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Appendices

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NIGERIAN ENVIRONMENTAL SURVEY

APPENDICES

APPENDIX I

LISTING OF DISCUSSIONS AND INSPECTIONS

VISIT TO LAGOS STATE

October 23-28, 1978

Discussion:

Permanent Secretary, Works & Planning
Chief Engineer, Sewage
Chief Engineer, Water
Chief Engineer, Highway
Chief Engineer, Drainage
Chief Engineer, Mechanical
Project Manager, Master Plan-Unit
Chief Town Planning Officer
Chairman & Officials of Lagos State Refuse Disposal Board
Permanent Secretary, Ministry of Agriculture & Natural Resources
Representatives of Office of Attorney-General
Lagos Island Local Government
Lagos Mainland Local Government
Mushin West Local Government
Mushin East Local Government
Ikeja Local Government & Supervisory Councillors & Officials
General Manager, Lagos State Development & Property Corp.

Inspection:

Iju Water Works
Incinerating Plants
University of Lagos
Federal Laboratory, Oshodi

VISIT TO IBADAN STATE

October 30-31, 1978

Discussion:

Ministry of Trade, Industries & Cooperatives
Ministry of Local Government & Information
Ministry of Agriculture & Natural Resources
Ministry of Works & Housing
Water Corporation
Ibadan Municipal Government
Ibadan Metropolitan Planning Authority
Property Development Corporation
University of Ibadan

VISIT TO KWARA STATE

November 1-4, 1978

Discussion:

Military Administrator
Emir of Ilorin & Chairman, Ilorin Local Government
Permanent Secretary, Ministry of Local Government
Permanent Secretary, MANR
Permanent Secretary, Ministry of Health
Permanent Secretary, Ministry of Econ. Dev.
Permanent Secretary, Ministry of Works & Transport
General Manager, Kwara Water Corporation
Emir of Borgu

Inspection:

Ilorin Public Water Works
Pulp and Paper Factory - Jebba
Kainji Dam
Bacita Sugar Factory
Iron & Steel Site - Ajaokuta

VISIT TO KANO STATE

November 8-10, 1978

Discussion:

Commissioner for Ministry of Trade, Industry & Cooperatives
Permanent Secretary and Officials - Ministry of Agriculture & Natural Resources
Permanent Secretary and Officials - Ministry of Works & Housing
Permanent Secretary and Chairman - Ministry for Local Gov't. & Community Develop
Kano Municipal Area Council

Inspection:

Kano Textile Printers Ltd.
National Oil & Chemical Marketing Company
Kano Urban Development Board
Water Resources and Engineering Construction Agency
Bayere University
Challawa Water Station
Federal Industries Ltd.
Nigex Ltd.
Holts Tanneries Ltd.

APPENDIX II

OVERVIEW OF NIGERIA'S EXISTING LEGAL AND INSTITUTIONAL ARRANGEMENTS RELATING TO ENVIRONMENT AND NATURAL RESOURCE MANAGEMENT

Introduction

This report[1] highlights some of the key legal and institutional arrangements involved with environmental or natural resource management matters in Nigeria. The information was obtained primarily during the EPA Survey Team visit, October 20-November 11, through much discussion with officials, and legal research.

Therefore, due to time constraints, it was not possible to do detailed legal research for each state. Rather, an effort was made to get some impression of the Federal-State relationship through the states visited and to highlight some of the states' legislation for illustrative purposes.

Therefore, particularly at the State level, this report is in no way intended as a comprehensive analysis of the Nigerian legal system relating to the environment. The intent is to present a good overview at the Federal level (since Federal legislation has in most areas been a pattern for State laws), and then state examples where they have been researched, without the expectation that these represent all states.

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[1] Information in this report was gathered substantially during the survery team visit. Two considerations have influenced the report in its present form: 1) time constraints which prevented further details through specific research if this member was to obtain the necessary information for an overview, and 2) a concern for a manageable size. I have tried to present an accurate account of the legal and institutional situation within these constraints. Comments are always welcome for clarification and completeness. Special thanks should be given to legal officials throughout Nigeria for their help in gathering information.

The potential capacity for local water management and pollution control contained by these statutory water corporations makes them very important institutions at the state level. They have the responsibility to ensure that water is supplied in potable quality and adequate quantity.[12] Some of the legislation requires that the water agencies "from time to time, . . . examine any surface or underground waters for the purposes of determining what, if any, pollution exists and the causes thereof . . . ." [13] Following the pattern of the Federal Waterworks Ordinance, state water corporation legislation prohibits pollution of water entering the waterworks by "any foul, noisome, or injurious matter, or any earth deposit or excavated matter . . . [14] These water agencies are key state institutions which should definitely be consulted and involved with any development of environmental regulation in the water supply area.

A note of caution is appropriate, however. Each State with a water authority has established the institution according to that State's particular needs. Therefore, it would not be appropriate to generalize too extensively when formulating Federal provisions affecting this area. For example, the jurisdiction of a water authority may vary from State to State. Oyo State's Authority is responsible for only water supply, with Public Works having sewage and drainage; Kano State Authority is responsible for all water resources including sewage and drainage. Also, the supervising body for a water authority may vary. In Oyo State, it is the State Military Governor; in Kwara, the Ministry of Works; in Kano, the military Governor. This highlights the need to allow States to comment on Federal guidelines affecting these areas so that particular circumstances can be taken into account for the State programs.

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[12] See, e.g., Kano Water Edict, Section 13(c); Oyo Water Edict, Section 6.

[13] Kano Water Edict, Section 10(g); Oyo Water Edict, Section 7(e).

[14] E.g., Kano Water Edict, Section 44; Oyo Water Edict, Section 40.

I. Background

Nigeria is a Federal Military Government (FMG). It has three governing bodies: the Supreme Military Council (SMC), the Federal Executive Council (FEC), and the National Council of States. The 23-person SMC combines the executive and legislative functions and is the top policymaking unit. It rules by decree. The 25-person FEC, with civilian and military members performs the role of a cabinet. The Head of State, Lt. Gen. Olusegun Obasanjo, heads both councils. The Military Governors of the States sit in an advisory capacity to the SMC on the National Council of States.

All 19 States have military Governors. To lay the groundwork for transition to civilian rule, each Governor now has a civilian administrator counterpart. The Governors appoint civilian commissioners for specific State Ministries. Each State government has an Executive Council and its own budget. The States derive a large part of their revenues from the Federal Government.

Except for placing government decrees beyond judicial review, military rule has done little to alter Nigeria's system of State and Federal courts. The Federal Supreme Court of Lagos, the court of final appeal, has orginal and appellate jurisdiction. The High Courts of Justice in the States have wide original jurisdiction and also hear appeals from lower-level courts.

The Judiciary is based on English Common Law, statutory law, customary law at some levels, and Islamic law in some areas on certain matters affecting Moslems. Presently, the statutory instrument at the federal level is the "Decree." The State Government's rule by "Edict." Both Federal and State Governments issue "regulations" pursuant to authority in Decrees of Edicts. The Local Governments enact "Bye-laws" for local matters when authorized by State or Federal

legislation (usually through a Local Government Edict, public health law, or road/traffic law). Bye-laws are always approved by the State Commissioner responsible for that matter.

II. Legislation Affecting Natural Resources

A. Land

The Land Use Decree, 1978,[1] has modified the traditional land use principles which have been practiced under customary law in Nigeria. This Decree, subject to certain exemptions, vests all state land in the Military Governor of the State to be "held in trust and administered for the use and common benefit of all Nigerians . . . ."[2] Previously land was more directly administered by local authorities for the same purpose.

In application, the Decree specifies that "all land in urban areas shall be under the control and management of the Military Governor of each State,"[3] and that all other land shall be under the control and management of the Local Government where the land is situated. The Decree also establishes a "Land Use and Allocation Committee" for each State, composed of members appointed by the Military Governor, to advise the Military Governor on all land use matters.[4] A similarly appointed group known as the "Land Allocation Advisory Committee" is established to advise each Local Government.[5] While the Military Governor is authorized to grant statutory rights of occupancy to any person for any purpose on any state land, the Local Government units are given the power to grant on non-urban land customary rights of occupancy to any person for grazing, agricultural, and other purposes ancillary to agricultural purposes.[6]

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[1] Federal Land Use Decree, 1978 (Decree No.6), 29 March 1978.
[2] Id., Section 1.
[3] Id., Section 2 (1) (a).
[4] Id., at Section 2(2).
[5] Id., at Section 2(5).
[6] Id., at Section 6.

B. Water

(1) Federal

At the federal level, the principle legislation is the Water Ordinance.[7] This ordinance was enacted in 1913 and has not been updated. However, discussions are currently underway within the responsible Ministry to amend and modernize the ordinance.

The Waterworks Ordinance regulates the supply from any waterworks to domestic, industrial, or agricultural uses, both public and private.[8] It prohibits the pollution of any waterworks or water which may be carried into the waterworks by "any foul, noisome or injurious matter, or any earth deposit, or excavated material."[9]

(2) State

Recent legislative developments in water regulation have come at the state level. Each State has its own waterworks legislation which is generally compatible with Federal legislation. Most states have state water authorities. For example, Kano and Oyo States have state legislation [10] establishing water corporations. It is through these corporations that a substantial part of the water activity is conducted. They are primarily responsible for water supply and the construction and management of waterworks projects necessary for water resource development at the local level.[11]

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7 Water Ordinance, Cap. 213, 1915, in Laws of the Republic of Nigeria 1958.
8 Id., at Section 2.
9 Id., at Section 22.
10 Kano State Water Resources and Engineering Construction Agency Edict, No. 3 of 1975 (hereinafter referred to as "Kano Water Edict"); Oyo State Water Corporation Edict, No. 24 of 1977 (hereinafter referred to as "Oyo Water Edict").
11 See, e.g., Kano Water Edict, Sections 9 and 10; Oyo Water Edict, Sections 6 and 7.

(3) River Basins

Two principle federal decrees are involved here: the River Basins Development Authorities Decree 1976 [15] and the Niger Delta Basin Development Authority Decree 1976.[16] The River Basins' Decree establishes 10 corporate river basin authorities to oversee in specified areas comprehensive development of underground water resources, schemes for flood and erosion control, construction of dams and other related works, and supply of water from its waterworks when so requested by the State Governments.[17] The Niger Delta Decree establishes a corporate authority for the Niger Delta Basin to develop that area.[18]

Both decrees give the respective authorities powers to control pollution in the rivers and lakes in each authority's area " in accordance with nationally laid-down standards,"[19] as well as general water management authority in their areas. Considering their broad range of powers and the expanse of territory they collectively cover, these authorities will need to be directly involved with development of regulatory schemes for environmental protection and natural resource management impacting their jurisdictions.

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[15] River Basins Development Authorities Decree 1976 (Decree No. 25) (hereinafter referred to as "River Basins Decree").
[16] Niger Delta Basin Development Authority Decree 1976 (Decree No. 37) (hereinafter referred to as "Niger Delta Decree").
[17] River Basins Decree, Sections 1 and 2.
[18] Niger Delta Decree, Sections 1 and 2.
[19] River Basins Decree, Section 2(1) (f); Niger Delta Decree, Section 3(1) (h).

(4) Navigable Waters and the Ocean

The Territorial Waters Decree 1967,[20] extends the limits of the territorial waters of Nigeria to twelve nautical miles. This is an extension with respect to jurisdiction over offences committed in those waters.

The Exclusive Economic Zone Decree 1978, establishes a Nigerian Exclusive Economic Zone (EEZ) of 200 miles.[21] Exclusive rights to exploration and exploitation of the natural resources of the seabed, subsoil, and superadjacent waters of the EEZ are vested in the Federal Government of Nigeria.[22] The Decree is subject to the provisions of any treaty and to any universally recognized rights of other states (including landlocked states).

The Sea Fisheries Decree 1971, [23] licenses sea fishing activities, prohibits certain fishing methods, and allows the Commissioner to regulate in the interest of sea fishing. No express provision discusses control of pollution for the protection of fish but this could arguably come within the regulatory powers of the Commissioner. Federal legislation for inland fisheries regulation is under consideration. At present this is a state matter, but federal regulation is contemplated to provide some standardization in waters shared by two or more states.

In the Petroleum Decree 1969, the Commissioner charged with responsibility for petroleum development is authorized to make regulations with respect to petroleum exploration and exploitation for "the

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20 Territorial Waters Decree 1967 (Decree No. 5), Sections 1 and 2.
21 Exclusive Economic Zone Decree 1978 (Decree No. 28), Section 1.
22 Id., at Section 2.
23 Sea Fisheries Decree 1971 (Decree No. 30).

prevention of pollution of water courses . . . [24] The Petroleum Refining Regulations 1974, require the manager directing a refinery operation to ensure that drainage and water conform to good refining practices.[25]

C. Forestry

At the Federal level, current legislation consists of the Forestry Act 1938.[26] The Ministry of Agriculture and Water Resources, Department of Forestry, began initiatives in 1975 to update the legislation. Negotiations are still underway with the Federal Ministry of Justice.

The existing legislation is effective only in federal forests. Since there are no national parks or forests, the law has served solely as a guide for state legislation and is not itself enforced. If the proposed Kanji National Parke is established, the Federal legislation will be used.

As indicated above, State legislation is the primary regulatory mechanism in forestry. States have generally followed the 1938 federal model. One example is the Forestry Law 1938, of the old Western Region.[27] When Oyo State was established out of the Western Region, the law was adopted from that version formerly in force (which was patterned after the Federal law). It has standard provisions relating to the establishment of Government Forest Reserves and Government Protected Forests.[28] It grants comprehensive powers to make regulations for forest management and control and prohibits certain unauthorized activities in forest reserves and protected forests.[29] There is substantial potential for regulation within the legislation but enforcement has been a major problem.

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[24] Petroleum Decree 1969 (Decree No. 51), Section 8 (b) (iii).
[25] Petroleum Refining Regulations 1974 (L.N. 45 of 1974), Section 43 (1).
[26] Forestry Act (Cap. 38) 1938, in Laws of the Rebublic of Nigeria 1958.
[27] Forestry Law (Cap. 38) 1938, Western Region.
[28] Id., Section 4-21
[29] Id., Sections 46, 49, 51.

Oyo State has now updated the old version of the Forestry law and has added some innovative provision. For example, it has established a Forest Trust Fund " to be applied for regeneration or afforestation of particular forest reserves or generally . . . .[30]

It appears that forestry legislation is in a period of flux in many States.

D. Wildlife

At the federal level, wildlife legislation is in a position similar to that of the forestry legislation. The states are the primary actors in wildlife management to the extent that it occurs. There is federal wildlife legislation that originally, during the colonial days, was used as a pattern for the regional legislation. Many States retain this old law.

The Federal Wildlife Animals Preservation Ordinance [31] was enacted in 1916, during the period when Lagos was a protectorate. It contains the standard colonial provisions, requiring licenses for the killing of certain game species according to various schedules. Several provisions and the schedules would need revision if the legislation were to comply with international norms developing through the Convention on International Trade in Endangered Species. State legislation patterned after the federal law would similarly need updating. Kano State has recently amended its wildlife law, increasing the penalties, and replacing the schedules with new lists of animals for which hunting is prohibited, "specially protected" animals, and "protected" animals.[32]

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30 Oyo State Forestry (Cap. 38) Edict 1970, (Edict No. 1), Section 31(1) and (2).

31 Wildlife Animals Preservation Decree (Cap. 221) of 1916, in Laws of Republic of Nigeria 1958.

32 Wild Animals Law (Amendment) Edict 1978 (Edict No. 13 of 1978).

E. Minerals

(1) Petroleum

The entire ownership and control of all petroleum in, under or upon any lands out to the 200-mile limit of the Exclusive Economic Zone is vested in the Federal Republic of Nigeria.[33] Petroleum regulation has gone through many phases in Nigeria, the current principle legislation being the Petroleum Decree 1969,[34] the Petroleum Refining Regulations 1974,[35] and the Nigerian National Petroleum Corporation Decree 1977.[36]

The legislation is detailed, authorizing regulations in a wide range of activities to maintain strong control over petroleum exploration and exploitation. In the regulations, "petroleum products" includes motor spirit, gas oil, diesel oil, automotive gas oil, fuel oil, aviation fuel, kerosene, liquified petroleum gas and any lubricating oil or grease or other lubricant.[37] The regulations require the manager of a refinery operation to "adopt all practicable precautions including the provisions of up-to-date equipment . . . to prevent the pollution of the environment by petroleum or petroleum products; and where such pollution occurs the Manager shall take prompt steps to control and, if possible, end it."[38]

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33 Petroleum Decree 1969 (Decree No. 51), Section 1.
34 Id.
35 Petroleum Refining Regulations 1974 (L. N. 45 of 1974).
36 Nigerian National Petroleum Corporation Decree 1977 (Decree No. 33).
37 Petroleum Refining Regulations 1974, Section 48.
38 Id., at Section 43.

Since 1977, the Nigerian National Petroleum Corporation (NNPC) has been responsible for overseeing the actual exploration, processing, purchasing, marketing, and research activities surrounding the petroleum industry in Nigeria.[39] It is a parastatal organization with commercial and regulatory activities. It appears that to-date the thrust of its efforts have been in the commercial area and efforts still are necessary in issuing regulations to fulfill its responsibilities in areas of management, inspection, protection of property and the environment.

Nigeria is a party to the International Convention for the Prevention of Pollution of the Sea by Oil (1954), and the Oil in Navigable Waters Decree 1968,[40] brings this convention in force nationally.

III. Health and Safety Legislation

A. Public Health

The Federal-State relationship with respect to Public Health legislation is, again, similar to that occurring with the forestry and wildlife legislation. The federal legislation was the colonial pattern which the states used (as they gained authority to regulate their own health areas), and continue to use today.

The federal Public Health Ordinance 1958[41] contains general provisions prohibiting nuisances including any pool, drain, well, collection of sullage water "or other thing in such a state or condition as to be injurious to health [42] It also prohibits the fowling of any water used as a supply to man or beast."[43] The broad authority within this Public Health legislation could arguably encompass environmental

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[39] Nigerian National Petroleum Corporation Decree 1977, Section 4.
[40] Oil in Navigable Waters Decree 1968 (Decree No. 34).
[41] Public Health Ordinance (Cap. 165) 1958.
[42] Id., at Section 7.
[43] Id., at Section 13.

regulation for human health protection, at least until a specific environmental protection regime and standards are enacted in each state.

B. Sewage and Refuse Disposal

This is essentially a State or local Government matter. Local Government edicts enacted by the States in 1976 provide that "a Local Government shall have responsibility for, and power to make bye-laws for . . . sewerage, refuse and nightsoil disposal . . . ."[44]

Using that power, local governments have issued bye-laws to regulate refuse disposal. For example, the draft Ibadan Municipal Government Collection and Disposal of Refuse Bye-Laws, 1978, made under the Local Government Edict. These bye-laws prohibit the deposit of refuse in other than an approved place and authorized a fee for municipal government refuse collection.[45]

In some cases States have established separate edicts. The Lagos State Government has proclaimed, for example, several separate edicts to relieve the refuse and litter problems in the city. Edict No. 9 (1977) established the Lagos State Refuse Disposal Board, which is still operating. (Several states have tried using Refuse Disposal Boards with varying degrees of success. For example the Refuse Board in Oyo State was dissolved in April 1978, with a new Division in the State Ministry of Works assuming the Board's responsibilities.) The Lagos State Environmental Sanitation Edict (1978) prohibits the disposal of rubbish and refuse in any place except those set aside by the proper authority for such purpose.[46] The Lagos State Ban on Street Trading Edict (1978) required the removal of street trader, a group contributing substantially to the litter on public streets and highways.

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[44] See, e.g., Oyo State Local Government Edict 1976 (Edict No. 5).
[45] Drabt Ibadan Municipal Government Collection and Disposal of Refuse By-Laws, 1978, Sections 3, 10-13.
[46] Lagos State Environmental Sanitation Edict 1978, Section 2.

C. Factories

Factory regulation is a federal matter, coming within the federal jurisdiction of trade and commerce. The federal factories' legislation has provisions for the health, safety, and welfare of the persons employed in the factories,[47] It requires the registration of factories (10 or more persons employed by manual labor for trade and gain) and authorizes government inspection of a plant for dangerous conditions and practices.[48] While the legislation does not apply to persons or conditions affecting persons outside the factory employ, the provisions in health, safety, and welfare for employed persons are comprehensive. The regulations define "occupational diseases" to include "lead poisoning, phosphate poisoning, mercury poisoning, manganese poisoning, arsenic poisoning, aniline poisoning, carbon bisulphide, benzene poisoning, chrome ulceration due to chromic acid or bichromate of potassium, sodium or ammonium anthrax silicosis, pathological manifestations due to radium or x-rays; toxic jaundice due to tetha-chorethane or nitro or amino derivatives of benzene or other poisonous substances, toxic anemia, primary epitheliomatus ulceration of skin due to the handling or use of tar, pitch, bitumen, mineral oil, paraffin, or the compounds, products or residues of these substances, poisoning by halogen derivatives of hydrocarbons of the aliphatic series, compressed air illness, asbestosis.[49]

D. Labour

Labour regulation is also a federal matter. The Labour Decree 1974 provides that where an industrial or agricultural undertaking is remote and isolated it shall be declared a labour health area and

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[47] Factories Act 1956 (Cap. 66), as amended, in Laws of Republic of Nigeria 1958.

