FINAL EVALUATION OF PETC COAL CONVERSION SOLID AND HAZARDOUS WASTES. FINAL REPORT, SEPTEMBER 15, 1977-NOVEMBER 30, 1979

PITTSBURGH UNIV., PA

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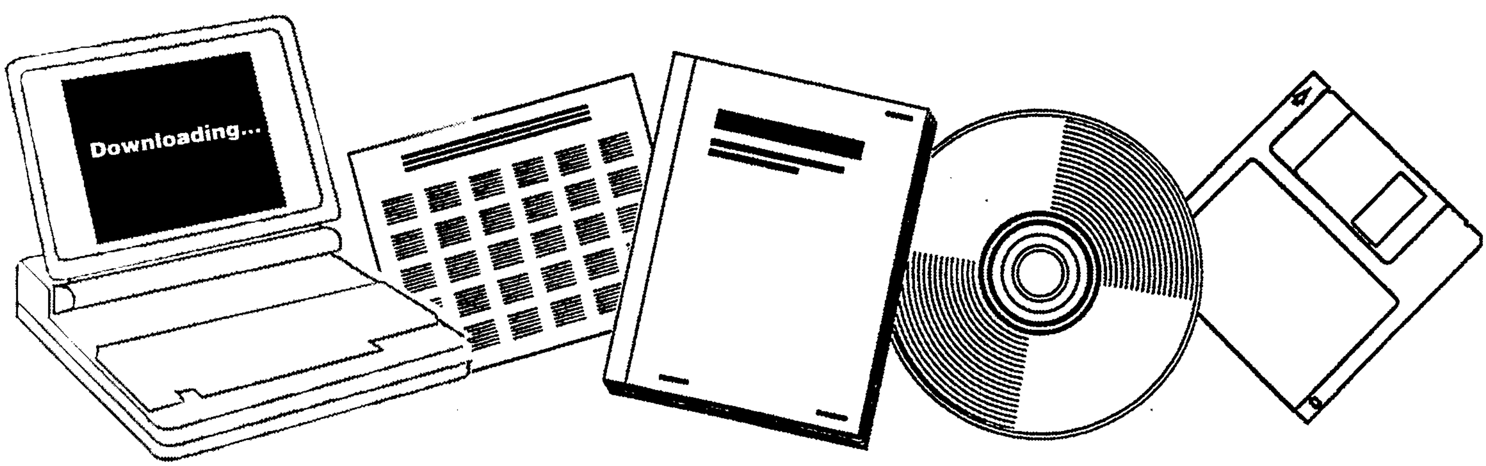

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FINAL EVALUATION OF PETC
COAL CONVERSION SOLID AND HAZARDOUS WASTES

Final Report

For the Period of September 15, 1977 to November 30, 1979

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ABSTRACT

Hazards and pollutional impacts from residuals generated at the Pittsburgh Energy Technology Center are explained in the context of hazardous waste regulations proposed by the federal government (RCRA). Nine hazard characteristics are defined and an overview of their significance to PETC is presented. Pollutional impacts on air, water and land are discussed in the energy research perspective. Legislative and statutory relationships between the Center and local, county, state and federal enforcement agencies are listed and analyzed. Expected liability resting on the Center in this framework is outlined.

One hundred and seven different chemical and indeterminate wastes were reported in an inventory conducted as an earlier task of this project. All of these are tabulated, classified in accordance with the latest proposed federal regulations, with recommended treatment and disposal methodologies included. Three extremely toxic chemicals appeared on the list and should be eliminated from all activities at the Center. All components of a general residuals management system (storage, transport, processing and disposal) are described with special emphasis on viable alternatives for management of PETC residuals.

The existing residuals management system is described to establish baseline conditions in preparing the recommended system. Management policies as they are presently practiced are included in the presentation. Regional resources applicable to the wastes generated at PETC are described in detail and located geographically with respect to the Center. Evolving techniques are presented where they have some promise for processing the specialized waste streams.

A recommended residuals management plan is offered for consideration. It includes the organizational arrangement of PETC personnel, a description of authority and responsibilities of the various human elements of the plan, an information network with detailed data sheets and installation of a mandatory manifest system, a carefully designed hazardous chemical storage area, and short as well as long term choices. In the short view, laboratory waste chemicals should be consigned to a responsible waste broker (as it is now handled). The indeterminate wastes (slags, chars, flyash and coal residues) should be characterized. An on-site incinerator to process flammable liquid residuals should be considered as a long range option. Joint venture processing and land disposal activity with other Energy Technology Centers is suggested.

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CHAPTER I

HAZARDS AND POTENTIAL POLLUTIONAL IMPACTS

1.0 Introduction

Virtually all of the handbooks available on comprehensive industrial waste management are based on pure materials within the occupational health and safety perspective. Recommended methodologies for treatment and disposal of mixed wastes for a wide range of substances. are practically nonexistent. The hazard parameters for most organic and inorganic materials are well-known.(1)(2)(3). Pure chemicals and homogenous materials may become wastes due to age (no longer fresh), lack of demand for the specific chemicals by the research projects being implemented, or simply due to housekeeping needs in the technology laboratory complex. Some test process waste streams may be relatively pure as they emerge from the operation of pilot plants demonstration units, or from full scale manufacture of specific energy products: however, trace amounts of highly toxic organics or heavy metals may render the entire waste stream hazardous in a statutory sense.

Energy technology centers generate pure wastes from the operation of chemical and physical testing laboratories as well as specific research operations. If materials are homogenous (unmixed), they may be easily defined with regard to the statutory requirements for handling, treatment and disposal. If the chemical wastes are aggregated for reduction of volume and ease of handling during transportation from the technology center site, they become more complex residuals requiring expertise in classifying the resultant material for regulatory purposes. In addition, greater risk of an industrial accident is present if two violently interactive substances are combined. Concentrations of toxic fractions are altered and chemical reactions may occur due to mixing-resulting in new chemical compounds with radically different hazardous characteristics.

In the context of this report, the hazard definitions are taken from the latest Environmental Protection Agency proposed regulations (4) mandated by the Resource Conservation and Recovery Act (P.L. 94-580) of 1976. Due to the thrust of the legislation, the regulations are intended to encompass the hazardous (synonomous with pollution) aspects of wastes in the disposal mode as well as the occupational safety and public health framework. The legal definition of a 'hazardous waste' dictates the approach taken by the regulations.

> "A solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may- (a) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; or (b) pose a substantial present or potential hazard to human health or the environment, when improperly treated, stored, transported, or disposed of, or otherwise managed." (5)

The statutes address the dangers of flammability (ignitable), reactivity, corrosivity, toxicity, pathogenicity and radioactivity as separate entities. Toxicity is mainly considered with regard to heavy metals in drinking water. This category is sub-divided into additional characteristics which include mutagenicity, bioaccumulation and organic fractions which are toxic to humans, animals and aquatic biota. Figure 1-1 diagrams the protocol utilized in making the determination of a statutory 'hazardous waste'.

Pollutional impacts from the wastes generated at the Energy Technology Center are in the context of receiving media (air, water or land) which influences the pathways for health effects. Changes in quality of

