPENDIX O

Management Guidelines

O-1 Guidelines for Handling of Hazardous Wastes

O-2 Potential for Recycling and Recovery of Hazardous Wastes

Guidelines for Handling of Hazardous Wastes

The following guidelines should apply to the operators of transport haulers or hazardous waste disposal sites.

1. Hazardous wastes should be separated into noncompatible waste categories (California, 1974):

Group 1-A

Alkaline caustic liquids
Alkaline cleaner
Alkaline corrosive liquids
Alkaline corrosive battery fluid
Caustic wastewater
Lime sludge and other corrosive
alkalies
Lime wastewater
Lime and water

Spent caustic

Group 1-B

Acid sludge
Acid and water
Battery acid
Chemical cleaners
Electrolyte, acid
Etching acid liquid or solvent
Liquid cleaning compounds
Pickling liquor and other
corrosive acids
Sludge acid
Spent acid
Spent mixed acid
Spent sulfuric acid

Potential consequences: Heat generation, violent reaction

Group 2-A

Asbestos waste and other toxic
wastes
Beryllium wastes
Unrinsed pesticide containers
Waste pesticides

Group 2-B

Cleaning solvents
Data processing liquid
Obsolete explosives
Petroleum waste
Refinery waste
Retrograde explosives
Solvents
Waste oil and other flammables and explosives

Potential consequences: Release of toxic substances in case of fire or explosion.

Group 3-A

Aluminum
Beryllium
Calcium
Lithium
Magnesium
Potassium
Sodium
Zinc powder and other reactive
metals and metal hydrides

Group 3-B

Any waste in Group 1-A or 1-B

Potential consequences: Fire or explosion. Generation of flammable hydrogen gas.

Group 4-A
Alcohols
Water

Group 4-B
Any concentrated waste in
Groups 1-A or 1-B
Calcium
Lithium
Metal hydrides
Potassium
Sodium
 SO_2Cl_2 , SOCl_2 , PCl_3 , CH_3SiCl_3 ,
and other water-reactive
wastes

Potential consequences: Fire, explosion, or heat generation.
Generation of flammable or toxic gases.

Group 5-A
Alcohols
Aldehydes
Halogenated hydrocarbons
Nitrated hydrocarbons and other
reactive organic compounds
and solvents
Unsaturated hydrocarbons

Group 5-B
Concentrated Group 1-A or 1-B
wastes
Group 3-A wastes

Potential consequences: Fire, explosion, or violent reaction.

Group 6-A
Spent cyanide solutions

Group 6-B
Group 1-B wastes

Potential consequences: Generation of toxic hydrogen cyanide
gas.

Group 7-A
Chlorates and other strong
oxidizers
Chlorine
Chlorites
Chromic acid
Hypochlorites
Nitrates
Nitric acid, fuming
Perchlorates
Permanganates
Peroxides

Group 7-B
Acetic Acid and other organic
acids
Concentrated mineral acids
Group 2-B wastes
Group 3-A wastes
Group 5-A wastes and other
flammable and combusti-
ble wastes

Potential consequences: Fire, explosion, or violent reaction.

2. Noncompatible wastes should not be mixed in the same transportation or storage container.
3. A waste should not be added to an unwashed transportation or storage container that previously contained a noncompatible waste.
4. Noncompatible wastes should not be combined in the same pond, landfill, soil-mixing area, well, or burial container. An exception is the controlled neutralization of

acids and alkalies in disposal areas. Containers which hold noncompatible wastes should be well separated by soil or refuse when they are buried. Ideally, separate disposal areas should be maintained for noncompatible wastes.

5. Noncompatible wastes should not be incinerated together. An exception is the controlled incineration of pesticides and other toxic substances with flammable solvents.

Potential for Recycling and Recovery of Hazardous Wastes

A list of potential recommendations for resource recovery by SIC were developed. These were not meant to be specific guidelines since the methods utilized will depend upon cost effectiveness and volumes. If the proposed Materials and Energy Recovery Act is passed, guidelines for resource recovery will be issued within a year after enactment. The following is a list for potential resource recovery by SIC:

201 & 202 - Meat and Dairy Products

1. Soil additive, conditioner
2. Re-use as feed
3. Animal by-product
4. Protein could be recovered from cheese whey.
5. Dried whey might be utilized in the preparation of polyurethane foam.

26 - Paper and Allied Products

1. Soil Conditioner
2. Steam generation and recovery is possible in both incineration of fibrous sludge and disposal in hog fuel boiler.
3. Reclamation of sludges for:
 - a) aggregate for building blocks
 - b) filler for asphalt tile and liquid emulsions
 - c) filler for fiberboard and other lined boards
 - d) filler paper, rubber, and other manufacturing materials
 - e) possible chemical recovery
4. Recovery of lime from causticizing operations in Kraft-wood pulping process

Industrial Inorganic Chemicals

1. Metal reclamation technically feasible
 - a) selective precipitation
 - b) electrowinning
 - c) liquid ion exchange

282 - Plastics Materials and Synthetic Resins, Synthetic Rubber, Synthetic and other Man-Made Fibers, Except Glass

1. Organic waste residues can be incorporated into asphalt or thermoplastics. The leach rate is low, and commercial units are available for large-scale installations.
 - a) Steam costs for distilling concentrated waste.
 - b) A fee of \$.01 per pound for asphalt, and \$.06 to \$.20 per pound for polythylene, for each pound of solids in the waste required to produce a final product containing about 60 weight percent solid waste.
 - c) The cost of neutralizing waste, if necessary, with caustic or lime.