[48] Id., at Section 5, Parts III, IV, V.

[49] The Factories (The Declaration of Occupational Diseases Notice) Regulations (L. N. 114 of 1956), Schedule.

the employer shall be required to comply with special regulations.[50] The special regulations which are authorized deal with planning and layout of towns and villages, construction and provision of public facilities and housing, supply of water, health services, etc.[51] The broad powers authorized here could be used to provide environmental controls and occupational health protection for workers. Since industrial activities are expanding into rural areas which could be classified remote and isolated, such regulation could promote environmentally sound industrial operations.

E. Food and Drugs

With the Food and Drugs Decree 1974,[52] food, drugs, cosmetics and devices manufactured, sold, and advertised became a federal matter and existing state laws in this area were repealed. This Decree is mentioned only for its possible extension to some type of preliminary hazardous substances or pesticide control when food is involved. The Decree provides that no person shall sell any food which "has in it or upon it any poisonous or harmful substance not being a food additive or contaminant of a type, and within the level, permitted by regulation . . . ."[53] Arguably this could be used for some pesticide control although it is unclear whether this extension could be upheld by legislative intent.

F. Pesticides and Hazardous Substances

Except for the Food and Drug Decree mentioned above there is no legislation in this area. Neither the federal nor state levels have adequate pesticide or fertilizer regulations, registration or packaging

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[50] Labour Decree 1974 (Decree No. 21), Section 65.
[51] Id., at Section 66.
[52] Food and Drugs Decree 1974 (Decree No. 35).
[53] Id., at Section 1(1) (a).

requirements, or control over handling and use. The country has expanded it use of chemicals in agriculture, and regulation is becoming increasingly necessary.

G. General Pollution

The broad responsibility to "control pollution" at the grassroots level is with Local Governments.[54] The Local Government Edicts enacted by the States in 1976 authorize Local Government units to enact bye-laws for the control of pollution. No such bye-laws were located in the states visited and time did not permit research of other states. But it is likely that this power could be used if Local Government officials received some Federal and State guidance, technical expertise, and financial support regarding possibilities.

H. Town and Country Planning

The States visited by the team had various arrangements for town planning. Local town planning is generally under Local Government units.[55] Above this level, the State Governments generally have Planning Authorities, usually under the Ministry of Works. States have used planning to varying degrees. For example, Kwara State established three planning authorities for the entire state (one for every four Local Governments). Following the master plans prepared for 102 communities in the State, these authorities are striving to organize development projects in a systematic manner. In Oyo State, a State Planning Authority approves citing for industrial states. While in Kano, the planning functions have been assumed by the Ministry of Works and Lands, and there appears to be no separate authority.

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[54] E.g., Oyo State Local Government Edict 1976 (Edict No. 5), Section

[55] E.g., Id., at Section

These authorities could play a significant role in influencing and guiding development and the kind of environmental impact resulting therefrom. It will be important to recognize this sector when developing Federal guidelines and State environmental programs.

IV. Government Institutions with Environmentally Related Responsibiliites

A. Federal Ministries

Several Federal Ministries have key environmental responsibilities.[56] They include:

Ministry	Area
Agriculture, Water, Resources, and Rural Development	agriculture, forestry, fisheries, game reserves, wildlife, rural development, control of water resources River Basin and Dam Development and irrigation, development of underground water, hydrology, water supply undertaggings
Health	Public Health, sanitation
Works, Housing and Urban Development	Housing policy and development, urban planning, and development, lands, protection of sea coast against erosion
Industries	Pollution and other environmental matters
Transport	Inland waterways, navigation, ports

B. Parastatals

Several statutory corporations conduct activities relevant to environmental protection.[57] The following were particularly discussed during the team survey:

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[56] Federal Republic of Nigeria Official Gazette, Government Notice No. 1030, (16th July, 1975) pp. 1095-1102, as amended by recent reorganizations.

[57] Id.

Organization	Responsibility Ministry	Activity
National Science and Technology Devel. Agency	Head of State	Research could be applicable to environmental protection matters
River Basin Authorities	Agric., Water Resources and Rural Development, in	control pollution
Nigerian Standards Organization	Industries	set standards for quality control of products in commerce and industry
Nigeria National Petroleum Corporation		regulation of petroleum industry.

C. Functions of Federal Division of the Environment

The Division of the Environment within the Federal Ministry of Industries has responsibility for "the formulation of national environmental protection policy; the formulation and monitoring of environmental standards for air, water, and land pollution, control of industrial pollution including factory effluents and noise; control of refuse and wastes disposal; coordination of State's programmes and activities on

regional planning and environmental protection; setting up standards for the control of outdoor advertisements and billboards; and for sewage and sanitation in human settlements, natural landscapes, forestry, game reserves and archeological sites."[58] It also has responsibility for evaluating the impact of urban development on the environment and liaising with other affected Federal and State Ministries to ensure planning and compliance with environmental control standards.[59]

These responsibilities have been established by Federal Executive Council decision and lack the necessary statutory enforcement authority in most areas.

D. Interministerial Environmental Groups

The Federal Executive Council directed in April 1977 that an interministerial committee, comprising the Ministries of Housing, Urban Development and Environment (Chairman), Health, Industries, Water Resources, and Works should be formed to study environmental pollution from industries. This Interministerial Committee was formed and has since expanded in representation and subject matter. Now it meets monthly, bringing information to the Director of the Division of the Environment (Chairman) on activities in the technical ministries of relevance to the Division's environmental mandate.

At one point, the establishment of a National Environmental Advisory Committee was proposed. But this proposal has not yet been approved. The interministerial Committee has been maintained and continues to be active.

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[58] Functions and Organization of the Federal Ministry of Housing, Urban Development and Environment, approved by Federal Executive Council, 17th March 1976, pp. 4-5 dealing with environmental functions transferred to Federal Ministry of Industries, December 16, 1977.

[59] Id.

V. Non-Governmental Groups with Environmental Interests

During meetings with Federal Nigerian officials, non-governmental initiative in the environment were discussed. These discussions were brief and by no means thorough. However the non-governmental activities mentioned will be noted here. (This is not meant to be a comprehensive account of all non-governmental activities underway.)

In February 1978, the launching ceremony was held for a national conservation youth group called the National Union for the Conservation of Nature and Natural Reources. Participation in this organization focuses on secondary students and recent graduates. Since the organization is just getting started, they are interested in project ideas. The Federal Assistant Director of Forests gave the launching ceremony address, and that department is encouraging the group as much as possible.

In 1976, a UNESCO-sponsored program for trainee teachers was initiated. Called the Youth Environmental Programme for West Africa, it is located at the Edujemi College of Education, acquired the services of a UNESCO advisor in 1977, and is supported by the Federal Forestry Department. Because time did not allow a visit with participants in this programme, I was unable to gather information on specific projects undertaken.

A National Committee of the World Wildlife Fund is in the planning stages. This effort has been gaining local support since the early 1970's, and plans to officially launch its program in late 1979 or early 1980. The pro-tem chairman of the group is Alhaji Chief S. L. Edu, a distinguished and successful member of the Nigerian Business community.

The World Wildlife Fund endorsement of a national chapter is conditioned upon official endorsement of the effort by the Federal Government. The Federal Commissioner for Agriculture, Rural Development, and Water Resources, on behalf of the Federal Government, has okayed the formation of the Committee; so the commitment has been given. Through discussions with Chief Edu, it appears that plans remain definite for establishment of the Committee, with the thrust being in the conservation of natural resources. This group could have substantial influence with government and the public. Where possible, their participation and that of other non-governmental environmental groups in environmental and natural resourece management issues could be useful in formulating and implementing sound programmes.

During discussions at the University of Ife, it was noted that there is an active Ecological Society of Nigeria, composed primarily of members from the academic community. The Society is assisting to sponsor a conference in 1979 on "Ecology and Development", which will be coordinated by the University of Ife.

Finally, Nigeria has a Man and the Biosphere program (MAB), which is sponsored by UNESCO. The organization is purely research oriented, with participants coming from the Universities. University professors take an area in wildlife or natural resources conservation and do research on it. There is need for more applied research and to help move toward this goal the Federal Forestry Department has been approved as a member.

VI. Policy Developments

A. Third National Development Plan 1975-80

The Third National Development Plan includes a section on "Environmental Policy."[60] This section recognizes Nigeria's growing problems in the environmental sector, both with respect to 'primary' environmental problems mainly attributable to underdevelopment (e.g., inadequate water supply, waste disposal, etc.), and 'secondary' environmental difficulties generated in the process of accelerated developments (e.g., pollution). It calls for efforts to grapple effectively with these problems and enhance the quality of life for all.

B. Fourth National Development Plan, 1981-86

Guidelines for preparation of the Fourth Development Plan call for increased attention "on providing the infrastructure for environmental assessment and management" particularly with respect to:

(i) Secondary Environmental Pollution -- especially with respect to industrial activities as they affect water, land, and air.

(ii) noise pollution.

(iii) natural disasters: - Floods, soil erosion, and desert encroachment.[61]

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[60] Third National Development Plan 1975-80, Vol. 1, p. 292 (Central Planning Office, Federal Ministry of Economic Development, Lagos).

[61] Guidelines for preparation of Chapter 11, "Housing and Environmental Development" for Fourth Plan period, environmental sections pp. 4-5, (sent to all government ministries as official Government intent for the plan period, copy available in office of Director of Federal Division of Environment.)

These guidelines also direct that the environmental characteristics of the country will be documented to achieve a meaningful environmental management program. Then based on this documentation, environmental quality standards will be proposed and made mandatory by legislation.

In addition the Department of Environment is called upon to adopt guidelines to enhance environmental conservation and prevent degradation. These guidelines shall include steps to ensure environmental planning as an integral part of all project planning by agencies.

In this regard the Government calls for the development of an environmental impact statement process for the Fourth Plan period:

> . . . [T]he feasibility studies for all projects, both private and government, shall be accompanied by an environmental impact statement.[62]

The guidelines provide that the onus will be on the owners of the project to take account of the likely environmental impact and show they have planned to mitigate it. Federal, State and local governments will be required to set appropriate standards according to any unique characteristics of the area. Finally, in the guidelines, the Government calls for the development of "a strong inspectorate unit" in the Federal Environmental Division.

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[62] Id., at 5.

VII. The New Constitution

On 1st October 1979, a new constitution shall come into force in Nigeria as the supreme law throughout the Federal Republic.[63] It establishes three branches of Federal Government: a federal National Assembly (consisting of a Senate and a House of Representatives), an Executive (with a President, Vice President and Ministers), and the Judiciary (Federal and State courts).[64] It also recognizes a system of local government through democratically elected local government councils.[65]

With respect to the environment, the new Constitution, in Chapter II, lists Fundamental Objectives and Directive Principles of State Policy. It provides that the State social order is founded on ideals of freedom, equality and justice, and that in furtherance of the social order:

> . . . exploitation of human or natural resources in any form whatsover for reasons other than the good of the community shall be prevented;. . . . . .[66]

Also, when discussing fundamental rights, the constitution provides for compensation for any compulsory acquisition of property according to specified procedures. But nothing in the provisions on compulsory acquisition will be allowed to affect any general law:

> . . . providing for the carrying out of work on land for the purpose of soil-conservation . . . . . [67]

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[63] Constitution of the Federal Republic of Nigeria (Enactment) Decree 1978, Decree No. 25, Schedule: The Constitution of the Federal Republic of Nigeria 1979, section 279

[64] Id., at sections 4-6.

[65] Id., at section 7.

[66] Id., at section 17(1) (d).

[67] Id., at section 40(1) and (2) (L).

That provision could have broad positive consequences in officially endorsing and protecting soil-conservation programs, which include a wide variety of measures in reforestation, water management, watersheds, agricultural practices, etc., to preserve and restore the nation's land areas.

The Second Schedule to the Constitution consists of a list of legislative powers. The exclusive Federal powers include regulation of sea fishing, interstate navigation, meteorology, mines and minerals, national parks, nationally significant archives, trade and commerce, interstate waters, etc.[68] Concurrent (Federal or State) powers include regulation of electric power; industrial, commercial, or agricultural development; scientific and technological research, etc.[69] Functions of the Local Government Councils include construction and maintenance of roads, drains and other public facilities, provision and maintenance of public conveniences and refuse disposal, development of agriculture and natural resources, (other than exploitation of minerals), provision of health services, regulation of sale of food to public, etc.[70] This breakdown of powers and responsibilities highlights the need for close coordination and consultation among all levels of government in environmental protection and natural resource management matters. Particularly Local Governments have significant impact as they deal directly with the people in many priority environmental areas: e.g., health, sanitation, water disposal, agriculture, natural resources management, etc. Both State and Local Governments should be consulted and their participation integrated into the development of specific regulatory schemes as much as possible for a responsive and successful environmental protection program.

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[68] Id., at Second Schedule, Part I.
[69] Id., at Second Schedule, Part II.
[70] Id., at Fourth Schedule.

APPENDIX III

EFFLUENT GUIDELINES AND EMISSION FACTORS
FOR
PULP AND PAPER

EPA 440/1-76/047-a
Group I, Phase II

Development Document for Interim Final and Proposed Effluent Limitations Guidelines and Proposed New Source Performance Standards for the

BLEACHED KRAFT, GROUNDWOOD, SULFITE, SODA, DEINK AND NON-INTEGRATED PAPER MILLS

Vol. I

Segment of the

PULP, PAPER, AND PAPERBOARD

Point Source Category

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

JANUARY 1976

SECTION II

RECOMMENDATIONS

INTRODUCTION

The effluent limitations for existing sources are shown in Table 1 and Table 2 for BPCTCA and BATEA, respectively. Standards of performance for new sources are shown in Table 3.

The average of daily values for 30 consecutive days should not exceed the maximum 30 day average shown in the tables. The value for any one day should not exceed the daily maximum as shown in the tables. The limitations and standards are in kilograms of pollutant per metric ton of production (pounds of pollutant per short ton of production). Effluents should always be within the pH range of 5.0 to 9.0.

For all of the wood pulping subcategories, the following allowances for BOD_5 and TSS should be added to BPCTCA effluent limitations for mills with wet woodyard operations as defined in Section IX:

	Max 30 day average kg/kkg (lbs/ton)	Max daily average kg/kkg (lbs/ton)
BOD_5	0.5 (1.0)	0.9 (1.8)
TSS	0.75 (1.5)	1.6 (3.2)

Production in kkg (tons) is defined as annual tonnage produced from pulp dryers (in the case of market pulp) and paper machines divided by the number of production days in the 12 month period. Pulp production is to be corrected, if necessary, to the "air dry" moisture basis.

Ammonia nitrogen effluent limitations will be developed at a later date for ammonia base sulfite mills. Insufficient data exists to determine representative ammonia nitrogen levels discharged by these mills, but sparse data indicate that their effluents contain 1 to 3 kg/kkg (2 to 6 lb/ton).

Color has been identified as a significant pollutant parameter for sulfite mills but effluent limitations or standards have not been established at this time. Sparse data indicate that effluents discharged from these mills contain 200 to 250 kg/ kkg (400 to 500 lb/ton) of color. No technology is foreseen to be available prior to 1983 for removing color from these effluents and thus color removal by sulfite mills is not practicable at this time.

TABLE 1

BPCTCA
Effluent Limations In kg/kkg(lbs/ton)

Subcategory	Maximum 30 Day Average BOD5	Maximum 30 Day Average TSS	Maximum Day BOD5	Maximum Day TSS
Dissolving Kraft	13.35 (26.7)	19.3 (38.6)	25.65 (51.3)	35.85 (71)
Market Kraft	7.9 (15.8)	15.85(31.7)	15.2 (30.4)	29.4 (58)
BCT Kraft	6.95 (13.9)	15.1 (30.2)	13.35 (26.7)	28.05 (56.1)
Fine Kraft	5.7 (11.4)	12.4 (24.8)	10.95 (21.9)	23.0 (46 0)
Papergrade Sulfite	19.6 (39.2)	24.0 (48.0)	37.6 (75.2)	44.6 (89)
Market Sulfite	20.85 (41.7)	26.65(53.3)	40.0 (80.0)	49.5 (99)
Low Alpha Dissolving Sulfite	22.35 (44.7)	27.4 (54.8)	42.9 (85.8)	50.85(101)
High Alpha Dissolving Sulfite	26.3 (52.6)	33.65(67.3)	52.3 (104.6)	62.5 (125.0)
GW-Chemi-Mechanical	7.05 (14.1)	10.45(20.9)	13.5 (27.0)	19.45 (38)
GW-Thermo-Mechanical	5.0 (10.0)	9.2 (18.4)	9.6 (19.2)	17.05 (34)
GW-CMN Papers	4.45 (8.9)	7.9 (15.8)	8.55 (17.1)	14.7 (29.)
GW-Fine Papers	4.0 (8.0)	7.3 (14.6)	7.7 (15.4)	13.5 (27.0)
Soda	7.2 (14.4)	13.4 (26.8)	13.85 (27.7)	24.8 (49)
Deink	9.45 (18.9)	14.2 (28.4)	18.15 (36.3)	26.35 (52)
NI Fine Papers	4.25 (8.5)	5.9 (11.8)	8.2 (16.4)	11.0 (22.0)
NI Tissue Papers	6.25 (12.5)	5.0 (10.0)	11.4 (22.8)	10.25 (20)
NI Tissue Papers (FWP)	6.4 (12.8)	9.45(18.9)	12.3 (24.6)	17.6 (35.2)

pH for all subcategories shall be within the range 5.0 to 9.0.

Zinc*

Subcategory	Maximum 30 Day Average kg/kkg(lbs/ton)	Maximum Day kg/kkg(lbs/ton)
GW:Chemi-mechanical	0.06 (0.12)	0.12 (0.24)
GW-Thermo-mechanical	0.05 (0.10)	0.105 (0.21)
GW:CMN Papers	0.05 (0.10)	0.105 (0.21)
GW:Fine Papers	0.048 (0.096)	0.095 (0.19)

*Applicable only to mills using zinc hydrosulfite.

TABLE 2
BATEA
Effluent Limitations in kg/kkg(lbs/ton)

Subcategory	Maximum 30 Day Average		Maximum Day	
	BOD5	TSS	BOD5	TSS
Dissolving Kraft	5.8 (11.6)	3.95(7.9)	11.15(22.3)	7.35(14.7)
Market Kraft	3.55(7.1)	2.6 (5.2)	6.8 (13.6)	4.8 (9.6)
BCT Kraft	3.0 (6.0)	2.05(4.1)	5.8 (11.6)	3.8 (7.6)
Fine Kraft	2.55(5.1)	1.75(3.5)	4.95(9.9)	3.25(6.5)
Papergrade Sulfite	8.9 (17.8)	3.0 (6.0)	17.1 (43.2)	5.6 (11.2)
Market Sulfite	10.05(20.1)	3.45(6.9)	19.3 (38.6)	6.4 (12.8)
Low Alpha Dissolving Sulfite	11.4 (22.8)	3.35(6.7)	21.9 (43.8)	6.25(12.5)
High Alpha Dissolving Sulfite	13.8 (27.6)	4.75(9.5)	26.5 (53.0)	8.8 (17.6)
GW-Chemi-Mechanical	3.9 (7.8)	1.65(3.3)	3.15(6.3)	3.1 (6.2)
GW-Thermo-Mechanical	2.1 (4.2)	1.45(2.9)	4.05(8.1)	2.65(5.3)
GW-CMN Papers	1.85(3.7)	1.45(2.9)	3.55(7.1)	2.65(5.3)
GW-Fine Papers	1.75(3.5)	1.35(2.7)	3.35(6.7)	2.55(5.1)
Soda	2.55(5.1)	1.75(3.5)	4.95(9.9)	3.25(6.5)
Deink	2.6 (5.2)	2.7 (5.4)	5.05(10.1)	4.95(9.9)
NI Fine Papers	1.35(2.7)	0.7 (1.4)	2.6 (5.2)	1.3 (2.6)
NI Tissue Papers	2.15(4.3)	1.1 (2.2)	4.15(8.3)	2.05(4.1)
NI Tissue Papers(FWP)	1.9 (3.8)	1.0 (2.0)	3.7 (7.4)	1.85(3.7)

pH for all subcategories shall be within the range 5.0 to 9.0.

TABLE 2 (cont.)
BATEA
Effluent Limitations in kg/kkg(lbs/ton)

Color

Subcategory	Maximum 30 Day Average kg/kkg(lbs/ton)	Maximum Day kg/kkg(lbs/ton)
Dissolving Kraft	125 (250)	250 (500)
Market Kraft	95.0 (190)	190 (380)
BCT Kraft	65.0 (130)	130 (260)
Fine Kraft	65.0 (130)	130 (260)
Soda	65.0 (130)	130 (260)

Zinc*

Subcategory	Maximum 30 Day Average kg/kkg(lbs/ton)	Maximum Day kg/kkg(lbs/ton)
GW:Chemical-mechanical	0.048 (0.096)	0.095 (0.19)
GW:Thermo-mechanical	0.0415(0.083)	0.085 (0.17)
GW:CMN Papers	0.0395(0.079)	0.085 (0.17)
GW:Fine Papers	0.0415(0.083)	0.075 (0.15)

*Applicable only to mills using zinc hydrosulfite.