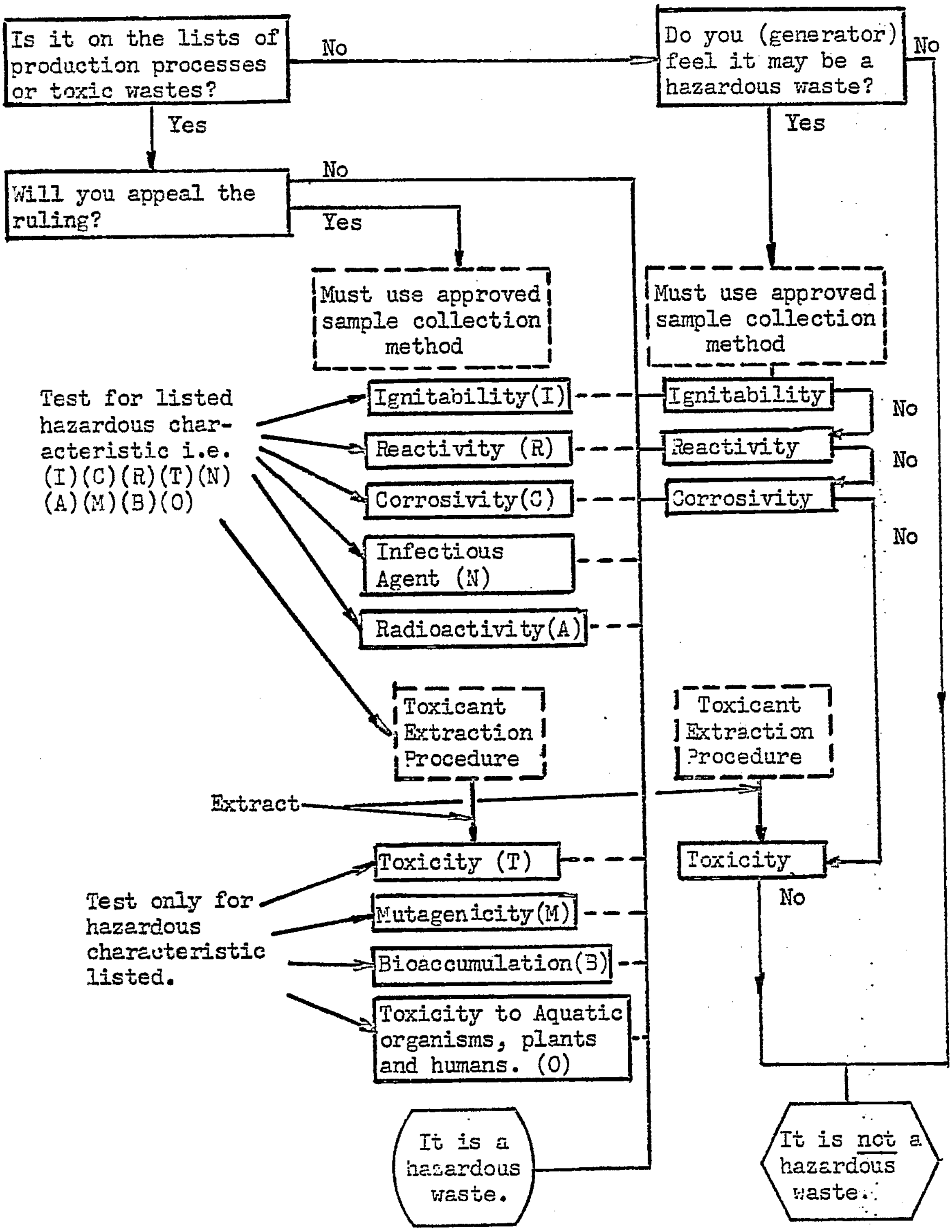

Figure 1-1 Protocol for Determination of Hazardous Waste Classification.

of the environment must be considered in addition to the potential for harmful effects on man and animal. In order to set water discharge limitations and determine the necessity for and level of treatment of the hazardous wastes, the various environmental impacts must be assessed.

Legislation and regulations have been promulgated for control of wastes from the various energy technology centers. Air pollution control ordinances cover the control of emmissions to the air media. Water quality criteria and discharge limitations in addition to land disposal requirements are in force for regulating transportation and disposal of waste streams on land and discharges to ground and surface waters.

The governmental institutions charged with enforcing the statutes include local, county-wide, regional, state and federal departments. All may have some authority with regard to control and enforcement of their particular ordinances covering the energy technology center activities. The regulations and pollution control requirements may differ with each institution. In some cases authority overlaps and some delegation of powers to the lower eschelon of government is instituted.

1.1 Significance of Internal Waste Management

Internal management of the wastes generated by the laboratories and testing activities at the Center will have considerable influence over the ultimate toxicity and hazardous nature of the residues. As an ancillary consequence, cost of handling and difficulty in disposing of the final waste product may increased significantly. There may be a synergistic increase in the toxicity or hazards due to mixing of two chemical wastes (which may not be considered hazardous separately). There is also the opportunity for diminishing the pollution impacts.

An opportunity may be available to neutralize the waste acids by mixing (properly) with waste alkaline substances also on-site.

Perhaps the most critical consequence of mixing non-interactive waste streams is the increase in volume of the overall waste which will be defined as hazardous in the statutory framework. A small concentration (.1 ppm) of cyanides or arsenic in the mixed conglomerate will be sufficient to render the total material 'hazardous' by regulation. Of greater importance to the Energy Technology Center is the presence of any organic substance with a calculated human LD_{50} (Lethal Dose 50 Percent Kill) less than 800 mg/kg in concentrations which may be as low as .04 mg/l depending on the toxicity. Some organic substances with these characteristics should be eliminated entirely from the complex.

The statutory 'hazardous classification' places constraints and special conditions on storage, transfer, transport and disposal of waste material. Consequently, a well-conceived policy for management of the variety of wastes streams generated at the Pittsburgh Energy Technology Center is necessary. Segregation and control at the generating locale can have a dominant effect on reducing hazards and costs.

Costs will not be substantially reduced in the processing of laboratory wastes due to the relatively small quantities to be processed. Classifying all of these wastes as 'hazardous' and proceeding according to the regulations can be a satisfactory management policy for this facet of the operations. The important parameter is proper handling and storage of the laboratory wastes to protect personnel exposed to the hazards (high toxicity chemicals, violent reactions and explosions). However, there is a substantial volume of spent solvents, waste oils and flammable liquids in addition to contaminated liquids from housekeeping and cleaning procedures. Periodic maintenance on test reactor vessels and storage tanks are also a source of relatively high volume residues which will exhibit the hazardous characteristics. Some cost savings may be realized with implementation of a management plan for these intermediate waste streams.

The greatest emphasis should be focused on developing the necessary data regarding the hazardous characteristics of the potentially gigantic (by volume) waste streams generated by pilot plant, demonstration units, and full-scale production facilities for conversion of coal to more convenient energy forms. Some process changes or pretreatment mechanisms may be necessary to avoid generating 'hazardous' wastes. There is an urgent need for directed research in this field.

1.2 Classification of Hazardous Wastes

The Resource Conservation Recovery Act of 1976 (P.L. 94-580) sets the criteria for designating hazardous wastes (Section 3001) within the context of the legislation. There are some special circumstances and exclusions from the Act. See Figure 1-2 for the protocol which can be used to determine the applicability of the federal legislation.

Two mechanisms are employed to define the wastes. Listing of particular chemical compounds, chemicals, and waste streams from listed processes are considered hazardous (statutory definition) simply by their presence on the list. The other basis for classification is based on the substance characteristics as stated in the regulation:

> "due to its intrinsic characteristics, properties, and potential hazard to human health or the environment when improperly managed, regardless of whether any individual waste is in fact managed safely." (4)