The product is used for road surfacing, building material component, agricultural purposes, and landfill.
2. Pyrolysis: Recovery of oil; problems exist concerning pollution effects. This process is currently under investigation.
3. Reclamation: The central problem is how to collect, crush, and pulverize plastics waste, while removing foreign matter so as to obtain a quality capable of reproduction at competitive prices. Current product investigation includes plastics material use in agriculture, fishery, and civil engineering. Product development must take into account the collection and treatment of waste derived from reproduction products as well.

283 - Drugs

1. Reuse residue as porous material for production of lighting building bricks

285 - Paints, Varnishes, Lacquers, Enamels, and Allied Products

1. Process change by manufacturers can reduce waste; substantial portion of dirty wash solvents recovered and reused.

287 - Agricultural Chemicals

1. Alternative treatment methods either under development or in use for organic tars/residues include:
 - a) chloronolysis conversion recovery
 - b) pyrolytic destruction and conversion to fuel or synthetic compounds

- c) advanced incineration processes coupled with electro-chemical or other processes to recover acids, chlorine, caustic, etc.
- 2. Processes to treat wastewater for organic removal or destruction without precipitation are under development. These include:
 - a) advanced, nondestructively regenerable carbon and resin absorption systems which recover the removed organics for use in one of the three organic sludge treatment processes above.
 - b) other systems involving chemical destruction/removal of the organics e.g., metal reduction, ozonation, or photocatalyzed chlorination/ozonation.

2874 - Phosphatic Fertilizers

- 1. Surface piles
- 2. Use as soil additive
- 3. Process modifications: activated gypsum as kiln feed from lime, sulfuric acid, and cement production - practiced to limited extent in U.S.
- 4. Fluoride recovery - very limited scale in practice

291 - Petroleum Refining

- 1. Coagulation sludges could be absorbed in cement manufacture.
- 2. Precious metals recovery possible; vanadium recovery from fly ash produced in fluid coke boiler is feasible.

30 - Rubber and Miscellaneous Plastic Products

- 1. Recovery of rubber waste

31 - Leather and Leather Products

- 1. Fleshings may be recovered for sale to rendering plants.
- 2. Hair may be saved, washed, dried, and baled for sale.
- 3. Raw hide trimmings may be saved, washed, dried, and baled for sale.
- 4. Tanned hide trimmings sold as by products.
- 5. Grease may be reclaimed and sold.

323 - Glass products, made of Purchased Glass

- 1. Possible reclamation of high-glass fractions of incinerator residue

324, 325, 326: - Cement, Hydraulic/Structural Clay Products/Pottery and Related Products

- 1. Air pollution control residuals:
 - a) Low alkali dust is reused

331 - Blast Furnaces, Steel Works, and Rolling and Finishing Mills

1. Furnace dusts: landfill, blast furnace dusts recycled to sinter plants.
2. Pickle liquor residue: lagooned, deep well injection, ocean dumping. The "duPont process" involves continuous neutralization of spent sulfuric acid pickle liquor with lime and the simultaneous oxidation of soluble iron to insoluble iron oxide to produce high-density, low-volume granular solids which are easily separated and disposed. This process produces one-sixth the amount of sludge produced from simple lime neutralization of the pickle liquor. The magnetic iron oxide is easily recoverable, and crystalline gypsum can be utilized for wall-board or cement manufacture. Those solids disposed in landfills are essentially insoluble, and they will not leach back in the soil. This process has been installed and is operating successfully at several locations. Process costs vary with the cost of lime, the composition of the waste pickle liquor, the method of solids disposal, and steel mill size.
3. Blast furnace slag: all purpose construction aggregate: mainly used for bases for cement and bituminous concrete, railroad ballast, concrete masonry block, portland cement concrete and fill. Other uses include roofing slag, mineral wool, agricultural slag, (high phosphorous slags used in fertilizer industry), glass, sewage trickling, filter medium, and anti-skid and ice control. All blast furnace slag currently produced is being utilized, but demand is insufficient to deplete older slag piles.
4. Steel-making slag: used for many of same purposes as blast furnace slag. Steel-making slag also used for blast furnace flux depending on individual mill factors such as type of ore being smelted, cost of limestone and dolomite, cost of coke, steels being produced, and phosphorous requirements in hot metals.

The high iron content of steel-making slags accounts for its less extensive reuse than is done with blast furnace slag. Low-iron content slag is desirable for agricultural uses and essential for construction slags. Magnetic removal of iron from steel slag is done by slag processors.