TABLE 3
NEW SOURCE PERFORMANCE STANDARDS
kg/kkg(lbs/ton)

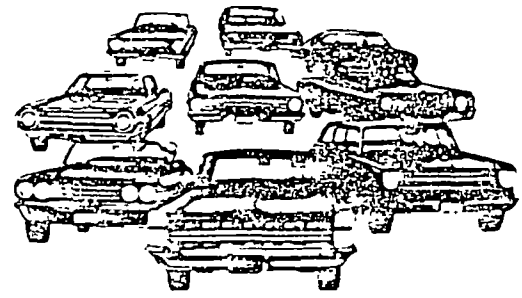
Subcategory	Maximum 30 Day Average BOD5	TSS	Maximum Day BOD	TSS
Dissolving Kraft	6.1 (12.2)	8.35(16.7)	11.75(23.5)	15.5 (31.0)
Market Kraft	2.65(5.3)	2.9 (5.8)	5.15(10.3)	5.35(10.7)
BCT Kraft	3.7 (7.4)	5.0 (10.0)	7.05(14.1)	9.3 (18.6)
Fine Kraft	2.55(5.1)	3.75(7.5)	4.95(9.9)	7.0 (14.0)
Papergrade Sulfite	4.65(9.3)	2.9 (5.8)	8.95(17.9)	5.35(10.7)
Market Sulfite	4.65(9.3)	2.9 (5.8)	8.95(17.9)	5.35(10.7)
Low Alpha Dissolving Sulfite	11.15(22.3)	10.0 (20.0)	21.45(42.9)	18.6 (37.2)
High Alpha Dissolving Sulfite	13.8 (27.6)	9.45(18.9)	26.5 (53.0)	17.6 (35.2)
GW-Chemi-Mechanical	3.9 (7.8)	3.3 (6.6)	7.5 (15.0)	6.15(12.3)
GW-Thermo-Mechanical	2.3 (4.6)	3.15(6.3)	4.45(8.9)	5.85(11.7)
GW-CMN Papers	2.0 (4.0)	3.15(6.3)	3.85(7.7)	5.85(11.7)
GW-Fine Papers	1.9 (3.8)	3.0 (6.0)	5.6 (7.4)	5.6 (11.2)
Soda	3.15(6.3)	4.3 (8.6)	6.0 (12.0)	7.95(15.9)
Deink	3.9 (7.8)	4.0 (8.0)	7.5 (15.0)	7.45(14.9)
NI Fine Papers	1.35(2.7)	1.4 (2.8)	2.6 (5.2)	2.6 (5.2)
NI Tissue Papers	2.15(4.3)	2.2 (4.4)	4.15(8.3)	4.1 (8.2)
NI Tissue Papers(FWP)	1.9 (3.8)	1.95(3.9)	3.7 (7.4)	3.65(7.3)

pH for all subcategories shall be within the range 5.0 to 9.0.

Zinc*

Subcategory	Maximum 30 Day Average kg/kkg(lbs/ton)	Maximum Day kg/kkg(lbs/ton)
GW.Chemi-mechanical	0.048 (0.096)	0.095 (0.19)
GW.Thermo-mechanical	0.0455(0.091)	0.09 (0.18)
GW:CMN Papers	0.0455(0.091)	0.09 (0.18)
GW·Fine Papers	0.044 (0.088)	0.09 (0.18)

*Applicable only to mills using zinc hydrosulfite.



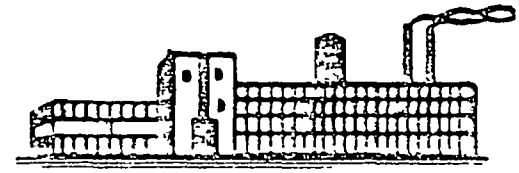
AP - 42

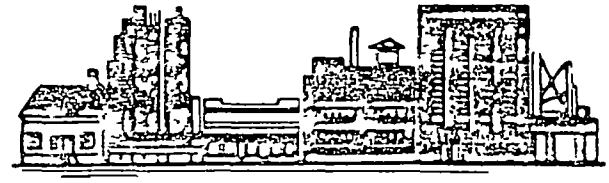
Part
A

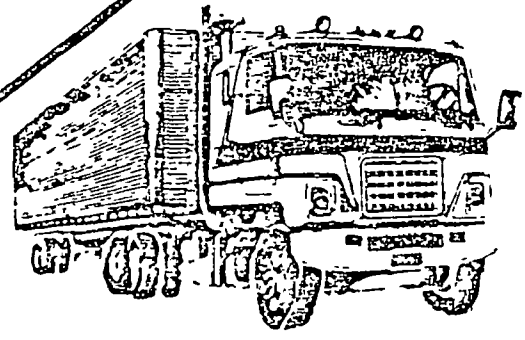
COMPILATION OF AIR POLLUTANT EMISSION FACTORS

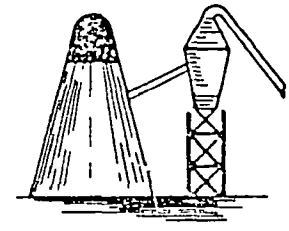
SECOND EDITION

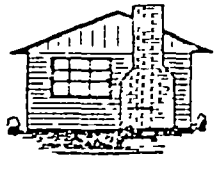
(Third Printing with Supplements 1–5)

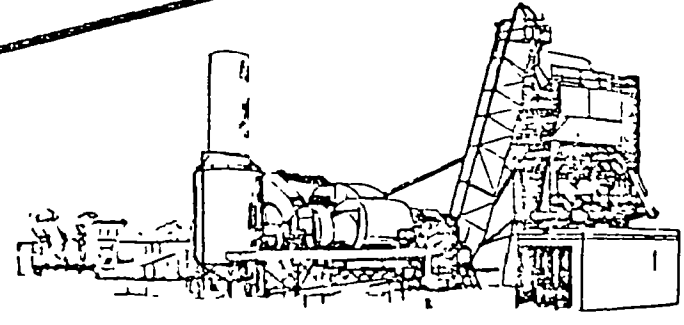


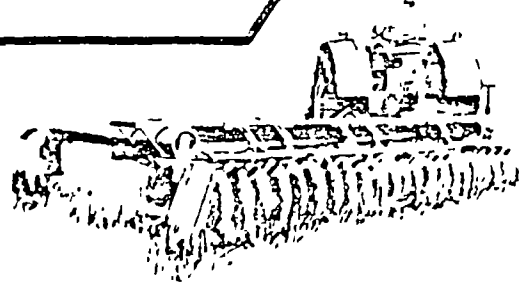












U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, N.C. 27711

10. WOOD PROCESSING

Wood processing involves the conversion of raw wood to either pulp pulpboard, or one of several types of wallboard including plywood, particleboard, or hardboard This section presents emissions data for chemical wood pulping for pulpboard and plywood manufacturing and for woodworking operations The burning of wood waste in boilers and conical burners is not included as it is discussed in Chapters 1 and 2 of this publication

10 1 CHEMICAL WOOD PULPING

Revised by Thomas Lahre

10 1 1 General[1]

Chemical wood pulping involves the extraction of cellulose from wood by dissolving the lignin that binds the cellulose fibers together The principal processes used in chemical pulping are the kraft, sulfite, neutral sulfite semichemical (NSSC), dissolving, and soda, the first three of these display the greatest potential for causing air pollution The kraft process accounts for about 65 percent of all pulp produced in the United States, the sulfite and NSSC processes, together, account for less than 20 percent of the total The choice of pulping process is determined by the product being made, by the type of wood species available, and by economic considerations

10 1.2 Kraft Pulping

10 1 2 1 Process Description[1,2]—The kraft process (see Figure 10.1.2-1) involves the cooking of wood chips under pressure in the presence of a cooking liquor in either a batch or a continuous digester The cooking liquor, or "white liquor," consisting of an aqueous solution of sodium sulfide and sodium hydroxide, dissolves the lignin that binds the cellulose fibers together

When cooking is completed, the contents of the digester are forced into the blow tank Here the major portion of the spent cooking liquor, which contains the dissolved lignin, is drained, and the pulp enters the initial stage of washing From the blow tank the pulp passes through the knotter where unreacted chunks of wood are removed. The pulp is then washed and, in some mills, bleached before being pressed and dried into the finished product.

It is economically necessary to recover both the inorganic cooking chemicals and the heat content of the spent "black liquor," which is separated from the cooked pulp Recovery is accomplished by first concentrating the liquor to a level that will support combustion and then feeding it to a furnace where burning and chemical recovery take place

Initial concentration of the weak black liquor, which contains about 15 percent solids, occurs in the multiple-effect evaporator Here process steam is passed countercurrent to the liquor in a series of evaporator tubes that increase the solids content to 40 to 55 percent. Further concentration is then effected in the direct contact evaporator This is generally a scrubbing device (a cyclonic or venturi scrubber or a cascade evaporator) in which hot combustion gases from the recovery furnace mix with the incoming black liquor to raise its solids content to 55 to 70 percent

The black liquor concentrate is then sprayed into the recovery furnace where the organic content supports combustion The inorganic compounds fall to the bottom of the furnace and are discharged to the smelt dissolving tank to form a solution called "green liquor " The green liquor is then conveyed to a causticizer where slaked lime (calcium hydroxide) is added to convert the solution back to white liquor, which can be reused in subsequent cooks Residual lime sludge from the causticizer can be recycled after being dewatered and calcined in the hot lime kiln

Many mills need more steam for process heating, for driving equipment, for providing electric power, etc , than can be provided by the recovery furnace alone Thus, conventional industrial boilers that burn coal, oil natural gas and in some cases, bark and wood waste are commonly employed.

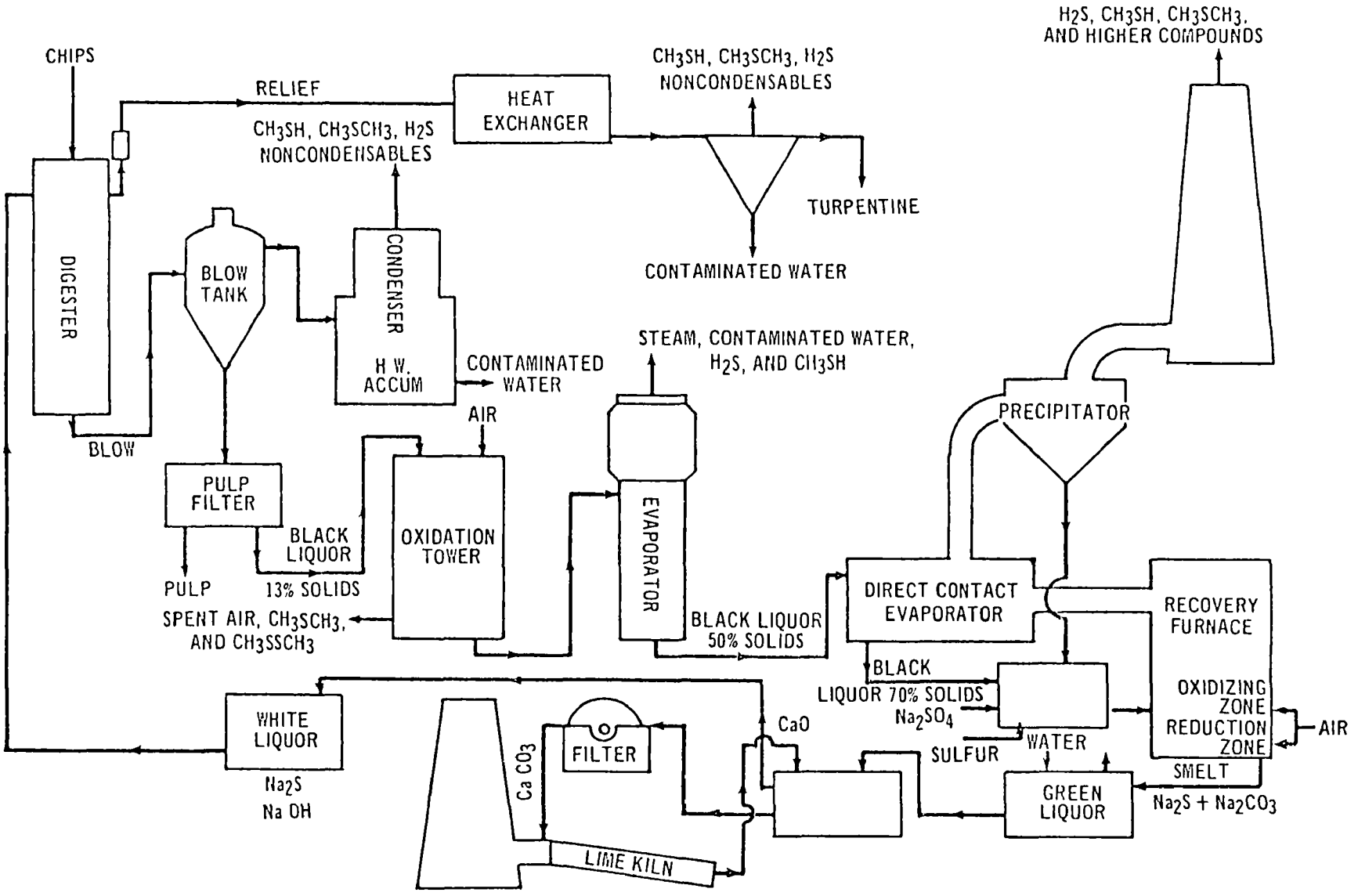


Figure 10 1 2-1 Typical kraft sulfate pulping and recovery process

10 1 2 2 Emission and Controls[1-6]—Particulate emissions from the kraft process occur primarily from the recovery furnace, the lime kiln, and the smelt dissolving tank These emissions consist mainly of sodium salts but include some calcium salts from the lime kiln They are caused primarily by the carryover of solids plus the sublimation and condensation of the inorganic chemicals

Particulate control is provided on recovery furnaces in a variety of ways In mills where either a cyclonic scrubber or cascade evaporator serves as the direct contact evaporator, further control is necessary as these devices are generally only 20 to 50 percent efficient for particulates Most often in these cases, an electrostatic precipitator is employed after the direct contact evaporator to provide an overall particulate control efficiency of 85 to ≥ 99 percent In a few mills, however, a venturi scrubber is utilized as the direct contact evaporator and simultaneously provides 80 to 90 percent particulate control In either case auxiliary scrubbers may be included after the precipitator or the venturi scrubber to provide additional control of particulates

Particulate control on lime kilns is generally accomplished by scrubbers Smelt dissolving tanks are commonly controlled by mesh pads but employ scrubbers when further control is needed

The characteristic odor of the kraft mill is caused in large part by the emission of hydrogen sulfide The major source is the direct contact evaporator in which the sodium sulfide in the black liquor reacts with the carbon dioxide in the furnace exhaust The lime kiln can also be a potential source as a similar reaction occurs involving residual sodium sulfide in the lime mud Lesser amounts of hydrogen sulfide are emitted with the noncondensible off-gasses from the digesters and multiple-effect evaporators

The kraft-process odor also results from an assortment of organic sulfur compounds, all of which have extremely low odor thresholds Methyl mercaptan and dimethyl sulfide are formed in reactions with the wood component lignin Dimethyl disulfide is formed through the oxidation of mercaptan groups derived from the lignin These compounds are emitted from many points within a mill, however, the main sources are the digester/blow tank systems and the direct contact evaporator

Although odor control devices, per se, are not generally employed in kraft mills, control of reduced sulfur compounds can be accomplished by process modifications and by optimizing operating conditions For example, black liquor oxidation systems, which oxidize sulfides into less reactive thiosulfates, can considerably reduce odorous sulfur emissions from the direct contact evaporator, although the vent gases from such systems become minor odor sources themselves Noncondensible odorous gases vented from the digester/blow tank system and multiple-effect evaporators can be destroyed by thermal oxidation, usually by passing them through the lime kiln Optimum operation of the recovery furnace, by avoiding overloading and by maintaining sufficient oxygen residual and turbulence, significantly reduces emissions of reduced sulfur compounds from this source In addition, the use of fresh water instead of contaminated condensates in the scrubbers and pulp washers further reduces odorous emissions The effect of any of these modifications on a given mill's emissions will vary considerably

Several new mills have incorporated recovery systems that eliminate the conventional direct contact evaporators In one system, preheated combustion air rather than flue gas provides direct contact evaporation In the other, the multiple-effect evaporator system is extended to replace the direct contact evaporator altogether In both of these systems, reduced sulfur emissions from the recovery furnace/direct contact evaporator reportedly can be reduced by more than 95 percent from conventional uncontrolled systems

Sulfur dioxide emissions result mainly from oxidation of reduced sulfur compounds in the recovery furnace It is reported that the direct contact evaporator absorbs 50 to 80 percent of these emissions. further scrubbing, if employed, can reduce them another 10 to 20 percent

Potential sources of carbon monoxide emissions from the kraft process include the recovery furnace and lime kilns The major cause of carbon monoxide emissions is furnace operation well above rated capacity, making it impossible to maintain oxidizing conditions.

Some nitrogen oxides are also emitted from the recovery furnace and lime kilns although the amounts are relatively small Indications are that nitrogen oxides emissions from each of these sources are on the order of 1 pound per air-dried ton (0 5 kg/air-dried MT) of pulp produced.[5 6]

A major source of emissions in a kraft mill is the boiler for generating auxiliary steam and power. The fuels used are coal, oil, natural gas, or bark/wood waste Emission factors for boilers are presented in Chapter 1.

Table 10 1 2-1 presents emission factors for a conventional kraft mill The most widely used particulate controls devices are shown along with the odor reductions resulting from black liquor oxidation and incineration of noncondensible off-gases.

10.1.3 Acid Sulfite Pulping

by Tom Lahre

10 1 3 1 Process Description[14] - The production of acid sulfite pulp proceeds similarly to kraft pulping except that different chemicals are used in the cooking liquor. In place of the caustic solution used to dissolve the lignin in the wood, sulfurous acid is employed. To buffer the cooking solution, a bisulfite of sodium, magnesium, calcium, or ammonium is used. A simplified flow diagram of a magnesium-base process is shown in Figure 10.1.3-1.

Digestion is carried out under high pressure and high temperature in either batch-mode or continuous digesters in the presence of a sulfurous acid-bisulfite cooking liquor. When cooking is completed, the digester is either discharged at high pressure into a blow pit or its contents are pumped out at a lower pressure into a dump tank. The spent sulfite liquor (also called red liquor) then drains through the bottom of the tank and is either treated and disposed, incinerated, or sent to a plant for recovery of heat and chemicals. The pulp is then washed and processed through screens and centrifuges for removal of knots, bundles of fibers, and other materials. It subsequently may be bleached, pressed, and dried in paper-making operations

Because of the variety of bases employed in the cooking liquor, numerous schemes for heat and/or chemical recovery have evolved. In calcium-base systems, which are used mostly in older mills, chemical recovery is not practical, and the spent liquor is usually discarded or incinerated In ammonium-base operations, heat can be recovered from the spent liquor through combustion, but the ammonium base is consumed in the process In sodium- or magnesium-base operations heat, sulfur, and base recovery are all feasible

If recovery is practiced, the spent weak red liquor (which contains more than half of the raw materials as dissolved organic solids) is concentrated in a multiple-effect evaporator and direct contact evaporator to 55 to 60 percent solids. Strong liquor is sprayed into a furnace and burned, producing steam for the digesters, evaporators, etc , and to meet the mills power requirements

When magnesium base liquor is burned, a flue gas is produced from which magnesium oxide is recovered in a multiple cyclone as fine white powder The magnesium oxide is then water-slaked and used as circulating liquor in a series of venturi scrubbers which are designed to absorb sulfur dioxide from the flue gas and form a bisulfite solution for use in the cook cycle. When sodium-base liquor is burned, the inorganic compounds are recovered as a molten smelt containing sodium sulfide and sodium carbonate This smelt may be processed further and used to absorb sulfur dioxide from the flue gas and sulfur burner In some sodium-base mills, however, the smelt may be sold to a nearby kraft mill as raw material for producing green liquor

Table 10 1.2-1. EMISSION FACTORS FOR SULFATE PULPING[a]
(unit weights of air-dried unbleached pulp)
EMISSION FACTOR RATING A

Source	Type control	Particulates[b]		Sulfur dioxide (SO_2)[c]		Carbon monoxide[d]		Hydrogen sulfide($S^=$)[e]		RSH, RSR, RSSR($S^=$)[e,f]	
		lb/ton	kg/MT	lb/ton	kg/MT	lb/ton	kg/MT	lb/ton	kg/MT	lb/ton	kg/MT
Digester relief and blow tank	Untreated[g]	–	–	–	–	–	–	0 1	0 05	1 5	0 75
Brown stock washers	Untreated	–	–	0 01	0 005	–	–	0.02	0 01	0 2	0 1
Multiple effect evaporators	Untreated[g]	–	–	0 01	0 005	–	–	0 1	0 05	0 4	0 2
Recovery boiler and direct contact evaporator	Untreated[h]	150	75 ,	5	2 5	2 - 60	1 - 30	12[l]	6[l]	1[l]	0 5[l]
	Venturi scrubber[j]	47	23 5	5	2 5	2 - 60	1 - 30	12[l]	6[l]	1[l]	0 5[l]
	Electrostatic precipitator	8	4	5	2 5	2 - 60	1 - 30	12[l]	6[l]	1[l]	0 5[l]
	Auxiliary scrubber	3 - 15[k]	1 5-7 5[k]	3	1 5	2 - 60	1 - 30	12[l]	6[l]	1[l]	0 5[l]
Smelt dissolving tank	Untreated	5	2 5	0 1	0 05	–	–	0 04	0 02	0 4	0 2
	Mesh pad	1	0 5	0 1	0 05	–	–	0 04	0 02	0 4	0 2
Lime kilns	Untreated	45	22 5	0 3	0 15	10	5	0 5	0 25	0 25	0 125
	Scrubber	3	1.5	0 2	0 1	10	5	0 5	0 25	0 25	0 125
Turpentine condenser	Untreated	–	–	–	–	–	–	0 01	0 005	0 5	0 25
Miscellaneous sources[l]	Untreated	–	–	–	–	–	–	–	–	0 5	0 25

[a] For more detailed data on specific types of mills, consult Reference 1.