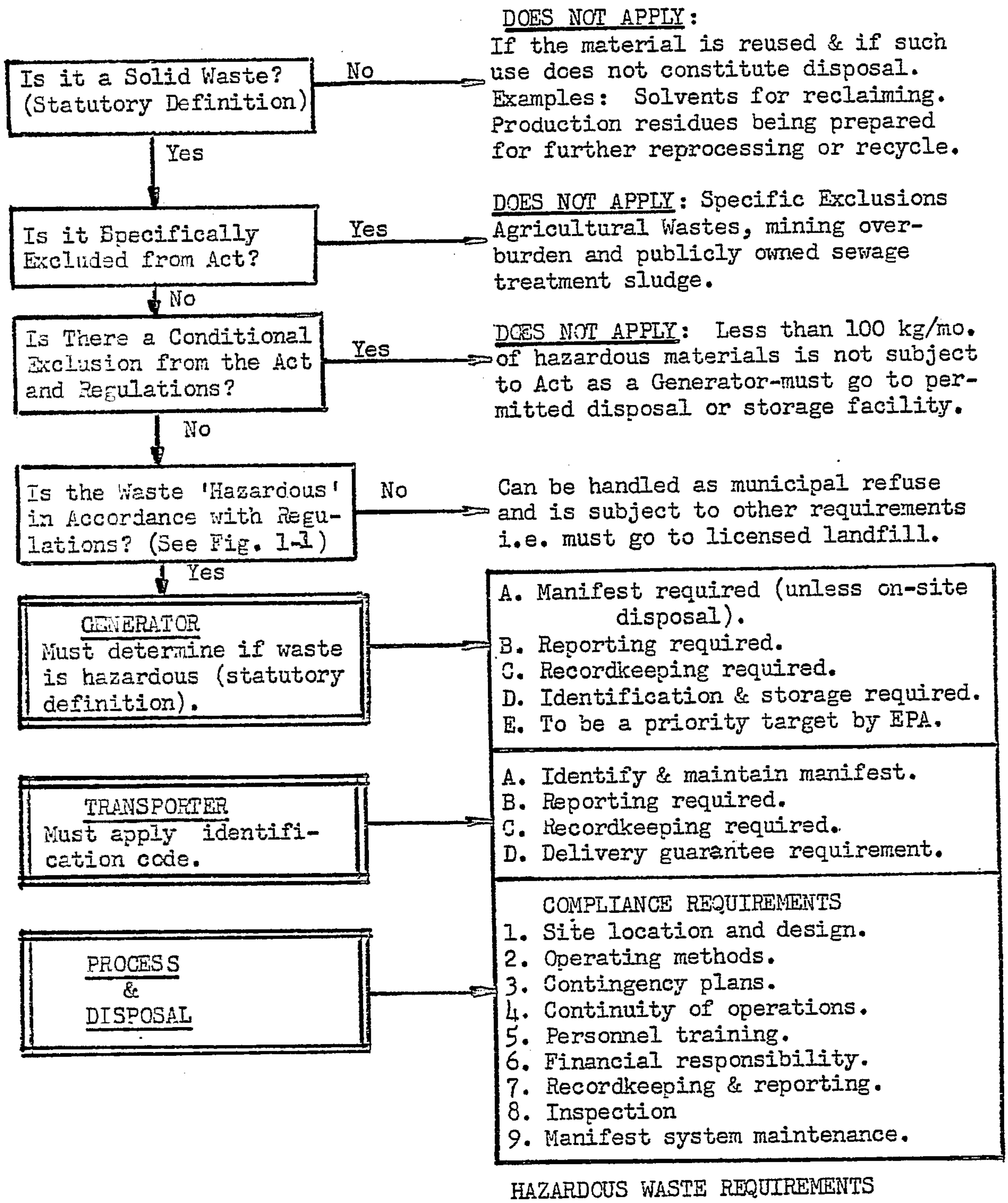

Figure 1-2 Protocol for Determination of Applicability of RCRA.

Another path may be used to declare a waste stream 'hazardous'- it can be placed in this category at the request of the Governor of a state or commonwealth, or an individual. This is the most likely route for coal conversion wastes to be included on the hazardous waste list. At the present time, utility wastes (flyash and flue gas desulfurization sludges) have been placed in a special category while research is conducted to make a determination. The fate of coal conversion wastes is in an ambiguous position and can be decided either way. Need for clarification is critical as the costs of treatment and disposal of massive volumes of materials can be effected in orders of magnitude. EPRI (Electric Power Research Institute) estimates the cost of disposing of one ton of wastes may rise to ninety dollars as compared to the present costs ranging from two to nine dollars. (6)

The characteristics selected to define a hazardous waste are: (1) ignitability; (2) reactivity; (3) corrosivity; (4) infectivity; (6) radioactivity; (7) and toxicity (using a toxicant extraction procedure to simulate the leaching of pollutants from the material when it is deposited in an open dump with municipal refuse). Toxicity is assessed with regard to the migration of heavy metals, mutagenicity of the simulated leachate, tendency to bioaccumulate, and the potential toxicity of organic fractions. Infectivity and radioactivity may not be relavent to the wastes generated at the Pittsburgh Energy Technology Center. Coal wastes and flyash have exhibited radioactivity. The possibility of radioactive elements in the wastes must be researched before this parameter can be dismissed from consideration. See Figure 1-1 for the protocol that will be useful in making the necessary classification.

1.3 Ignitable Waste

1.3.1 Definition

A solid waste is an ignitable waste (hazardous due to this characteristic) if a representative sample of that waste:

A. (1) has a flash point less than 60°C (140°F) in the liquid state,

(2) or under conditions incident to the management of the waste is liable to cause fires through friction, absorption of moisture, spontaneous chemical changes, or retained heat,

(3) or when ignited burns so vigorously and persistently as to create a hazard.

B. is a compressed gas as defined flammable in the federal DOT regulations 49 CFR 173.300.

C. is an oxidizer as defined in federal DOT regulations i.e.

> "is a substance such as chlorate, permanganate, peroxide, nitrocarbo nitrate, or a nitrate that yields oxygen readily to stimulate combustion." (7)

1.3.2 Overview

This hazard parameter (ignitable waste) must be considered with respect to pure substances (liquids), mixed chemical wastes in the liquid state with ignitable fractions, solid state of combustible wastes, and ignitable chemicals in an aqueous solution. For the relatively pure materials listed as laboratory wastes in Table 2-1, a determination is not difficult. The flash point value of the particular substance is sufficient to classify the waste as hazardous. Thirty three of the listed laboratory waste chemicals were classified in this manner. Mixtures of the flammable liquids would also fall in this category. Most of the ignitable liquid wastes generated in the Pittsburgh Energy Technology Center can be mixed without reactions.

Most of the bulk wastes are mixed materials both in make-up and state. Semi-solids (sludges) and solids (flyash and slag) will make up the major portion of the waste streams generated by the pilot plant operations and proposed demonstration facilities for coal conversion projects. Waste water treatment plant residues will not be ignitable wastes as defined by the statutes. Tank residues from intermediate process materials storage may be ignitable. There is need for research and investigation to make this determination.

Analytical measurement of the chemical fraction of mixed waste streams is one approach in assessing the ignitable characteristics of the material. However, most of the ignitable wastes are organic in nature which will influence the cost of analysis. After an analysis is made, the concentrations of the flammable fractions can be assessed to provide some data for classification. A viable procedure for classifying the wastes produced at the technology center would include:

a. Checking the value of the flash point of the pure chemical from the available handbooks.

b. Determination of the concentration ranges of the flammable constituents in the mixed waste stream.

c. Consider the physical state of the waste i.e. approximately two percent concentration of the critical constituent in an aqueous liquid would certainly not be an ignitable waste.

d. Actual laboratory testing to determine the flash point of the mixed material. If the waste stream is non-hazardous in every other respect, it would be advisable to perform the recommended tests.

However, toxic organic fractions may be the critical factor in classification of the waste as hazardous. More research is needed to identify the kinetics of ignitability of substantial waste streams expected from the process activities at the Pittsburgh Energy Technology Center.

There are two approaches to be considered in handling of ignitable materials after they become wastes. One is to segregate the waste streams into ignitable and non-ignitable groups. The ignitable wastes would then be processed as a hazardous substance during the storage, transfer, transport and disposal phases. The feasibility of this methodology is highly dependent on quantities generated. Regulations are very specific with regard to handling and packing the materials for transport. Disposal facilities (incinerators) are available for proper destruction of this material. Installation of a small (50 gallons per hour) liquid waste incineration may be economically feasible. Cost is the factor for comparing this alternative to off-site burning of the ignitable wastes.

If the flammable (in the pure state) substance can be agglomerated into another waste stream (optimally with a fine particle, chemically inert waste such as flyash or slag) concentrations may be reduced to the point that the waste is no longer ignitable. The hazard of ignitability may be eliminated allowing a less costly transport and disposal alternative. However, it is difficult to predict all possible circumstances when handling and disposing of the treated waste to assure complete control at all times. This is an alternative worthy of study as the costs of transport and disposal can be reduced in orders of magnitude. Quantities to be processed will have a strong influence on the choice.

1.4 Reactive Waste

1.4.1 Definition

"A solid waste is defined as a reactive waste if it:

A. (1) is normally unstable and readily undergoes violent chemical change but does not detonate,

(2) forms potentially explosive mixtures with water, or

(3) generates toxic fumes when mixed with water, or

(4) is a cyanide or sulfide bearing waste which might generate toxic fumes under mildly acidic or basic conditions.

B. (1) is capable of detonation or explosive reactions, but requires a strong initiating source or must be heated under confinement before initiation takes place, or

(2) which reacts explosively with water.

C. is readily capable of detonation or of explosive decompisition or reaction at normal temperatures and pressures.

D. is a forbidden explosive as defined by DOT regulation 49 CFR 173.51, 173.53, or 173.58" (4)

A mixed waste can be tested to determine its reactivity by one of two tests recommend in the regulations : an Explosion Temperature Test is described in Appendix 'A' of the regulations, and a Thermal Stability Test described in the federal DOT regulation .

1.4.2 Overview

The expected critical parameter which will place the residual into the statutory hazardous classification is either the toxic organic fraction or the ignitible nature of the material. There are some compounds listed in Table 2-1 which can be classified as reactive based on the character of the pure material. A few of the laboratory waste chemicals are oxidizers and should be segregated throughout the handling and disposal operations. The ethers (when aged) may form unstable peroxides which become highly explosive with initiation of the blast by shock or heat. A number of the chemicals will generate toxic fumes if heated and some substances will become reactive in the presence of an oxidizer. If all other tests including ignitability are negative when assessing the hazard parameters, then it might be advisable to conduct the tests for a reactivity determination. The tests may be avoided if the general nature of the mixed waste is known.