When slag is wasted, costs of \$1-\$2/ton are incurred, mainly due to railroad and slag pot maintenance charges.
5. Water pollution control residuals: treatment of oil-water emulsions from cold mill waste to reclaim oil, \$.04-\$0.07/ton.
6. The Bureau of Mines is working on a developmental project to pelletize blast furnace dust. The pellets would then be charges to iron or steel-making furnaces. A related experimental project is exploring the prospects of zinc recovery from electric furnace dusts.

332 - Iron and Steel Foundries

1. Arc furnace dust has a potential use as colorants; pelletized and used for road
2. Sand reclaimer waste has a potential use as a fill, aggregate in masonry products, grog in structural clay products.
3. Cupola waste has a potential use as a soil conditioning, source of micronutrients, grog in clay bodies, constituent of molding sands, road fill. Cupola slag used on road for icy conditions.
4. Shot blast dusts has a potential use when pelletized for reprocessing, used in powder metallurgical applications,
5. Sand reclamation: may require special resin; wary of contaminants, obstacles are mostly economic rather than technical.

333 - Primary Smelting and Refining of Nonferrous Metals

1. Metal chlorides may be drummed and sold to refineries.
2. Gypsum sludge (or calcium sulfate/calcium sulfite sludge) results from "wet" neutralization of air pollution abatement derived sulfuric acid. Final disposal would require closed loop settling ponds with minimum permeability lining materials. A pilot study has been investigating a "dry" sulfuric acid neutralization process that would yield a hard crust dry gypsum product. Gypsum sludge can be reclaimed for gypsum wallboard and other materials.
3. Red sludge, (a by-product formed in the manufacture of aluminum from bauxite), may be:
 - a) Smelted and used for production of crude iron or steel in a process designed for sludge of approximately 40% moisture content. This practice is suitable for sludge with ferric oxide content of at least 45% on a dry basis.
 - b) Used for high quality brick materials. This process requires sludge with low ferric-oxide content.
 - c) Used as flocculating agent purification of waste water. A scaled-up red mud plant could turn out 500-600 tons per day of steel at competitive prices. Estimated capital investment is \$20-\$30 million(1971).
The process would enter the alloy steel market. The plant is considered technically feasible, though there are still reservations about red mud dewatering and dealing with its caustic content.
4. Alum sludge is more amenable to dewatering with polyelectrolyte conditioning. Sludge from the aluminum anodizing process could be neutralized and pelletized. The aluminum hydroxide ($\text{Al}(\text{OH})_3$) is then agglomerated and filtered to give a powder with humidity of 20-30%. The by-product $\text{Al}(\text{OH})_3$ is useful as a paper production reagent, an absorbent for pollution production, fire-resistant bricks, alumina ceramics, etc.

5. A three-stage process has been developed for recovery of metals, particularly zinc, but also cadmium and copper, from zinc plant residues. An estimated 80 percent of the zinc in zinc plant residue may be recovered. The process involves:
 - a) leaching in a strong sulfuric acid solution
 - b) residue from the first step is neutralized to a pH of 5.0-5.3
 - c) residue from the second step is dried, ground into small particles, leached in weak sulfuric acid solution, and filtered to separate zinc sulfate from the residue.
6. Zinc smelter wastes may be used as an aggregate in particular phases of highway construction
7. A method to process industrial fly dusts containing sulfur and smelter mixed oxides, and other metal oxides containing zinc and lead, to give a crude lead, a slag rich in sulfur and zinc, and a secondary fly dust which can be sintered has been developed. The essence of the process involves mixing of the fly dusts and metal oxides with barium sulfate and an excess of a reducing agent, such as coke, and melting the mixture at a temperature between 820° and 1,000° C. The crude lead melt is 95 percent pure, (the yield of lead is about 85 percent), and the slag could be used as charge for a zinc smelter.
8. A producer of copper rods can use diatomite filters to remove copper fines. The resultant coke is about 60 percent copper, thus making it salable.

34 - Fabricated Metal Products, Except Machinery and Transportation Equipment

1. Waste-plus-waste treatment method (experimental level) - used on variety of acid and alkaline electroplating wastes to recover substantial amounts of valuable metals.
2. Metal recovery from plating waste can take place by:
 - a) Extraction of metals from rinse water by chemical precipitation electrolytic recovery, or in exchange
 - b) Concentration of rinse water by evaporation (useful for large chromium plating installations) or reverse osmosis (used in nickel plating)
3. Preliminary studies indicate heavy metal hydroxide sludge may be used as an addition to low-grade cement mortars and concretes. Indications are that the sludge-cement bind is permanent, rendering the sludge insoluble. Sludge addition is on the order of 2-3 percent (dry residue) relative to the cement weight. Building materials that this material can be used for include flagstones, fences, tiles, electric cable housings, etc. The sludge-cement paste might also be used for road foundations and production of gas concrete.

37 - Transportation Equipment

1. Iron and steel swarf from machining operations can be regarded as low value scrap. A process called Macro Mesh converts the swarf into metal powder that can be used for the production of powder metal parts.