[b] References 1, 7, 8

[c] References 1, 7, 9, 10

[d] References 6, 11 Use higher value for overloaded furnaces.

[e] References 1, 4, 7-10, 12, 13 These reduced sulfur compounds are usually expressed as sulfur.

[f] RSH methyl mercaptan, RSR-dimethyl sulfide, RSSR-dimethyl disulfide

[g] If the noncondensible gases from these sources are vented to the lime kiln, recovery furnace, or equivalent, the reduced sulfur compounds are destroyed .

[h] These factors apply when either a cyclonic scrubber or cascade evaporator is used for direct contact evaporation with no further controls.

[i] These reduced sulfur compounds (TRS) are typically reduced by 50 percent when black liquor oxidation is employed but can be cut by 90 to 99 percent when oxidation is complete and the recovery furnace is operated optimally

[j] These factors apply when a venturi scrubber is used for direct contact evaporation with no further controls.

[k] Use 15(7 5) when the auxiliary scrubber follows a venturi scrubber and 3(1 5) when employed after an electrostatic precipitator

[l] Includes knotter vents, brownstock seal tanks, etc When black liquor oxidation is included, a factor of 0 6(0 3) should be used

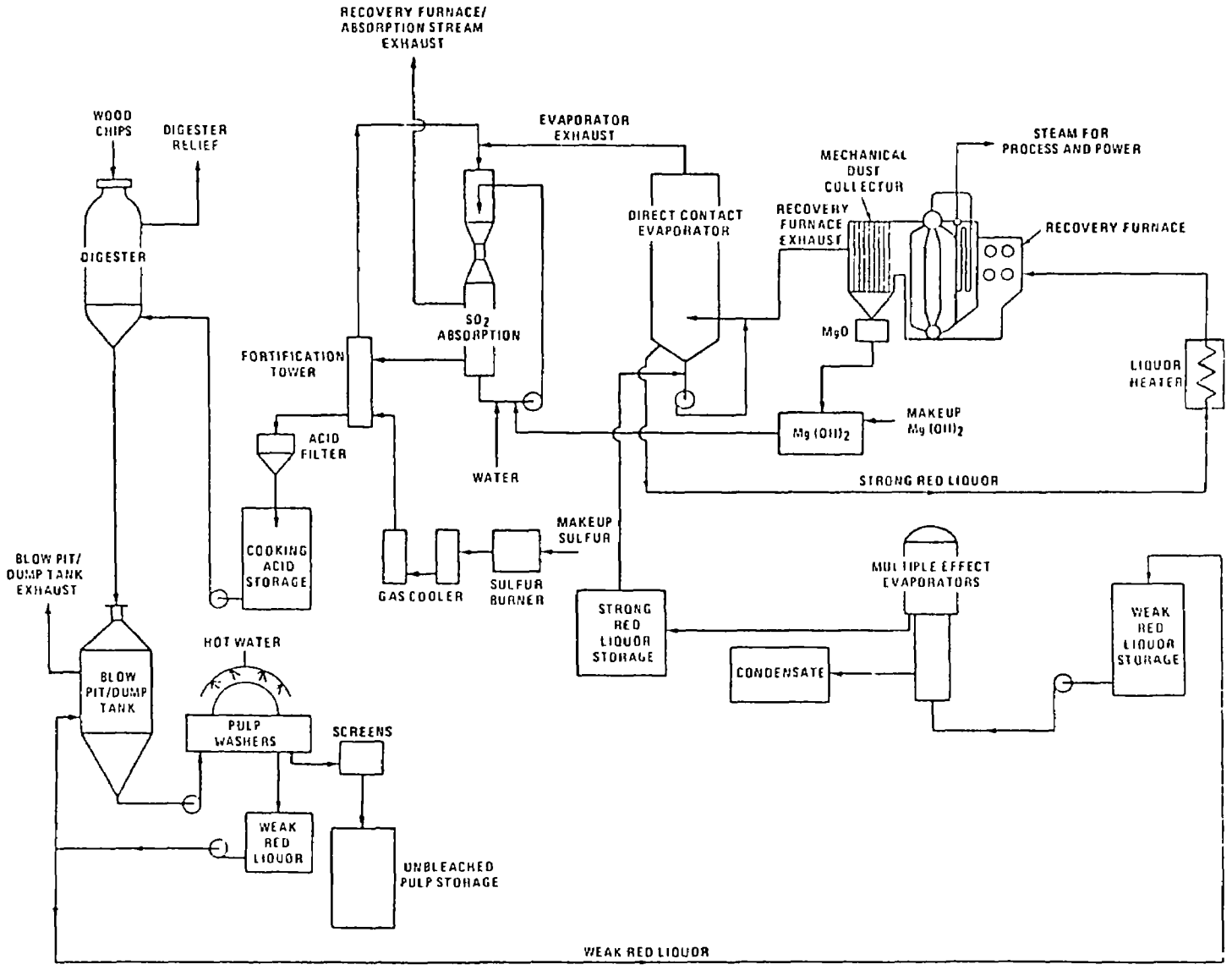


Figure 10 1 3-1. Simplified process flow diagram of magnesium-base process employing chemical and heat recovery.

If recovery is not practiced, an acid plant of sufficient capacity to fulfill the mill's total sulfit requirement is necessary. Normally, sulfur is burned in a rotary or spray burner. The gas produced i then cooled by heat exchangers plus a water spray and then absorbed in a variety of different scrubbe containing either limestone or a solution of the base chemical. Where recovery is practiced, fortific tion is accomplished similarly, although a much smaller amount of sulfur dioxide must be produce to make up for that lost in the process.

10.1.3.2 Emissions and Controls[14] - Sulfur dioxide is generally considered the major pollutant c concern from sulfite pulp mills. The characteristic "kraft" odor is not emitted because volatile r duced sulfur compounds are not products of the lignin-bisulfite reaction.

One of the major SO_2 sources is the digester and blow pit or dump tank system. Sulfur dioxide present in the intermittent digester relief gases as well as in the gases given off at the end of the coo when the digester contents are discharged into the blow pit or dump tank. The quantity of sulfur oxid evolved and emitted to the atmosphere in these gas streams depends on the pH of the cooking liquo the pressure at which the digester contents are discharged, and the effectiveness of the absorptio systems employed for SO_2 recovery. Scrubbers can be installed that reduce SO_2 from this source by as much as 99 percent.

Another source of sulfur dioxide emissions is the recovery system. Since magnesium-, sodium-, an ammonium-base recovery systems all utilize absorption systems to recover SO_2 generated in the r covery furnace, acid fortification towers, multiple-effect evaporators, etc., the magnitude of S emissions depends on the desired efficiency of these systems. Generally, such absorption systen provide better than 95 percent sulfur recovery to minimize sulfur makeup needs.

The various pulp washing, screening, and cleaning operations are also potential sources of SO These operations are numerous and may account for a significant fraction of a mill's SO_2 emissions not controlled.

The only significant particulate source in the pulping and recovery process is the absorption syste handling the recovery furnace exhaust. Less particulate is generated in ammonium-base systems th magnesium- or sodium-base systems as the combustion productions are mostly nitrogen, water vapo and sulfur dioxide.

Other major sources of emissions in a sulfite pulp mill include the auxiliary power boilers. Emi sion factors for these boilers are presented in Chapter 1.

Emission factors for the various sulfite pulping operations are shown in Table 10.1.3-1.

10.1.4 Neutral Sulfite Semichemical (NSSC) Pulping

10.1.4.1 Process Description[1,7,15,16] - In this process, the wood chips are cooked in a neutral solution sodium sulfite and sodium bicarbonate. The sulfite ion reacts with the lignin in the wood, and th sodium bicarbonate acts as a buffer to maintain a neutral solution. The major difference between th process (as well as all semichemical techniques) and the kraft and acid sulfite processes is that only portion of the lignin is removed during the cook, after which the pulp is further reduced by mechan cal disintegration. Because of this, yields as high as 60 to 80 percent can be achieved as opposed to 50 t 55 percent for other chemical processes.

Table 10.1.3-1. EMISSION FACTORS FOR SULFITE PULPING[a]

Source	Base	Control	Emission factor[b]				Emission factor rating
			Particulate		Sulfur Dioxide		
			lb/ADUT	kg/ADUMT	lb/ADUT	kg/ADUMT	
Digester blow pit or dump tank[c]	All	None	Neg[d]	Neg	10 70	5 35	C
	MgO	Process change[e]	Neg	Neg	2 6	1 3	C
	MgO	Scrubber	Neg	Neg	1	0 5	B
	MgO	Process change and scrubber	Neg	Neg	0 2	0 1	B
	MgO	All exhaust vented through recovery system	Neg	Neg	0	0	A
	NH_3	Process change	Neg	Neg	25	12 5	D
	NH_3	Process change and scrubber	Neg	Neg	0 4	0 2	B
	Na	Process change and scrubber	Neg	Neg	2	1	C
	Ca	Unknown	Neg	Neg	67	33 5	C
Recovery system[f]	MgO	Multiclone and venturi scrubbers	2	1	9	4 5	A
	NH_3	Ammonia absorption and mist eliminator	0 7	0 35	7	3 5	B
	Na	Sodium carbonate scrubber	4	2	2	1	C
Acid plant[g]	NH_3	Scrubber	Neg	Neg	0 3	0 2	C
	Na	Unknown[h]	Neg	Neg	0 2	0 1	D
	Ca	Jenssen scrubber	Neg	Neg	8	4	C
Other sources[i]	All	None	Neg	Neg	12	6	D

[a] All emission factors represent long-term average emissions

[b] Factors expressed in terms of lb (kg) of pollutant per air dried unbleached ton (MT) of pulp All factors are based on data in Reference 14

[c] These factors represent emissions that occur after the cook is completed and when the digester contents are discharged into the blow pit or dump tank Some relief gases are vented from the digester during the cook cycle, but these are usually transferred to pressure accumulators, and the SO_2 therein is reabsorbed for use in the cooking liquor These factors represent long-term average emissions, in some mills, the actual emissions will be intermittent and for short time periods

[d] Negligible emissions

[e] Process changes may include such measures as raising the pH of the cooking liquor, thereby lowering the free SO_2, relieving the pressure in the digester before the contents are discharged, and pumping out the digester contents instead of blowing them out

[f] The recovery system at most mills is a closed system that includes the recovery furnace, direct contact evaporator, multiple effect evaporator, acid fortification tower, and SO_2 absorption scrubbers Generally, there will only be one emission point for the entire recovery system These factors are long-term averages and include the high SO_2 emissions during the periodic purging of the recovery system

[g] Acid plants are necessary in mills that have no or insufficient recovery systems

[h] Control is practiced, but type of control is unknown

[i] Includes miscellaneous pulping operations such as knotters, washers, screens, etc

The NSSC process varies from mill to mill. Some mills dispose of their spent liquor, some mills recover the cooking chemicals, and some, which are operated in conjunction with kraft mills, mix their spent liquor with the kraft liquor as a source of makeup chemicals. When recovery is practiced, the steps involved parallel those of the sulfite process.

10.1.4.2 Emissions and Controls[1,7,15,16]. Particulate emissions are a potential problem only when recovery systems are employed. Mills that do practice recovery, but are not operated in conjunction with kraft operation often utilize fluidized bed reactors to burn their spent liquor. Because the flue gas contains sodium sulfate and sodium carbonate dust, efficient particulate collection may be included to facilitate chemical recovery.

A potential gaseous pollutant is sulfur dioxide. The absorbing towers, digester/blow tank system, and recovery furnace are the main sources of this pollutant with the amounts emitted dependent upon the capability of the scrubbing devices installed for control and recovery.

Hydrogen sulfide can also be emitted from NSSC mills using kraft-type recovery furnaces. The main potential source is the absorbing tower where a significant quantity of hydrogen sulfide is liberated as the cooking liquor is made. Other possible sources include the recovery furnace, depending on the operating conditions maintained, as well as the digester/blow tank system in mills where some green liquor is used in the cooking process. Where green liquor is used, it is also possible that significant quantities of mercaptans will be produced. Hydrogen sulfide emissions can be eliminated if burned to sulfur dioxide prior to entering the absorbing systems.

Because the NSSC process differs greatly from mill to mill, and because of the scarcity of adequate data, no emission factors are presented.

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10.2 PULPBOARD

10.2.1 General[1]

Pulpboard manufacturing involves the fabrication of fibrous boards from a pulp slurry. This includes two distinct types of product, paperboard and fiberboard. Paperboard is a general term that describes a sheet 0.012 inch (0.30 mm) or more in thickness made of fibrous material on a paper-forming machine.[2] Fiberboard, also referred to as particle board, is thicker than paperboard and is made somewhat differently.

There are two distinct phases in the conversion of wood to pulpboard: (1) the manufacture of pulp from raw wood and (2) the manufacture of pulpboard from the pulp. This section deals only with the latter as the former is covered under the section on the wood pulping industry.

10.2.2 Process Description[1]

In the manufacture of paperboard, the stock is sent through screens into the head box, from which it flows onto a moving screen. Approximately 15 percent of the water is removed by suction boxes located under the screen. Another 50 to 60 percent of the moisture content is removed in the drying section. The dried board then enters the calendar stack, which imparts the final surface to the product.

In the manufacture of fiberboard, the slurry that remains after pulping is washed and sent to the stock chests where sizing is added. The refined fiber from the stock chests is fed to the head box of the board machine. The stock is next fed onto the forming screens and sent to dryers, after which the dry product is finally cut and fabricated.

10.2.3 Emissions[1]

Emissions from the paperboard machine consist mainly of water vapor; little or no particulate matter is emitted from the dryers.[3-5] Particulates are emitted, however, from the fiberboard drying operation. Additional particulate emissions occur from the cutting and sanding operations. Emission factors for these operations are given in section 10.4. Emission factors for pulpboard manufacturing are shown in Table 10.2-1.

Table 10.2-1. PARTICULATE EMISSION FACTORS FOR PULPBOARD MANUFACTURING[a]
EMISSION FACTOR RATING: E

Type of product	Emissions	
	lb/ton	kg/MT
Paperboard	Neg	Neg
Fiberboard[b]	0.6	0.3

[a]Emission factors expressed as units per unit weight of finished product.
[b]Reference 1.

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10 3 PLYWOOD VENEER AND LAYOUT OPERATIONS

By Thomas Lahre

10 3 1 Process Description[1]

Plywood is a material made of several thin wood veneers bonded together with an adhesive Its uses are many and include wall sidings, sheathing, roof-decking, concrete-formboards, floors and containers.

During the manufacture of plywood, incoming logs are sawed to desired length, debarked, and then peeled into thin, continuous veneers of uniform thickness (Veneer thicknesses of 1/45 to 1/5 inch are common) These veneers are then transported to special dryers where they are subjected to high temperatures until dried to a desired moisture content After drying, the veneers are sorted, patched, and assembled in layers with some type of thermosetting resin used as the adhesive The veneer assembly is then transferred to a hot press where, under presssure and steam heat, the plywood product is formed Subsequently, all that remains is trimming, sanding, and possibly some sort of finishing treatment to enhance the usefullness of the plywood

10 3 2 Emissions[2,3]

The main sources of emissions from plywood manufacturing are the veneer drying and sanding operations A third source is the pressing operation although these emissions are considered minor

The major pollutants emitted from veneer dryers are organics These consist of two discernable fractions (1) condensibles, consisting of wood resins, resin acids, and wood sugars, which form a blue haze upon cooling in the atmosphere, and (2) volatiles, which are comprised of terpines and unburned methane—the latter occurring when gas-fired dryers are employed The amounts of these compounds produced depends on the wood species dried, the drying time, and the nature and operation of the dryer itself In addition, negligible amounts of fine wood fibers are also emitted during the drying process

Sanding operations are a potential source of particulate emissions (see section 10 4) Emission factors for plywood veneer dryers without controls are given in Table 10 3-1.

Table 10 3-1 EMISSION FACTORS FOR PLYWOOD MANUFACTURING
EMISSION FACTOR RATING B

Source	Organic compound[a,b]			
	Condensible		Volatile	
	lb/10^1 ft^2	kg/10^3 m^2	lb/10^4 ft^2	kg/10^3 m^2
Veneer dryers	3 6	1 9	2 1	1 1

[a]Emission factors expressed in pounds of pollutant per 10,000 square feet of 3/8 in plywood produced (kilograms per 1,000 square meters on a 1-cm basis)

[b]References 2 and 3

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APPENDIX IV

REFUSE MANAGEMENT IN DEVELOPING COUNTRIES

A. Objectives

The objectives of the refuse program are to promote the protection of health and the environment by:

1. Providing technical and financial assistance to State and local governments and agencies for the development of refuse management plans which will promote improved refuse management techniques (including more effective organizational arrangements), new and improved methods of collection, processing, or recovery of refuse and the environmentally safe disposal of refuse.

2. Providing grants for the design, construction, acquisition, and maintenance of refuse systems, equipment and facilities.

3. Prohibiting future open dumping on the land and requiring the conversion of existing open dumps to sanitary landfills which do not pose a danger to the environment or to health.

4. Regulating the transportation and disposal of hazardous or industrial wastes which have adverse effects on health and the environment.

5. Providing for the promulgation of rules, regulations, and guidelines for solid waste collection, transport, separation, recovery, and disposal practices and systems.

6. Promoting a national research and development program for improved solid waste management and resource conservation techniques, more effective organizational arrangements, and new and improved

methods of collection, processing, and environmentally safe disposal of refuse and non-recoverable residues.

7. Promoting the demonstration, construction, and application of refuse or solid waste management practices which preserve and enhance the quality of the environment.

8. Establishing a cooperative effort among the Federal, State, and local governments and their designated agencies.

9. Instituting a permit or licensing system for private haulers or industrial, commercial or hazardous wastes to insure that the refuse is disposed in a sanitary landfill and is not dumped in a promiscuous manner.

B. Definitions

1. The term "refuse or solid waste" means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discharged material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities.

2. The term "refuse management" means the systematic administration of activities which provide for the collection, separation, storage, transportation, transfer, processing, treatment and disposal of refuse.

3. The term "refuse facility" includes: a) any collection, processing or resource recovery system or component thereof; b) any system, program, or facility for resource conservation and; c) any facility for the treatment of refuse including hazardous wastes, whether such facility is associated with facilities generating such waste or otherwise.

4. The term "refuse planning" includes refuse management, comprehensive planning, implementation planning, or management, as well as guidelines, rules, regulations, and agreements which further the objectives.

5. "Hazardous waste" means any refuse or combination of refuse or solid wastes which, because of its quantity concentration, physical, chemical, or infectious character, may cause or significantly contribute to an increase in serious irreversible, or incapacitating reversible, illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

C. Refuse Collection-Disposal Guidance

Refuse management is the orderly process of picking up from many locations the discards of a community and hauling them off to a processing or disposal site. The objectives of the collection disposal cycle should be to: 1) protect the health and aesthetic conditions of the community by collecting and disposing of refuse in a sanitary fashion; 2) provide a desired level of service in terms of frequency and point of collection on a continuing basis and 3) achieve these objectives with the highest productivity at the least cost to the government.

By definition, increased productivity means more tons collected per hour with the same or less labor. Generally, this will result in the lowest cost. Many people think the only means to increase productivity is for laborers to work harder. In general, this is not true. Higher productivity can be achieved in almost any refuse system through the correct policy decisions and improved management techniques in operations.

Primary management decisions affecting productivity are: 1) system policies on method of collection and funding; 2) equipment selection; 3) vehicle routing - scheduling; 4) distance and time to the disposal site and 5) management of the operation.