In some cases it might be possible to assess the probability of violent reactions due to mixing of two wastes. The available literature does list some well known reactive waste classes. Table 1-1 was developed by the California Department of Health (8) and the chemical industry has accumulated a data base regarding first level reactions of various chemical wastes.

Coal conversion processes are not expected to produce reactive wastes as a consequence of the operation of pilot plant and demonstration operations. The major bulk (volume) of wastes are residues from pyrolysis or combustion processes in which the reactive fractions have gone through chemical changes. However, there is no data in the literature regarding this aspect of the waste characteristics. Some study should be devoted to ascertaining the accuracy of the intuitive reasoning utilized.

While it may be advantageous to keep any reactive wastes segregated throughout the research process or pilot plant study stage - there are very few disposal services in existence that are able to properly handle this type of waste stream. Unit costs would be extremely high (a minimum cost regardless of volume would be assessed to cover potential risks),

Group 1-A	Group 1-B
Acetylene sludge 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	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 Spent acid Spent mixed acid Spent sulfuric acid
Potential consequences: Heat generation, violent reaction.	
Group 2-A	**Group 2-B**
Asbestos waste and other toxic wastes Beryllium wastes Unrinsed pesticide containers Waste pesticides	Cleaning solvents Data processing liquid Obsolete explosives Petroleum wastes Refinery waste Retrograde explosives Solvents Waste oil and other flammable explosive wastes
Potential consequences: Release of toxic substances in case of fire or explosion.	
Group 3-A	**Group 3-B**
Aluminum, Sodium Beryllium, Magnesium Lithium, Potassium Calcium Zinc power and other reactive metals and metal hydrides	Any waste in Group 1-A or 1-B
Potential consequences: Fire or explosion; generation of flammable hydrogen gas.	
Many wastes, when mixed with others at a hazardous waste facility can potentially produce adverse human health and environmental effects through means such as the following: (1) heat generation, (2) violent reaction, (3) release of toxic fumes and gases as a rusult of mixing, (4) release of toxic substances in case of fire or explosion, (5) fire or explosion, and (6) generation of flammable or toxic gases.	

Table 1-1 Potential Consequences of Mixing Incompatible Wastes (8)

Group 4-A	Group 4-B
Alcohols Water	Any concentrated waste in Groups 1-A and 1-B Calcium Lithium Potassium Metal hydrides Sodium SO_2Cl_2, $SOCl_2$, PCl_3, CH_3SiCl_3, and other water-reactives
Potential consequences: Fire, explosion, or heat generation; generation of flammable or toxic gases.	
Group 5-A	**Group 5-B**
Alcohols Aldehydes Halogenated hydrocarbons Nitrated hydrocarbons and other reactive organic compounds Unsaturated hydrocarbons	Concentrated Group 1-A or 1-B wastes Group 3-A wastes
Potential consequences: Fire, explosion or violent reaction.	
Group 6-A	**Group 6-B**
Spent cyanide and sulfide solutions	Group 1-B wastes
Potential consequences: Generation of toxic hydrogen cyanide or hydrogen sulfide gas.	
Group 7-A	**Group 7-B**
Chlorates and other strong oxidizers Chlorine Chlorites Chromic Acid Hypochlorites Nitrates Nitric acid, fuming Perchlorates Permanganates Peroxides	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 combustible wastes
Potential consequences: Fire, explosion, or violent reaction.	
Above is a summary list of potentially incompatible waste materials or components and the adverse consequences resulting from mixing of waste in one group with waste in another group.	

Table 1-1 Potential Consequences of Mixing Incompatible Wastes (contd)

Proper internal control and handling of reactive wastes would be difficult without highly trained, careful personnel at the Technology Center. Reactive (very highly reactive) materials should be avoided if possible, and substitutes used in the research activities. If there are no alternative materials available to meet project objectives, a safety officer should direct the use of the substances of concern. Table 2-1 identifies some of the reported waste chemicals that are classified in this category.

There is a dearth of specific information on the reactivity of second order (two mixed chemicals) and practically no data exists on waste mixtures of more than two chemical substances. A study should be implemented to determine if a special program is needed to insure the safety of Technology Center personnel during internal handling of laboratory wastes.

Although there may be reactive components in the wastes streams that are generated during the pilot plant and demonstration phase of the ongoing projects, the concentrations reported (which may be trace amounts) lead to the conclusion that they are not reactive wastes. Accumulated residues in the storage tanks and reactors may be classified as reactive substances depending on the physical and chemical characteristics of the specific materials. There is a need for study to characterize them with some accuracy.

1.5 Corrosive Waste

1.5.1 Definition

A waste defined in this category is corrosive if a representative sample of the waste is:

A. aqueous (liquid with water) and has a pH less than or equal to 3.0 or greater than or equal to 12.0.

B. a substance which has a corrosion rate greater than 0.25 inches per year on SAE 1020 steel at a temperature of 130°F.

1.5.2 Overview

Only the first part of the above definition has relevance to the activities at the Pittsburgh Energy Technology Center. The corrosion rate when steel is exposed to the substance is necessary to develop specifications for the containers utilized in storing and transporting the corrosive materials. The high and low pH aqueous solutions can be injurious to any exposed skin tissue and especially to the eyes. Proper occupational safety precautions must be taken in the handling of the corrosive materials in all phases of handling and disposal. Handling of acids and bases must be controlled and internal personnel must be trained to avoid serious injuries and prevent accidents. Laboratory chemicals will alway include some sulfuric and hydrochloric acids, as well as sodium hydroxide and ammonium hydroxide, which are within the statutory definition of a hazardous waste.

Concern for the proper pretreatment and disposal of this waste category is based on the higher solubility of toxic heavy metal ions at low and high pH values in aqueous solutions. Possible release and migration of toxic metals to potable water supplies and thereby to humans with concomitant health effects is of utmost concern. Consequently, controlled handling and disposal of spent acids and alkali is required.

There may be some opportunity to practice on-site neutralization of the corrosive wastes when both alkaline and acidic materials are available as wastes. A careful analysis is needed to determine feasibility as the chemical reaction is quite strong, and fumes generated during the neutralization process must be controlled. Large volumes of sludge (approximately equal to the original acid volume) are one consequence of the treatment. In full scale coal conversion operations it may be feasible to construct and operate an on-site neutralization plant if there are sufficient quantites of both waste available. A viable sludge disposal scheme is also needed before on-site treatment can become practical. Some research is needed in this area.

1.6 Infectious Wastes

1.6.1 Definition

The regulations address the question of infectivity (pathogenicity) by listing the types of activities that will generate wastes which contain pathogenic agents. In addition, specific bacteria and viruses are listed. Covered in this category are hospitals, surgeries, vetinary clinics, etc.

1.6.2 Overview

In the perspective of coal conversion facilities and energy technology centers, this sub-classification would not appear to be relevant. Normal precautionary operating procedures used in the daily operation of the clinic or medical facility (contained in a large technology center) should be sufficient to eliminate any applicability of this category.

Other regulations will cover the handling of sanitary wastes at the site. All precautions to protect the public health (internal and external to the source) are taken in response to state and local health department requirements.

1.7 Radioactive Wastes

1.7.1 Definition

A solid waste is a hazardous waste if it is not covered by the Atomic Energy Act of 1954 and if a representative sample of the waste has either of the following properties:

(1) The average radium-226 concentration exceeds 5 picocuries per gram for solid wastes or 50 picocuries (radium-226 and radium-228 combined) per liter of liquid wastes; as determined by specific tests in the appendix of the regulations.

(2) The total radium-226 activity equals or exceeds 10 microcuries for any single discrete source. (4)

1.7.2 Overview

The radioactive characteristic does not appear to apply to any laboratory wastes reported in the inventory (9). If radioactive isotopes are used as tracer elements in the research activity at the energy technology center, it would be included in the wastes covered by the Atomic Energy Act of 1954 and not subject to RCRA.

Some references in the literature report radioactive nucleides in wastes generated by coal cleaning plants and coal-fired power plants. An adequate data base is not available at this time to make a judgement on the relevancy of radioactive wastes to coal conversion processes. It would appear that the characteristics of the coal would be influential in effecting the radioactivity level in discharges to air, water, or land receptors. Some study would be helpful in obtaining the data base needed to make informed decisions, but should be considered (at this stage) as a low priority.