D. Collection Methods and Funding Policies

The initial decisions on the type of collection-disposal practices should be predicated on the long-range funding commitment by the local government to operate the system. In many instances, local governments have acquired vast amounts of new equipment, but did not make provision for the follow-up on funding to adequately maintain and operate the collection disposal system. It is not unreasonable to assume that annual operating costs will be about equal to the initial capital investment made in the equipment. Thus, a city purchasing two million dollars worth of new trucks must also plan on spending two million dollars annually over the next five years for labor, repairs, maintenance insurance, overhead and administrative costs. In a typical U.S. collection system, costs for various functions are: labor 60 percent; maintenance and truck operation 20 percent; depreciation 10 percent and administration 10 percent. In the U.S., collection costs are generally 85 percent of total collection-disposal costs and the land disposal aspects accounts for only 15 percent of system costs.

The higher the annual operating budget, the higher can be the level of service to the citizens. Cities with high budgets often have twice a week household collection from the backyard, whereas cities with lower budgets have once a week curbside collection.

An overlooked fact in the U.S. refuse collection-disposal cycle is that 15 percent of the U.S. refuse, generally in rural areas, is not house to house collection. The homeowner in these communities

must transport or carry their waste to a centralized location for bulk bin collection. Often, the bulk bins are 1-5 miles from the residents homes.

Very few governments in developing nations are affluent enough to afford a high level of refuse collection service. Therefore, bulk bin collection appears to be least costly, most productive means of collection, and ordinary sanitary landfilling the least costly means of disposal. The following table of average U.S. collection-disposal costs is presented to help decision makers understand the economics of various collection-disposal options and their costs.

1. Type of Refuse and Generation Rates

In general, the more affluent a community, the more waste is generated. While the U.S. generation rate of citizens is 2.75 pounds per person a day, a good typical generation rate in developing nations is 0.5kg or about 1 pound per person per day. Another big variation is type of waste. In the U.S., about 75 percent of the waste is inorganic or combustible materials, whereas in developing nations, about 75 percent of the waste stream is organic or vegetable matter. The weight of uncompacted organic refuse is 400 pounds per $\underline{M}^3$ or about 3 times greater than inorganic refuse. Therefore, the type, size, and kind of equipment utilized for collection and disposal of organic wastes should take this into consideration. For example, compacting inorganic waste to 500 kg per cubic yard is difficult, whereas compacting organic wastes in devloping nations to the same density is not difficult. Naturally, the heavier density of organic wastes will influence the size and type of truck, (chassis, frame, axles and body) needed to do the job.

U.S. Average Costs Per Ton For Various

Refuse Options 1978

(Costs include Interest and Depreciation on Capital)

Activity	Dollars per ton	Ratio to landfill costs
Landfilling	4.15	1.0
Collection		
(individual houses)	32.00	7.7
Collection Bulk Bins		
(a) Rear Loaders 6M3	24.25	5.8
(b) Front Loaders 6M3	13.00	3.1
(c) Tilt Frames 26M3	6.00	1.4
Transfer Station to Landfill (17 mile-1 way distance)	6.40	1.5
Incinerators (80 percent organics)	30.00	7.2
Incinerators-Supplemental Fuel (80 percent inorganics)	48.00	11.5

In developing nations, the large amount of organic material and its corresponding density have not always been understood in selection of equipment. For example, three men can usually lift a barrel of inorganic material into a packer truck, whereas a barrel full of organic matter cannot be lifted into a truck. However, organic waste is more dense than inorganic waste, thus compaction and blowing or loose refuse is not a serious problem. Thus, the weight and density of vegetable wastes is a contributing factor to utilizing bulk mechanical collection of refuse in developing countries.

2. Door to Door Collection

This is the highest level of service a community can provide its citizens. It is also the most expensive, about $45 per household per year or $30 a ton. It assumes every citizen or household has a container, or purchases plastic bags, that trucks can maneuver down the streets, and a dependable, highly organized labor force is available for collection. About 75 percent of the U.S. is collected once a week at the curb. For those affluent citizens in the U.S., as well as developing nations who desire a higher level of service, such as more frequent collection or backyard carryout service, it is customary to contract with private haulers of the refuse and pay a higher price direct to the hauler for the higher level of service. This same principle could be applied to collection from affluent citizens in developing nations.

3. Bulk Bin Collection

This is the lowest level of service and the lowest cost method of collection a government can provide the citizens. Bulk bins or containers ranging in size from $6M^3$ to $26M^3$ are common

throughout the world. About 15 percent of the U.S. citizens refuse and all of the commercial and industrial waste is collected in this manner. The bulk bins are placed at strategic or convenient locations and citizens transport their waste to the centralized bin locations.

Bulk bins can and should work well in developing nations for the following reasons:

a. It is the most cost effective means in terms of labor and equipment necessary to do the job. Costs per ton, depending on size of containers, are only one-fourth to one-half of the costs of door to door collection.

b. Management is simplified. Fewer trucks and number of workers are needed thereby reducing management problems.

c. Maneuvering trucks down narrow streets is avoided.

d. Collection can be done at night and the time lost negotiating day-time traffic may increase productivity by 50 percent, thus lowering costs. All big U.S. cities do night-time collection in central areas of the cities.

e. Injuries are reduced since laborers do not lift the refuse.

f. If night collection is instituted, truck maintenance can be done during the day.

g. Most cities in developing nations now have centralized points for locating bulk bins such as markets, dust bins, and night soil stations; these points are known and used by the citizens.

h. Based on the U.S. experience, 97 percent of the citizens can and will get their refuse to a central collection point (bulk bin) and there is no reason to think citizens in developing nations will not follow the same trend.

i. Weight of refuse (organics) is heavier in developing nations and thus mechanical means for loading vehicles is warranted.

Common objections to bulk bins are:

a. Some affluent citizens insist on pickup at their house. These citizens should either pay a private hauler or have their household help carry the refuse to a centralized location.

b. What do we do with all the excess labor?

Excess labor should be utilized with wheelbarrows, s shovels, and brooms in cleaning up the streets, ditches, gutters, and around the centralized bin locations and depositing the refuse into the bulk bins for collection.

c. Drivers must be paid a night wage differential. This is a valid argument to bulk bin collection at night, but the increased productivity will more than make up the difference. The higher night wage differential can also help the city attract and hold qualified, trained drivers.

e. Drivers are subject to robberies and equipment to vandalism. Conventional dumping of bulk bins does not require drivers to leave the truck, therefore, robbery is difficult. Trucks can be equipped with floodlights on top of the cab to discourage vandals, and the driver and helper can carry mace or other gas repellants to discourage vandals.

4. Selection and Placement of Bulk Bins

It is not unusual for a city to operate two types of bulk bin systems. Small bins of the $6M^3$ - $9M^3$ are placed in strategic locations in residential areas, perhaps one per city block. Larger $26M^3$ to $45M^3$ bins are placed at market areas, public housing developments, apartments, government buildings, and other areas where there is a high concentration of people. Although the body of the truck is quite different for collecting each type of bin, selection of the truck chassis, motor, etc. might be the same. About 80 percent of all truck repair costs are for the chassis and only 20 percent for the packer (body). Cities which can standardize the truck frame, engine, and transmission, will have lower maintenance costs, since the mechanics must only learn to repair one kind of truck and the city can reduce the number of spare parts in their inventory.

When utilizing bulk bins for refuse, it is important to keep the sides as low as possible so citizens can throw their refuse over the side. If the sides are high, wood or concrete platforms must be constructed so citizens can walk up a ramp to throw their refuse into the bin. In general, a 48-inch high bin is the recommended height. Cities need not reduce the M^3 size of the bin to have low sides, but merely change the length or width of the bulk bin. Although the initial capital cost for bins is high, bins usually have a 10-year life and can be easily fabricated by local companies. Hinged tops or sliding sides are not worth the extra investment. The purpose is to reduce blowing paper, insects, rodents, and odor. In practice, only one lid in 100 containers in developing nations or the U.S. is ever entirely closed. Also, the trouble with lid maintenance and problems of filling the bulk bins full is eliminated if lid or sliding sides are not used.

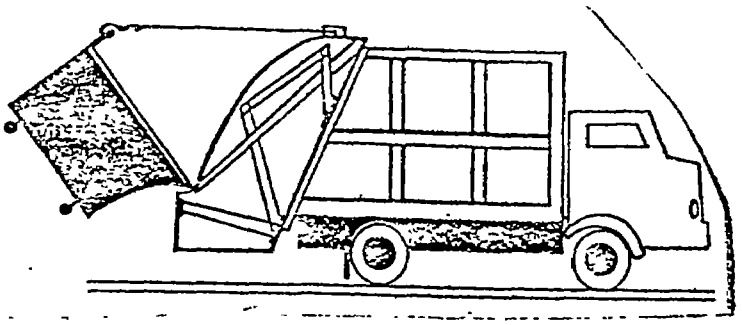
There are four primary types of bulk bin collection equipment on the market (Table 2 presents 3 types).

a. Rear loading compactors - This is the least efficient method and most costly, for several reasons. Trucks must back up to the container and often laborers must push, pull, or position the container before hooking onto the container. Even bulk bins with wheels are difficult to position, since they drag in mud, on stones, or in depressions. Also, maintenance of the wheels is difficult and expensive. Dumping the containers with a cable and winch is slow. Because of the time and extra labor needed for emptying the bins, this system is estimated at 10 ton per day per truck or $30 a ton in the U.S. This assumes two trips a day to the landfill, loose inorganic waste at 140 pounds per M^3 and $45,000 for the vehicle. Naturally, hydraulic dumping systems, compaction cycle time, traffic, and distance between bins and to the landfill will influence all the cost examples.

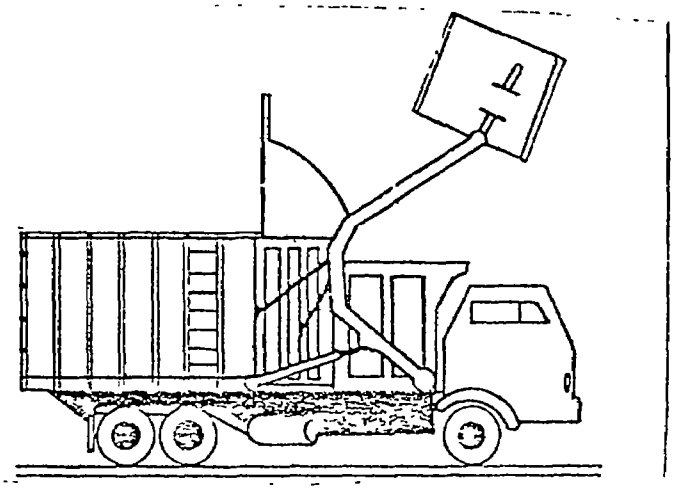
b. Front loading compactor trucks. This is the most customary type of commercial or bulk bin collection vehicle used in the United States. In practice, it can be operated with only the driver. Truck costs range from $50,000 to $70,000 depending on the size of truck and packer. Based on two trips a day to a disposal site, these vehicles generally move 20 ton a day at $15.00 per ton. Bin sizes are generally $3M^3$ to $6M^3$. Larger trucks must have tandem rear axles which have higher operating costs than do smaller, single rear axle trucks.

c. Roll off or tilt frame non-compaction trucks are generally used to move large amounts of heavier density wastes such as the organic wastes in developing countries. Container

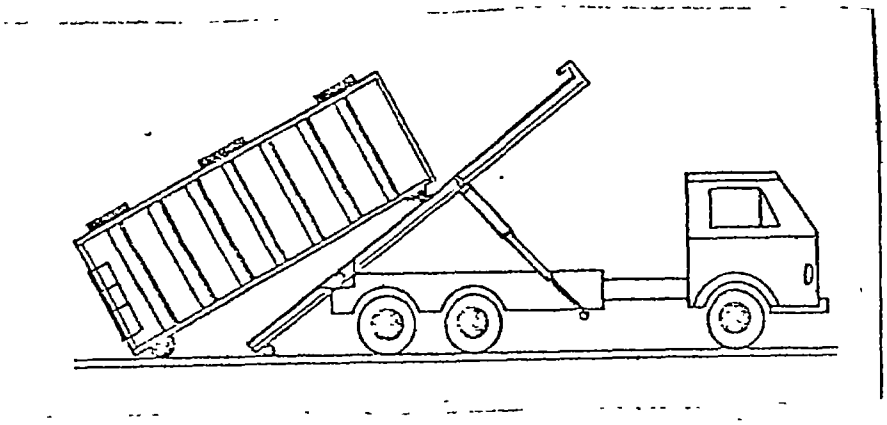
Three types of Bulk Container Trucks



Bulk Container - Rear Loading Average 10 Tons Per Day at $30.00 per ton.



Front Loading Compactor Truck Average 19 Tons Per Day at $15.00 per ton.



Tilt Frame or "Roll Off" Non Compactor Trcuk Average 38 Tons per day at $7.50 per ton.

(bin) size and truck size can be varied to accommodate weight and density of refuse. A $26M^3$ bin hauling loose refuse generally does not need a tandem axle truck. Costs for this system are estimated at $7.50 per ton for about four trips daily to the disposal site. Nets or tarpaulins should be provided for covering the load if it is overly full, windy conditions exist, or the refuse is high in organics, such as paper. However, most vegetable refuse found in developing countries is moist enough so that nets are not necessary.

d. Side loading compactor trucks is a fourth means of dumping bulk bins. Laterally moving arms extend 30 inches out from the truck to grab the bin and hoist it up high to dump the containers. Most of the systems employing these arms use 300 gallon round plastic or steel containers, but the arms are adaptable to rectangular $6M^3$ bins. The advantages of this type of mechanical loading are that the truck can collect bins in 12 foot streets, the truck never needs to back up, and the compaction is all done from front to rear, eliminating the need and cost for multi-push and packing blades. Also, the empty vehicle weight is less than conventional rear packers, allowing more payload. Typical cost estimates are $15.00 per ton for moving 20 ton a day.

Conventional side loading packers for bulk bins have been on the market for years, but these require additional labor to position the bins, the same as required by rear packers. These are not as cost efficient as the newer type side loaders.

5. Decisions on Number of Bulk Bins

The first and most important decision administrators must make is the volume of waste generated in the city on a daily basis and the weight of the refuse. If we assume a generation rate in developing nations of 0.5kg per person a day and 200kg to a cubic meter, then a city of 1 million inhabitants needs 1250 cubic meters of boxes daily. Twenty percent additional should be added for seasonal variations and contingencies. Thus, 1500 M^3 in bins are needed for each million persons. If we assume the city plans to empty each bin every two days, and operate the system 6 days a week using the 20 percent seasonal variation to take care of the 7th nonwork day, then 3,000 M^3 in bulk bins are needed per million residents.

A more difficult decision is to determine the mix of $26M^3$ bins and $6M^3$ bins. Since the larger bins are the least costly to collect, planners should first attempt to locate sites where the large bins can be placed and serviced. Population density and truck services should also be considered. If a $6M^3$ bin were placed at the corner of a city block to service more than 2,000 persons, it would have to be serviced daily. In general, for cost effectiveness and service, it works best to locate as many $26M^3$ bins at strategic locations as possible. If we assume 60 sites for large $26M^3$ bins were located, then the need for 1,560 cubic yards of bins are satisfied. The remaining 1,440 cubic yards needed for collection every two days would require 250 of the $6M^3$ bins. Planning for the location, size and frequency of collection is never perfect, and adjustments will be needed after the collection system is started. Rather than change the size of bulk container, or location, the easiest adjustment is to change the frequency of service.

For example, a $26M^3$ bin at a market might need serviced daily, whereas a $26M^3$ bin at an apartment might only need emptied twice a week. The same principle applies to $6M^3$ bins. Radio equipped trucks and a supervisor who reports when bins are full will pay for itself quickly in mileage costs saved servicing partially filled bins.

6. Determining the Number of Trucks

Determining the number of trucks needed is more difficult than determining the number and size of bins. Time and motion studies are needed to determine: minutes needed to service each container; time between containers; time to disposal site; time to return; time needed at disposal site and return; time to and from the garage; allowances for breakdowns and other variables. This phase of a refuse system design should be done by a multi-discipline task force of engineers, planners, and transportation experts who often, under the best of circumstances, can overlook the fact that time delays at a landfill or transfer station, adverse weather conditions, or accidents on main roads, can and will impact seriously on the number of trucks needed. Collection at night can help reduce the error in the number of trucks needed because of less traffic congestion and delays which occur during night operations.

There is no rule of thumb or standard for determining the number of trucks needed for a city. Each municipality must, by necessity, calculate the time needed for each vehicle to service a given number of bulk bins and then add at least 20 percent to the fleet of trucks for downtime, repairs, and contingencies.

If we assume the tilt frame trucks make four trips a day to the disposal site and there are 30 of the $26M^3$ sites to be removed nightly, then 8 trucks are needed. If each of the front loading compactor trucks can make 3 round trips to the disposal site with 5,000kg loads, then each truck can service 12 of the $6M^3$ bins nightly. Since 125 of the $6M^3$ bins must be serviced nightly, 13 trucks are needed. This does not allow for breakdowns and contingencies.

In summary, for each one million persons, the city would need 60-$26M^3$ bins and 8 trucks and 250 of the $6M^3$ bins and 13 trucks. To accommodate breakdowns, repairs, and maintenance, every municipality must have spare vehicles. Some cities with excellent maintenance programs are able to operate with only 10 percent spare vehicles, but the normal amount is 20-30 percent spare vehicles.

All cities must make extensive plans for phasing in new collection practices over a 1-3 year period, since training of drivers, mechanics, and supervisors and routing of vehicles, takes time and diligent work. It is imperative that a city do one area at a time and do a thorough, complete job before moving to another area. Spreading crews and trucks over an entire city leads to chaos and a breakdown of what might have been a good job if confined to one area.

7. Landfills and Transfer Stations

The lowest cost means of refuse disposal is landfilling (Table I). The second lowest cost means of disposal is to process the refuse through a transfer station on to transfer trailers, generally hauling 15 tons each to the landfill. The general rule of thumb of when it is advisable to initiate the use of transfer stations for hauling refuse to remote land-

fills is: when the round trip time to the landfill requires more than one hour and 10 minutes driving time, or when the haul distance is more than 15 miles one way.

Assuming a city has a landfill in the south and east quadrant, often the most cost effective means of collecting and disposing of refuse is to direct haul from these quadrants to the landfill and erect transfer stations for the north and west quadrants.

Many cities today have one or two primary roads bisecting the main city and these roads can provide fast access to a new landfill 10-15 miles from the center city if the landfill is located adjacent to the main highway and if refuse is hauled at night when traffic congestion is limited. Some communities in the U.S. have found it to their advantage to use toll roads to reach a remote landfill rather than erect a transfer station or contend with center city traffic.

Sanitary landfilling is the least costly operation in refuse collection and disposal and should be utilized when and where practical. In the U.S., the average cost in 1978 was $4.15 per ton. In general, as tons placed per day increase, costs for landfilling decrease. Costs for taking refuse through a transfer station add an estimated $6.40 per ton to refuse costs. This assumes an average 34 mile round trip haul. Hauling costs are estimated at 12 cents per ton per mile for truck and driver.

New York, placing 13,000 tons a day, had an average cost of $247 per ton in 1977 and Dallas, Texas, operating 7 landfills in 1978, had average costs of less than $3.00 per ton. Over 80 percent of all landfill costs are for equipment and the labor to operate the equipment.

There are 5 primary principles to operating a sanitary landfill around which policy makers should center their decisions: a) protection of the groundwater for the present and foreseeable future, especially if it will contaminate a public water supply; b) discouragement of scavengers, usually through the use of fences; c) control of insects and rodents; d) no open burning and; e) periodic covering with dirt of the site. This latter aspect is the most expensive aspect of landfill operation.

Although bulldozers have been the favored piece of landfill equipment over the years, the trend toward landfill compactors is rapidly gaining acceptance. The big advantage of landfill compactors is that the refuse is more densely packed, therefore more refuse can be put in the same amount of space at no additional cost over a conventional bulldozer. Hauling of cover material should be done with a scraper which moves 15-30 M^3 of dirt.

8. Incinerators and Composters

Only 4 percent of the U.S. waste stream is burned in incinerators. Incinerators have not proven feasible due to high operating costs. They are also a major source of air pollution. Only about seven incinerators can meet the U.S. air pollution standards. In the 1950's, over 300 municipalities had incinerators, and by 1978 this had decreased to about 42 cities.

The feasibility of operating incinerators in the U.S. is much more favorable than in developing nations because the refuse is 80 percent inorganics such as paper, rubber, and plastics, which burn without supplemental fuel. In order to burn organic refuse of the type found in developing nations, supplemental fuel must be used. This is both expensive and directly opposed to energy conservation. In addition to the technology needed to build the plants, skilled, trained workers are needed to operate the plant on a 24-hour basis for economy of scale.

Typical skills needed to operate a facility are certified welders, electrical and mechanical engineers, tool and die mechanics, and firebrick masons. Explosions do occur from paint, propane cans, and other volatile materials, putting the incinerator out of use, often for long periods of time. Electrostatic precipitators, while doing a good job, require considerable amounts of electricity and periodic maintenance. Electrical brownouts or blackouts of a power supply for even a short period of time can often result in a long and costly delay on starting up the operation again. In all cases, there is an incinerator residue of 10-35 percent, depending on the completeness of the burn and amount of glass, metal, and other non-combustibles present. This must be transported to the landfill. Thus, the decision to install incinerators in developing countries before an adequate refuse collection disposal system is instituted cannot be considered a prudent, rational decision.

Composting of organic wastes is a more rational decision. However, composting is much more expensive than landfilling and has several disadvantages. How do you separate the organic from inorganic wastes with a high degree of reliability. Pieces of glass in compost are not wanted by farmers since it cuts their feet and the feet of their animals. Anaerobic digestion of the organic matter must occur before the compost is trucked to the farm and this requires some technical ability for controlling the time, temperature, air, and turning of the organic matter before it becomes compost. A major problem is trucking the compost to farms and spreading the compost. Trucking is expensive, and farmers don't want the compost during the growing season or rainy season. Farmers do not have the equipment to spread the compost and the city might have to purchase a compost spreader or pay the farmer to spread the compost. Finally, compost is not a fertilizer.

Over the years, urban dwellers in all nations have gotten the mistaken impression that compost is a substitute for organic fertilizer. Compost is a soil conditioner, especially good for loosening up clay-type soils. The fertilizer value for increasing crop yield, especially nitrogen, is less than 0.2 percent. Thus, one ton of compost has a fertilizer value equal to a 2.5kg bag of urea (nitrogen) fertilizer. Farmers are rational individuals and will always select fertilizer over compost. In summary, the best use of compost is to spread it on undeveloped land before the land is brought into production.

E. Operational Management

Assuming several policy decisions have been made on funding-type of service and equipment needed to do the job, operational management decisions must be made and implemented that will result in a viable refuse collection-disposal system.

Operational management of any refuse system in any city or nation is difficult. Most municipal administrators have the ability to manage white collar workers and their related functions in an office situation. When this same expertise is applied to the management of blue collar workers, a fleet of trucks and a big repair-maintenance facility, something goes wrong. Often, municipal administrators cannot communicate with the blue collar workers, or can't identify with the basic problems and needs of the workers to keep the system functioning in an efficient manner. In one instance, maintenance of 50 trucks was in chaotic condition because the city purchasing department exercised control over vehicle parts by holding up the paperwork for two months, even though the refuse budget adequately provided for parts acquisition. Labor unrest existed in another city because some drivers worked only 3 hours a day while others worked 6 hours daily. Administrators and planners had not balanced the workload equally among the crews. This should be done on an annual basis and always has the support of the unions.

Many management studies in recent years have pointed out that wages are not the number one issue in developing and maintaining a contented labor force. More important factors are working conditions, good equipment, a fair equitable workload, a grievance procedure, and support of management in their work.

In our experience, the management skills and chain of command that will work best in any municipal refuse collection and disposal system is similar to the military chain of command. The Administrator (Battalion Major) passes orders to his department heads for collection, disposal, and maintenance (Lieutenants). The department heads pass orders to supervisors (first sergeants), onto foremen (staff sergeants), to drivers or mechanics (corporals), who direct laborers (privates). The key to drawing this parallel between army organization and municipal waste management is the supervisor or first sergeant. In the army, as well as a refuse collection system, supervisors or first sergeants have the ability to communicate between blue collar workers and managers (officers).

Based on a large number of observations, retired military personnel have been very successful when placed in a corresponding position in refuse management. Often, supervisors or foremen from large construction companies provide another source of trained personnel who have the ability to communicate between blue collar workers and management.

The three primary problems in refuse management which lead to a breakdown of the system are 1) vehicle maintenance, 2) span of control over vehicles and crews and 3) "permissiveness" in management. All require diligent management to overcome.

Vehicle maintenance is the number one management problem contributing to missed collections and a breakdown of the refuse collection disposal system. New York, with 1700 refuse trucks generally has

600 down for repair daily. No other vehicle takes the abuse of a refuse truck. It must make hundreds of starts and stops a day in traffic congestion, often over poor roads, and then negotiate a landfill with full load. Although driver abuse is a contributing factor to vehicle breakdowns, most vehicle malfunctions are attributable to improper truck specifications. For these reasons, it is almost impossible to over-spec a refuse truck. Frames should be extra heavy duty, axles should be over-specified by 30-35 percent to take the wear and tear of a landfill. Engines, transmissions, drive shaft and rear end should be the best available. No one has ever complained that a refuse truck was too strong for the job.

While many cities base their purchases on low bid, the trend is toward life cycle costing. Under this method, truck purchases are based on what the total lifetime cost of the vehicle will be over 5 years, not the initial purchase price (Table 3). Almost all refuse trucks are depreciated over 5 years.

It is much more important to develop data on the truck costs over a five-year period than the body or packer mechanism. Truck maintenance costs are about 80 percent of total costs and the body only 20 percent of the maintenance costs. Often, good quality bodies can be removed from old chassis and placed on new trucks for several additional years of life.

Well managed maintenance garages are generally divided into three units: 1) normal or periodic maintenance for oil and lubrication, 2) small repairs such as brakes, fuel, electrical, tires, and 3) major maintenance for the drive train. There have been two trends in recent years for major maintenace. First, complete dealer or truck manufacturer maintenance of the drive train and second, the use of modular or replacement engines rather than rebuilding engines in the maintenance shop. If a chassis manufacturer must also

TABLE 3. EXAMPLE LIFE CYCLE COSTS

Year:	1	2	3	4	5
Capital Investment and Depreciation:					
Trade-in value (% of delivery price)	75%	55%	40%	30%	25%
Investment, start	50,000	37,500	27,500	20,000	15,000
Year-end value	37,500	27,500	20,000	15,000	12,500
Yearly capital cost	12,500	10,000	7,500	5,000	2,500
Debt Service and Insurance:					
Average yearly investment	43,750	32,500	23,750	17,500	13,750
Yearly debt cost @ 12%	5,250	3,900	2,850	2,100	1,650
Operation and Maintenance:					
Yearly estimated cost	3,000	4,000	6,000	9,000	12,000
Downtime:					
Availability factor	95%	94%	91%	88%	85%
Hours not available	60	120	180	240	300
Cost @ $10/hr	600	1,200	1,800	2,400	3,000
Reserve vehicle					
Obsolescence:					
Productivity factor	98%	96%	94%	92%	90%
Extra hours required to match Production of new model	40	80	120	160	200
Cost @ $10/hr	400	800	1,200	1,600	2,000
Total Annual Cost	$21,750	$19,900	$19,350	$20,100	$ 21,150
Cumulative Vehicle Cost	$21,750	$41,650	$61,000	$81,100	$102,250

prepare a bid for drive train maintenance over a a five year period, it will force life cycle costing on the decision makers and the initial purchase of the truck chassis will be more favorably spec'd for the job. Performance bonding should accompany the drive train maintenance contract.

Poor maintenance of refuse trucks often occur when the work must be performed in garages which service highway, police, and other municipal vehicles. Most mechanics don't want to work on big, old, smelly, dirty, refuse trucks and thus these vehicles are serviced last. Therefore, a separate garage for refuse vehicles is recommended.

Selection of mechanics and training is difficult. In any nation, there is a shortage of heavy equipment mechanics. In general, these workers require higher pay if a city is to retain competent, qualified truck mechanics. Many municipal garages servicing refuse trucks often employ the wrong type of mechanics or do not provide them with the proper equipment. A study of 200 refuse trucks in a major U.S. city over 30 days indicated 117 trucks needed electrical repairs, 90 brake service, 89 body, and 61 fuel repairs. Only 48 trucks needed engine work. Thus, this garage needed more mechanics who knew and understood electrical problems and brakes than they did engine mechanics.

Training of mechanics is generally best accomplished by sending the men off to school rather than trying to train them on the job. However, aptitude for the type of training is very important. A man who has an interest in brakes or transmissions may not have the same inclination to learn electrical repairs. Tire changers might not have a desire to learn hydraulic cylinder repair. An electrical system repair mechanic might best be recruited from an electronic school. A good brake mechanic might be obtained from a farm implement dealer. If the mechanics, even after specialized training, are not capable of doing the job, they should be put to work on

something else and training of replacement mechanics started over again. In the U.S., it is not unusual to employ one good mechanic for every 5-7 trucks. While this ratio is not possible in developing nations, one quality mechanic can often do the work of several uninterested, poorly trained or wrong aptitude mechanics. The role of the foreman and supervisor of the maintenance garage is to continually circulate thru the shop monitoring the mechanics and work being performed.

Periodic maintenance is a necessity. Often, the excuse is used that there is not time available. If this is a problem, schedule oil changes and grease jobs on weekends or at the opposite time of collection, even though overtime must be paid to mechanics. Tires and batteries should be checked daily and replaced if they show any signs of malfunctioning during operation. It is false economy to carry tires and batteries on vehicles until they break down. The lost time of drivers and workers, as well as the expense of on-route repair or towing, is higher in the long run than discarding tires and batteries before they are worn out.

For some refuse collection systems, it has worked well to schedule periodic and small maintenance repair jobs at night, if collection is made during the day or during the day if the trucks are operated at night. Standardization of truck chassis types, body engines, transmissions, etc., will facilitate a higher level of performance by mechanics since they only need to learn repair of one type of truck. It also allows the maintenance garage to carry a minimum number of parts. All garages should carry a large number of the common parts and inventory control of these parts is very important.

An adequate replacement supply of belts, radiators, fuel injectors, clutches, generators, starters, etc. will, in the long run, make it possible to keep the fleet operating. The worst practice appears to be overstocking of infrequently used parts or carrying an inventory of parts for obsolete or salvaged vehicles.

A service contract with the seller of truck chassis for repair of the drive train components has several advantages for local municipal governments. The need for highly skilled mechanics necessary to repair or overhaul transmissions and engines is avoided. Often, the city wage scale is not sufficient to attract these specialized mechanics. To overhaul these major items, specialized equipment for servicing is needed and cities cannot afford this equipment for limited use. Some dealer contracts guarantee the minimum number of trucks that will be operational each day or provide for backup trucks when an excessive number are in the shop for major repairs. In general, the number of vehicles down for repair in a well managed maintenance facility is 10 percent of the fleet. In poorly managed maintenance facilities, 25-35 percent down for repairs is not uncommon. In general, each lost truck hour costs the city $10 for not having use of the truck.

Everyone subscribes to "periodic maintenance", but in reality seldom achieves the objective. Too often, the words "we don't have time" or "every truck has to go out today" is the excuse used for not performing periodic maintenance. This is false economy and will quickly lead to serious and costly breakdowns. Clogged oil, air, and fuel filters on diesel trucks can ruin engines quickly, causing onroute breakdowns and expensive repairs. A leaking hydraulic cylinder can quickly lead to a scored cylinder and the need for replacement at a cost of several thousand dollars, all because a few dollars worth of gaskets or packing weren't installed at the first sign of deterioration.

It is very easy for the casual, uninformed observer to determine the quality of a refuse maintenance garage. Is the garage clean and neat? Are tires and tools put away? Is the floor covered with oil and grease? Are the tires, batteries, and parts lying all over the place, or are they neatly stored? Is the garage large and well-lighted or small and dingy? Does the outside yard look like a

truck salvage yard or a new truck dealers parking lot? The answer to these questions will almost always determine the quality of the service of the maintenance garage.

Span of control over vehicles, drivers, and crews is the second largest contributing factor to poor refuse management. Depending on the size of the city, a large number of trucks and workers leave a central garage each morning with a $50,000 piece of equipment to do a job and report back to the garage 8 hours later. During this period of time, drivers and crews are often out-of-touch with any sort of management. They have no supervision to keep them working and will tend to featherbed. Often, they are confronted with unusual situations or problems. The truck breaks down, a traffic jam or detour ruins their work schedule and productivity. Often, a man is injured. The crew or driver may not know the route if they are substituting for the regular crew; overlap of routes, half-filled trucks and missed collections result.

Two methods are generally helpful in overcoming the problems associated with span of control. The use of radio equipped trucks and foremen in pickup trucks driving the area providing supervision generally work best. If a driver can communicate his problem to a central office, and if the supervisor can shuffle trucks or crews around, the seriousness or productivity delay of onroute problems can be minimized. In cities utilizing bulk bins for the collection of refuse, the supervisor can make the decision by radio of which containers are full and need tipping, thus increasing productivity and reducing costs. Foremen and supervisors should have the ability to reroute trucks to save time and be able to place containers so they are in the most advantageous position for refuse collection. Other duties of foremen are to switch and interchange crew members who work well together and train new drivers on routes. In practice, about 1 foreman is needed for each 5-7 routes. Radio equipped trucks can and will increase productivity, thereby lowering costs

and recovering the initial investment in a short period of time. They are especially helpful if the city is divided into areas for collection and all trucks and crews must stay in the area until the entire job is completed.

Permissive management of labor is the third factor contributing to poor refuse collection and disposal. Collection of refuse is not a choice vocation even for blue collar workers. Refuse collection is dirty, smelly, heavy, boring, and a physically exhausting occupation with little chance of advancement. For these reasons, the drivers and workers attracted into the occupation are not of the highest caliber. In the U.S., as well as other nations, many of the employees are functional illiterates. However, this does not prevent these individuals from being excellent sanitation workers providing they are trained and given incentives such as pay, vacations, and the opportunity to go home early when the job is done. In practice, low I.Q. drivers may be more desirable because they concentrate on one thing--driving--while high I.Q. drivers often have their mind on other things.

In the U.S., as well as developing nations, poor refuse management can generally be attributed to permissive management. Absenteeism is not dealt with harshly; the city has no grievance procedure; drinking on the job is allowed; truck abuse by drivers is overlooked; accidents forgiven; featherbedding and loafing tolerated. A normal 8-hour workday with one hour of non-productive time quickly can degenerate into a 4 or 5 hour workday. In essence, workers will do no more than they are required to do. If administrators and supervisors tolerate permissiveness in the maintenance garage, onroute, or at the landfill, then the solid waste system will be very costly to operate and eventually break down.

For these reasons, management must develop rules and regulations regarding employee relations and enforce them. A grievance procedure with several steps to dismissal is the recommended method. Common problems and courses of action practiced in some cities are automatic 3-day suspension for drinking on the job, grounding the driver for accidents at a reduced pay level until the accident is investigated, dismissing employees for several unexcused absences or instances of truck abuse. Many a driver has caused $5-$10,000 damage to a truck by trying to "clutch" it out of a hole in a landfill; no refuse system should tolerate this kind of truck abuse from drivers.

Contract Coliection and Disposal of Refuse

Because management of any refuse system is different under the best of conditions, many U.S. cities are contracting with private firms for collection. Some of the large U.S. cities turning part of their collection service over to private firms are New Orleans, Oklahoma City, and Phoenix. Several hundred smaller cities have turned over the entire operation to private firms.

Common reasons given by these cities for contracting the service are: 1) no new capital for equipment, 2) labor problems are too difficult to negotiate, 3) our present management can't implement the changes needed, and 4) private firms can do it at less cost. All of these statements are valid except the fact that private firms can do it at less cost. By definition, any city should be able to collect refuse at less cost because cities don't pay the same taxes and are non-profit. In reality, refuse collection-disposal in many U.S. cities is so poorly managed that private firms can often provide the service at 25-40 percent less cost because of better management practices. In general, private contractors pay higher wages than do cities, but they usually have

a productivity per worker or per truck that is double that of the city. Private firms tend to purchase only the best equipment and often depreciate it over 3 years. They dismiss employees who do not produce. Maintenance is of primary importance. Laborers are placed on an incentive system to get the job done quickly and thoroughly. In essence, private firms provide diligent management. However, some U.S. cities such as Pontiac and Flint, Michigan, St. Petersburg, Florida, and Springfield, Mass., have municipal managed systems that are lower in cost than would be the service if it were done by private firms. Thus, the decision of whether to contract the refuse collection-disposal operation or do it with city equipment and employees should rest on the capability of the city to effectively manage and continually fund the system.

APPENDIX V

ENVIRONMENTAL ASSESSMENT INFORMATION FOR DEVELOPMENT OF A PERMIT

INDUSTRIAL PLANT EVALUATION FORM

GENERAL

Company: _____ Date Visited: _____

Location: _____ EPA Personnel: _____

Contact: _____

Title: _____ Phone No. _____

Main Office: _____

_____

_____

Raw Materials Used: _____

_____

_____

Finished Products & Current Production Rates: (Flow Diagram) _____

_____

_____

Rated Plant Capacity: _____

Previous Studies: _____

_____

_____

OPERATIONS

No. of Days/Week _____ No. of Hrs/Day _____

No. of Production Employees _____

_____

Date Plant Began Operating _____

Current Operating Permits & Applications Filed: _____

_____

_____

WATER SUPPLY & USES

Source(s) _____

_____

_____

Treatment. _____

_____

_____

Use(s) & Quantity Used. _____

_____

_____

Analysis: _____

_____

_____

WASTE SOURCES & TREATMENT

A. Domestic Waste Quantity: _____

_____

Type of Treatment: _____

_____

Receiving Water: _____

_____

Analysis _____

_____

B. Process Waste(s) _____

_____

Source & Quantity: _____

_____

Treatment (flow diagram) _____

Receiving Waters (State classification and uses) _____

Analysis of Effluent _____

FUTURE PLANS (Expansion, modification of process, water reuse, by-product recovery, etc

LD NOTES & OBSERVATIONS:

By _____(Signature)

Date_____

APPENDIX VI

TYPICAL UNITED STATES WASTEWATER DISCHARGE PERMIT

EXHIBIT B

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

ORDER NO. 77-0
NPDES NO. CA0005894

WASTE DISCHARGE REQUIREMENTS
FOR
LOUISIANA-PACIFIC CORPORATION
Humboldt County

The California State Water Resources Control Board (State Board) finds that:

1. Louisiana-Pacific Corporation and its predecessor, Georgia-Pacific Corporation, have submitted applications for federal permits, a technical report pursuant to the Water Quality Control Plan for Ocean Waters of California (Ocean Plan), and supplemental information in letters and petitions which describe the corporation's discharges to the Pacific Ocean and Humboldt Bay.

2. Louisiana-Pacific Corporation discharges effluents containing pollutants from kraft pulping processes, pulp bleaching processes, and pulp drying processes located in its bleached kraft market pulp mill; from its water treatment plant processes; and from a hydraulic barker at its sawmill into the Pacific Ocean, a water of the United States. Minor amounts of steam vault liquors from softwood veneer manufacturing processes which use direct steaming for the conditioning of logs, powerplant wastewaters, wastebearing stormwater runoff, and domestic sewage are contained in the discharge. These effluents, which flow at up to 30 MGD, are discharged through diffusers located near Latitude 40°47'N., Longitude 124°14'W., from a 3000-foot outfall at a depth of 35 to 40 feet. This discharge is hereby designated 001.

   The discharger has eliminated discharge of industrial process wastes to Humboldt Bay, however, the presence of mill operations to the bay may result in discharges or spills, waste-bearing stormwater runoff or leachate from chips or fuel to Humboldt Bay.

   The discharger discharges noncontact cooling water from two compressors, jointly designated 002 and 003, and a powerplant hereby designated 004, to Humboldt Bay at points located near Latitude 40°47'N., Longitude 124°13'W.

   Mill activities may result in discharge of waste or leachate from chips or fuel to groundwater of the S. on Peninsula.

3. The Regional Board adopted the Water Quality Control Plan for the North Coastal Basin (Basin Plan) on March 20, 1975, and adopted revisions thereto on March 25, 1976. The Basin Plan incorporates the Ocean Plan and the Water Quality Control Policy for the Enclosed Bays and Estuaries of California. It contains effluent limitations and water quality objectives for Pacific Ocean discharges and prohibits most discharges to Humboldt Bay.

4. The beneficial uses of Pacific Ocean and Humboldt Bay include:

   a. industrial water supply
   b. navigation
   c. water contact recreation
   d. noncontact water recreation
   e. ocean commercial and sport fishing
   f. marine habitat
   g. fish migration
   h. fish spawning
   i. shellfish harvesting

5. The beneficial uses of shallow fresh groundwater on the Samoa Peninsula include domestic water supply. The uncertainty of supply and the susceptibility of this water to degradation from over pumping, percolation of sewage, by salinity from dredged material disposal and other activities has encouraged development by the Humboldt Bay Municipal Water District (HBMWD) of a water system utilizing Mad River supply. Groundwater in areas relying upon its use should be protected with minimum risk of degradation from waste discharges.

6. The discharger has requested exemptions from:

   a. Ocean Plan Table A effluent limitations on:

      Floating particulates
      Suspended solids
      Settleable solids
      Turbidity, and
      pH,

   b. Ocean Plan Table B effluent limitations on chromium

   c. the time schedule provision of State Board Resolution No 7 -5; and

   d. EPA Effluent Limitations Guidelines based limitations on.

      BOD and pH.