1.8 Toxic Wastes

1.8.1 Definition

A. A solid waste is a hazardous waste if an extract, obtained by applying the prescribed toxicant extraction procedure (TEP) to a representative sample of the waste,has concentrations of a contaminant that exceeds any concentrations listed in Table 1-2.

B. In addition to wastes subjected to the toxicant extraction procedure, specific waste streams and residues from specific processes listed in the regulations are considered hazardous by administrative decision of the Administrator of the U.S. Environmental Protection Agency.

C. In addition to the above, a list of controlled chemicals which are considered priority pollutants are considered hazardous by administrative decision as above.

D. In addition to all of the above, a list of substances classified by the U.S. Department of Transportation as Poison A, Poison B, or ORM-A are also classified as hazardous.

At this point in time, only the substances listed in the Interim Primary Drinking Water Standards are considered to determine a yes/no toxicity hazard rating. The Environmental Protection Agency is considering the application of the Water Quality Criteria (under the Clean Water Act) as a basis for setting other extract substance levels for the hazardous waste definition under this heading. Table 1-3 lists other substances or parameters which may become applicable when considering toxicity.

The application of interim primary drinking water standards to the concentrations(of the substances listed) in the toxicant extract is all

CONTAMINANT:	Extract level, milligrams per liter
Arsenic	0.50
Barium	10.0
Cadmium	0.10
Chromium	0.50
Lead	0.50
Mercury	0.02
Selenium	0.10
Silver	0.50
Endrin (Pesticide)	0.002
Lindane (Pesticide)	0.040
Methoxychlor (Chlorinated Biphenyl)	1.0
Toxaphene (Pesticide)	0.050
2,4-D (Pesticide)	1.0
2,4,5-TP (Pesticide)	0.10

Table 1-2 Extract Levels of Heavy Metals & Pesticides-Hazardous Wastes Classification. Ten Times Primary Drinking Water Standards.(4)

CONTAMINANT:	Extract level, milligrams per liter
Chloride	2500
Copper	10
Foaming Agents	5
Hydrogen Sulfide	0.5
Iron	3
Manganese	0.5
Sulfate	2500
Total Dissolved Solids	5000
Zinc	50
Color	150 Color Units
Odor	30 TO Numbers
pH	6.5 - 8.5

Table 1-3 Extract Levels of Heavy Metals and Other Water Quality Parameters-Hazardous Wastes Classification. Ten Times Secondary Drinking Water Standards. (4)

that is required for determining whether a waste (which is not specifically listed in the statutes) is to be classified as hazardous due to its toxicity.

1.8.2 Overview (Toxicity-Trace Metals)

Most laboratory chemicals (or waste chemicals resulting from laboratory activity) fall into two main categories of statutory hazardous wastes. They are either inorganic chemicals with toxic metals fractions or organic wastes which are toxic to humans, plants and animals. Because the residues are mainly coal derived chemicals or similar in nature to coal fractions, approximately ninety percent (90%) are organic. Precedence indicates that this group of wastes will be classified as 'hazardous' by administrative decision based on the type of generating activity (similar to coking operations). Many of the laboratory toxic wastes are highly flammable and will be regulated under the ignitable wastes section of the regulations. The vast majority (by bulk) of the laboratory wastes reported will not be considered toxic by virtue of release of toxic heavy metal ions.

A reasonable policy for handling and disposal of the laboratory residues at the Pittsburgh Energy Technology Center is to declare all of the wastes as being hazardous (by legislative definition). This would be feasible except in the case of some non-hazardous wastes which may constitute a large proportion (by volume) of the total wastes generated on the site. Of critical importance in the viability of the above policy is the miscellaneous waste group reported as flyash, slag, lime sludge, and wastewater. They appear to make up eighty percent (80%) of the total volume of wastes reported in the inventory. The wastes listed in this group are of undeterminable classification with the data available at the present time. More study is required to determine the characteristics of this particular group of materials. Expenses incurred in handling and disposal of these residues will have a dominant influence on the overall costs of operation. Consequently, a program for developing the data needed to characterize (with regard to the statutory classification of hazardous wastes) this group of wastes is of utmost importance.

Residues generated by pilot and demonstration plants will mainly be in the form of flyash, char, wastewater treatment plant sludges and some water treatment chemicals. The main bulk of the wastes will fall into the indeterminate category. Of greatest concern will be the possible listing of the residues as hazardous wastes by administrative decision due to the type of generating activity. The flyash and chars will be classified as 'hazardous' due to the heavy metal ions which may leach from them when disposed of on land. There is some potential for the application of the hazardous waste classification on all coal conversion plant residues. A cost-effective handling and disposal program will be imperative, but it must be based on data which is not available at this point in time. More research and study is needed if reasonable handling schemes are to be formulated.

1.9 Other Hazardous Characteristics

In addition to toxic heavy metal fractions which may be released from the residues with resulting migration to potable water supplies, the hazard characteristics of mutagenecity, bioaccumulation (by aquatic organisms, animal, plants, and man), and toxic organic substances must be considered in the statutory definition of a hazardous waste. The testing procedures listed in the regulations are applied to the toxicant extract which is induced by prescribed sample preparation methods. Perhaps the most significant aspect of the methodology is the direct inclusion of the liquid fraction of the residues (separated by pressure filtration or centrifugation). This supernatent or filtrate will, in the case of the laboratory chemicals, be made up of the chemical itself(if any portion of the waste is in the liquid state). Concentrations of organic substances as high as one hundred percent of the waste may be considered to be the toxicant extract. Dependence on low concentrations to exhibit non-hazardous characteristics with regard to mutagenicity or bioaccumulation is questionable. In the case of mutagenicity and bioaccumulation a threshold which will give negative results from the prescribed tests may not exist. A concentration of one part per million of toxic organic substances is sufficient to classify the residue in the 'hazardous' category.

1.9.1 Mutagenicity

1.9.1.1 Definition

A waste stream is defined as mutagenic if (a) the substance contains at least one mg/l of any compound found on the Controlled Substance List for mutagenic activity. This list is presented as Appendix IX in the proposed regulations (4) and includes thirty three chemicals.

1.9.1.2 Overview-Mutagenicity

A review of Table 2-1 reveals at least three compounds found in the laboratories at the Pittsburgh Energy Technology Center are on the list of controlled substances. The most ubiquitous substance with known mutegenic potential is benzene. This chemical may also be the largest volume waste stream of the laboratory residues. Carbon tetrachloride appears on the list but is reported in very small quantities. Other substances reported in the inventory of laboratory chemical wastes - not on the controlled substances list -are cited in the literature as mutagens and carcinogens. These are indicated in the tabulation in Table 2-1. The major mitigating circumstance regarding the mutagenic substances is that they are also highly flammable and would be classified as hazardous substances regardless of their mutagenic characteristic. Consequently, this hazard would have little influence on an overall management plan for laboratory wastes.

There is some question regarding the mutagenic activity of the high volume wastes generated by the usual activities at the Energy Technology Center. The flyash, slag and lime sludge reported is approximately 95-98 percent (by weight) of all the industrial wastes generated at the site. These materials are not characterized with regard to the trace fractions of potential mutagenic substances. Polycyclic aromatic hydrocarbon (PAH) compounds, some of which exhibit highly mutagenic activity, are found in some of the residues listed above. An administrative classification of "hazardous due to mutagenic activity" on some of the above waste streams is a distinct possibility. There is a lack of data at the present time to make an assessment of the mutagenic characteristics of energy center waste streams. A need for study is urgent as the costs of handling and disposal of the materials in this category will have a dominant effect on overall expenses. Due to the volumes generated, disposal costs may be increased by order of one or two magnitudes (10-100 times).

It is even more imperative to develop some data on the process wastes that will result from demonstration and full size coal conversion facilities. The design of acceptable disposal techniques for the solid waste streams originating from coal conversion processes and sludges resulting from wastewater treatment is of primary concern in the feasibility of the alternative processes. Costs of handling and disposal can dictate the need for pretreatment or process changes in the entire operation.

1.9.2 Bioaccumulation

1.9.2.1 Definition

A waste stream will be considered bioaccumulative (and therefore 'hazardous') if a positive result is obtained in a prescribed Bioaccumulation Potential Test. Reverse-phase liquid chromatography techniques are utilized in the measurement of octanol/water partition coefficients which exhibit a specific correlation to biocentration of substances in fish. Compounds (toxicant extract) with a P log coefficient greater than or equal to 3.5 are considered bioaccumulative if the compound is not biodegradable. A biodegradation assay is used to finally rule out bioaccumulation of the suspect (positive) substance before it can accumulate.

1.9.2.2 Overview-Bioaccumulation

Most of the bioaccumulative compounds identified in the literature are high molecular weight polynuclear aromatic hydrocarbons and pesticides. (11) This hazard classification is not expected to be a critical problem in the handling of laboratory wastes at the facility. Most of the substances that may fall in this category will exhibit two other hazard characteristics i.e. ignitability and toxic organic fraction. Carbon tetrachloride would be a chemical of concern in this context. Some consideration for the elimination of carbon tetrachloride should be studied.

Demonstration project and coal conversion waste streams have not been researched to any extent in the perspective of generating bioaccumulative substances. Wastewater treatment plant residues may have some bioaccumulation potential and should be examined to determine the general characteristics of this waste stream due to the potentially large volumes of wastes that may be generated. Twenty thousand gallons per day of a biologically active sludge are produced by the wastewater treatment plant of the coke works of United States Steel Corporation at Clairton. (11) There is a dire need for research in this area.

1.9.3 Toxic Organic Fraction

1.9.3.1 Definition

The toxicant extract must be assessed for any organic substance which has a calculated human LD_{50} (lethal dose resulting in 50 percent kill) less than 800 mg/kg at a concentration (in the extract) in mg/l greater than or equal to 0.35 times its LD_{50} value expressed in units of mg/kg. Table 2-1 lists the laboratory waste chemicals that fall into this class.

1.9.3.2 Overview-Toxic Organic Fraction

Some laboratory wastes reported in the inventory (9) fall into the hazardous category by virtue of their toxicity as measured by the oral lethal dose (LD_{50}) for rats. On the basis of a calculated LD_{50}= 800 mg/kg for humans (the methodology for calculated values is LD_{50}=0.16 X LD_{50}(rats)). Table 2-1 lists the allowable concentrations (in the toxicant extract) of the various organic chemicals which fall into this classification. Of concern is the pure chemical in the liquid form which becomes an integral portion of the toxicant extract.

On the basis of listing of the substances (by DOT) as a poison i.e. phenol (which has an allowable concentration of 23 mg/l as calculated by the methodology listed in the regulations), all of the non-listed organic compounds reported at the facility associated with lower allowable concentrations should be of great concern in the occupational health perspective. Twelve waste chemicals listed in Table 2-1 should be handled as highly toxic substances by this criterion. Great care must taken in the handling of acetonitrile, phenyl mercaptans, benzyl mercaptans, benzyl isothourea hydrochloride, dicyclopentadiene, dimethyl gloxamine, rhodanine, and quinoline. Dimethylene triamine appears to be an especially potent poison.

Process wastes generated by the individual test projects usually implemented at the Pittsburgh Energy Technology Center cannot be categorized from the present data base. Quinolines have been reported in the literature in concentrations up to 100 mg/l (10). The presence of other toxic organic chemicals are also likely as the process wastes streams contain most of the coal chemicals listed in the inventory. The fate of the various organic fractions produced (coal chemicals derived by the conversion process) is unknown. Considerable research efforts will be needed to determine the possible environmental impacts of the high volume waste streams (flyash, char, raw wastewater, and wastewater treatment plant residues).

1.10 Pollutional Impacts

1.10.1 Air Pollution

Environmental impacts from gaseous emissions at the Energy Technology Center are divided into two classes i.e. internal work space and the external environment. Discharges of fumes and vapors must be viewed in the context of occupational health and safety. All precautionary measures covering toxic gaseous emissions are dictated by OSHA (U.S. Occupational Safety and Health Administration) with implementation in the laboratory design and construction. State building licences cover the fire safety elements of the facility. This aspect is not in the purview of this study project. Exhaust ducts and hoods over working areas in the laboratory are usually contained in the original laboratory design. Specific laboratory procedures in which toxic fumes are generated are well known and incorporated in standard procedures established by science management.

Fume pretreatment prior to release to the unconfined environment may be a requirement established by the rules and regulations promulgated by OSHA, EPA or the cognizant state authority (PennDER-Occupational Health). General emissions to the air environment are covered by regulations of the state (PennDER-Bureau of Air Quality Monitoring) or the county (Allegheny County Health Department-Bureau of Air Pollution). In general, the low volume releases of toxic gases to the atmosphere from laboratory operations have a very low enforcement priority at all of the aforementioned agencies. At the present time, this particular environmental impact does not appear to present a problem that must be addressed by the Pittsburgh Energy Technology Center.

The potential stack emissions resulting from pilot plant operations are of undetermined significance due to the relatively low volume releases of exhaust gases with specifically controlled environmental pollutants (particulates, sulfur oxides, nitrogen oxides). Hydrocarbon releases may be of concern with new regulations that are now being promulgated. Demonstration scale units and full scale coal conversion plants will of necessity require flue gas emission control (where there are emissions) as part of the overall plant design. This aspect is beyond the scope of this project.

Fugitive dusts and vapors must be controlled by existing enforcement regulations in the operation of on-site and off-site waste processing and disposal facilities. In the case of incineration, all of the units processing hazardous wastes (without exception) will need stack gas cleaning elements (wet scrubbers or baghouses) due to the wide spectrum of toxic and odorous gas fumes which result from the combustion of these wastes. Concomitant with wet scrubbing, the cleaning water will need pretreatment prior to discharge.

1.10.2 Water Pollution

Potential environmental impacts from direct discharge of spent laboratory chemicals are dependent on waste quantities, concentrations, and characteristics of the receiving medium. Phenols will combine with disinfecting chlorine used in water treatment plants to result in compounds which have taste and odor impacts on the treated water at extremely low concentrations. Little is known of the material transport mechanisms, consequently there is a risk of slugs (with little dilution) of toxic chemicals reaching animal or man. Aquatic organisms - especially in the embryonic stage of their growth - are susceptible to toxic effects (at low concentrations) of many of the listed laboratory chemical wastes.

A productive stream can be rendered sterile if particularly potent chemical wastes were released.

Of concern in the migration of laboratory chemical wastes is their high toxicity and concentrations, but the quantities generated at the Center afford opportunities for the environment to buffer the impacts. The usual migration dynamics indicate a slow release (when the chemical migrates indirectly to the water) and tremendous dilution ratios will attenuate the environmental insults to the extent that they will be too small to be measured. Effluent limits and water quality criteria will not be exceeded if direct discharges to the receiving stream are avoided.

Large volume wastes produced at the Energy Technology Center evoke a different set of impacts. Although the wastes may not be highly toxic and concentrations of the toxic fraction may be low, the consequences of direct placement in the water are of great concern. Deposition of lime sludge (which may be in the chemical form of calcium sulfite) in the stream may radically change the DO of the water. Consequences can include the elimination of most of the aquatic biota. The calcium sulfite will be oxygen demanding and cause a sag in the dissolved oxygen required for survival by the fish in the stream. Water quality for drinking, recreation, industrial and other uses can be seriously effected.

Flyash and slag may leach toxic heavy metal ions which in the long term will cause detrimental health effects in plants, animals, aquatic biota and man. As stated previously, the characteristics (chemical and physical) of the high volume, relatively non-toxic wastes are not documented sufficiently to predict all of the potential pollutional impacts. Placement of large masses of very fine particle wastes will act as a siltation blanket (although the material may not release heavy metals) to cover the bottom benthic organisms that are necessary to maintain the aquatic ecology of the receiving stream.

1.10.3 Land Contamination

Impacts from the disposal of wastes on land are assessed in the context of ground and surface waters. Using this perspective, any assessment must include chemical nature of the wastes, hydrogeological and topographical features of the disposal site, design and operation of this facility.

Chemical characteristics of the laboratory chemical wastes are known in terms of the pure substances. Many of the materials are toxic, corrosive, and/or flammable. The flammable wastes may be highly volatile and present some fume problems. Actual handling of the materials at the land disposal location must be carried out with the safety of the operating personnel as the primary objective. Potential danger from fires or explosions must be minimized. Hazardous nature of the various wastes must be identified in order to safely handle them in the disposal phase of management.

Leaching of toxic fraction are a concern but the hydrogeological features of the disposal site and the design can attenuate and in some instances actually prevent migration of the substances of concern. The very small (relatively) volumes involved would preclude serious consequences of pollution from land disposal as the soils have some clean-up capabilities. However, legally the operation will be subject to many stringent requirements which must be carefully considered in order to make this alternative feasible. More study is needed to determine the material transport kinetics involved in toxic waste migration from land management.