7. Regarding the exemptions from Ocean Plan effluent limitations requested by the discharger:

   a. Floating Particulates. The absence of any limitations on floating particulates will not interfere with compliance with the water quality objectives set forth in Chapter II of the Ocean Plan and will not interfere with compliance with the effluent quality requirements set forth in Chapter IV, Table B of the Ocean Plan.

   b. Suspended Solids. Discharge of suspended solids at the rates specified herein will not interfere with compliance with the water quality objectives set forth in Chapter II of the Ocean Plan and will not interfere with compliance with the effluent quality requirements set forth in Chapter IV, Table B of the Ocean Plan. Since the suspended solids from the water treatment plant consist of silt from the Mad River that would normally be discharged to the ocean, it is appropriate that the limitations on suspended solids be on a net basis. Thus, the monitoring requirements will be established so as to give credit for suspended solids resulting from water treatment plant operators.

   c. Settleable Solids. The absence of any limitations on settleable solids will not interfere with compliance with the water quality objectives set forth in Chapter II of the Ocean Plan and will not interfere with compliance with the effluent quality requirements set forth in Chapter IV, Table B of the Ocean Plan.

   d. Turbidity. The absence of any limitations on turbidity will not interfere with compliance with the water quality objectives set forth in Chapter II of the Ocean Plan and will not interfere with compliance with the effluent quality requirements set forth in Chapter IV, Table B of the Ocean Plan in that the turbidity from the water treatment plant consists of silt and clay from the Mad River that would normally be discharged to the ocean.

   e. pH. Discharge of effluent with a pH within the range specified herein will not interfere with compliance with the water quality objectives set forth in Chapter II of the Ocean Plan and will not interfere with compliance with the effluent quality requirements set forth in Chapter IV, Table B of the Ocean Plan.

   f. Compliance and Time Schedule Provision of State Board Resolution No. 74-43. The discharger has presented substantial evidence that compliance with chromium limitations based on Chapter IV, Table B of the Ocean Plan is not possible through application of source controls and the best practicable control technology currently available.

8. On June 21, 1976, the discharger submitted to the Regional Board a request for variance from EPA effluent limits based on fundamentally different factors. The request was supplemented by testimony and evidence presented by the discharger during the course of public hearings before both the Regional Board and the State Board.

   Based upon said testimony and evidence, the State Board finds that effluent exceeding the EPA guideline limitations for BOD and pH has substantially no adverse effect on the marine environment when properly diffused; that there will be few if any water quality benefits associated with treatment for BOD or pH, that there will be substantial environmental and energy costs associated with treatment for BOD and/or pH; and that, therefore, under the precedent established by the U. S. Court of Appeals (Fourth Circuit) in its decision in the case of Appalachian Power Company vs. Train, a variance from the EPA guideline limitations is warranted. The State Board therefore grants herein a variance from effluent limitations from EPA guideline limitations for pH and for BOD generated in the pulp mill, subject to final approval of the variance by the Administrator of EPA.

9. EPA has not promulgated an effluent guideline for hydraulic barking operations associated with saw mills. The State Board finds that application of a separate limit based on the EPA Guidelines for the Barking Subcategory of the Timber Products Processing Point Source Category (40 CFR 429.12) for BOD and suspended solids contributed by the sawmill hydraulic barker is appropriate.

10. Except as provided in Finding 8, above, effluent limitations pursuant to Section 301 of the Federal Water Pollution Control Act and amendments thereto are applicable to the discharge. The limits are contained in Code of Federal Regulations.

11. The discharger has requested that limits for BOD as established in Code of Federal Regulations be delered from requirements for discharge to open ocean waters by diffusers. The State Board finds that adoption of BOD limitations is appropriate to its regulation of discharges to the Pacific Ocean.

12. The State Board has notified the discharger and interested agencies and persons of its intent to prescribe waste discharge requirements for the discharge and has provided them with an opportunity to submit their written views and recommendations.

13. The State Board in a public hearing heard and considered all comments pertaining to the discharge.

14. The discharger is currently discharging under waste discharge requirements issued by the Regional Board on September 4, 1968, and its monitoring and reporting under Monitoring and Reporting Program No. 74-212 adopted by the Regional Board on December 11, 1974.

IT IS HEREBY ORDERED THAT Louisiana-Pacific Corporation, in order to meet the provisions contained in Division 7 of the California Water Code and regulations and guidelines adopted thereunder, shall comply with the following:

A. Prohibitions

1. The discharge of waste to Humboldt Bay, except as provided under B. 4. of this order, is prohibited.

2. The discharge of waste to shallow groundwaters of the Samoa Peninsula, except in which groundwater is unsuitable for domestic use, is prohibited.

3. The discharge of waste to the Pacific Ocean, except as provided under D. 2. of this order, is prohibited.

4. Discharge of radioactive materials in excess of the limits prescribed in Section 30269 of the California Administrative Code is prohibited.

5. Discharge of any wastewater pollutants resulting from plywood manufacturing which utilizes veneer as a raw material is prohibited.

B. Effluent Limitations

1. The discharge of an effluent to the Pacific Ocean which exceeds the following is prohibited:

Constituents	Units	30-day[a/] Average	30-day[b/] Median	30-day[c/] 90th %ile	Daily Maximum
Flow	MGD	30	--	--	36
BOD_5 (pulp)	lbs/day[d/]	9,821	--	--	18,849

a/ The average of values in any 30 consecutive day period. Compliance will not be determined if fewer than four samples are analyzed.
b/ The value which is not exceeded in 50 percent of the samples in any 30 consecutive day period. Compliance will not be determined if fewer than four samples are analyzed.
c/ The value which is not exceeded in 90 percent of the samples in any 30 consecutive day period. Compliance will not be determined if fewer than four samples are analyzed.
d/ Based on 610 tons per day average annual production.

Constituent	Units	30-day[a] Average	30-day[b] Median	90-day[c] 90th %tile	Daily Maximum
BOD_5 (Hyd. Barker)	lbs/cu.ft.[f]	0.03	--	--	0.09
	lbs/day	1,500	--	--	4,500
BOD_5 (Veneer)	lbs/cu.ft.[g]	0.015	--	--	0.045
	lbs/day	283	--	--	849
Suspended Solids [e] (pulp)	lbs/day[d]	20,008	--	--	37,088
Suspended Solids [e] (Hyd. Barker)	lbs/ft.[f]	0.144			0.431
	lbs/day	7,200	--	--	21,550
Grease & Oil	mg/l	--	10	15	--
pH	within the limits 5.0 and 9.0				

2. The discharge of an effluent in excess of the following limits is prohibited: [h/i]

Constituents	Units	50% of time	10% of time
Arsenic	mg/l	0.01	0.02
Cadmium	mg/l	0.02	0.03
Copper	mg/l	0.2	0.3
Lead	mg/l	0.1	0.2
Mercury	mg/l	0.001	0.002
Nickel	mg/l	0.1	0.2

---

e/ In addition to the suspended solids in the raw water supply.

f/ Pounds of BOD_5 or suspended solids per cubic foot of wood processed through the hydraulic barker.

g/ Pounds of BOD_5 per cubic foot of production in terms of veneer, if that is the final product of this facility, or per cubic foot of plywood if the veneer is further processed into plywood at this facility.

h/ The maximum allowable daily mass emission rate for each constituent listed in Item 2 above shall be calculated from the total waste flow occurring each specific day and the concentration specified (continued on next page).

Constituents	Units	50% of time	10% of time
Silver	mg/l	0.02	0.04
Zinc	mg/l	0.3	0.5
Cyanide	mg/l	0.1	0.2
Phenolic Compounds	mg/l	0.5	1.0
Total Chlorine Residual	mg/l	1.0	2.0
Ammonia (expressed as nitrogen)	mg/l	40.0	60.0
Total Identifiable Chlorinated Hydrocarbons 1/	mg/l	0.002	0.004
Toxicity Concentration	tu	1.5	2.0

3. The discharge of an effluent in excess of the following limits is prohibited: h/ 1/

Constituent	Units	50% of time	10% of time
Total Chromium	mg/l	0.005	0.01

4. The discharge of noncontact cooling water to Humboldt Bay in excess of the following limits is prohibited:

30-day Average	Daily Maximum
22.0°C	24.0°C

5. Upon approval by the Administrator of EPA of the finding of "fundamental difference" cited in Finding 8, above, the following limitations shall apply in lieu of the limitations in B. 1., above, for the following parameters. The limitations contained in B. 1. shall continue to apply for all other parameters. Should the Administrator approve a variance but find that limitations other than the following are appropriate, the Regional Board shall revise these waste discharge requirements consistent with the limitations approved by the Administrator.

---

h/ in waste discharge requirements as that not to be exceeded more than 10 percent of the time. The mass emission rate of the discharge during any 24-hour period shall not exceed the maximum allowable daily mass emission rate.

1/ The maximum allowable monthly mass emission rate for each constituent listed in Item 2 above shall be calculated from the total waste flow occurring in each specific month and the concentration specified in waste discharge requirements as that not to be exceeded more than 50 percent of the time. The mass emission rate of the discharge during any monthly period shall not exceed the maximum allowable monthly mass emission rate.

1/ Total Identifiable Chlorinated Hydrocarbons shall be measured by summing the individual concentrations of DDT, DDD, DDE, aldrin, BHC, chlordane, endrin, heptachlor, lindane, dieldrin, polychlorinated biphenyls, and other identifiable chlorinated hydrocarbons.

Constituent	Units	30-day Average	Daily Maximum
BOD_5 (pulp)	lbs/day[d/]	48,800	97,600

within the limits 3.0 and 10.0

C. Receiving Water Limitations

1. The discharge shall not cause floating particulates, foam, or grease and oil to be visible.

2. The discharge shall not cause aesthetically undesirable discoloration of the ocean surface.

3. The transmittance of natural light shall not be significantly reduced at any point outside the initial dilution zone.

4. The discharge shall not cause the dissolved oxygen concentration outside the initial dilution zone at any time to be depressed more than 10 percent from that which occurs naturally.

5. The discharge shall not cause the pH outside the initial dilution zone to be changed at any time more than 0.2 units from that which occurs naturally.

6. The discharger shall not cause a violation of any other applicable existing water quality standard for the receiving water adopted pursuant to the Federal Water Pollution Control Act and implementing regulations. If more or less stringent applicable water quality standards are promulgated or approved pursuant to Section 303 of the Federal Water Pollution Control Act and implementing regulations, the Regional Board shall revise or modify this order in accordance with such more or less stringent standards.

7. In areas where shellfish are harvested, the discharge shall not cause the median total coliform organism concentration to exceed 70 per 100 ml nor shall the total coliform organism concentration exceed 230 per 100 ml 10 percent of the time.

8. The concentration of organic materials in marine sediments shall not be increased above that which would degrade marine life.

9. The discharge shall not cause toxic conditions to exist in the receiving water.

10. The discharge shall not cause the following limits to be exceeded after initial dilution:

Constituents	Units	50 Percentile	90 Percentile	Maximum
Grease and Oil	mg/m^2	10	20	--
Floating Particulates	mg dry wt/m^2	1.0	1.5	--
Toxicity	Toxicity Units	--	--	0.05

D. Provisions

1. Neither the treatment nor the discharge of pollutants shall create a pollution or a nuisance as defined by the California Water Code.

2. The discharge shall achieve rapid initial dilution and effective dispersion to minimize concentrations of pollutants not removed by treatment. The diffusion system shall provide an initial dilution of effluent with seawater exceeding 100:1 at least 50 percent of the time and exceeding 80:1 at least 90 percent of the time.

3. The discharge of noncontact cooling waters shall not elevate the temperature of Humboldt Bay to the detriment of beneficial uses of Humboldt Bay.

4. The discharger shall comply with the following time schedules to assure compliance with Effluent Limitations B. 1., B. 2., B. 3., and B. 5. All other provisions of this permit shall be applicable upon adoption.

Task	Compliance Date	Report of Compliance Due
Limitations B. 1. and B. 5.		
Commence preparation of plans and specifications for control facilities	April 1, 1977	April 15, 1977
Compliance	July 1, 1977	July 15, 1977
Limitations B. 2		
Progress report	May 1, 1977	May 15, 1977
Commence construction of control facilities	January 1, 1978	January 15, 1978
Compliance	July 1, 1978	July 15, 1978

Task	Compliance Date	Report of Compliance Date
Limitations B 3.		
Progress report	October 1, 1977	October 15, 1977
Progress report	July 1, 1978	July 15, 1978
Progress report	April 1, 1979	April 15, 1979
Progress report	January 1, 1980	January 15, 1980
Commence preparation of plans and specifications for control facilities	July 1, 1980	July 15, 1980
Progress report	April 1, 1981	April 15, 1981
Commence construction of control facilities	January 1, 1982	January 15, 1982
Progress report	October 1, 1982	October 15, 1982
Compliance	July 1, 1983	July 15, 1983

The discharger shall submit to the Regional Board on or before each compliance report date, a report detailing his compliance or noncompliance with the specific schedule date and task.

If noncompliance is being reported, the reasons for such noncompliance shall be stated, plus an estimate of the date when the discharger will be in compliance. The discharger shall notify the Regional Board by letter when he has returned to compliance with the time schedule.

5. The discharger shall notify the Regional Board not later than 180 days in advance of implementation of any plans to alter production capacity of the product line of the manufacturing, producing or processing facility by more than ten percent. Such notification shall include submittal of a new Report of Waste Discharge and appropriate filing fee.

6. The discharger shall file with the Regional Board a Report of Waste Discharge at least 120 days before making any material change or proposed change in the character, location or volume of the discharge.

7. The discharger shall submit to the Regional Board by January 30 of each year, an annual summary of the quantities of all chemicals, listed by both trade and chemical names which are used for cooling and/or boiler water treatment and which are discharged.

The discharger shall submit to the Regional Board each month with the monthly effluent monitoring report a summary of the quantity of chromium contained in any chemicals used which reach the waste stream or which might reach the waste stream in the event of an upset or breakdown.

8. The requirements prescribed herein do not authorize the commission of any act causing injury to the property of another, nor protect the discharger from his liabilities under federal, state, or local laws other than those adopted pursuant to the Federal Water Pollution Control Act, nor guarantee the discharger a capacity right in the receiving waters.

9. The discharge of any radiological, chemical, or biological warfare agent is prohibited.

10. The discharger shall permit the Regional Board:

    a. entry upon premises (during normal business hours) in which an effluent source is located or in which any required records are kept;

    b. access to copy any records required to be kept under terms and conditions of this order;

    c. inspection of monitoring equipment or records; and

    d. sampling of any discharge.

11. All discharges authorized by this order shall be consistent with the terms and conditions of this order. The discharge of any pollutant more frequently than or at a level in excess of that identified and authorized by this order shall constitute a violation of the terms and conditions of this order.

12. The discharger shall comply with a Monitoring and Reporting Program issued by the Regional Board Executive Officer and the General Provisions for Monitoring and Reporting and any modifications to these documents as specified by the Regional Board Executive Officer. Monitoring reports shall be submitted to the Regional Board and U. S. Environmental Protection Agency for each month, by the 15th day of the following month, beginning not later than the date specified in the Monitoring and Reporting Program issued by the Regional Board Executive Officer. Monitoring and Reporting Program No. 74-212 shall remain in effect until superseded or revoked.

13. The discharger shall maintain in good working order and operate as efficiently as possible any facility or control system installed by the discharger to achieve compliance with the waste discharge requirements

14. Collected screening, sludge, and other solids removed from liquid wastes shall be disposed of at a legal point of disposal, and in accordance with the provisions of Division 7.5 of the California Water Code. For the purpose of this requirement, a legal point of disposal is defined as one for which waste discharge requirements have been prescribed by a Regional Water Quality Control Board and which is in full compliance therewith.

15. After notice and opportunity for a hearing, this order may be terminated or modified for cause, including, but not limited to:

    a. violation of any term or condition contained in this order;

    b. obtaining this order by misrepresentation, or failure to disclose fully all relevant facts;

    c. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

16. If a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Federal Water Pollution Control Act, or amendments thereto, for a toxic pollutant which is present in the discharge authorized herein and such standard or prohibition is more stringent than any limitation upon such pollutant in this order, the Regional Board shall conduct a public hearing and consider revising or modifying this order in accordance with such toxic effluent standard or prohibition and so notify the discharger.

17. In the event the discharger is unable to comply with any of the conditions of this order due to:

    a. breakdown of waste treatment equipment;

    b. accidents caused by human error or negligence; or

    c. other causes such as acts of nature;

    the discharger shall notify the Regional Board Executive Officer by telephone as soon as he or his agents have knowledge of the incident and confirm this notification in writing within two weeks of the telephone notification. The written notification shall include pertinent information explaining reasons for the noncompliance and shall indicate what steps were taken to correct the problem and the dates thereof, and what steps are being taken to prevent the problem from recurring.

13. This order expires five years from the date of adoption and the discharger must file a Report of Waste Discharge in accordance with Title 23, California Administrative Code, not later than 180 days in advance of such date as application for issuance of new waste discharge requirements.

19. In the event of any change in control or ownership of land or waste discharge facilities presently owned or controlled by the discharger, the discharger shall notify the succeeding owner or operator of the existence of this order by letter, a copy of which shall be forwarded to the Regional Board.

20. By January 1, 1981, the discharger shall submit to the Regional Board a plan for achieving effluent limitations representing Best Available Technology Economically Achievable as determined by applying the EPA effluent limitations guidelines applicable to this discharge on that date. If the discharger desires a variance for economic reasons under the provisions of Section 301(c) of the FWPCA, such a request, along with all supporting material required by applicable regulations, shall be submitted to the Regional Board by July 1, 1980.

21. This order shall serve as a National Pollutant Discharge Elimination System permit pursuant to Section 402 of the Federal Water Pollution Control Act, or amendments thereto, and shall take effect at the end of ten days from the date of adoption hereof, provided the Regional Administrator has no objections.

22. These waste discharge requirements supersede the waste discharge requirements issued by the Regional Board on September 4, 1968.

Certification

I, Bill B. Dendy, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an order adopted by the California State Water Resources Control Board on AUG 17 1977

Bill B Dendy

Bill B. Dendy
Executive Officer

APPENDIX VII

SAMPLE SPCC PLAN FORMAT
FROM
AMERICAN PETROLEUM INSTITUTE BULLETIN D-16

(Prior to completing Part I, refer to regulations and instructions page 5.)

SPILL PREVENTION CONTROL & COUNTERMEASURE PLAN

PART I
GENERAL INFORMATION

1. Name of facility _____

2. Type of facility _____

3. Location of facility _____

_____

_____

4. Name and address of owner or operator

Name _____

Address _____

_____

_____

5. Designated person accountable for oil spill prevention at facility

Name and title _____

6. Facility experienced a reportable oil spill event during the twelve months prior to Jan. 10, 1974 (effective date of 40 CFR Part 112) (If YES complete Attachment #1) _____

MANAGEMENT APPROVAL

This SPCC Plan will be implemented as herein described

Signature _____

Name _____

Title _____

CERTIFICATION

I hereby certify that I have examined the facility, and being familiar with the provisions of 40 CFR, Part 112, attest that this SPCC Plan has been prepared in accordance with good engineering practices

_____
Printed Name of Registered Professional Engineer

(Seal)

_____
Signature of Registered Professional Engineer

Date _____ Registration No _____ State _____

PART I
GENERAL INFORMATION

7. Potential Spills — Prediction & Control

Source	Major Type of Failure	Total Quantity (bbls)	Rate (bbls/hr)	Direction of Flow*	Secondary Containment

Discussion:

*Attach map if appropriate.

Name of facility _____

Operator _____

PART I
GENERAL INFORMATION

[Response to statements should be YES, NO, or NA (Not Applicable)]

8. Containment or diversionary structures or equipment to prevent oil from reaching navigable waters are practicable (If NO, complete Attachment ±2) _____

9 Inspections and Records

A The required inspections follow written procedures _____

B The written procedures and a record of inspections, signed by the appropriate supervisor or inspector, are attached. _____

Discussion _____

10 Personnel, Training, and Spill Prevention Procedures

A Personnel are properly instructed in the following

(1) operation and maintenance of equipment to prevent oil discharges, and _____

(2) applicable pollution control laws, rules and regulations _____

Describe procedures employed for instruction: _____

B Scheduled prevention briefings for the operating personnel are conducted frequently enough to assure adequate understanding of the SPCC Plan _____

Describe briefing program _____

Name of facility _____

Operator _____

(Prior to completing Part II, Alternate A, refer to regulations and instructions pages 6-7.)