Fly ash, slag, flue gas desulfurization sludges and coal cleaning wastes have been managed by land disposal methods for a long time. The operations have been successful where cngineered sites were used. In most locations, fly ash and slag have not caused severe environmental problems to the water medium, but this appears to be dependent on the chemical nature of the particular waste. FGD sludges have been pretreated to prevent stabilization problems. Coal cleaning residues were successfully managed at locations which were engineered properly. Due to the projected volumes to be generated by full-scale coal conversion facilities and demonstration plants, environmental pollution problems are likely in this activity. Potential environmental impacts due to storage (on land) of vast quantities of wastes with soluble heavy metal fractions and the costs of disposing of large masses of materials are factors of concern.

Site selection (for minimal environmental pollution) is the main mechanism for pollution prevention in designing the disposal site. A properly (hydrogeological and topographical) selected location is the one most effective method for minimization of environmental insults. Effective surface water diversion structures to minimize infiltration to the deposited solid wastes is necessary to reduce or even prevent (by precluding saturation-field capacity of the wastes) leachate formation and resulting migration from the disposal area. Daily operational techniques (efficient compaction) and effective maintenance of the structures, as well as designed grading will also effect the potential impacts from the operation. The above is essential for viable land disposal of the high volumes of wastes usually generated at coal conversion facilities.

Pretreatment (stabilization or solidification) of some of the residues, especially the sludges, may be necessary to minimize, attenuate or prevent leaching of toxic heavy metal ions from the high volume waste streams. As the federal regulations are now proposed, stabilization will be mandatory in the case of all liquid and semi-solid hazardous wastes.

1.11 Legislation and Regulations

Three, and possibly four, tiers of governmental agencies are now involved in enforcement of environmental controls with regard to transport, processing and disposal of solid wastes normally generated at the Pittsburgh Energy Technology Center. Table 1-4 is a tabular presentation of the political entities involved and the sphere of operations for each category. The following presentation will describe the relevant regulations and enforcement agency policy and procedures that are followed at the present time.

1.11.1 Local Requirements

At the present time, there are no local ordinances on the books to control the types of wastes generated at the Pittsburgh Energy Technology Center. Local statutes do exist to cover storage and collection of municipal refuse. The local fire marshal may have some authority to dictate safety requirements for handling and storage of flammable products and ignitable wastes generated at the facility. OSHA regulations which are more detailed and stringent may supercede the marshall's authority. State police permits may be required for any buried storage tanks containing flammable substances.

	BOROUGH OR TOWNSHIP	ALLEGHENY COUNTY	COMMONWEALTH OF PENNSYLVANIA	FEDERAL U.S. ENVIRONMENTAL PROT. AGENCY
GENERATOR	Storage and/ or Collection Ordinance (for refuse only)		Storage Regulations-on site Identification of Industrial Waste Characteristics. Chapter 75 (Act 241-S.W. Mgt. Act)	
TRANSPORTER	Licensing of Transport Vehicle (fee only). Some functional regulations i.e. a covered body is required (municipal refuse only) VEHICLE LICENSE	Licensing and Registration of Transport Vehicle. (fee only) Check compliance with state regulations. All liquid and solid waste carriers require licensing VEHICLE LICENSE	General Requirements i.e. Proper vehicle design for industrial wastes-Chapter 75 State P.U.C. Licensing-limitation on hauling in restricted areas.	U.S. DOT regulations cover container specifications 49 CFR Subchapter G. Vehicle spec. i.e. stainless steel tanks for acid, safety design for flammables, etc. Warning signs on vehicles. Partial Manifest System.
TREATMENT & PROCESSING	Building and Occupancy Permits. Zoning variance if necessary BUILDING PERMIT	Delegation of Authority from Commonwealth to County for inspections and monitoring.	Industrial Waste Permit is required if there are any water discharges or impoundments from the BuWQM (PennDER). A Solid Waste Processing Permis is needed. I.W. & S.W. PERMITS	NPDES permit from EPA is required for any water discharges. May need a permit from Corp of Engrs or Coast Guard in case of oil processing. NPDES PERMIT
INCINERATION	Building and Occupancy Permits. Zoning variance if necessary. BUILDING PERMIT	Delegation of Authority by Commonwealth (PennDER) to County for inspection and enforcement. ACHD Air Pollution Control Bureau Permit for prototype which includes a performance test after installation. Article XVIII (County Regulation) FACILITY PERMIT	Authority Delegated to County by PennDER.(BuAQM) by renewable contract. State incinerator permit is required (County will monitor performance tests). Clean Air Act INCINERATOR PERMIT EFFLUENT DISCHARGE PERMIT (Water)	Primacy given to Commonwealth by EPA for approved plan. EPA acts to enforce Clean Air Act if other agencies are not effective.
LAND DISPOSAL	Construction or Occupancy Permit. Grading Ordinance may apply. Zoning variance may be required OCCUPANCY PERMIT	Delegation of Authority by Commonwealth (PennDER) to County (by contract) for inspection and enforcement. County disposal site permit is required. DISPOSAL SITE PERMIT	Act 241 (Chap. 75 Regulations) Div. SWM-PennDER revies design. State S.W. Permit is required. If water discharge must be treated I.W. Permit is needed. Dams & Encroachment Permit may be requir. for impoundments. Soil Erosion & Sedimentation Plan must be app'd. S.W. PERMIT I.W. PERMIT DAMS & ENCROACHMENT PERMIT	Primacy given to Commonwealth. NPDES permit is required for treatment plant discharges. NPDES PERMIT

Table 1-4 Institutional Framework for Environmental Control Enforcement in 1979 (Prior to RCRA Implementation)

The Solid Waste Management Act of 1968 (Pennsylvania Act 241) mandates local involvement in control of industrial and hazardous wastes. Interpretation of this clause of the Act implies responsibility of municipalities to collect and dispose of industrial wastes safely, if the generator fails to comply with the covering statutes. This authorization has not been challenged in the courts, nor has any local government chosen to carry the burden of collection, transport and disposal of industrial wastes produced within its borders.

Federal legislation (Resource Conservation and Recovery Act- P.L. 94-580) has preempted both state and local institutions with regard to proper management of solid wastes. Primacy for enforcement of federally approved regulations will be taken by the Commonwealth within eighteen months of promulgation of the federal statutes. Local involvement will be limited to issuance of building and occupancy permits for processing facilities, zoning variances where needed, and grading restrictions in the case of land disposal operations. Special use permits may be required if specifically indicated in the local zoning ordinance.

1.11.2 Environmental Pollution Control-Allegheny County

Allegheny County's mandate to enforce environmental statutes is founded on delegation of authority by annual contract with the state. Article VIII for solid waste management, Article IX for water quality monitoring, and Article XVIII for air pollution control are the county regulations which apply to the activities at the Pittsburgh Energy Technology Center. They are the major mechanisms utilized by county personnel to enforce compliance with the statutes which are compatible with the state and federal regulations (12).

Air Pollution Control Bureau (Allegheny County Health Department) involvement covers controlling fumes and flue gas emission from the stacks and exhausts at the Center. Fugitive dusts from disposal site operations and determination of compliance capability of waste incinerators used to process the residues generated are also under the jurisdiction of this bureau.(13) OSHA (federal Occupational Safety and Health Agency) is mainly concerned with the environment of the work place. The regulations are directed to controlled worker exposure and management of highly hazardous substances. Beryllium and asbestos concentration in the internal ambient air are limited to estimated safe levels with respect to injury and health effects on the operating personnel. This aspect of environmental hazards is beyond the scope of this presentation. There may be some relavent statutes (OSHA) covering the discharges of particularly hazardous substances to the atmosphere from the internal air ducting system. A new hydrocarbon release regulation, now in the process of promulgation by the county, may have some compliance requirements on the Center's laboratory and pilot plant projects.

Of some importance to any proposed management plan for solid and liquid residues generated at the Pittsburgh Energy Technology Center is the regulatory requirement of an operating permit (issued by the county) for any incinerator within the geographical bounds of the county. This permit is issued in two stages -the first stage provides for a technical design review and assessment of test data resulting from prototype unit operations which assure the incinerator's ability to comply with emission standards. After installation, the actual unit must undergo performance tests to prove that compliance. The final permit is then issued. Due to the delegation of authority by PennDER, a state permit is given simultaneously with the county document. In order for the PETC staff to determine full legality (at the present time) of processing and disposal of the Center's flammable wastes, two permit identification numbers are needed for documentation when off-site incineration is claimed to be the disposal method.

Liquid and solid wastes which will be processed by other techniques fall into the purview of the Solid Waste and Water Quality Monitoring Bureau (Allegheny County Health Department). Authority by annual contract has been delegated by the Commonwealth to the County. This section does not specifically issue permits for industrial waste treatment installations (PennDER issues them). If the final disposition of the waste substances will be on land within the County, a permit is needed. A concurrent technical review of proposed sites is conducted by both state and county personnel. Dual permits are issued at the same time. (14).

County personnel are used as the primary enforcement mechanism. They make periodic inspections and investigations into compliance with the relevant regulations. County regulations (Article VIII and IX) cover the requirements for management of industrial and municipal wastes. The state and county statutes are almost identical. A special vehicle license tag is required for all transport units operating in the county. This is not a control mechanism, but is used as a revenue collection procedure.

1.11.3 Environmental Control & Enforcement -Pennsylvania

The Commonwealth's activity in enforcement of pollution control derives its authority from the federal constitutional mandate to "protect the public health." State's rights primacy with respect to environmental quality is firmly established by legal precedents. Control of liquid and solid residues produced at the Energy Technology Center are monitored by three bureaus (Bureau of Air Quality Monitoring, Bureau of Water Quality Management, and the Bureau of Solid Waste Management) of the Pennsylvania Department of Environmental Resources. Regional and central office (Harrisburg) staff are involved in review and inspection activity. Authorization for enforcement and establishment of specific criteria were by legislation, specifically by Pennsylvania's Clean Air Act, Clean Streams Law and Solid Waste Management Act.

Fugitive dusts and fumes are under the aegis of the Bureau of Air Quality Monitoring. This enforcement activity has been delegated to Allegheny County by renewable contract dependent on equal or more stringent regulations. A low priority has been placed on this phase of air quality control, consequently the state and county have expended minimal, if any, resources for enforcement of the statutes. The aparrent policy of both organizations appears to be that of acting only on specific citizen's complaints.

Effluent discharges to surface and ground water are controlled by the Bureau of Water Quality Management on a regional basis. Stream monitoring is conducted by this bureau which operates an analytical laboratory in Pittsburgh. Control (and enforcement) is accomplished by implementation of a permit system (industrial waste permits, impoundment permit, and/or dams and encroachment permit) for any waste water treatment facility, with corresponding federal NPDES (National Pollutant Discharge Elimination System) permits for the specific discharges involved. The regional water quality planner (PennDER) sets the limits on discharges using heavy metal ion concentrations, biological parameters, and water quality measurements as the criteria for the receiving stream. Additional permits from Dams & Encroachment Division (BuWQM) may be needed if the stream flow or river bed is significantly altered. If run-off character of the drainage basin is changed (by encapsulation of tributaries, etc.) this permit would be required before installation. All impoundments with volumes exceeding 250,000 gallons require a BuWQM permit.

Solid waste management is the major tool for protecting the water and land environment. The Bureau of Solid Waste Management has the major responsibility to ensure proper processing and disposal of liquid, semi-solid and solid wastes on land. A state permit is mandatory before a solid waste disposal site or processing facility can be operated. Process facilities include incinerators, pre-processing solid waste operations, disposal sites and transfer stations. The Solid Waste Management Act (Act 241) and the PennDER regulations (Chapter 75) cover the criteria for compliance with the statutes relavent to physical and hydrogeological character of the site, design and operations of the facilities and disposal locations. Main concern of this division (in the case of incineration) are the proper disposal of the residues resulting from the incineration process and liquid effluents which may reach the water environment.

The regulations do not address the subject of liability in the case of pollution episodes from transport, storage, processing and disposal of chemical and hazardous wastes. The statutes do require the generator (Pittsburgh Energy Technology Center) to identify the wastes and inform the transporter of the constituents and the hazards associated with them (PennDER Regulations - Chapter 75, paragraph 40). At the present time, there is no mandatory requirement for a detailed manifest and reporting system which traces the movement of the wastes from the generator to the ultimate disposal location.

Proposed processing and disposal methodologies must be submitted to the county and state authorities for approval on a case-by-case basis if the wastes are to be disposed of in Allegheny County. Only state approval is required if the material moves across county lines. Under the present enforcement system, hazardous wastes moving out of the state are not controlled by PennDER agencies. The extent of state involvement in this instance is to inform the cognizant out-of-state agency of the ultimate fate of the residues (as reported by the waste disposal vendor). Theoretically the regulations of the adjoining states -West Virginia and Ohio- would prevail regarding proper processing and disposal.

A special relationship exists between the Commonwealth and federal facilities (PETC) within its borders. The Department of Environmental Resources (Pennsylvania) interprets federal and state statutes to determine the limits of their authority with regard to federal installations. They believe their regulations (Chapter 75) are applicable to the Pittsburgh Energy Research Center. Authority for this applicability is not the state law, but a presidential directive to all federal agencies to comply with state environmental statutes. However, the policy of PennDER does not require licensing or permits for processing and disposal operations on federal lands (if the activity is implemented as part of a federal program). Cooperation between federal (on-site) personnel and state enforcement officials is the mechanism used to ensure compliance. (16)

1.11.4 Environmental Protection -Federal Involvement

Prior to passage of RCRA (P.L. 94-580), the federal Environmental Protection Agency was active in the solid and hazardous waste field only with educational and funding programs. The Solid Waste Act of 1965 provided authority to fund state enforcement agencies (manpower grants) and demonstration projects. Federal enforcement took the form of legal assistance to the state and county enforcement authorities in court disputes over pollution incidents. Initiation of the legal action was left to the local institution. Some environmental protection measures are enforced by the federal Department of Transportation (in the case of non-compliance with federal regulations covering transport of hazardous substances) and by the Coast Guard for oil or chemical spills into navigable rivers or tributaries. The NPDES program also attempts to control effluents to the surface waters.

USEPA involvement in control of solid wastes generated at the Center is minimal at the present time. As stated above, a presidential directive has been the instrument for cooperation and compliance with state and local ordinances by the federal installations in Pennsylvania. This situation has been radically altered with passage of the Resource

Conservation and Recovery Act (P.L. 94-580) on October 21, 1976. This act specifically includes federal agencies as one of the entities covered by the legislation.

The Pittsburgh Energy Technology Center will be subject to compliance with the federal statute as a "generator" of hazardous wastes. Although the laboratory waste chemicals may not accumulate at a rate in excess of 220 pounds (100 kilograms) per month, the comparatively large waste streams (characteristics mainly unknown) will qualify the facility. This is one important reason for developing data and classifying the indeterminate residues. Potential on-site processing and/or disposal alternatives will be under the purview of this new legislation. Federal permits will be needed for any PETC involvement. At the very least, manifest system implementation, identification (which is now required under the state regulations) and reporting requirements must be met when the proposed regulations are promulgated and adopted.

1.11.5 PETC Liability - Solid Waste Management

During the interim period prior to promulgation of federal regulations and state acceptance of primacy regarding solid waste management, liability relationships existing at the present time are in force. Some time will be allowed (five years after promulgation) for compliance with RCRA statutes. Pittsburgh Energy Technology Center liability is limited to accidents and pollution episodes only on-site. The Center must identify the hazards and the wastes in sufficient detail to allow the transporter and processor to take the necessary precautions and implement the legal packaging and marking specifications dictated by U.D. Department of Transportation. In the case of spills or damage occuring during the moving phase of the operation, the transporter is fully covered by general liability insurance. At the present time, there is no liability coverage at the disposal site for slow releases of hazardous materials into the water environment. Either the landowner or operator of the disposal facility is subject to legal and civil actions for any damage resulting from pollution at the facility. If the discharges can be uniquely traced to a specific generator, he may be held liable for negligence in not insuring safe disposal of the hazardous residues. There is no legal precedent which establishes this liability to a federal facility.

The Resource Conservation and Recovery Act attempts to remedy this inconsistent and confusing situation regarding liability and damage due to hazardous substance discharges. Disposal sites will be required to show financial responsibility to insure continuity of the operation and proper closure of the site without environmental impacts. The owner/operator will need to establish a closure trust fund and deposit the cash required before the facility permit is issued. As of this date, there are no insurance companies or bonding agencies that will cover liability due to pollutional releases or bond performance. Establishment of a national trust fund with financing from surcharges assessed against the wastes processed by the disposal industry has been suggested.