PART II, ALTERNATE A
DESIGN AND OPERATING INFORMATION
ONSHORE FACILITY (EXCLUDING PRODUCTION)

A Facility Drainage

1. Drainage from diked storage areas is controlled as follows (include operating description of valves, pumps, ejectors, etc *(Note: Flapper-type valves should not be used)* _____

2. Drainage from undiked areas is controlled as follows (include description of ponds, lagoons, or catchment basins and methods of retaining and returning oil to facility) _____

3. The procedure for supervising the drainage of rain water from secondary containment into a storm drain or an open watercourse is as follows (include description of (a) inspection for pollutants, and (b) method of valving security) (A record of inspection and drainage events is to be maintained on a form similar to Attachment #3) _____

Name of facility _____

Operator _____

PART II. ALTERNATE A
DESIGN AND OPERATING INFORMATION
ONSHORE FACILITY (EXCLUDING PRODUCTION)

[Response to statements should be YES, NO, or NA (Not Applicable)]

B. Bulk Storage Tanks

1. Describe tank design, materials of construction, fail-safe engineering features, and if needed, corrosion protection _____

2. Describe secondary containment design, construction materials and volume _____

3. Describe tank inspection methods, procedures, and record keeping _____

4. Internal heating coil leakage is controlled by one or more of the following control factors
   (a) Monitoring the steam return or exhaust lines for oil _____
   Describe monitoring procedure _____
   (b) Passing the steam return or exhaust lines through a settling tank, skimmer, or other separation system _____
   (c) Installing external heating systems _____

5. Disposal facilities for plant effluents discharged into navigable waters are observed frequently for indication of possible upsets which may cause an oil spill event _____
   Describe method and frequency of observations _____

Name of facility _____

Operator _____

PART II, ALTERNATE A
DESIGN AND OPERATING INFORMATION
ONSHORE FACILITY (EXCLUDING PRODUCTION)

[Response to statements should be YES, NO, or NA (Not Applicable)]

C. Facility Transfer Operations, Pumping, and In-plant Process

1 Corrosion protection for buried pipelines

(a) Pipelines are wrapped and coated to reduce corrosion _____

(b) Cathodic protection is provided for pipelines if determined necessary by electrolytic testing _____

(c) When a pipeline section is exposed, it is examined and corrective action taken as necessary _____

2 Pipeline terminal connections are capped or blank-flanged and marked if the pipeline is not in service or on standby service for extended periods _____

Describe criteria for determining when to cap or blank flange _____

3 Pipe supports are designed to minimize abrasion and corrosion and allow for expansion and contraction _____

Describe pipe support design _____

4 Describe procedures for regularly examining all above-ground valves and pipelines (including flange joints, valve glands and bodies, catch pans, pipeline supports, locking of valves, and metal surfaces) _____

5 Describe procedures for warning vehicles entering the facility to avoid damaging above-ground piping _____

Name of facility _____

Operator _____

PART II, ALTERNATE A
DESIGN AND OPERATING INFORMATION
ONSHORE FACILITY (EXCLUDING PRODUCTION)

[Response to statements should be YES, NO, or NA (Not Applicable)]

D. Facility Tank Car & Tank Truck Loading/Unloading Rack

Tank car and tank truck loading/unloading occurs at the facility (If YES, complete 1 through 5 below) _____

1. Loading/unloading procedures meet the minimum requirements and regulations of the Department of Transportation _____

2. The unloading area has a quick drainage system _____

3. The containment system will hold the maximum capacity of any single compartment of a tank truck loaded/unloaded in the plant _____
Describe containment system design, construction materials, and volume. _____

4. An interlocked warning light, a physical barrier system, or warning signs are provided in loading/unloading areas to prevent vehicular departure before disconnect of transfer lines _____
Describe methods, procedures, and/or equipment used to prevent premature vehicular departure. _____

5. Drains and outlets on tank trucks and tank cars are checked for leakage before loading/unloading or departure _____

Name of facility _____

Operator _____

PART II. ALTERNATE A
DESIGN AND OPERATING INFORMATION
ONSHORE FACILITY (EXCLUDING PRODUCTION)

[Response to statements should be YES, NO, or NA (Not Applicable)]

I. Security

1. Plants handling, processing or storing oil are fenced

2. Entrance gates are locked and/or guarded when the plant is unattended or not in production

3. Any valves which permit direct outward flow of a tank's contents are locked closed when in non-operating or standby status

4. Starter controls on all oil pumps in non operating or standby status are:
   (a) locked in the off position, and
   (b) located at site accessible only to authorized personnel

5. Discussion of items 1 through 4 as appropriate

6. Discussion of the lighting around the facility

Name of facility

Operator

(Prior to completing Part II, Alternate B, refer to regulations and instructions page 7.)

PART II, ALTERNATE B
DESIGN AND OPERATING INFORMATION
ONSHORE OIL PRODUCTION FACILITY

[Response to statements should be YES, NO, or NA (Not Applicable).]

A Facility Drainage

1 Drainage from diked storage areas is controlled as follows (include operating description of valves, pumps, ejectors, etc.) _____

2 The procedure for supervising the drainage of rain water from secondary containment into a storm drain or an open watercourse is as follows (include description of (a) inspection for pollutants and (b) method of valving security) (A record of inspection and drainage events is to be maintained on a form similar to Attachment C-3) _____

3 Field drainage ditches, road ditches, and oil traps, sumps, or skimmers, if such exist, are inspected at regularly scheduled intervals for accumulations of oil. Describe inspection procedures, intervals, and methods employed to remove oil _____

B Bulk Storage Tanks

1 Describe tank design, materials of construction, and fail-safe engineering features _____

Name of facility _____

Operator _____

PART II, ALTERNATE B
DESIGN AND OPERATING INFORMATION
ONSHORE OIL PRODUCTION FACILITY

[Response to statements should be YES, NO, or NA (Not Applicable)]

2 Describe secondary containment design, construction materials, and volume: _____

3 Describe tank examination methods and procedures _____

C. Facility Transfer Operations

1 Describe scheduled basis for examinations of above-ground valves and pipelines and salt water disposal facilities _____

2 Describe flowline maintenance program to prevent spills: _____

D. Oil Drilling and Workover Facilities

1. A blowout preventer (BOP) assembly and well control system is installed before drilling below any casing string and, as required during workover operations _____
2. The BOP assemoly is capable of controlling any expected wellhead pressure _____
3. Casing and BOP installations conform to state regulations _____

Name of facility _____

Operator _____

(Prior to completing Part II, Alternate C, refer to regulations and instructions page 8.)

PART II, ALTERNATE C
DESIGN AND OPERATING INFORMATION
OFFSHORE OIL DRILLING, PRODUCTION, OR WORKOVER FACILITY

[Response to statements should be YES, NO, or NA (Not Applicable).]

A. Facility Drainage

1. Oil drainage and collection equipment is used to catch small oil leakage around pumps, glands, valves, flanges, expansion joints, hoses, drain lines, separators, treaters, tanks, etc _____.
2. Drains direct all oil to a central sump or equivalent. _____
3. Where drains and sumps are not practicable, oil collection equipment is emptied as often as necessary to prevent overflow _____
   Discuss frequency of surveillance and removal of oil from collection equipment. _____

B. Sump System

A sump system is used at this facility (If YES, complete 1 and 2 below) _____

1. Describe operation of sump and drain liquid removal system _____

2. Describe preventive maintenance inspection, test program, and record keeping: _____

Name of facility _____

Operator _____

PART II, ALTERNATE C
DESIGN AND OPERATING INFORMATION
OFFSHORE OIL DRILLING, PRODUCTION, OR WORKOVER FACILITY

[Response to statements should be YES, NO, or NA (Not Applicable)]

C. Separator and Treater Dump Valves

In areas where pollution risk is high as a result of dump valve failure is the predominant mode of failure in the closed position? ____

If YES, describe safety equipment and procedures used to prevent oil discharges to the water when dump valve failure occurs _____

D. Tanks

Describe equipment used to prevent oil discharges (include discussion of corrosion protection measures) _____

E. Pollution Prevention Equipment and Systems

Written inspection and testing procedures for pollution prevention equipment and systems are shown on Attachment #1

F. Well Control Systems and Equipment

1. *Producing Wells* Types of surface and subsurface shut-in valves and devices utilized at this facility are described as to the method of operation and control on Attachment #5
2. *Drilling and Workover Operations* A blowout preventer (BOP) assembly and well control system is installed before drilling below any casing string and, as required during workover operations ____

Name of facility _____

Operator _____

PART II, ALTERNATE C
DESIGN AND OPERATING INFORMATION
OFFSHORE OIL DRILLING, PRODUCTION, OR WORKOVER FACILITY

[Response to statements should be YES, NO, or NA (Not Applicable)]

2 The BOP assembly is capable of controlling any expected wellhead pressure _____
3. Casing and BOP installations conform to state regulations _____

G *Written Instructions for Contractors*
1. Written instructions discussing duties and obligations to prevent pollution are prepared for contractors servicing a well or systems appurtenant to a well or pressure vessels _____
2 These instructions are maintained at the offshore facility _____
3. An authorized representative of the owner or operator is present under certain circumstances and conditions to intervene when necessary to prevent a spill event _____

H Flowlines
1 All headers have check valves on individual flowlines _____
2 Where the shut-in well pressure is greater than the working pressure of the flowline, manifold valves, and flowline header valves, the flowline shall have a high pressure sensing device and shut-in valve at the wellhead to prevent overpressuring (unless a pressure relief system is provided) _____

I Pipelines
1 Describe corrosion protection measures for pipelines within the facility. _____

2 Submarine pipelines connected to the facility are adequately protected against environmental stresses and fishing operations _____
3 Describe submarine pipeline inspection-for-failure procedures and record keeping _____

Name of facility _____

Operator _____

SPCC PLAN, ATTACHMENT #1
SPILL HISTORY

(Complete this form for any reportable spill(s) which has (have) occurred from this facility during the twelve months prior to January 10, 1971 into _____ navigable water)

1 Date _____ Volume _____ Cause: _____

Corrective action taken _____

Plans for preventing recurrence _____

2. Date _____ Volume _____ Cause: _____

Corrective action taken. _____

Plans for preventing recurrence _____

3. Date _____ Volume _____ Cause. _____

Corrective action taken. _____

Plans for preventing recurrence. _____

Name of facility _____

Operator _____

SPCC PLAN, ATTACHMENT #2
OIL SPILL CONTINGENCY PLANS AND WRITTEN COMMITMENT OF MANPOWER

Secondary containment or diversionary structures are impracticable for this facility for the following reasons (attach additional pages if necessary).

	Yes
A strong oil spill contingency plan is attached	_____
A written commitment of manpower is attached	_____

Name of facility _____

Operator _____

SPCC PLAN, ATTACHMENT #3
ONSHORE FACILITY BULK STORAGE TANKS
DRAINAGE SYSTEM

Inspection Procedure:

Record of drainage, bypassing, inspection, and oil removal from secondary containment

Date of Drainage	Date of Bypassing Open	Closed	Date of Inspection	Oil Removal	Supervisor's or Inspector's Signature

Name of facility _____

Operator _____ _____

SPCC PLAN, ATTACHMENT #4
OFFSHORE OIL DRILLING, PRODUCTION, OR WORKOVER FACILITY
POLLUTION PREVENTION EQUIPMENT AND SYSTEMS

Pollution Prevention Equipment:

Description	Inspection Procedures	Test Procedures

Inspection or Test Date	Condition	Action Taken	Supervisor's or Inspector's Signature

Name of facility _____

Operator _____

SPCC PLAN ATTACHMENT #5
OFFSHORE OIL DRILLING, PRODUCTION, OR WORKOVER FACILITY
WELL CONTROL SYSTEMS AND EQUIPMENT

List type(s) of surface and subsurface well shut-in valves and devices used to maintain control of wells, showing (a) method of activation and control, and (b) description.

Item	Method of Activation and Control	Description

Name of facility _____

Operator _____

APPENDIX B

FMC'S SPCC PLAN

COPY TO 2/26/77
W.C. W.C. SMITH - EPA
W. M. BLANKENSHIP - EPA
E.C. LADD - FMC

SPILL PREVENTION CONTROL AND COUNTERMEASURE PLANS

The EPA requires a Spill Prevention and Countermeasure Plan (SPCC). The following details the plan as required under Federal Regulations 40 CFR 112, "Oil Pollution Prevention".

All oil storage or bulk use areas in the plant have been reviewed. The following is the SPCC for each situation.

Environmental Manager, E. W. Sutton, is designated as accountable for oil spill prevention, and will report necessary items to line management.

1. Scrap Oil

Scrap or used lubricating oil, transformer oil, paint thinners, etc., are stored behind 28-3, in 55-gallon metal drums. Minor spills are absorbed in the ground. When some 1000 gallons of scrap oil is accumulated, it is currently removed by Craigsville Distributing, Inc., and used to spray on their coal piles at Chelyan, West Virginia.

Since the aggregate storage is less than 1320 gallons [112.1(c)(2)], the provisions of Section 112 do not apply. No further control is required; existing control is adequate.

2. Transformers

There are 92 oil filled transformers in the plant with a total of 111,081 gallons of oil. Sizes range from 15 to 11,640 gallons. They are all provided with electrical overload protection and, in the event of overpressure, have a top relief valve. In the event of overpressure, top gasses are released, not the oil. The larger transformers have continuous temperature monitoring.

The transformers are under constant operator surveillance and a continuous inspection and maintenance program. The transformer oil is checked annually for dielectric strength.

In view of the construction of these units, their necessary upkeep, and constant monitoring, no further oil spill protection is required.

3. Carbon Disulfide Plant

The Carbon Disulfide Plant uses a kerosene-type absorption oil. 17,000 gallons is in T-302, the storage tank, and 4,000 gallons is circulating in the system. In early 1973 an American Petroleum Institute (API) design oil-water separator was put into service. The unit is 75 feet long, 11 feet wide, and 5 feet deep. A skimmer is provided to pump collected oil back to a process tank. Curbs and dikes in the oil-containing section of the plant insure that all spills drain to the API tank.

3. Carbon Disulfide Plant, continued

The oil storage tank and oil pump are contained within an adequate concrete dike area, which can be isolated.

Oil is unloaded from a 7,000 gallon tank truck. The unloading station area is properly diked and oil spills are pumped into the API separator.

All equipment and tanks are under control of round-the-clock operators and supervision. Repairs are made as required under a written work order system, signed by the responsible supervisor.

The plant is fully fenced, and entrance gates guarded by watchmen. On evening and midnight shifts the watchmen make hourly total plant patrols. The Carbon Disulfide Plant has round-the-clock chemical operators. The chemical operators continually monitor the entire oil system as part of their normal duties. A high level alarm is provided on inlet of the API separator to alert the operators of any unusual situation.

The facility has adequate lighting for both the patrolling watchmen, and in-plant operators.

All personnel are properly trained in the operation and maintenance of the equipment. All understand the operation of the equipment as it is part of a continuously-operating chemical process operating unit.

4. Hydrogen Peroxide Plant

The Hydrogen Peroxide Plant uses a kerosene-type work solution. 112,000 gallons is contained in storage tanks and 172,000 gallons is circulated within the process. The main storage tank of 47,000 gallons is protected by an earthen dike, secured with heavy crushed stone, with a valved off drain which is only opened to drain any accumulated rainwater An unused extractor vessel in the new process area is used to store an additional 35,000 gallons of oil. A 2,000 gallon storage tank is located in the southwest corner of the process area. The entire process area is curbed and diked, so that any spills or runoffs are collected in a common drain sewer. This discharges to a 25,000 gallon retention tank. Oil collected in the retention tank is pumped back to the process unit. Overflow water from the tank discharges to a fly ash settling basin This discharge is clear, however any oil particles in the discharge are retained by the absorbant fly ash particles. The water discharge from the fly ash basin is through an underflow weir to further prevent any oil spillage.

The cooling system in this chemical process unit is captive, recirculating through cooling towers. Any oil leaks from heat exchangers are retained in the cooling tower basins.

Oil is unloaded from tank cars in the process area. Any spills flow into the collection system and are retained in the oil retention tank.

4. Hydrogen Peroxide Plant, continued

All equipment and tanks are under control of round-the-clock operators and supervision. Repairs are made as required under a written work order system, signed by the responsible supervisor.

The plant is properly fenced, with the entrance gate guarded by operators. On evening and midnight shifts the operators make hourly total plant patrols. The Hydrogen Peroxide Plant has round-the-clock chemical operators. The chemical operators continually monitor the entire oil system as part of their normal duties.

A level alarm (red light) is on the 25,000 gallon oil retention tank. It is set to alert the operation when 1000 gallons of oil is in the tank.

The facility has adequate lighting for the patrolling in-plant operators.

All personnel are properly trained in the operation and maintenance of the equipment. All understand the operation of the equipment as it is part of a continuously operating chemical process operating unit.

5. Bens Run Oil Storage Tank

Gas well No. 101 at Bens Run has a separator, and an oil storage tank containing 4200 gallons. The tank contains water and drip oil from the gas. We plan to relocate this tank in the summer or fall of 1974. When relocated the tank will be provided an earthen dike, a drain line and valve. The valve will be locked in the closed position. It will be opened by supervision when necessary to drain off rainwater In the event of an oil spill, portable pumps will be used to remove the oil. No pumping system will be provided.

The tank will be inspected periodically and repairs, including painting, will be done as necessary.

The tank is contained in a fenced area, and is monitored daily. No lighting is provided, as it is in a remote area.

Training requirements are minimal as operation of the tank is under direct supervision of management.

Festus J. Roseberry, Jr.
Registered Professional Engineer
Certificate No. 4815

EWSutton
10-8-74

APPENDIX VIII

STATE AND LOCAL REFUSE PLANNING GUIDELINES FOR FINANCIAL ASSISTANCE GRANTS

The objectives of program guidelines are to assist state and local governments in developing and implementating methods which are environmentally sound for the collections, processing, and disposal of refuse from all sources. The objectives are to be accomplished through Federal financial and technical assistance to State and local authorities for planning and implementing programs.

Primary considerations for the State and local planning and financial assistance effort shall consider:

1. The varying local, geologic, hydrologic, climatic, and other circumstances under which different refuse practices are required in order to insure the reasonable protection of the quality of the ground and surface waters from leachate contamination, the reasonable protection of the quality of the surface waters from surface runoff contamination, and the reasonable protection of ambient air quality.

2. Characteristics and conditions of collection, storage, processing, and disposal operating methods, techniques and practices, and location of facilities where such operating methods, techniques, and practices are conducted, taking into account the nature of the material to be disposed.

3. Methods for closing or upgrading open dumps for purposes of eliminating potential health hazards.

4. Population density, distribution, and projected growth.

5. Geographic, geologic, climatic, and hydrologic characteristics.

6. The type and location of transportation.

7. The profile of industries.

8. The constituents and generation rates of refuse.

9. The political, economic, organizational, financial, and management problems affecting comprehensive refuse management.

10. Types of resource recovery facilities and resource conservation systems which are appropriate.

A. Minimum Requirements for Approval of State and Local Plans Submitted for Grant Financing

1. The plan shall identify a) the responsibilities of State or local authorities in the implementation of the plan, b) the distribution of Federal funds to the authorities responsible for development and implementation of the plan, and c) the means for coordinating planning and implementation under the plan.

2. The plan shall provide the establishment of new open dumps within the jurisdictions and contain requirements that all refuse originating in other jurisdictions shall be disposed of in sanitary landfills or otherwise disposed of in an environmentally sound manner.

3. The plan shall provide for the closing or upgrading of all existing open dumps within the State or local jurisdictions.

4. The plans shall provide for the establishment of such State or local regulatory powers as may be necessary to implement the plan.

5. The plan shall provide for the disposal of refuse in sanitary landfills or any combination of practices that may be necessary to use or dispose of such waste in a manner that is environmentally sound.

For purposes of complying with this plan, each State or its designated local entity must provide for a minimum of one sanitary landfill for each 2 million persons and one hazardous and/or industrial waste disposal site per state. As a minimum criterion for a sanitary landfill or hazardous refuse disposal site, the site must provide for a facility where there is no reasonable probability of adverse effects on health or the environment from disposal of refuse at such facility. Primary criteria for the classification of a landfill as "sanitary" shall be: a) adverse effects on groundwater and surface water b) discouragement of scavengers c) control of vectors d) a prohibition on open burning and e) periodic soil covering of the site.

It is estimated that annual funding requirements for this program will approximate N3,000,000 for states or their designated local governments and agencies to conduct and update refuse planning programs.

B. Grants for Equipment and Facilities

Local governments or their authorized representatives whose proposal is covered by an approved plan are eligible for financial assistance for the acquisition of equipment and facilities to be used in the collection, processing and disposal of refuse. The primary types of facilities and the related equipment eligible for funding in a priority order are: 1) sanitary and hazardous or industrial landfills 2) collection of refuse 3) transfer points or stations and 4) incinerators, composting or other resource recovery facilities and efforts.

Eligible organizations for grant and technical assistance are states, counties, cities, communities and interlocal government agencies or authorities. Private and profit orientated organizations are not eligible.

Criteria for award. The following criteria and points may be used to select the projects:

1.	Applicants ability to successfully manage	30
2.	Applicants ability to fund continual operation	30
3.	Need	15
4.	Cost-benefit based on tons of refuse and citizens served	15
5.	Cost sharing by applicant	10
6.	Fixed Basic Point additions	
	a) Landfills (general purpose)	30
	b) Landfills (hazardous wastes)	40
	c) Collection	20
	d) Transfer stations	15
	e) Incinerators, composters, other resource recovery initiatives	5

Although the intent of this financial assistance is to provide capital for equipment and facilities but not to provide funding for operating costs, long-range contracts with the equipment manufacturer or his designated supplier for maintenance of new equipment are eligible for funding providing the supplier provides a performance bond.

Annual funding under this program will approximate N15,000,000 for states and local governments or their designated agencies to acquire equipment and facilities for refuse collection, processing and disposal.